TERRESTRIAL MAGNETISM

The cost of the preparation and publication of this report has been defrayed from the Fund which was raised by public subscription in memory of Captain R. F. Scott and his companions.

BRITISH (TERRA NOVA) ANTARCTIC EXPEDITION
1910--1913

1 APRIL 1953

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TERRESTRIAL MAGNETISM

BY

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LONDON:
PRINTED AND PUBLISHED BY
HARRISON AND SONS, LTD., 44-47, ST. MARTIN'S LANE, W.C. 2
FOR THE COMMITTEE OF THE CAPTAIN SCOTT ANTARCTIC FUND.

1921.

HARRISON AND SONS, LTD.,
PRINTERS IN ORDINARY TO HIS MAJESTY,
44–47, ST. MARTIN'S LANE, W.C.2.

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AUTHOR'S INTRODUCTION.

AFTER the return of the Expedition to England in 1913 the magnetic curves and the observation books from Cape Evans, together with notebooks by the two magnetic observers, Dr. G. C. Simpson, F.R.S., and Capt. C. S. Wright, were handed to me at Kew Observatory. An arrangement was come to between the Director of the Meteorological Office and the Committee charged with the preparation of the material for press, which set free a sixth of my official time up to the end of 1917 for dealing with the magnetic results. The observations taken by the naval officers, except a few taken at Cape Adare, were reduced under the supervision of the late Commander Harry Pennell, R.N. They were finally transferred to me along with the observations at Cape Adare, which had been partly reduced by the observers, Lieut. (now Commander) V. Campbell, R.N., and Surgeon G. M. Levick, R.N.

The preparation of the material obtained at Cape Evans has taken much longer than was originally contemplated. It soon became obvious that publication would not be possible during the progress of the war. Thus no object was to be gained by hurrying on the completion of the work. The data were accordingly used for a variety of researches which could not have been undertaken if early publication had been essential.

Before the Expedition set sail, 36 term hours had been selected, and a request had been issued to a number of observatories to take quick-run magnetograms during these hours, and to send copies of the records for comparison with the corresponding records to be obtained in the Antarctic. Twenty-three observatories co-operated in this scheme, which thus resulted in the accumulation of a large mass of material. Having participated in several of these international quick-run programmes I can appreciate the large amount of trouble taken by the staffs of the co-operating stations. It inevitably happened that some of the term hours occurred during the night at many of these stations, and so made a specially onerous claim on the staff. The principal object of the term hours was to secure corresponding open time scale records of magnetic disturbances from different parts of the world. The chief reason for having so large a number of term hours was to increase the chance of including one or more considerable disturbances. The chance that a pre-arranged hour will be highly disturbed is very small, especially in comparatively quiet years like 1911 and 1912.

Quick-run curves have disadvantages as well as advantages. The time of occurrence of a bold movement can of course be determined much more exactly on a quick-run trace than on an ordinary trace, provided quick running does not prejudice the uniformity of rotation of the drum carrying the photographic paper. But what would be a bold movement on an ordinary curve possesses in a quick run so slight an inclination to the time axis that the accuracy with which turning points can be determined is less than might be expected, and the correspondence or lack of correspondence between the movements at remote stations becomes a very difficult thing to decide. When disturbance is small the ordinary diurnal variation is not relatively insignificant. It depends on the local time, and so differs at different stations. Also, as we now know, there is really no such thing as a regular diurnal variation depending only on the season of the year and independent of the magnetic character of the day. The disentangling of what is local from what is general in minor disturbances must be difficult, and it is in fact a task for which we do not as yet have sufficient knowledge. Thus while there are certain enquiries for which quick-run curves seem likely to be essential, the subject requires more consideration than it has yet received.

Owing to the growth of artificial disturbances there are a good many observatories, the records from which are not above suspicion. Their value for ordinary purposes may be but little affected, but the significance of small short-period oscillations is open to doubt. Some of the records actually received from the co-operating observatories obviously suffered in this way, and were not suitable for the study of any but the larger disturbances.

To show an adequate appreciation of the labour entailed by the taking of the quick runs, I decided to utilise the records for a purpose not originally contemplated, viz., an investigation into one aspect of the scheme of measurements of "magnetic activity" due to the late Professor Bidlingmaier. This entailed a considerably greater amount of arithmetic than had been anticipated. Another somewhat onerous research was into the diurnal variation of magnetic disturbance as given by hourly "character" figures, following again a lead given by Professor Bidlingmaier.

The most onerous research of all was a comparison of a selection of magnetic disturbances as recorded in the Antarctic and elsewhere. It was realised soon after the Antarctic work was undertaken that such a comparison was likely to advance knowledge more than a study of minor disturbances in the quick-run curves. After careful inspection of the Antarctic and Kew curves, a list of disturbed times was prepared and issued to selected observatories, with a request for copies of the curves for the times on the list. A very generous response was made by the following observatories: Sitka and Honolulu (through the Superintendent U.S. Coast and Geodetic Survey), Agincourt (Toronto), Buitenzorg, Mauritius, Alibag (Bombay), and Helwan. Also the Eskdalemuir curves were put at my disposal by the Director of the Meteorological Office.

After the whole work had been completed, a paper appeared by Dr. S. Chapman* giving the general results of comparisons of a number of magnetic storms having "sudden commencements" recorded by a series of observatories, including several of those mentioned above. Somewhat curiously a corresponding incident occurred in the case of the National Antarctic Expedition of 1902–04. After all I had intended to do in discussing the magnetic results of that expedition had been done, there appeared the first of the two large volumes in which Professor Kr. Birkeland† described the results of magnetic observations made in the Arctic regions in 1902–03. In that case I decided to leave what had been written unaltered, but to write an additional

* 'Roy. Soc. Proc.,' A, vol. 95, p. 61.

† 'The Norwegian Aurora Polaris Expedition, 1902—03,' vol. I.

chapter comparing the Arctic and Antarctic records. In the present case I have so far followed the precedent set on the previous occasion as to leave what had been already written unaltered. Thus any statement in the present volume which agrees with conclusions drawn by Dr. Chapman is quite independent, and any statement that may seem to controvert his opinions is absolutely unprejudiced. The further precedent of writing a fresh chapter has not been followed. Professor Birkeland supplied data for individual magnetic storms which were represented in the Antarctic, whereas Dr. Chapman deals only with mean results from a number of storms, few if any of which were represented in the Antarctic curves.

In the execution of the work I have received valuable help from Mr. James Foster, a retired member of the old Kew Observatory staff. With the aid of a boy assistant he took all the curve measurements, and did all the calculations required for the hourly values, the daily maxima and minima, and the diurnal inequalities. He likewise measured all the quick-run curves at 5-minute intervals, and carried through the very laborious arithmetic required for the calculation of the magnetic "activity." Besides checking all the arithmetic, I took all the curve measurements required for the discussion of the disturbances. This was not work which could have been satisfactorily delegated to an assistant. Disturbances are very irregular phenomena, and it seemed impossible to lay down in advance any prescribed method of treatment likely to prove universally satisfactory. Without a minute study of individual disturbances it would be difficult to obtain the general grasp of the subject desirable for a critical discussion. But for the permission to use part of my official time the work could hardly have been done. In addition a considerable proportion of my leisure time has had to be given, especially during the last two years. Arduous as the work has been, it has entailed none of the physical strain to which the observers who obtained the data were exposed. The conditions under which they observed bore considerable resemblance to those of our soldiers on active service, while, unlike the soldiers, they had to look for little appreciation of their labours except from a very small minority of their fellow-countrymen. It has been my endeavour to show my personal appreciation of the task executed in the Antarctic by doing what I can to utilise the results to the best advantage.

C. CHREE.

January, 1919.

Since the above was written Chapter XIV has been added, dealing with the relation between aurora and magnetic disturbance. It was rendered possible by the kind co-operation of Capt. C. S. Wright. I have also to thank Col. H. G. Lyons, F.R.S., for advice and assistance while the work was passing through the press, and I wish to express my indebtedness to Messrs. Harrison and Sons for the great care and skill exercised in the reproduction of the magnetic curves.

C. CHREE.

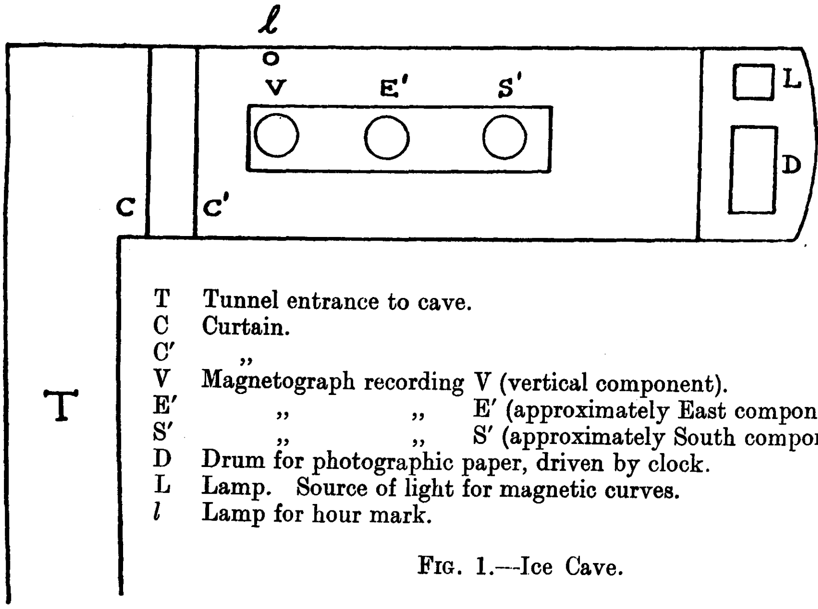
January, 1921.

CHAPTER I.

DESCRIPTION OF BASE STATION AT CAPE EVANS. RESULTS OF ABSOLUTE OBSERVATIONS.

Section 1.—The magnetic work in the Antarctic at the base station at Cape Evans was carried out by Dr. G. C. Simpson, F.R.S., and Capt. C. S. Wright. His official duties recalled Dr. Simpson to India at the beginning of the second year, and subsequently Capt. Wright was in charge of the magnetograph. The installation of the instruments and a number of details relating to their subsequent working were described by Dr. Simpson in a notebook which he put in my hands, and from which I shall make a number of quotations in the following brief summary of events.

It was decided that a cave dug in the ice would have many advantages over an ordinary hut as a magnetograph chamber. For one thing, it would be much less liable



T Tunnel entrance to cave.
C Curtain.
C′ „
V Magnetograph recording V (vertical component).
E′ „ „ E′ (approximately East component).
S′ „ „ S′ (approximately South component).
D Drum for photographic paper, driven by clock.
L Lamp. Source of light for magnetic curves.
l Lamp for hour mark.

FIG. 1.—Ice Cave.

to rapid changes of temperature. The digging of the cave was begun on January 14, 1911, and completed within a week. The cave is shown roughly in plan in Fig. 1. Its length ran approximately East-West, and the entrance tunnel North–South. "The height of the cave was a little over 6 feet, so one could stand upright and work in comfort. The cave was made dark by covering the inside walls and roof with felt. Two curtains (C and C′ in the figure) closed the entrance."

Before the erection of the magnetograph the intensity of H (the horizontal force) in the cave was compared with that in the absolute magnetic hut, a question to which we shall return presently.

Dr. Simpson's description of the way the magnetograph was supported is as follows :—" For reasons which need not be gone into here I was not able to take stone pillars or slabs of slate for the magnetic instruments, but took a wooden table instead. The three instruments (marked V, E′ and S′ in Fig. 1) were on a table consisting of a slab of hard wood, 137 × 30 × 3·2 cms., which was screwed on to two very solid hard wood pillars about 25 cm. in cross section, firmly set into the solid frozen ground of the cave. The whole table was so solid that I expected no difficulty with it ; but as the diary shows, it did warp and caused a great deal of trouble when the temperature of the cave was changing during the autumn and spring. The lamp and drum (L and D in the figure) were on another table extending across the far end of the cave and supported by being let into the solid ice walls of the cave."

The instruments marked V, E′ and S′ in Fig. 1 were intended to record changes in the vertical component of magnetic force and in two horizontal components, one directed to Astronomical East, the other to Astronomical South. To secure this, the magnet for the E′ instrument should have been oriented true North and South, and that for the S′ instrument true East and West. The orientation was done on January 21 with the aid of a compass. The result, unfortunately, did not prove satisfactory. Subsequent orientation by astronomical methods, carried out in August and September, 1911, showed an error of 7° 36′ in the orientation. Consequently the instrument marked E′ measured changes of force in the direction 7° 36′ South of East, and that marked S′ measured changes of force in the direction 7° 36′ West of South.

The adjustment of the magnetograph was commenced on January 25, and an experimental record was taken during the subsequent night. It was found that one of the quartz fibre suspensions was too fine, and fibres having a diameter of about 0·06 mm. were adopted for both the E′ and S′ instruments.

Originally the lamp marked L in Fig. 1 was an oil lamp, but it smoked so badly during the trial runs that it was decided to replace it by an electric lamp. A battery of 12 storage cells was accordingly set up for the purpose, and leads taken from it to the cave.

The usual arrangement for securing time marks on the photographic sheet is to have the light from the lamp L, which goes to form the base line, interrupted hourly by a shutter actuated by the clock which drives the drum. This method remained in operation throughout, but an additional time mark which extended right across the width of the sheet was secured by Dr. Simpson in the following way :—" At each hour a clock (called the standard or S clock) automatically switched the current from the lamp (L in Fig. 1) in the lantern to a lamp (l) placed in such a position that it illuminated the cylindrical lens (*i.e.* the condensing lens just in front of the photographic sheet on the drum), and produced a black line across the record. I had a bell in the lamp circuit which rang loudly whenever the current failed ; when the current was being switched from one circuit to the other the current was broken sufficiently to give a single knock of the clapper on to the bell. The hour lamp circuit was closed for approximately 20 seconds, when the current was switched back to the lamp in the lantern, the bell giving a single sound when this happened. When I wished to compare the time recorded on the trace with the chronometer it was only necessary to be at the chronometer at the hour and note the time of the two bell rings. . . Each morning at 8 o'clock, as soon as the first (or make) bell rang, I went over to the chronometer and was ready there when the second bell rang to note the time. . . I attempted to keep the error of the S clock less than 1 minute."

The regular use of the magnetograph began on February 1. Considerable trouble was experienced at the start. As it so happened, magnetic conditions at the time were highly disturbed, and during the first week there was so much crossing and intercrossing of the V, E′ and S′ traces that their identification was too uncertain for satisfactory measurements to be made. Steps were at once taken to surmount this difficulty, and after the first week there was little further trouble on that account.

Section 2.—The absolute determinations of declination (D) and horizontal force (H) were all taken with unifilar magnetometer No. 25, employing for declination the collimator magnet 25B, and for horizontal force the collimator magnet 25A, and the mirror magnet 25C. The instrument though old was in good repair, having been overhauled by Mr. A. W. Dover shortly before the expedition set sail, the constants of the magnet being freshly determined at Kew Observatory. The magnet 25A being well seasoned, retained its magnetic moment wonderfully well under the trying conditions to which it was exposed.

All the observations of inclination (I) were taken with the dip circle No. 26. At the start use was made of two needles, Nos. 2 and 8, belonging to No. 26. Needle No. 2 was discarded for a time after March 3, 1911, being replaced by needle No. 5, also belonging to dip circle No. 26. Needles Nos. 8 and 5 remained in use until March 3, 1912, when needle No. 5 had to be replaced by needle No. 2. Another change had to be made in July, 1912, when needles Nos. 1 and 2 of circle 186 replaced needles Nos. 8 and 2 of circle 26. It is hardly likely that the change of needles was wholly without effect on the observed values of the dip, but the conditions in the Antarctic differ so enormously from those at Kew Observatory, where comparative readings had been taken with the several needles, that it is impossible to say what the effect may have been.

The following is Dr. Simpson's account of the procedure followed in the absolute observations* :—" The Kew methods were followed with one or two slight variations. The dip was first determined in the usual way, two needles being used. A vibration observation was then made. Before June 9 (1911) sufficient care was not taken to see that the thermometer recorded the correct temperature of the magnet. On this date the practice was commenced of leaving the magnet at least 15 minutes in the vibration box before the swings were commenced. In the note entered to January 24 (see later) reasons are given for cutting down the number of swings from 165 to 95. Even then there was nearly always a large shift of the zero during the observation causing the time

* The order of the observations was not always the same.

of the swing to the right to be different from that to the left. Deflection observations were then taken in the usual way, the distances being 42 and 56 cms. with end pieces on the bar (these were pieces which could be attached to the ordinary deflection bar, lengthening it sufficiently to get suitable deflection distances for the low value of H found in the Antarctic). Another vibration observation was then made, the object being to eliminate as far as possible the effect of a change of field between the determinations of mH and m/H (m being the magnetic moment of the magnet). A declination observation was then made. The instrument was clamped in a suitable position, and scale readings between which the magnet was swinging noted for three minutes. The magnet was then inverted and the scale readings during another three minutes noted. The magnet was again placed upright (*i.e.* as before the inversion) and the first observation repeated. The whole process occupied 10 minutes. The vernier was read before and after the observation to see that the instrument did not move during the observation. Great care was taken with the torsion. Any torsion found at the beginning was removed and the torsion at the end measured and noted."

The note dated January 24 referred to above is as follows:—"There are such large changes in the declination that before the needle has made 100 swings the centre of the scale is in most cases not crossing the vertical wire. For this reason the number of swings has been reduced to 95 instead of the usual 165. This procedure will be followed in all our absolute determinations."

The usual procedure is to note the time of each fifth transit from 0 to 65, and then after a pause from 100 to 165. Combining transit 0 with transit 100, transit 5 with transit 105 . . . and finally transit 65 with transit 165 one gets 14 observations of the time of 100 vibrations. The procedure followed by Dr. Simpson was to observe each fifth transit from 0 to 95 without a pause. By combining transits 0 and 50, 5 and 55 . . . he got ten observations of the time of 50 vibrations.

As already mentioned, the time when the observations commenced was much the most disturbed period of the whole two years, 1911 being a considerably more disturbed year than 1912, and midsummer (December–January) being the most disturbed period of the year in the Antarctic. The curtailment of the ordinary scheme would seem to have been unavoidable under the conditions then prevailing, but during most of the subsequent time, and especially during the winter months it could probably have been followed, possibly with advantage.

One of the drawbacks to the usual procedure is that, owing to the low value of H in the Antarctic, the time required for 165 swings is much longer than in England, and an increase in the time increases the trouble arising from changes of declination. This difficulty might have been turned by observing every third instead of every fifth swing.

During 1911 there was on the average about 1 absolute observation of each element per week. The number declined during 1912, especially during the later months. In the case of a declination magnetograph of a stable type at a station where large disturbance is rare, one absolute observation a week should suffice to maintain a very high degree of accuracy in base values. But under the conditions prevailing at Cape Evans, a considerably larger number of absolute observations would have been necessary for base values of the accuracy called for when mean values are calculated for individual days. At Cape Evans the elements recorded by the magnetograph and the elements observed with the absolute instruments were in no case the same. Thus even under the most favourable conditions an increased number of absolute observations would have been desirable. In the case in fact of the vertical force, an absolute instrument giving the force directly will, I suspect, have to be invented before base line values of high precision can be obtained in high magnetic latitudes. It is obviously impossible to hope for accuracy to 1γ or even to 10γ in values of vertical force, when one has to arrive at them indirectly with the aid of a dip circle, and an error of $1'$ in the dip implies an error of 300γ in vertical force.

Section 3.—Table I, p. 8, gives a summary of the results of the absolute declination observations at Cape Evans. They were all taken with the collimator magnet 25B. The times refer to 180° E., that having been adopted after full consideration by Dr. Simpson. Also, in accordance with the method he adopted of showing the results, the declination is measured from South to East. The more usual procedure is to measure declination from North in the clockwise direction, so that what appears as 25° 20′ for example in the table would usually be described as 154° 40′, or 154° 40′ E. I am quite alive to the fact that a good deal can be said, and is not unlikely to be said, against the procedure adopted here. But it seemed to me in view of the problems arising in connection with the magnetograph to have a balance of advantages when dealing with the absolute observations. In the case of the diurnal inequality the ordinary definition is adopted. The table includes some observations made in December, 1911, and January, 1912, at a temporary station on sea ice, over deep water at some distance from shore. These are distinguished by an asterisk, and are specially considered later.

In some months, *e.g.*, October and November, 1911, the hour of observation is fairly uniform, but in other months, *e.g.*, April, 1911, the time varies considerably. Also there is considerable difference between the mean hour of observation in different months, *e.g.*, May, 1911, and May, 1912. Such variability is of little if any importance under normal conditions at a station furnished with a magnetograph, because ordinarily one relies entirely on the curve measurements for mean monthly and annual values. But in view of the uncertainties which we shall presently encounter, when dealing with the base values of the Antarctic curves, a close approach to uniformity in the hour of the absolute observations would have had much to commend it.

Table II, p. 9, summarises in like fashion the results of the absolute observations of H. The complete observation, as already explained, consisted of two vibration experiments with an intervening deflection experiment. The deflections being made at the unusually great distances of 42 and 56 cms., the correction factor $1+Pr^{-2}$ involving the distance r and the "distribution constant" P was *a priori* certain to be of trifling importance. A value was, however, determined for P in the usual way, combining all the deflection observations, 64 in number, which appeared satisfactory. The resulting value of P was so nearly zero that no correction was necessary.

Besides H, Table II gives the values obtained for *m*, the magnetic moment of the collimator magnet 25A reduced to 0° C. With a magnet as seasoned as 25A the magnetic moment, though not an absolute constant, shows only a small gradual loss. The fluctuations in *m* apparent in Table II in the case of observations during the same month represent in the main observational uncertainties. They represent no doubt to some small extent inaccuracies of setting the magnet or reading the verniers, but arise in the main from the natural fluctuations in H continually in progress. The approach to uniformity in the value of *m* is the best criterion usually available in judging of the quality of H observations. Any large abnormality, such as occurs for instance in the values for March 3 or July 11, 1912, justifies the rejection of the observation for base line purposes, or for the determination of P. In the case of the observations taken during December, 1911, and January, 1912, on sea ice, no deflections were made. These observations are distinguished by an asterisk and are separately discussed. As no deflections were taken, no value was obtained for *m*.

Table III, p. 11, includes the results of the absolute dip observations. There was internal evidence that the observation on February 23, 1911, with needle No. 2 was not satisfactory and it was rejected, the result from No. 8 being alone employed for the base value calculation. In general, the agreement between the results obtained with the two needles is eminently satisfactory. The behaviour, however, of needle No. 8, which was subsequently discarded, appeared somewhat doubtful during the two later observations of June, 1912, and use was made only of the results from the other needle. As in the case of D and H, observations were taken on sea ice during December, 1911, and January, 1912. These are marked with an asterisk, the values are obviously in excess of those at the base station.

Section 4.—In view of the special uncertainties encountered in the curve base line values it seemed worth while getting out the monthly mean values as derived directly from the absolute observations. These are given in Table IV, p. 15. The first three columns give the mean values of D, H and I as obtained directly from the entries in Tables I, II and III, without making any allowance for the fluctuations in the hour of observation already alluded to. The few observations deemed faulty were of course omitted. The last three columns give the same results as modified by a correction intended to reduce them to the mean value for the day. This correction was not derived from measurement of the curves at the actual times of observation, but from the mean diurnal inequality for all days of the month. It would be absolutely accurate only if the days of absolute observation were exactly average days. This is the less likely to be the case the fewer the days of observation during the month.

The reason for confining the first set of mean values at the foot of Table IV to the 20 months, March, 1911, to October, 1912, was that the results for November, 1912, were incomplete, so that its omission was desirable. This entailed the omission of February, 1911, if the mean epoch were to coincide with January 1, 1912, as was obviously expedient. The absolute observations in February, 1911, were few and to some extent preliminary, so that the omission of that month was hardly a loss.

The main object of Table IV is to aid in the elucidation of two questions, the existence of a decided annual inequality, and the nature of the secular change. These objects were both promoted by the grouping of the months adopted in the last five lines of the table. By midwinter is meant the four months May to August, and by midsummer the four months November and December, 1911, with January and February, 1912. Equinox includes the four months March, April, September and October. Further discussion of the results of Table IV may conveniently be deferred until we are in a position to deal with the corresponding results derived from the curve measurements.

Table I.—Absolute Observations of Declination (D).

Date.	From.	To.	Mean Time.	Declination (East of South).
1911.	h. m.	h. m.	h. m.	° ′
February 17 ...	16 9	16 24	16 16	25 17·0
„ 23 ...	16 0	16 14	16 7	24 22·6
March 3 ...	16 42	16 55	16 48	25 20·4
„ 9 ...	16 19	16 35	16 27	25 24·2
„ 20 ...	15 57	16 11	16 4	25 14·9
„ 24 ...	15 49	16 3	15 56	25 5·9
„ 31 ...	14 25	14 42	14 33	24 47·0
April 11 ...	13 15	13 32	13 23	24 36·0
„ 15 ...	14 53	15 10	15 1	25 8·2
„ 26 ...	18 38	18 55	18 46	25 34·5
May 4 ...	19 41	19 58	19 49	25 37·8
„ 11 ...	19 30	19 47	19 38	25 38·4
„ 20 ...	19 31	19 48	19 39	25 41·4
„ 26 ...	18 46	19 3	18 54	25 28·9
June 3 ...	18 20	18 32	18 26	25 21·2
„ 9 ...	19 38	19 52	19 45	25 11·1
„ 16 ...	18 42	18 58	18 50	25 11·1
„ 21 ...	19 17	19 31	19 24	25 10·3
„ 29 ...	19 1	19 13	19 7	25 33·5
July 6 ...	18 43	18 53	18 48	25 9·4
„ 17 ...	18 57	19 7	19 2	25 9·9
„ 24 ...	18 48	18 58	18 53	25 33·8
„ 27 ...	19 7	19 17	19 12	25 6·0
August 5 ...	18 35	18 45	18 40	25 17·0
„ 12 ...	19 5	19 15	19 10	25 32·3
„ 18 ...	18 44	18 54	18 49	25 31·3
„ 28 ...	15 17	15 27	15 22	25 13·0
September 1	16 36	16 46	16 41	25 50·8
„ 9	17 8	17 18	17 13	25 30·7
„ 16	16 30	16 44	16 37	25 45·1
„ 23	16 6	16 18	16 12	25 9·1
October 4 ...	18 24	18 34	18 29	25 21·4
„ 12 ...	17 51	18 1	17 56	25 16·7
„ 20 ...	18 48	18 58	18 53	25 45·8
„ 28 ...	18 32	18 42	18 37	25 3·7
November 3...	18 22	18 32	18 27	25 24·9
„ 11...	18 9	18 19	18 14	25 47·0
„ 18...	18 9	18 19	18 14	25 55·6
„ 24...	18 6	18 16	18 11	25 33·0
1911.	h. m.	h. m.	h. m.	° ′
December 2	17 45	17 55	17 50	24 56·8
„ 9	18 25	18 35	18 30	25 26·8
„ 18	17 58	18 8	18 3	25 55·6
„ 23	18 33	18 43	18 38	25 1·1
„ 27	17 16	17 22	17 19	26 12·5*
„ 29	17 53	18 3	17 58	25 32·1
1912.				
January 2 ...	16 44	16 54	16 49	25 59·1*
„ 5 ...	18 5	18 15	18 10	25 49·3
„ 11 ...	15 24	15 34	15 29	24 20·2*
„ 12 ...	17 53	18 3	17 58	25 8·8
„ 16 ...	15 48	15 58	15 53	25 32·2*
„ 22 ...	17 32	17 42	17 37	25 11·0
„ 23 ...	16 20	16 30	16 25	25 34·3*
„ 23 ...	17 36	17 46	17 41	24 45·1*
„ 30 ...	18 10	18 20	18 15	25 28·9
February 5 ...	18 0	18 10	18 5	25 20·3
„ 12 ...	16 29	16 41	16 35	24 52·7
„ 24 ...	17 58	18 8	18 3	26 31·5
March 3 ...	17 22	17 32	17 27	25 16·0
„ 7 ...	15 47	15 57	15 52	25 29·4
„ 18 ...	16 19	16 29	16 24	25 21·0
„ 24 ...	16 0	16 12	16 6	25 22·8
April 2 ...	16 23	16 33	16 28	25 8·9
May 7 ...	17 8	17 20	17 14	25 5·7
„ 16 ...	16 37	16 47	16 42	25 11·6
„ 21 ...	16 57	17 7	17 2	25 9·3
„ 29 ...	16 40	16 50	16 45	25 29·6
June 6 ...	16 45	16 55	16 50	25 2·1
„ 19 ...	17 38	17 48	17 43	25 24·6
„ 28 ...	16 56	17 6	17 1	25 42·3
July 11 ...	13 45	13 55	13 50	24 45·1
„ 21 ...	16 48	16 58	16 53	25 0·8
August 9 ...	17 10	17 20	17 15	24 59·9
„ 24 ...	17 2	17 12	17 7	25 28·8
September 7	16 31	16 44	16 37	25 4·9
„ 24	16 3	16 15	16 9	24 28·7
October 7 ...	16 14	16 26	16 20	25 42·4
	18 11	18 23	18 17	25 49·9
November 9 ...	18 15	18 25	18 20	25 38·1

* Observation taken on sea ice.

TABLE II.—Absolute Observations of Horizontal Force (H).

Date.	First Vibration.	Deflection.	Second Vibration.	H.	m.
1911.	h. m. to h. m.	h. m. to h. m.	h. m. to h. m.	γ	
February 17	17 3 17 16	18 15 18 49	—	4289	967·1
" 23	16 40 16 53	17 25 18 10	—	4275	961·5
March 3	17 25 17 37	18 30 19 2	—	4247	957·1
" 9	17 16 17 30	18 15 18 48	—	4247	962·6
" 20	16 44 16 58	17 17 17 49	18 0 18 14	4317	959·1
" 24	16 35 16 48	17 10 17 44	17 53 18 7	4231	960·5
" 31	15 22 15 35	15 57 16 35	16 47 17 0	4270	959·6
April 11	14 5 14 17	15 21 16 0	16 13 16 26	4207	958·7
" 15	12 57 13 9	13 35 14 5	14 16 14 29	4213	959·1
" 26	16 29 16 42	17 15 17 45	18 6 18 20	4246	957·6
May 4	17 41 17 55	18 12 18 53	19 7 19 21	4214	958·5
" 11	17 27 17 39	18 2 18 43	18 57 19 10	4197	958·8
" 20	17 10 17 23	17 45 18 28	18 52 19 6	4195	963·4
" 26	16 45 16 57	17 23 18 5	18 14 18 27	4207	958·7
June 3	16 27 16 39	16 56 17 33	17 45 17 58	4239	959·8
" 9	17 42 17 55	18 11 18 48	19 0 19 12	4225	959·7
" 16	16 44 16 57	17 13 17 48	18 2 18 15	4227	957·0
" 21	17 13 17 25	17 48 18 25	18 40 18 52	4238	959·8
" 29	16 56 17 9	17 23 18 0	18 15 18 28	4238	959·5
July 6	16 45 16 58	17 17 17 50	18 1 18 14	4226	958·4
" 17	16 56 17 8	17 25 18 0	18 12 18 25	4239	955·9
" 24	16 49 17 2	17 19 17 53	18 8 18 21	4223	957·9
" 27	16 56 17 10	17 32 18 7	18 20 18 33	4224	957·7
August 5	16 43 16 55	17 11 17 46	17 58 18 11	4227	957·0
" 12	17 4 17 16	17 34 18 11	18 22 18 35	4229	958·1
" 18	16 53 17 6	17 27 18 1	18 11 18 24	4233	957·3
" 28	16 9 16 21	16 57 17 30	17 43 17 56	4284	959·9
September 1	14 51 15 4	15 16 15 50	16 0 16 12	4265	954·9
" 9	14 59 15 12	15 36 16 9	16 21 16 33	4246	957·9
" 16	14 29 14 43	15 1 15 43	15 57 16 12	4302	950·8
" 23	14 15 14 27	14 47 15 15	15 30 15 43	4295	955·3
October 4	16 29 16 41	17 0 17 34	17 46 17 58	4261	954·6
" 12	16 16 16 29	16 44 17 10	17 19 17 32	4226	957·9
" 20	17 11 17 24	17 40 18 12	18 20 18 34	4262	957·5
" 28	16 38 16 51	17 6 17 36	17 47 18 0	4261	957·3
November 3	16 49 17 2	17 46	16 54 18 7	4302	958·0
" 11	16 34 16 46	17 4 17 28	17 41 17 54	4269	955·7
" 18	16 24 16 37	16 51 17 19	17 28 17 40	4266	956·2
" 24	16 30 16 43	17 0 17 27	17 38 17 51	4283	957·0
December 2	16 13 16 26	16 34 17 5	17 14 17 27	4272	958·6
" 9	16 45 16 58	17 12 17 46	17 55 18 8	4269	957·9
" 18	16 17 16 30	16 45 17 10	17 21 17 33	4280	958·6
" 23	16 43 16 56	17 10 17 35	18 2 18 15	4311	957·9
" 27	16 27 16 41	—	16 46 17 0	4115*	—
" 29	16 15 16 28	17 9	17 18 17 31	4288	956·5

* Observation on sea ice.

TABLE II.—*Continued.*

Date.	First Vibration.		Deflection.		Second Vibration.		H.	*m.*
1912.	h. m.	to h. m.	h. m.	to h. m.	h. m.	to h. m.	γ	
January 2	17 33	17 45	—		17 50	18 3	4081*	—
,, 5	16 30	16 43		17 27	17 37	17 50	4287	952·6
,, 11	16 4	16 18	—		16 27	16 40	4124*	—
,, 12	16 17	16 30	16 42	17 12	17 20	17 33	4355	958·3
,, 16	16 33	16 46	—		16 48	17 1	4104*	—
,, 22	15 52	16 4	16 15	16 45	16 58	17 11	4325	956·6
,, 23	16 59	17 12	—		17 16	17 28	4135*	—
,, 30	16 30	16 42	16 57	17 27	17 38	17 50	4305	954·9
February 5	16 18	16 30	16 45	17 15	17 24	17 36	4281	958·4
,, 12	14 0	14 13	14 40	15 15	15 50	16 7	4261	958·3
,, 24	16 20	16 32	16 44		17 23	17 35	4309	954·5
March 3...	15 7	15 22	15 50	16 21	16 45	17 0	4159 ?	983·4 ?
,, 7...	13 10	13 23	14 25	14 54	15 16	15 30	4308	951·5
,, 18...	14 6	14 19	14 52	15 22	15 41	15 55	4242	958·5
,, 24...	14 5	14 19	14 39	15 8	15 30	15 44	4260	957·7
April 2	14 17	14 29	14 51	15 21	15 42	15 55	4247	957·2
May 7	14 49	15 2	15 34	16 7	16 29	16 42	4239	955·5
,, 16	14 31	14 44	15 11	15 41	16 2	16 15	4260	959·2
,, 21	14 27	14 39	15 4	15 35	16 19	16 32	4269	957·8
,, 29	14 20	14 34	14 58		15 56	16 9	4257	956·3
June 6	14 25	14 38	15 0	15 29	16 6	16 19	4257	958·3
,, 19	15 4	15 19	15 55	16 25	17 3	17 17	4243	956·1
,, 28	14 33	14 49	15 17	15 47	16 24	16 38	4260	955·5
July 11	12 4	12 17	12 38	13 14	14 49	15 2	4361 ?	933·9 ?
,, 21	14 33	14 47	15 17	15 43	16 13	16 26	4258	956·0
August 9	14 27	14 39	15 23	15 57	16 35	16 48	4274	956·1
,, 24	14 41	14 54	15 28	15 53	16 33	16 47	4277	956·8
September 7	13 57	14 10	14 28	14 59	15 44	15 57	4268	956·7
,, 24	14 7	14 20		15 6	15 36	15 48	4395 ?	963·3 ?
October 7	14 8	14 21	14 45	15 9	15 45	15 58	4286	957·3
November 2	15 0	15 14	16 0	16 45	16 54	17 9	4329	953·3

* Observation on sea ice.

Table III.—Absolute Observations of Inclination (I).

Date.	Needle No.	Time.	Mean Time.	Inclination from Single Needles.	Mean from Two Needles.
1911.		h. m. to h. m.	h. m.	° ′	° ′ ″
February 17	8	14 45 15 14	15 0	86 30·15	86 29 43
„ 17	2	15 19 15 46	15 32	86 29·28	
„ 23	8	14 19 15 27	14 53	86 21·68	—
„ 23	2	14 39 15 10	14 55	86 12·81 ?	
March 3	8	14 58 15 58	15 28	86 29·44	86 28 3
„ 3	2	15 12 15 44	15 28	86 26·65	
„ 9	8	15 4 15 39	15 22	86 26·56	86 26 59
„ 9	5	14 45 15 54	15 20	86 27·40	
„ 20	8	14 30 15 39	15 5	86 23·75	86 23 42
„ 20	5	14 49 15 26	15 7	86 23·66	
„ 24	8	14 43 15 11	14 57	86 21·65	86 21 40
„ 24	5	14 26 15 25	14 55	86 21·68	
„ 31	8	13 13 13 51	13 32	86 26·66	86 27 2
„ 31	5	13 2 14 5	13 34	86 27·40	
April 11	8	12 15 12 44	12 30	86 25·22	86 26 23
„ 11	5	12 0 12 55	12 28	86 27·55	
„ 15	8	11 57 12 23	12 10	86 28·56	86 28 26
„ 15	5	11 46 12 34	12 10	86 28·32	
„ 26	8	15 26 15 48	15 37	86 26·25	86 27 10
„ 26	5	15 8 15 59	15 33	86 28·09	
May 4	8	16 26 16 59	16 43	86 27·25	86 26 47
„ 4	5	16 7 17 15	16 41	86 26·31	
„ 11	8	16 6 16 38	16 22	86 28·06	86 27 39
„ 11	5	15 50 16 54	16 22	86 27·25	
„ 20	8	15 58 16 25	16 12	86 26·94	86 27 0
„ 20	5	15 38 16 38	16 8	86 27·06	
„ 26	8	— —	—	86 28·34	86 28 5
„ 26	5	15 25 16 18	15 52	86 27·81	
June 3	8	15 14 15 46	15 30	86 27·32	86 26 11
„ 3	5	15 2 15 58	15 30	86 25·06	
„ 9	8	16 28 16 53	16 40	86 26·34	86 26 43
„ 9	5	16 20 17 1	16 40	86 27·10	
„ 16	8	15 31 15 58	15 45	86 27·25	86 27 4
„ 16	5	15 20 16 9	15 45	86 26·87	
„ 21	8	15 55 16 25	16 10	86 26·40	86 27 1
„ 21	5	15 41 16 37	16 9	86 27·62	
„ 29	8	15 46 16 10	15 58	86 24·72	86 25 11
„ 29	5	15 37 16 22	16 0	86 25·66	

TABLE III.—*Continued.*

Date.	Needle No.	Time.		Mean Time.	Inclination from Single Needles.	Mean from Two Needles.
1911.		h. m.	to h. m.	h. m.	° ′	° ′ ″
July 6	8	15 32	16 0	15 46	86 27·27	86 27 13
,, 6	5	15 21	16 12	15 46	86 27·15	
,, 17	8	15 46	16 15	16 0	86 26·78	86 26 49
,, 17	5	15 36	16 25	16 0	86 26·84	
,, 24	8	15 35	16 2	15 49	86 29·00	86 29 12
,, 24	5	15 26	16 12	15 49	86 29·40	
,, 27	8	15 41			86 27·66	86 27 3
,, 27	5	15 28	16 18	15 53	86 26·44	
August 5	8	15 39	16 4	15 52	86 26·37	86 26 34
,, 5	5	15 27	16 12	15 50	86 26·75	
,, 12	8 ?	15 58	16 20	16 9	86 26·78	86 26 41
,, 12	5 ?	15 48	16 31	16 9	86 26·59	
,, 18	8 ?	15 49	16 12	16 0	86 26·22	86 26 26
,, 18	5 ?	15 39	16 21	16 0	86 26·66	
September 1...	8	13 39	14 3	13 51	86 26·50	86 27 7
,, 1...	5	13 27	14 18	13 53	86 27·72	
,, 9...	8	13 40	14 9	13 55	86 25·78	86 26 9
,, 9...	5	13 30	14 19	13 55	86 26·53	
,, 16...	8	13 0	13 48	13 24	86 25·78	86 25 33
,, 16...	5	13 12	13 35	13 24	86 25·32	
,, 23...	8	12 53	13 16	13 4	86 24·87	86 25 37
,, 23...	5	12 38	13 26	13 2	86 26·37	
October 4	8	15 9	15 37	15 23	86 25·16	86 25 33
,, 4	5	14 57	15 49	15 23	86 25·94	
,, 12	8	14 54	15 22	15 8	86 25·54	86 26 7
,, 12	5	14 43	15 35	15 9	86 26·69	
,, 20	8	15 59	16 25	16 12	86 24·72	86 25 19
,, 20	5	15 46	16 36	16 11	86 25·90	
,, 28	8	15 25	15 55	15 40	86 24·44	86 24 28
,, 28	5	15 14	16 7	15 40	86 24·50	
November 3	8	15 38	16 4	15 51	86 19·28	86 19 47
,, 3	5	15 26	16 15	15 51	86 20·28	
,, 11	8	15 19	15 48	15 34	86 25·04	86 24 59
,, 11	5	15 8	15 59	15 34	86 24·94	
,, 18	8	14 53	15 47	15 20	86 26·18	86 25 57
,, 18	5	15 6	15 35	15 20	86 25·72	
,, 24	8 ?	15 21	15 47	15 34	86 21·94	86 22 29
,, 24	5 ?	15 10	15 57	15 34	86 23·03	
December 2	8	14 54	15 20	15 7	86 24·12	86 24 9
,, 2	5	14 40	15 33	15 7	86 24·19	
,, 9	8	15 29	15 56	15 43	86 24·81	86 24 53
,, 9	5	15 17	16 9	15 43	86 24·97	

Table III.—*Continued.*

Date.	Needle No.	Time. h. m.	to h. m.	Mean Time. h. m.	Inclination from Single Needles. ° ′	Mean from Two Needles. ° ′ ″
1911.						
December 18	8	15 3	15 33	15 18	86 21·72	86 22 37
„ 18	5	14 53	15 45	15 19	86 23·53	
„ 23	8	15 12	15 39	15 26	86 24·06	86 24 13
„ 23	5	15 1	15 51	15 26	86 24·38	
„ 27	8	14 55	15 25	15 10	86 30·18	86 30 1*
„ 27	5	14 38	15 37	15 8	86 29·84	
„ 29	8 ?	15 12	15 34	15 23	86 25·18	86 25 43
„ 29	5 ?	15 0	15 44	15 22	86 26·25	
1912.						
January 2	8 ?	15 44	16 9	15 57	86 35·81	86 35 43*
„ 2	5 ?	15 32	16 19	15 55	86 35·62	
„ 5	8	15 19	15 44	15 32	86 22·54	86 22 20
„ 5	5	14 55	15 56	15 26	86 22·15	
„ 11	8	14 23	14 47	14 35	86 34·10	86 34 13*
„ 11	5	14 12	14 58	14 35	86 34·35	
„ 12	8	15 5	15 30	15 18	86 21·06	86 21 24
„ 12	5	14 55	15 40	15 18	86 21·75	
„ 16	8 ?	14 51	15 15	15 3	86 33·60	86 33 10*
„ 16	5 ?	14 38	15 27	15 3	86 32·75	
„ 22	8	14 44	15 8	14 56	86 23·03	86 23 18
„ 22	5	14 32	15 18	14 55	86 23·56	
„ 23	8	15 24	15 48	15 36	86 32·32	86 32 55*
„ 23	5	15 12	16 1	15 36	86 33·50	
„ 30	8	15 25	15 48	15 36	86 23·62	86 23 30
„ 30	5	15 15	15 56	15 36	86 23·38	
February 5	8	15 15		—	86 24·28	86 24 19
„ 5	5	15 5	15 49	15 27	86 24·34	
„ 12	8		12 57	—	86 26·60	86 26 33
„ 12	5	12 15	13 9	12 42	86 26·50	
„ 24	8	15 9	15 35	15 22	86 23·75	86 23 57
„ 24	5	15 0	15 45	15 22	86 24·16	
March 3	8	13 28	14 0	13 44	86 21·88	
„ 3	5	13 15	14 15	13 45	86 26·75	
„ 7	8	11 54	12 35	12 15	86 26·19	86 26 17
„ 7	2	12 0	12 26	12 13	86 26·37	
„ 15	8	12 33	13 21	12 57	86 24·81	86 25 35
„ 15	2	12 46	13 8	12 57	86 26·34	
„ 18	8	12 22	13 7	12 44	86 26·56	86 26 31
„ 18	2	12 38	12 58	12 48	86 26·46	
„ 24	8	12 17	13 4	12 41	86 24·97	86 25 22
„ 24	2	12 28	12 54	12 41	86 25·75	
April 2	8	12 46	13 10	12 58	86 24·68	86 24 41
„ 2	2	12 31	13 18	12 54	86 24·69	

* Observation on sea ice.

Table III.—*Continued.*

Date.	Needle No.	Time.	Mean Time.	Inclination from Single Needles.	Mean from Two Needles.
1912.		h. m. to h. m.	h. m.	° ′	° ′ ″
May 7	8	13 28 13 49	13 39	86 25·24	86 25 32
„ 7	2	13 12 13 59	13 35	86 25·84	
„ 16	8	12 51 13 19	13 5	86 24·81	86 25 51
„ 16	2	12 35 13 29	13 2	86 26·90	
„ 21	8	12 35 13 21	12 58	86 24·44	86 25 8
„ 21	2	12 47 13 13	13 0	86 25·82	
„ 29	8	12 46 13 7	12 56	86 24·38	86 25 17
„ 29	2	12 35 13 16	12 56	86 26·18	
June 6	8	12 50 13 30	13 10	86 25·90	86 26 5
„ 6	2	13 0 13 20	13 10	86 26·25	
„ 19	8	13 25 14 7	13 46	86 24·09 ?	
„ 19	2	13 35 13 57	13 46	86 25·69	
„ 28	8	12 58 13 21	13 9	86 24·41 ?	
„ 28	2	12 34 13 29	13 1	86 26·21	
July 11	1	16 30 16 55	16 42	86 25·62	86 25 25
„ 11	2	16 19 17 5	16 42	86 25·22	
„ 21	1	12 54 13 35	13 15	86 25·88	86 26 8
„ 21	2	13 4 13 27	13 15	86 26·38	
August 9	1	12 36 13 21	12 58	86 25·47	86 25 40
„ 9	2	13 13		86 25·88	
„ 24	1	12 46 13 10	12 58	86 24·03	
„ 24	2	12 30 13 19	12 54	86 21·53 ?	
September 7...	1	12 20 12 39	12 30	86 25·25	86 24 46
„ 7...	2	12 8 12 48	12 28	86 24·28	
„ 24...	1	12 4 12 40	12 22	86 22·78	86 22 35
„ 24...	2	12 13 12 31	12 22	86 22·40	
October 7	1	12 12 12 32	12 22	86 23·69	86 23 21
„ 7	2	12 1 12 40	12 20	86 23·00	
„ 31	1	14 35 15 15	14 55	86 22·59	86 23 13
„ 31	2	15 20 15 50	15 35	86 23·82	
November 2	1	12 15 12 45	12 30	86 26·00	86 24 31
„ 2	2	12 49 13 11	13 0	86 23·03	
„ 9	1	11 6 11 33	11 20	86 26·68	86 25 55
„ 9	2	11 36 11 58	11 47	86 25·16	

Table IV.—Mean Monthly Values from Absolute Observations.

Month or Season.	Absolute Observations Uncorrected.			Absolute Observations Corrected.		
	D.	H.	I.	D.	H.	I.
1911.	° ′	γ	° ′	° ′	γ	° ′
February	24 49·8	4282	86 25·7	24 52·3	4221	86 29·2
March	25 10·5	4262	86 25·5	25 16·3	4210	86 27·6
April	25 6·2	4222	86 27·3	25 16·2	4190	86 27·9
May	25 36·6	4203	86 27·4	25 13·4	4177	86 28·5
June	25 17·4	4233	86 26·4	24 55·5	4213	86 27·4
July	25 14·8	4228	86 27·6	24 53·1	4202	86 28·9
August	25 23·4	4243	86 26·6	25 7·9	4221	86 27·5
September	25 33·9	4277	86 26·1	25 24·7	4253	86 26·7
October	25 21·9	4253	86 25·4	24 55·3	4216	86 27·0
November	25 40·1	4280	86 23·3	25 8·8	4234	86 25·7
December	25 22·5	4284	86 24·3	25 6·8	4241	86 26·0
1912.						
January	25 24·5	4318	86 22·6	25 6·1	4270	86 24·7
February	25 34·8	4284	86 24·9	25 25·4	4242	86 26·5
March	25 22·3	4270	86 25·4	25 17·3	4251	86 25·8
April	25 8·9	4247	86 24·7	25 5·6	4229	86 25·1
May	25 14·0	4256	86 25·5	25 6·6	4244	86 25·7
June	25 23·0	4253	86 26·0	25 18·6	4244	86 26·2
July	24 53·0	4258	86 25·8	24 56·8	4246	86 26·2
August	25 14·4	4275	86 24·8	25 5·8	4255	86 25·0
September	24 46·8	4268	86 23·7	24 43·1	4249	86 24·0
October	25 42·4	4286	86 23·3	25 32·5	4259	86 24·7
November	25 38·1	—	86 25·2	25 15·9	—	86 26·5
Mean, March, 1911–October, 1912	25 19·6	4260	86 25·3	25 8·8	4232	86 26·4
Midwinter, 1911	25 23·0	4227	86 27·0	25 2·5	4203	86 28·1
„ 1912	25 11·1	4260	86 25·5	25 6·9	4247	86 25·8
Equinox, 1911	25 18·1	4253	86 26·1	25 13·1	4217	86 27·3
„ 1912	25 15·1	4268	86 24·3	25 9·6	4247	86 24·9
Midsummer, 1911–12 ...	25 30·5	4291	86 23·8	25 11·8	4247	86 25·7

CHAPTER II.

MEASUREMENT OF CURVES. TIME USED. STANDARDISATION OF CURVES. SCALE VALUES AND BASE VALUES.

Section 5.—The number of methods proposed for measuring curves is large, and more than one is in frequent use. The most obvious and probably on the whole the most usual plan is simply to measure the ordinate of the unsmoothed curve at exact hours—which may be G.M.T., or time differing by exact hours from G.M.T., or mean local time, or the time of some meridian unrelated to Greenwich—and to ascribe the measured value to the hour in question. If we are dealing with an element but little liable to sudden changes or rapid oscillations, or if we are measuring the curves of a long period of years and have in view only the nature of the regular diurnal variation, this method is probably at once the simplest and the best. But if we are dealing with a highly variable element and want to treat of individual days or of the diurnal inequalities of individual months, this method leaves a great deal to chance. To meet this, the most obvious course is to estimate in some way the mean value of the ordinate for the 60 minutes centering at an hour. The measurement of the area bounded by the curve, the base line and the ordinates at the beginning and end of the 60 minutes is theoretically the most exact way of getting the mean ordinate. But in practice it presents difficulties when the curve shows rapid oscillations, and other methods have been generally adopted. Special scales have been made, or the curve has been smoothed by drawing a free-hand pencil trace giving its general trend. The last-mentioned method is normally the quickest, and in a skilful hand may give excellent results. But it requires much judgment, and when the curve not merely oscillates, but departs widely from the shape normally characteristic of the hour, the results tend to become arbitrary. The method actually adopted in the present case was that used in dealing with the curves of the 1901–04 Antarctic Expedition. A glass scale was constructed having parallel lines at a distance apart equivalent to 20 minutes on the time scale of the magnetograms, and the ordinates of the unsmoothed curve were read at each 20-minute interval to the nearest 0·5 mm. The value ascribed to the hour was the arithmetic mean of the three measurements taken at the exact hour and at 20 minutes before and after the hour.

Dr. Simpson had decided to use not local time but the time of the 180th meridian, 54·4 minutes in advance of local time. This was certainly convenient in connection with the term hours, which had been arranged for the taking of quick runs in connection with co-operating observatories; 8 p.m. G.M.T., for example, becoming 8 a.m. of the nominal day at the Antarctic station. But a departure of 54½ minutes from local time has obvious disadvantages, and I felt some doubt whether it might not be better to employ the time of 165° E, subtracting an hour from Dr. Simpson's times and thus getting within some $5\frac{1}{2}$ minutes of local time. Eventually, however, I decided to follow Dr. Simpson. Thus the hours appearing in the tables of hourly values, pp. 450 to 515, refer to the meridian 180° E. Hours 0 and 24 really answer to a time 54·4 minutes in advance of local midnight, and hour 12 to a time 54·4 minutes in advance of local noon, &c. As already mentioned, Dr. Simpson had introduced a method of producing a dark line right across the trace at each hour, and this was as a rule accepted as representing the exact hour. There were usually small corrections wanted to the time as shown, but making allowance for small and irregular time corrections, especially when the variation throughout the 24 hours is a sensible fraction of the whole correction, involves an amount of trouble disproportionate to the advantage reaped in the case of diurnal inequalities. When it comes to minutely comparing disturbances at different stations it is a different matter, and even small corrections when accurately known may become important.

Section 6.—Another question difficult to decide was how to present the results of the curve measurements. As already explained, the two magnetographs intended to give the variations in the N–S and E–W components were really oriented so as to give the variations of components along the two azimuths 7° 36′ East of North (or West of South), and 7° 36′ South of East (or North of West). If we call the components to nominal South and East as derived directly from the curve measurements S′ and E′, while S and E are the components to true South and East, we have

$$\left.\begin{aligned} S &= 0{\cdot}991\ S' + 0{\cdot}132\ E' \\ E &= 0{\cdot}991\ E' - 0{\cdot}132\ S' \end{aligned}\right\} \quad . \quad . \quad . \quad . \quad (1).$$

Thus it would have been possible to deduce hourly values of S and E from the measured values of S′ and E′, and to have given these in the tables of results in the present volume. In not adopting this course I may not have the approval of all physicists. The principal reasons for showing the hourly values of S′ and E′, rather than those of S and E, were: 1. Anyone anxious to get the values of S and E at any particular hour can readily derive them by means of equations (1); 2. Force magnetographs—especially those like the Eschenhagen of light construction—are subject to change of scale values, and the scale value is sometimes not as uniform across the full width of the sheet as is desirable. The Antarctic instrument recording E′, according to the scale value determinations, retained from start to finish a scale value which was practically constant. But the other, recording S′, in the earlier part of its career showed a considerable change, and the scale value determinations did not show the development of the change as clearly as might be desired. Error in the accepted scale value of the S′ instrument does not affect the type but only the amplitude of the diurnal variation in S′, as it leaves the relative values of the hourly measurements unaltered; but it obviously will affect relatively as well as absolutely the hourly values calculated for S and E; 3. Even supposing absolutely accurate knowledge of the scale values of both instruments, it would have been an extremely arduous, hardly, in fact, a possible operation to determine the daily maximum and minimum values of S and E and the times of their occurrence.

The absolute range of an element, as derived from the two extreme values of the day, may not be an exact measure of any definite physical quantity, but it undoubtedly serves in the great majority of cases to give a good general idea of the character of the day as quiet or disturbed. Theoretically a small range might go with a great amount of disturbance, the disturbing forces tending to reduce the natural maximum and exalt the natural minimum, or else merely producing numerous oscillations of small amplitude. This is, however, rarely if ever the actual case. We practically never get an exceptionally small range on a day that is disturbed, or an exceptionally large range on a wholly quiet day. Occasionally, it is true, we get a large range on a day the greater part of which is quiet, the disturbance being confined to a few hours. If the days of a month were classified solely by regard to the ranges of the elements, the days might not come exactly in the order they would occupy if an exact numerical measure of disturbance were possible ; but at all events the days near the top of the list would one and all be much more disturbed than the average day, and the converse would be true of the days near the foot of the list. Again the relative size of the mean absolute daily range for a month and the range of the corresponding diurnal inequality affords a very good idea of the greater or less prevalence of irregular disturbing forces. Influenced by these considerations, it was decided that the fundamental tables should give the hourly values and daily maximum and minimum values of S′ and E′, that the diurnal inequalities of S′ and E′ should be got out in the first place, and that the diurnal inequalities of S and E should be derived from these equally with the diurnal nequalities of D (declination) and H (horizontal force).

Section 7.—A common source of trouble in force magnetographs is the necessity for a temperature correction. This was a grave difficulty in the case of the vertical force magnetograph in 1901–04. Temperature in the Antarctic has large and rapid fluctuations, and when a magnetograph with a large temperature coefficient is exposed to such changes not merely are the temperature corrections large, but they are apt to be uncertain, because we are obliged to assume that the temperature recorded by the thermograph is that of the magnet and of whatever else contributes to the temperature coefficient. In 1911–12, though the instruments were the same, the difficulty practically did not exist. The position of the magnetograph was such that in spite of the rapid external changes of temperature the thermograph trace seldom departed sensibly from a straight line. The only occasions when the trace was sensibly curved were when ice had to be removed from some part of the instrument by applying heat, or when other special work called for the continued proximity of the observers. On these occasions there was always some unavoidable loss of trace, and it thus seemed the best course to disregard the record for a short additional time until the disturbing effect on the temperature had ceased to be of importance. The temperature in the cavern had a considerable seasonal variation. Such slow changes, however, hardly call for any direct application of temperature corrections, as they are provided for by the changes in the base line values derived from the absolute observations. Accordingly no temperature corrections have been applied. This may introduce some slight additional uncertainty into questions such as the relation between the mean values of the elements on different days of the same month. But under the disturbed conditions natural to the Antarctic it would, I suspect, require a much larger number of absolute observations than were actually taken —considerable though the number was—and a much more elaborate system of curve measurements than that adopted, to enable mean daily values of the elements to be determined with the accuracy now aimed at in the best European and American observatories.

Though the external changes of temperature in the Antarctic are exceptionally large and sudden, the range of the regular diurnal variation of temperature is exceptionally small throughout the year. In the cavern *a priori* reasons alone, quite apart from the positive evidence of the thermograph, would have justified the conclusion that any regular diurnal variation of temperature must have been very small indeed. Thus we have every reason to believe that none of the diurnal inequalities obtained for the magnetic elements have suffered sensibly from the non-application of temperature corrections.

Section 8.—The method of determining the scale values will best be understood by reference to Fig. 2, which shows diagrammatically the relative positions of the drum and

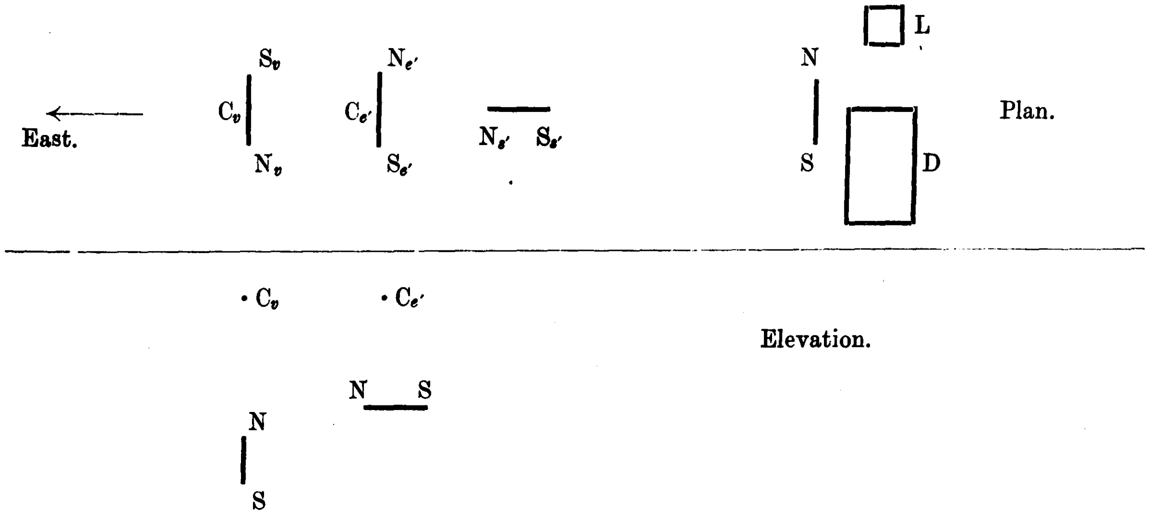


FIG. 2.—Scale Value Determinations.

lamp and the several magnets. The recording part, including the drum and lamp, was on the same level as the three magnetographs. Nearest the drum came $N_{s'}$ $S_{s'}$, the magnet intended to register the variations of the North–South component of force; this magnet should have been oriented true East and West. Next came the magnet $N_{e'}$ $S_{e'}$ intended to register the variations of the West–East component; it should have been oriented true North and South. Furthest away came the vertical force magnet N_v S_v. The centres of these magnets may be regarded as approximately in a straight line, intended to be oriented East and West and perpendicular to the axis of the drum. Owing to the mistake already mentioned, all the horizontal directions were really 7° 36′ in error. The deflections were all made with the collimator magnet 25A. The box containing the magnet was placed on each occasion in a definitely fixed position, the inversion of the magnet being effected by turning the box end for end. When deflecting $N_{s'} S_{s'}$ the collimator magnet occupied the position N S (broadside position) shown in the diagram, its axis being level with that of the deflected magnet. In this position turning the magnet box end for end altered the field surrounding $N_{s'} S_{s'}$ by $2m/r^3$, where m is the moment at the time of N S, and r the distance (100·5 cms.) between the centres of the magnets. When deflecting $N_{e'} S_{e'}$ the collimator magnet box was supported on a shelf attached to the table supporting the magnetographs, so situated that the centres of the deflecting and deflected magnets were in the same vertical line, the former being underneath the table. The deflecting magnet in this case was oriented East–West (nominal), *i.e.*, perpendicular to the deflected magnet. Turning the box end for end altered the field again by $2m/r^3$, r being, however, in this case only 65·7 cms. When deflecting $N_v S_v$ the collimator magnet was supported on a second shelf at a lower level than the first. In this case the deflecting magnet was vertical, its centre being again in the same vertical as the centre of the deflected magnet and below it. The position being the end-on position, turning the box round altered the field by $4m/r^3$, the distance r between the centres of the magnets being in this case 86·2 cms. The three distances were carefully measured after the shelves had been fixed. Owing to the greater proximity of the deflecting magnet the deflection on the trace was greatest for the instrument recording E′. The change of force due to rotation of the deflecting magnet through 180° was in this case about 680γ, the corresponding change of ordinate being some $10\frac{1}{2}$ cms. In the case of the instrument recording V the greater distance of the deflecting magnet was partly compensated by its being in the end-on instead of the broadside position ; the change of force was about 600γ and the change of ordinate about 8 cms. In the case of the instrument recording S′ not merely was the distance considerably the greatest, but the position was the broadside one. Thus the change of force produced was only about 190γ, and the change of ordinate varied according to the sensitiveness from 2·1 to 2·8 cms. Consequently, supposing the deflection measured with equal accuracy in the three cases, the probable error in the scale value deduced was even under the quietest conditions much greater for the S′ than the E′ instrument. Supposing natural disturbance in progress at the time, as was usually the case, a disturbance of given size would naturally cause about four times as large an error in the estimated scale value of the S′ instrument as in that of the E′ instrument. The results of the several scale value determinations are given in Table V.

Before discussing Table V some of the assumptions made call for comment. Taking for example the V magnetograph, it was assumed that the change of field at the position of the magnetograph magnet produced by turning the collimator magnet end for end was $4m/r^3$, r being the distance between the centres of the magnets, and m the moment of the collimator magnet as deduced from the absolute observations, after making

TABLE V.—Scale Values (equivalents in force of 1 mm. ordinate).

1911.	E′.	S′.	V.	1912.	E′.	S′.	V.
	γ	γ	γ		γ	γ	γ
March 2	6·53	8·83	7·54	January 1	6·48	6·57	7·66
April 1	6·49	8·75	7·50	February 4	6·43	6·95	7·75
July 7	6·44	8·10	7·51	„ 22	6·45	6·87	7·89
August 7	6·44	6·75	7·76	March 9	6·49	6·87	8·06
„ 21	6·45	6·65	7·59	„ 26	6·47	6·96	7·73
September 12 ...	6·43	6·66	7·70	„ 29	—	6·76	—
October 5	6·43	6·86	7·62	May 1	6·47	6·93	8·06
„ 30	6·47	6·85	7·59	„ 31	6·46	6·91	8·23
				June 7	—	6·86	—
				„ 26	6·46	6·85	7·87
				July 3	—	6·86	—
				August 2	6·42	6·85	7·81
				September 10 ...	6·46	6·89	7·78
				October 11	6·47	6·76	8·03
				„ 13	—	6·82	—

allowance for any difference of temperature. During the time spent at Cape Evans the magnetic moment of the collimator magnet fell off only about 1 per cent. Thus any error arising in connection with the value of m must have been extremely small. A second possible source of error arises in connection with the sufficiency of the formula assumed for the interaction of the two magnets. The complete expression for the magnetic force at the "poles" of the deflected magnet is $2mr^{-3}(1 + Pr^{-2} + Qr^{-4})$ where P and Q are the so-called distribution constants. The deflections of any one magnetograph magnet were all made at only one distance, so there was no direct evidence of the negligibility of the P and Q terms. Considering, however, that the distance r was in no case less than 65 cms., the error due to the neglect of the higher terms seems unlikely to have been as large as 1 per cent., and probably was a good deal less.

The apparent variations shown by Table V in the scale value of E′ are quite remarkably small, considering Antarctic conditions, and afford no evidence whatever of any real change. Accordingly, the mean value 1 mm. $= 6{\cdot}46\gamma$ was accepted as applicable to the whole period. Between April 1 and August 7, 1911, it seems clear that the scale value of the S′ curve diminished, but there is no distinct evidence of any change after the latter date. Accordingly a mean value 1 mm. $= 6{\cdot}82\gamma$ was accepted as applicable from August, 1911, to the end. The question as to exactly how and when the change of scale value in S′ came in presents difficulties. The fact that an apparent change had occurred was noticed by Dr. Simpson after the observation on August 7, and the repetition on August 21 of the deflection experiment was partly intended to make sure that no mistake had been made. He was then certain that a change had occurred, but was unable to reach any satisfactory explanation of its occurrence. After the event it is of course easy to see that more frequent scale value determinations would have been advisable in the early months. The only thing that could be done was to examine minutely the curves and the base value determinations. The apparent difference between the results on March 2 and April 1 may well be fortuitous. Thus there is no certain evidence of a change prior to April 1, but some time between April 1 and July 7 it seems pretty clear that a measurable change must have come in. Examination of the curve and base values suggested that the change most probably took place on June 5 between 14 h. and 15 h., as there then occurred a large change of ordinate almost certainly of instrumental origin. Accordingly the scale value of 1 mm. = $8 \cdot 8\gamma$ was applied from February to 14 h. on June 5, and a scale value of 1 mm. = $8 \cdot 1\gamma$ was accepted as applicable from 15 h. on June 5 to some date subsequent to July 7. During July there were several small discontinuities, and apparently at times the magnet was not moving freely. The magnet, a small flat piece of steel, moved in a very confined space between copper dampers. The damping is very good, but a slight want of level or slipping of the supporting fibre may lead to contact between the magnet and damper. The appearance of the trace on one or two occasions suggested that some obstruction of this kind existed, but between whiles the movement of the magnet was obviously free. No single curve showed a large change such as would naturally accompany an alteration of scale value from 1 mm. = $8 \cdot 1\gamma$ to 1 mm. = $6 \cdot 8\gamma$. Four base value determinations had been made in July, following five in June. But no decisive evidence was forthcoming from these, there being irregularities in the base values deduced whether $8 \cdot 1\gamma$ or $6 \cdot 8\gamma$ was accepted as the value of 1 mm. After considering the parallel changes in the absolute daily ranges in E′ and S′, it was decided to apply the value 1 mm. = $8 \cdot 1\gamma$ up to the end of July and introduce the value 1 mm. = $6 \cdot 82\gamma$ on August 1.

In the case of V the scale value found on August 7, 1911, suggests a change, but this is not confirmed by the observation on August 21. Some readjustment of the magnet took place on October 26, but judging by the determinations on October 30, 1911, and January 1, 1912, this did not alter the scale value. It is clear, however, that a rise of scale value did occur, though no intentional change was made, early in 1912. The V instrument was relevelled on January 19, 1912, and the change may have occurred then, but in the absence of any definite evidence it was assumed to have occurred at the end of January, and the mean result given by the observations from February 4 to October 11, 1912, viz. 1 mm. = $7 \cdot 92\gamma$, was accepted as holding from February 1 up to the end. Prior to this 1 mm. = $7 \cdot 61\gamma$ was accepted.

As the uncertainties just described in the S′ and V scale values may arouse misgiving, a word or two on the subject may not be amiss. As regards V, the change from $7 \cdot 61\gamma$ to $7 \cdot 92\gamma$ represents only 4 per cent. If it occurred on January 19, 1912, instead of on January 31, the only effect would be an underestimate of less than 2 per cent. in the range of the diurnal inequality for January, and an underestimate of some 4 per cent. in the absolute range on eleven individual days. Error in a scale value, be it noticed, has no effect on the type of the inequality in the element directly concerned. The times of maximum and minimum and the phase angles of the Fourier waves are not influenced. It is true, however, that the diurnal inequality of an element such as I (Inclination) which is based on more than one of the elements directly recorded is affected, as has been already pointed out in the case of E and S.

It must not be supposed that the uncertainties we have observed in the Antarctic are by any means outstanding. There are few even of the best observatories which exhibit a constancy of scale value as good as that exhibited by E′, and many show changes in the V scale value at least as troublesome as that met with in the Antarctic instrument. In fact, except in the case of D instruments, Gordian knots as to scale values have to be cut at most observatories to an extent not generally realised.

Section 9.—The determination of the base line values was a somewhat complicated process. In Fig. 3 suppose OE and OS directed towards true East and South, while

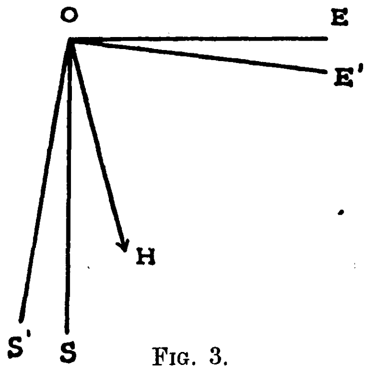


FIG. 3.

OE′ and OS′ make with them the angle 7° 36′. Then so far as the horizontal plane is concerned, the curves showed the variations in the cave in the forces E′ and S′ directed respectively along OE′ and OS′, while the absolute observations gave the absolute values in the hut of the horizontal force H and the declination D. Let us first suppose for simplicity that no magnetic difference existed between the cave and the hut. In the Antarctic H is low, and consequently the fluctuations in D during large disturbances are great. If one attempts to allow with mathematical precision for such large changes, complications come in. For one thing, any change in H implies a corresponding change in the force equivalent of a 1′ change in D. Two practical considerations, however, come in. From our general knowledge of the type of magnetograph, it is improbable that the scale value was absolutely uniform across the full width of the sheet, while the results of any absolute observation taken during a specially disturbed time would be affected by such considerable uncertainties that any attempt at great nicety in the deduction of the corresponding base line value would be labour wasted. A further consideration was that the observations did not suggest any *large* secular change.

Suppose at any time H, E′ and S′ corresponding values of the horizontal force and its components along OE′ and OS′, θ and ϕ being the inclinations of the resultant H to OS′ and OS respectively. Then we have

$$E' = H \sin\theta,\ S' = H \cos\theta \qquad . \quad . \quad . \quad . \qquad (2).$$

Corresponding small changes $\varDelta H$, $\varDelta\theta$, $\varDelta E'$ and $\varDelta S'$ are connected by the equations

$$\left.\begin{aligned} \varDelta E' &= \varDelta H \sin\theta + H\varDelta\theta \cos\theta, \\ \varDelta S' &= \varDelta H \cos\theta - H\varDelta\theta \sin\theta, \\ \varDelta H &= \varDelta E' \sin\theta + \varDelta S' \cos\theta, \\ H\varDelta\theta &= \varDelta E' \cos\theta - \varDelta S' \sin\theta. \end{aligned}\right\} \quad . \quad . \quad . \quad . \qquad (3).$$

If H and θ represent certain standard values, E′ and S′ will represent corresponding standard values, and ΔH, $\Delta\theta$, ΔE′ and ΔS′ will represent any not too large corresponding departures from these standard values.

The standard values accepted were

$$\overline{\mathrm{H}} = 4260\gamma\ ;\ \ \overline{\phi} = 25^\circ\ 20', \text{ and hence } \overline{\theta} = 32^\circ\ 56'\ ;$$

these being very nearly the mean values given by all the absolute observations when combined. Corresponding to these we have

$$\overline{\mathrm{E}}' = 2316\gamma,\ \overline{\mathrm{S}}' = 3575\gamma.$$

As $\theta - \phi$ is constant, and so $\Delta\theta = \Delta\phi$, we have supposing $\phi - \overline{\phi}$ in circular measure,

$$\left.\begin{aligned} \mathrm{E}' &= 2316\gamma + \sin\theta\,(\mathrm{H} - \overline{\mathrm{H}}) + \overline{\mathrm{H}}\cos\theta\,(\phi - \overline{\phi}), \\ \mathrm{S}' &= 3575\gamma + \cos\theta\,(\mathrm{H} - \overline{\mathrm{H}}) - \overline{\mathrm{H}}\sin\theta\,(\phi - \overline{\phi}). \end{aligned}\right\} \quad . \quad . \quad (4).$$

If at the time to which the above equations refer e and s are the ordinates of the E′ and S′ curves, E_o and S_o the base line values, and c_e, c_s the respective scale values, then

$$\mathrm{E}' = \mathrm{E}_o + ec_e,\quad \mathrm{S}' = \mathrm{S}_o + sc_s.$$

Consider now the ordinary H observation as taken in the Antarctic, consisting of a vibration experiment during which the mean values of the E′ and S′ ordinates are e_1 and s_1, a deflection experiment during which the mean values of the ordinates are e_2 and s_2, and finally a vibration experiment with mean ordinates e_3 and s_3. Then the appropriate mean values of the ordinates are

$$e = \tfrac{1}{4}\,(e_1 + 2e_2 + e_3)\ ;\ \ s = \tfrac{1}{4}\,(s_1 + 2s_2 + s_3).$$

Suppose similarly e' and s' to be the mean ordinates during the declination observation on the same day. Then we have

$$\begin{aligned} \mathrm{E}_o + ec_e &= 2316\gamma + \sin\theta\,(\mathrm{H} - \overline{\mathrm{H}}) + \overline{\mathrm{H}}\cos\theta\,(\phi - \overline{\phi}), \\ \mathrm{E}_o + e'c_e &= 2316\gamma + \sin\theta\,(\mathrm{H}' - \overline{\mathrm{H}}) + \overline{\mathrm{H}}\cos\theta\,(\phi' - \overline{\phi}). \end{aligned}$$

Adding, and dividing by 2, we find

$$\mathrm{E}_o + \tfrac{1}{2}c_e\,(e+e') = 2316\gamma + \sin\theta\,\{\mathrm{H} - \overline{\mathrm{H}} - \tfrac{1}{2}\,(\mathrm{H} - \mathrm{H}')\} + \overline{\mathrm{H}}\cos\theta\,\{\phi' - \overline{\phi} + \tfrac{1}{2}(\phi - \phi')\}.$$

What the absolute observations give directly is H and ϕ', while H − H′ and $\phi - \phi'$ are derived from the curve measurements and the relations

$$\begin{aligned} \mathrm{H} - \mathrm{H}' &= \sin\theta\ c_e\,(e - e') + \cos\theta\ c_s\,(s - s'), \\ \overline{\mathrm{H}}\,(\phi - \phi') &= \cos\theta\ c_e\,(e - e') - \sin\theta\ c_s\,(s - s'). \end{aligned}$$

Eventually we get

$$\begin{aligned} \mathrm{E}_o = 2316\gamma + \sin\theta\ (\mathrm{H} - \overline{\mathrm{H}}) + \cos\theta\ \overline{\mathrm{H}}\ (\phi' - \overline{\phi}) - \tfrac{1}{2}c_e\,(e + e') \\ + \tfrac{1}{2}\cos 2\theta\,.\,c_e\,(e - e') - \tfrac{1}{2}\sin 2\theta\,.\,c_s\,(s - s') \quad . \quad (5), \end{aligned}$$

and similarly we find

$$\begin{aligned} \mathrm{S}_o = 3575\gamma + \cos\theta\ (\mathrm{H} - \overline{\mathrm{H}}) - \sin\theta\ \overline{\mathrm{H}}\ (\phi' - \overline{\phi}) - \tfrac{1}{2}\ c_s\,(s + s') \\ - \tfrac{1}{2}\sin 2\theta\,.\,c_e\,(e - e') - \tfrac{1}{2}\cos 2\theta\,.\,c_s\,(s - s') \quad . \quad (6). \end{aligned}$$

Taking $32° 56'$ for θ, and 4260γ for $\overline{\mathrm{H}}$, we have

$$\sin\theta = \cdot 544,\ \cos\theta = \cdot 839,\ \sin 2\theta = \cdot 913,\ \cos 2\theta = \cdot 409,$$
$$\overline{\mathrm{H}}\ \sin\theta = \cdot 674\,(180 \times 60/\pi),\ \overline{\mathrm{H}}\ \cos\theta = 1 \cdot 040\,(180 \times 60/\pi).$$

Subsequent to July, 1911, when c_e and c_s had the respective constant values $6 \cdot 46\gamma$ and $6 \cdot 82\gamma$, the working equations were with $(\phi' - \overline{\phi})$ expressed in minutes of arc

$$\mathrm{E}_o = 2316\gamma + 0 \cdot 544\ (\mathrm{H} - \overline{\mathrm{H}}) + 1 \cdot 040\ (\phi' - \overline{\phi}) - 3 \cdot 23\ (e + e') + 1 \cdot 32\,(e - e') - 3 \cdot 11\ (s - s') \quad . \quad . \quad . \quad (5'),$$

$$\mathrm{S}_o = 3575\gamma + 0 \cdot 839\ (\mathrm{H} - \overline{\mathrm{H}}) - 0 \cdot 674\ (\phi' - \overline{\phi}) - 2 \cdot 95\ (e - e') - 3 \cdot 41\ (s + s') - 1 \cdot 39\ (s - s') \quad . \quad . \quad . \quad (6').$$

In actual practice e represented the arithmetic mean of 8 curve measurements, taken respectively at $\frac{1}{4}$ and $\frac{3}{4}$ of the time interval answering to each of the vibration experiments, and at $\frac{1}{8}$, $\frac{3}{8}$, $\frac{5}{8}$ and $\frac{7}{8}$ of the time interval answering to the deflection experiment; while e' represented the arithmetic mean of 2 curve measurements, taken respectively at $\frac{1}{4}$ and $\frac{3}{4}$ of the time interval answering to the declination observation. s like e was the mean of 8 curve measurements, and s' like e' the mean of 2.

To determine the V base value, let e'', s'', v'' be corresponding mean ordinates of the E′, S′ and V curves answering to the mean time of the dip observation. Then the values of E′ and S′ at the time of the observed dip are respectively $\mathrm{E}_o + e''c_e$ and $\mathrm{S}_o + s''c_s$, and the corresponding value of H, viz. H″, is given by

$$\mathrm{H}'' = \overline{\mathrm{H}} + (\mathrm{E}_o + e''c_e - \overline{\mathrm{E}}')\sin\theta + (\mathrm{S}_o + s''c_s - \overline{\mathrm{S}}')\cos\theta,$$

where, as before, $\theta = 32° 56'$.

If I be the observed inclination

$$\mathrm{V} = \mathrm{H}'' \tan \mathrm{I} = \mathrm{V}_o + c_v v'',$$

where c_v is the scale value of the V curve, and V_o the base line value. Thus finally

$$\mathrm{V}_o = \mathrm{H}'' \tan \mathrm{I} - c_v v'' \quad . \quad . \quad . \quad . \quad . \quad . \quad (7).$$

The mean ordinates e'', s'', v'' each represented the arithmetic mean of 4 measurements answering to $\frac{1}{8}$, $\frac{3}{8}$, $\frac{5}{8}$ and $\frac{7}{8}$ of the interval occupied by the dip observation.

Table VIA gives the base values as computed from the absolute observations separately considered, and the temperature shown by a thermometer in the cave at the time of the dip observation. The values enclosed in parentheses were considered unsatisfactory for one reason or another and were discarded.

TABLE VIA.—Base Values from Individual Observations.

Date.	E′.	S′.	V.	Temperature (Centigrade).
1911.	γ	γ	γ	°
February 17	1752	2724	69521	− 7·0
,, 23	1713	2697	67596	− 7·8
March 3	1767	2765	(69042)	− 9·5
,, 9	1749	2741	68260	−10·8
,, 20	1746	2759	68289	−13·0
,, 24	1713	2747	67972	−12·2
,, 31	1716	2769	68327	−12·6
April 11	1709	2708	68021	−14·0
,, 15	1714	2715	67712	−15·0
,, 26	1711	2675	68090	−17·0
May 4	1732	2660	67753	−18·0
,, 11	1726	2671	67950	−20·0
,, 20	1720	2667	67744	−21·0
,, 26	1733	2688	68038	−21·0
June 3	1712	2713	68037	−20·1
,, 9	1718	2748	68174	−20·0
,, 16	1712	2740	67920	−20·1
,, 21	1713	2741	68206	−22·5
,, 29	1710	2747	68101	−24·0
July 6	1711	2807	68100	−26·0
,, 17	1717	2758	67952	−24·1
,, 24	1745	2727	(68604)	−24·8
,, 27	1720	2755	68051	−24·7
August 5	1715	2879	68108	−25·5
,, 12	1748	2873	68026	−26·0
,, 18	1743	2866	68027	−26·4
,, 28	1765	2899	—	—
September 1	1754	2869	(68415)	−25·5
,, 9	1751	2871	68006	−25·8
,, 16	1747	2860	68248	−26·2
,, 23	1744	2865	67967	−25·8
October 4	1722	2887	68015	−24·0
,, 12	1726	2882	68070	−23·6
,, 20	1747	2864	68062	−23·0
,, 28	1726	2887	68086	−22·5
November 3	1756	2861	67954	−21·7
,, 11	1732	2885	68008	−20·0
,, 18	1764	2870	68094	−19·3
,, 24	1736	2896	67839	−18·0
1911.	γ	γ	γ	°
December 2	1741	2876	67864	−17·0
,, 9	1740	2872	67964	−15·9
,, 18	1771	2850	68050	−14·1
,, 23	1748	2869	68004	−14·2
,, 29	1774	2857	68080	−13·2
1912.				
January 5	1760	2880	67846	−13·0
,, 12	1711	2908	68010	−12·6
,, 22	1782	2866	68003	−11·5
,, 30	1781	2876	68093	−10·0
February 5	1753	2953	68045	− 9·4
,, 12	1760	2969	68013	− 9·3
,, 24	1769	2992	67970	−10·5
March 3*	(1698)	(2898)	(65735)	−11·5
,, 7	1767	2993	68023	−11·9
,, 18	1764	2985	67925	−13·3
,, 24	1765	2996	67853	−13·9
April 2	1724	2996	67611	−14·2
May 7	1717	2990	67785	−17·0
,, 16	1733	2999	68123	−17·0
,, 21	1728	2995	67917	−18·2
,, 29	1751	2983	67893	−18·8
June 6	1723	3000	68195	—
,, 19	1754	2957	67677	−19·4
,, 28	1769	2972	68384	−19·8
July 11*	(1789)	(3071)	(69601)	−19·5
,, 21	1715	2980	68135	−19·6
August 9	1721	2993	68121	−19·9
,, 24	1747	2982	67750	−19·3
September 7	1722	2995	67847	−19·6
,, 24	1726	2990	67749	−20·0
October 7	1741	2974	67750	−20·0
November 2	(1762)	2964	—	—

* Value obtained for m on this day erratic.

Section 10.—Some general considerations may help to explain the choice actually made of base line values. Consider the simplest possible case—much simpler than that presented in the Antarctic—viz., a declination magnetograph of a stable type in a dry chamber in ordinary latitudes, not exposed to local disturbances, artificial or otherwise. In the absence of alteration in the magnet, its supports and the optical arrangements, there is no reason why the base value should alter at all. Accidents of course may happen, and the assumption of an invariable base line value would be a rash one ; but, as a matter of fact, any alteration is unlikely to be large, and if careful absolute observations are taken at not too long intervals, any change that may occur is easily determined to a high degree of accuracy. Barring some serious accident, the scale value cannot alter sensibly, thus no uncertainties can arise on that ground. The element recorded by the magnetograph and the element observed with the absolute instrument are the same. The time required for an absolute observation is much less than that required in the case of any other magnetic element, and the accuracy in European latitudes is ordinarily greater. Thus the inter-comparison of the observational and the curve value is at once direct, simple and accurate. Next in facility and in accuracy, under normal conditions, comes the H magnetograph. This shares with declination the advantage that the element recorded is the same as that directly observed. The disadvantages as compared with declination are that the absolute observation takes ten times as long, and has seldom half the accuracy, while the scale value can alter, and complications arise from the existence of a temperature coefficient. When the magnetographs dealing with the magnetic force in the horizontal plane record, as those in the Antarctic did, two rectangular components, each is dependent both on the D and the H observation, and any weakness or defect in either absolute observation affects the base value for both magnetographs. Thus the chances of error coming in are at least doubled, while the difficulty of localising any error and tracing its consequences are much enhanced. This does not necessarily mean that the balance of advantages must be with the D and H magnetographs, as compared with E and S magnetographs.

One weak point with the D magnetograph is that its scale value, when expressed in terms of force, depends on the local value of H. For instance, a D magnetograph having a scale value of 1 mm. = 1 minute of arc, has in terms of force

$$\begin{aligned} 1 \text{ mm.} &= 10{\cdot}5\gamma \text{ where H} = 0{\cdot}36 \text{ C.G.S.} \\ &= 5{\cdot}25\gamma \quad \text{,,} \quad \text{,,} = 0{\cdot}18 \\ &= 1{\cdot}3\gamma \quad \text{,,} \quad \text{,,} = 0{\cdot}045 \end{aligned}$$

Under ordinary European conditions 1 mm. = $5{\cdot}25\gamma$ is a convenient enough scale value. But 1 mm. = $10{\cdot}5\gamma$ is too low a sensitiveness for the comparatively quiet equatorial regions, where H approaches $0{\cdot}36$; while 1 mm. = $1{\cdot}3\gamma$ is much too high a sensitiveness for polar regions, where a low value of H is accompanied by an exceptional amount of magnetic disturbance. Thus there may be excellent reasons for preferring E and S to D and H magnetographs ; but absolute instruments being as at present, the former choice inevitably introduces more difficulty and less certainty in base line value determinations.

The V magnetograph is usually the most troublesome. To obtain absolute values for comparison with curve measurements, one has to combine absolute observations of H and I taken at different times and with different instruments, each observation occupying a considerable time. An observation with a dip circle takes much longer than a declination observation, and possesses much less accuracy, while the V magnetograph has usually a larger temperature coefficient than an H, E or S magnetograph, and is more liable to change both as regards its scale value and its base line value. In high magnetic latitudes the equivalent in vertical force of 1′ of dip is large—at the Antarctic station it exceeded 300γ —, thus even with the best and least variable of dip instruments it is futile to expect any very high accuracy in the base line value derived from a single observation. The dip circle in use at the Antarctic base station seems to have behaved well, but of the needles originally in use first one and then the other had to be discarded. A reserve needle belonging to the circle also gave out, and the two needles finally in use really belonged to another circle. It is hardly likely that the five needles in use at one time or another would, when at their best, have given absolutely the same dip, and probably some of them continued in use after appreciable deterioration had set in.

At stations where importance is attached to the mean values of the elements for individual days, a separate base value must be assigned to each day, if not to shorter intervals of time. If the differences between the base values derived from successive absolute observations are all small—which implies a good magnetograph and first-rate observing under favourable conditions—daily base values can be obtained either by arithmetical or graphical processes, which if not reliable to 1γ have at least considerable claim to respect. A glance, however, at the individual results in Table VIA shows that assigning base values to individual curves, even in the case of E′ and S′, would merely simulate an appearance of accuracy. Failing that, the most usual course is to assign base values to individual months, accepting for each month the mean result of all the determinations made during that month. There is, however, a serious objection to this course in the present case, owing to the fewness of the observations in some of the months, especially the later months of 1912. Also, if one calculates monthly mean base values in the usual way from the data in Table VIA, one finds that there is no regular progression, such as one would expect if the only effective cause were a progressive drift in the instrument or a seasonal temperature effect.

Section 11.—In the case of E′ a decided difference presented itself between the midsummer and midwinter months, but the differences between successive months seemed to be largely accidental. It was thus decided to accept generally as the base value for month n, $(b_{n-1} + b_n + b_{n+1})/3$, where b_n represents the mean value obtained from the observations of the month n alone. For the month of February, 1911, the mean of the two determinations made in that month was accepted, and the value accepted for October and November, 1912, represented the one reliable observation made during these two months. Fortunately, in these two cases the values accepted fit in fairly well with the run of the values obtained for the adjacent months. March and April, 1912, had also to be treated somewhat differently from the other months owing to a sudden change of base line which occurred on March 26 in connection with a quick run. The distances apart of the E′, S′ and V base lines altered during the changing of papers, affording clear evidence that something had happened. It was obviously a quiet time, and yet in the short interval there was a change of 5 mm., representing 32γ in the E′ ordinate. It was decided to accept this as a measure of the discontinuity, and to assign to the few subsequent March days the same base value as for April. The base values finally accepted for E′ are given in Table VIb.

TABLE VIb.—Base Line Values Accepted.

E′.		S′.		V.	
1911.	γ	1911.	γ	1911.	γ
February 10–28 ...	1732	February 10–28 ...	2710	February 10-28 ...	68558
March 1–31	1727	March 1–31	2756	March 1–31	68212
April 1–30	1726	April 1–30	2690	April 1–16	67803
				„ 17–30	68218
May 1–31	1718	May 1–24	2690	May 1–3	67829
		„ 25–31	2677	„ 4–31	67871
June 1–30	1721	June 1-5 (13 h.) ...	2682	June 1–2	68057
		„ 5 (15 h.)–30 ...	2747	„ 3–20	68110
July 1–31	1726	July 1–3	2747	July 1–3	68070
		„ 4–10	2759	„ 4–31	68055
		„ 11–18	2767		
		„ 19–31	2755		
August...	1738	August	2873	August	68055
September	1741	September	2873	September	68055
October	1742	October	2873	October	68055
November	1744	November	2873	November	67974
December	1753	December	2873	December	67990
1912.		1912.		1912.	
January	1758	January 1(0 h.)–1 (14 h.)	2873	January	67990
		„ 1 (17 h.)–31 ...	2882		
February	1762	February 1–26 ...	2971	February	68009
		„ 27–29 ...	2992		
March 1–26 (10 h.) ...	1761	March	2992	March	67891
„ 26 (12 h.)–31 ...	1730				
April	1730	April	2992	April	67891
May	1735	May	2992	May	67891
June	1732	June 1–6 (8 h.) ...	2992	June	67956
		„ 7 (12 h.)–30 ...	2980		
July	1733	July	2980	July	67956
August	1724	August	2980	August	67956
September	1733	September	2980	September	67956
October	1741	October 1–13 (11 h.) ...	2980	October	67956
		„ 13 (12 h.)–31 ...	2964		
November	1741	November	2964	November	67956

Assigning separate base line values to individual months introduces, of course, a fictitious discontinuity between the entry under 24 h. on the last day of a month and the entry under 0 h. on the first day of the next month. The force, of course, was really the same, though shown as different. But the same thing happens, though less obviously, when one assigns separate base values to separate days. It may, of course, take a number of days for the accumulated error to amount to 1γ and so become visible. These discontinuities may be hidden by confining the tabulated values to the hours of 1 to 24, because it is then impossible to say by mere inspection that the difference between the entries under 24 h. on day n and under 1 h. on day $n + 1$ is not wholly due to a real change of force. But discontinuities are not removed by merely concealing them.

In the case of S′ there were in several months a succession of small dislocations which introduced an element of uncertainty. Such discontinuities may arise in several ways. The introduction of iron into the immediate neighbourhood of a magnetograph introduces a discontinuity which disappears with the removal of the iron. In such a case the effect is not usually confined to one of the magnetographs, and is comparatively easy to detect and allow for. Again a discontinuity may arise from a knock to the magnetograph, or slight movement of the bench supporting it. This is usually adequately dealt with by assigning an alteration to the base line value equal to the discontinuity shown by the curve ordinate. But a discontinuity may also arise from the yielding of some impediment, such as is provided by an obstructive hair or by grazing friction, to the free movement of the magnet. In such a case, instead of a smooth continuous curve, we may have a succession of small dislocations connected by straight portions of curve, the tendency in the magnet to move being resisted until the motive power prevails sufficiently to secure a jerky movement. The sum of the discontinuous movements *may* in such a case represent the full movement the magnet would have made if quite free, but even if it does the ordinate of a straight portion of curve will not in general give the current value of the force quite correctly. If the phenomenon is at all prominent, the only satisfactory course is to wholly omit the curve for purposes such as the calculation of the diurnal inequality. In such a case it is practically impossible, without some extraneous source of information, to decide whether there was or was not a real change of base value. In the Antarctic small vibratory movements of the magnet were so much the rule that a dislocation preceded by an absolutely straight portion of curve presumably represented sticking, or friction of some kind. There were several examples of this in the S′ curves, but on other occasions the magnet, judging by the oscillatory nature of the curve both before and after the discontinuity, appeared to be quite free. Dislocations of the latter kind appeared in the curves of May 25, June 5, July 3, 10 and 18, 1911, and October 13, 1912. As an example of the methods employed, take the case of June and July, 1911. On June 5 there was an undoubted large change of condition which could not be bridged. During the rest of June and July the base values found showed irregular fluctuations. There were a succession of small discontinuities equivalent in force to $+ 12\gamma$ on July 4, $+ 8\gamma$ on July 11 and $- 12\gamma$ on July 19; but no clear suggestion of a drift of base line in either direction. It was accordingly assumed that no real change of base line had occurred except what was produced by the above dislocations. On this hypothesis the base line value was, say, b up to the time of the first dislocation, $b + 12\gamma$ between the first and second dislocations, $b + 20\gamma$ between the second and third, and $b + 8\gamma$ after the last dislocation. Referring to Table VIA, we thus get the following eight values for b :—

From the last four observations of June, 2748γ, 2740γ, 2741γ and 2747γ ;

from the four observations of July, 2795γ, 2738γ, 2719γ and 2747γ.

The mean of the eight values 2747γ was thus accepted for the value of b. This gives 2759γ as applicable between the first and second dislocation, and so on.

On January 1, 1912, there were some hours' loss of trace. Some work had to be done to the S′ magnetograph, entailing a large temporary change of temperature. On June 6 and 7, 1912, there were numerous dislocations suggesting sticking of the magnet, and a considerable portion of curve had to be rejected, and base values had to be settled independently for the earlier and later parts of the month. The base line values finally accepted for S′ are given in Table VIB. Though representing a great deal of consideration they are undoubtedly more open to criticism than the base line values assigned to E′. When a discontinuity occurred near the middle of a day a suitable allowance was made for the hourly values during the shorter portion of the day, without formally altering the base line value. The two processes of course are really identical. This was also the course adopted when, as sometimes happened, there were two or more discontinuities in the course of a day which practically neutralised one another. In all such cases special care was taken to ensure that the effect of the discontinuities on the maximum and minimum values for the day was duly allowed for.

The V base line values enclosed in brackets in Table VIA were omitted for various reasons. That found on March 3, 1911, differed very largely from all the subsequent results of the month, and as there was an abnormally large difference between the two dip needles there was presumably some observational error. On July 24, 1911, the mean observed dip was 2′ higher than on July 27, a result impossible to reconcile with what was shown by the curves. On September 1, 1911, the dip observed with needle No. 5 seemed abnormally high. On March 3 and July 11, 1912, the H observation was almost certainly at fault.

Table VIB shows the base line values finally accepted for V. In obtaining them the chief guiding principle was that apart from the change of scale value in January, 1912, the only known systematic cause for change of base line value was change of temperature. In view of the fact that a difference of 1′ in dip meant a change of 300γ in V, differences of the order of 30γ in base line values could not possibly be substantiated without a much larger number of dip observations than were actually taken. The reason for assigning special base line values to a few days at the commencement of each of the three months May, June and July, 1911, was simply the existence of small discontinuities in the curves. The changes accepted were equivalent to bringing the ends of the curve before and after the dislocation into line. The apparent difference between the earlier and later parts of April, 1911, is really fictitious. There were often two lines visible on the sheet, both coming from the fixed mirror of the V magnetograph. They remained at a fixed or approximately fixed distance apart. One, which was usually much the brightest, was normally accepted as the true base line. But during the earlier part of April, 1911, this line was so faint that it was more convenient to use the other. The apparent change in the base line value, viz. 415γ, is really the equivalent in force of the distance between the two lines.

Obviously no very high degree of precision can be claimed for the V base line values. Under conditions such as prevailed in the Antarctic, where $1''$ in the dip meant 5γ in V, it is obvious that no V base line values which depend ultimately on a dip instrument can reasonably be expected to have any high accuracy. An instrument is obviously wanted giving absolute values of V directly.

CHAPTER III.

LOCAL DISTURBANCE AT BASE STATION.

Section 12.—Magnetic disturbance may arise in various ways, and is a very difficult thing to define. If we take declination by way of illustration, ordinary charts show isogonals, *i.e.*, lines of equal declination, as nearly straight, or possessed of but slight curvature, for lengths of 50 or 100 miles. These lines represent a sort of average state of matters for places within a zone a considerable number of miles in width. If declination were actually observed at a number of stations all situated on an isogonal line, some of the values encountered would differ considerably from the value shown on the chart. The places at which these departures were large would naturally be regarded as highly disturbed; those places at which they were small would be regarded as only slightly disturbed or undisturbed. If the values obtained for declination or any other magnetic element at places only a mile or two apart differ considerably, there is unquestionably local disturbance. At some places sensible differences are found between points only a few yards apart; or, in extreme cases, between points in the same vertical, a few feet or even inches apart. A large mass of magnetic rock at a depth of a mile or two may cause a considerable local disturbance, but the disturbance will be sensibly the same at points only a few yards apart. This need not, however, be the case if the disturbance arises from rocks in or near the surface of the ground, and still less so if the cause is artificial, *e.g.*, if it is due to magnetic material in the building where the observations are taken, or in the actual support of the magnetic instrument itself. If considerable disturbance is found at any spot, it is not safe to assume that it is the same at all places within the same room, even if we are certain that no magnetic materials have been used in its construction.

In the case of the 1902–04 Antarctic Expedition observations taken on the ice in McMurdo Sound, only about $1\frac{3}{4}$ miles away from the magnetic hut, gave for H the value ·0433, while the mean value observed in the hut itself was ·0657. In the case of ice over deep water, if a source of disturbance exists, it must be at a considerable distance from the magnetometer. Thus the presumption is that it was the magnetic hut which suffered mainly from disturbance, and that the source was pretty superficial. Under such circumstances the disturbance might well be sensibly different in the magnetograph and absolute observation huts, even if we assume there was no magnetic material in either. In 1902–04 no absolute observations were made in the magnetograph hut, so that nothing positive was known. In 1911–12, however, comparisons were made of the absolute hut and the magnetograph cave, and also of the hut and a station on the sea ice about 2,835 yards away from the hut.

In the case of the hut and cave the comparison was confined to H, and complete observations were not taken in the cave, vibrations only being observed there. Comparisons were made on three occasions in January, 1911, before the magnetographs were installed. Each comparison consisted of two sets of vibrations in the cave, and an intermediate set in the hut. As the magnetographs were not in operation, it is impossible to say how uniform the value of H was at one and the same station during the three sets of vibrations constituting a comparison. As the comparisons were in midsummer, the season when the Antarctic disturbances were most in evidence and diurnal inequalities largest, invariability in the value of H throughout the time required for the three sets of vibrations is *a priori* most unlikely, and as a matter of fact the particulars recorded of the vibrations imply considerable disturbance during some of the vibration sets. It is probable, however, especially in view of the similarity of the results reached on the three occasions, that the mean result suffered but slightly from magnetic changes during the observations.

If T_c and T_h denote the observed times of vibration in the cave and hut, and we neglect the effect of the torsion of the suspension and of any difference in temperature between the hut and cave, we have—

$$H_c/H_h = (T_h/T_c)^2 \quad \ldots \ldots \quad (8),$$

where H_c and H_h represent the values of H in the cave and hut. As a matter of fact, the temperature during the first set of vibrations in the cave was always slightly lower than that in the hut, but the mean temperatures of the magnet during the hut and cave experiments differed by only about 1° C. Again, the same suspension was used throughout. Thus any uncertainties arising from temperature or torsion should be trifling.

The result assumes of course that there was no sensible permanent change of moment in the magnet during the vibrations on any single occasion; but this may safely be assumed in the case of an old magnet in careful hands. The values thus obtained on the three occasions for H_c/H_h were

0·9478, 0·9522, and 0·9499, mean 0·951.

The error is unlikely to have been more than one or two parts in 1000. The difference thus found between H_c and H_h is not large. Still it is not small enough, considering the proximity of the hut and cave, to warrant the conclusion that variations in the value of H throughout either the cave or the hut were negligible. In view of a 5 per cent. difference it would no doubt have been well if observations had been taken at more sites than one in both hut and cave, and at different heights above the ground. A point arises immediately in connection with the latter question. The observations in the hut were made presumably with the magnetometer in the position it occupied during the ordinary magnetic observations. But the complete H observation consists of both a vibration and a deflection. The former gives mH', where H' is the value of H at the position occupied by the collimator magnet during the vibration, while the latter gives m/H'', where H'' is the value of H at the position occupied by the deflected magnet. These two positions are in the same vertical, but in the ordinary Kew pattern magnetometer they are at a distance of about $5\frac{1}{2}$ cms. apart. The heights of the two points above the top of the tripod or pillar supporting the magnetometer are roughly in the ratio of 4 : 3, while the heights above the floor are roughly in the ratio of 18 : 17. As we shall see presently, there is some reason to believe that the local disturbance was mainly confined to the hut. Thus the point raised is conceivably of importance. If the source of the disturbance was the natural rock underfoot, or magnetic material in the framework of the hut itself, the difference between H′ and H″ could hardly exceed 1 or 2 per cent. of H. Assuming no magnetic material in the magnetometer itself, the most unfavourable case would be that of an unseen nail or other iron object near the extreme top of the supporting pier. In such a case the departure of H″ from the undisturbed value might be double that of H′, the difference between the undisturbed value and that given by the ordinary complete observation would then be 50 per cent. larger than the difference between H′ and H. Such an extreme case is most unlikely, but we are obviously hardly justified in assuming that exactly the same value would have been obtained for H_c/H_h if the comparison had involved the ordinary complete observations, including both vibrations and deflections. Also we cannot be sure that H was absolutely uniform throughout the whole cave.

The comparisons between the hut and a station on the sea ice were made nearly a year later, during December, 1911, and January, 1912. The H observations on sea ice comprised vibrations only, but there were complete observations of both declination and dip. They were taken on five separate days, viz., December 27, and January 2, 11, 16 and 23, at about the usual time of the absolute observations. Observations were not taken in the hut on the same days, but there were complete observations in the hut on nine December and January days, including December 23 and 29, and January 5, 12, 22 and 30. Thus the base values deduced for the curves from the December and January observations in the hut should supply an excellent basis for the comparison, at least in the case of H and D. In the case, however, of H the ice observations supply the value not of H but of mH. To utilise them we must assign a value or values to m. The six ordinary observations between December 23 and January 30 supplied the following values 957·9, 956·5, 952·6, 958·3, 956·6 and 954·9. Under the Antarctic conditions we may reasonably regard the differences between these values as accidental, and accept their mean 956·1 as a closely approximate value for m during all the observations on the sea ice. In this case all the ordinary corrections were applied in reducing the absolute observations. Also the curves were measured, and due allowance made for variations in H throughout the comparisons. The final results obtained were as follows :—

Date.	H from observations on sea ice.	H calculated from the curves.	$\frac{\text{curve value}}{\text{value on ice.}}$
	γ	γ	
December 27, 1911	4115	4293	1·043
January 2, 1912	4081	4274	1·047
„ 11, 1912	4124	4305	1·044
„ 16, 1912	4104	4282	1·043
„ 23, 1912	4135	4304	1·041
Means	4112	4292	1·044

The curves were not highly disturbed on any single occasion and, as the curve values show, the departures of H from its mean value were small. Thus the observational conditions were distinctly favourable for high accuracy.

In the case of observations taken with the magnetometer on a tested tripod supported on ice over deep water, there is no reason to fear any sensible difference between what we have called above H′ and H″. Thus in this case we have a quite satisfactory comparison, provided we may assume that *variations* in the value of H derived from the curves, *i.e.*, from the ice cave—apply to the magnetic hut. As a matter of fact, the values of H derived from the curves for the mean times of the hut observations and the ice observations differed so little that a small percentage error in the allowance made for this difference would be quite immaterial.

The ice observations incidentally supply an answer to the question whether in the ordinary hut observations there was any decided difference between what we have called above H′ and H″. We have only to compare the values obtained for mH in the hut observations between December 23 and January 30, with those obtained in the observations on ice. The corresponding mean values of $\log_{10} m\mathrm{H}$ were 1·61518 for the hut, and 1·59451 for the ice. From this we find

$$\mathrm{H}'/\mathrm{H}_i = 1\cdot049,$$

where H′ has its previous meaning and refers to the hut, while H_i is the value of H at the ice station.

Our previous result was equivalent to

$$(\mathrm{H}'\ \mathrm{H}'')^{\frac{1}{2}}/\mathrm{H}_i = 1\cdot044.$$

Thus the difference between the values of H′ and H″ in the hut was certainly very small, if not absolutely zero.

Again, if the disturbance in the hut had been due to magnetic material in a supporting pier, the effect should have diminished as the height above the pier was increased, which implies that H″ should exceed H′. The above calculation in the contrary makes H′ the larger, though the difference is really too small to rely on.

The comparison between cave and hut embodied in (8) really refers to H′. Thus in utilising the two comparisons to obtain the relation between H_c and H_i it is fairest to accept for $\mathrm{H}_h/\mathrm{H}_i$ the value 1·049. Doing so, we find

$$\mathrm{H}_c/\mathrm{H}_i = (\mathrm{H}_c/\mathrm{H}_h)\,(\mathrm{H}_h/\mathrm{H}_i) = 0\cdot951 \times 1\cdot049 = 0\cdot998.$$

The difference of the ratio from unity is certainly not in excess of the probable error in the determination.

We seem thus entitled to conclude that at the spot in the cave where the vibrations were taken H had a practically undisturbed value, supposing of course this was true of the sea ice. Appreciable disturbance may conceivably have existed in other parts of the cave, including the positions subsequently occupied by the magnetographs, but if so, it is most improbable that any such disturbance was serious.

In the case of D observations in the field, the chief difficulty usually relates to the azimuth of the distant mark employed. This difficulty was turned by Dr. Simpson in a simple manner. A careful determination of the true bearing of Cape Barne had been made from the magnetic hut in connection with the time work. Using a theodolite, Dr. Simpson measured the angle subtended at the hut by the line joining Cape Barne to the site of the ice observation. This gave him the true bearing of the ice station from the hut, and so conversely of the hut from the ice station. When observing D on the ice, he used the hut as distant mark. D was observed at the ice station on five days, two observations being made on the last day. The following are the results of these observations and of the corresponding values of D derived from the curves—the latter really referring of course to the absolute hut, the observations at which served to determine the base values :—

Date.	D from observations on sea ice.	D calculated from the curves.	D on ice − D in hut.
	° ′	° ′	′
December 27, 1911	26 12	24 50	+82
January 2, 1912	25 59	25 55	+ 4
„ 11, 1912	24 20	24 25	− 5
„ 16, 1912	25 32	25 35	− 3
„ 23, 1912	25 34	24 58	+36
„ 23, 1912	24 45	25 40	−55
Means	25 24	25 14	+10

The calculated values were deduced from the measured values of E′ and S′ by means of the formula

$$D = \tan^{-1} (E'/S') - 7^\circ\ 36'.$$

The close agreement between the results obtained on the three intermediate days and the large differences between the results obtained on the first and last days make a somewhat curious contrast. The mean of the six observations is affected by so large a probable error that little weight can be attached to it. But in any case it seems reasonably clear that the difference was small, which is at least consistent with the absence of any sensible local disturbance of D in the magnetic hut.

Corroborative evidence is forthcoming from the absolute D observations in the hut. The six nearest in time to the ice observations were taken on December 23 and 29, and January 5, 12, 22 and 30. The mean time of observation in these six days was 18 h. 6 m., and the final mean value of D was 25° 22′. The mean hour of the six ice observations was 16 h. 36 m. If we take the mean of the diurnal inequalities from all days for December and January, we find the declination counted from South to East 18′ larger at 18 h. than at 16½ h. Thus for comparison with the results at the ice station we should reduce the mean of the values observed in the hut from 25° 22′ to 25° 4′, making the excess of D on the ice 20′. This last comparison assumes D to be on the average equally affected by disturbance on the days of the hut and ice observations, and cannot, at least theoretically, claim the same accuracy as the comparison made through the curves.

In the case of the dip the uncertainties in the base line values of V are so large that a comparison of the hut and ice station based on curve readings taken at the times of the ice observations would possess little if any advantage over a comparison based immediately on the absolute observations. From the hut observations nearest in point of time and the observations on ice we obtain the following results :—

Magnetic Hut. Cape Evans.			Station on Sea Ice.		
Date.	Mean Time.	Dip.	Date.	Mean Time.	Dip.
	h. m.	° ′ ″		h. m.	° ′ ″
December 23, 1911 ...	15 26	86 24 13	December 27, 1911 ...	15 9	86 30 1
,, 29, 1911 ...	15 22	86 25 43	January 2, 1912 ...	15 56	86 35 43
January 5, 1912 ...	15 29	86 22 20	,, 11, 1912 ...	14 35	86 34 13
,, 12, 1912 ...	15 18	86 21 24	,, 16, 1912 ...	15 3	86 33 10
,, 22, 1912 ...	14 56	86 23 18	,, 23, 1912 ...	15 36	86 32 55
,, 30, 1912 ...	15 36	86 23 30			
Mean	15 21	86 23 25	Mean	15 18	86 33 12

Considering the close agreement between the mean hours of observation at the two places, no allowance need be made for regular diurnal variation. Also, considering the comparatively small range in the values observed at either place, it is pretty clear that the mean of either set of values cannot be much affected by disturbance. We may thus accept the difference between the two mean values as at least a close approximation to the true difference between the values of the dip in the hut and at the ice station. This would give a departure from verticality in the needle of $206'\cdot 8$ on the ice, as compared with $216'\cdot 6$ in the hut. From this point of view the difference is not negligible. In fact, if it arose from a difference between the values of V at the two stations that difference would be very considerable.

It is easily seen, however, that the difference is sufficiently accounted for otherwise. In fact, we find at once—

$$\tan\,(86^\circ\ 33'\ 12'')\ /\ \tan\,(86^\circ\ 23'\ 25'') = 1\cdot 048.$$

Thus the difference is almost exactly accounted for by the difference between the values obtained for H at the two places.

The conclusions we thus arrive at are that, at the place of the absolute observations in the hut D and V were nearly if not quite normal, but H was some 5 per cent. higher and I some 10′ lower than if there had been—as presumably was the case at the ice station—no local disturbance.

As to the cave we have clear evidence that at one point at least H was practically undisturbed. There is also some evidence pointing to the absence of any serious disturbance in D. Dr. Simpson's notes describing the installation of the magnetographs in the cave proceed as follows:—" The orientation of the instruments was made magnetically. A determination of the declination was made with a theodolite and its magnet needle on the beach a little to N.E. of the hut, the declination was found to be N. 149 E. (*i.e.*, 31° East of South). A landing compass was used in this case to get the E.W. line with this value of the declination." We know that the astronomical meridian thus laid down was subsequently found to be 7°·6 in error. This error would be explained if at the time the orientation was fixed the declination, instead of being 31° East of South as supposed, had been only $23\frac{1}{2}$°. As the mean observed value in the hut was $25\frac{1}{3}$°, we have thus considerable reason for believing that the values of D in the hut and cave did not differ very much. As the D disturbance in the hut was certainly small, this would imply that there was not much disturbance of D in the cave.

Section 13.—The nature of the influence of local disturbance on regular and irregular magnetic changes is a subject on which observation seems hitherto to have thrown little light. Local disturbance might influence observational results in two ways. It might in the first place make the changes at a fixed spot different from what they would have been if the source of disturbance did not exist. It might in the second place, if the local disturbance had a rapid space variation, lead to irregularities in the results of absolute observations, unless these were taken at an absolutely fixed spot. This second source of trouble need not, I think, be considered in the present case.

It is quite conceivable that the magnetic field at a locally disturbed site might possess diurnal and annual changes peculiar to itself. For instance, if the disturbance arose from a thin surface layer of highly magnetic rock, the annual and diurnal variations of temperature in this might lead to sensible annual and diurnal changes in the magnetic field in the immediate neighbourhood. This, however, seems a remote contingency in the present case. The disturbance effect in the magnetic field was only of the order 200γ. The regular diurnal variation of temperature in the Antarctic is very small, so that with any reasonable temperature coefficient a sensible effect on the magnetic diurnal variation through heating of the surface is hardly conceivable. The difference between the temperatures at midsummer and midwinter is considerable, so that a sensible effect on the annual magnetic inequality is less improbable, but it could not possibly be large.

There is, however, another way in which local disturbance may affect the diurnal inequality. If we suppose that, as is most probable, the diurnal inequality represents in the main the action of electrical currents at a considerable height in the atmosphere, the size of these currents and so the magnetic field due to them is unlikely to be influenced by local disturbance at or below ground level, at least when the source of disturbance is as limited in extent as it would seem to have been in the present case. If this be so, then the departures ΔE, ΔS, ΔV at any given instant from the mean value for the day would be the same in the cave and the hut. The inequalities found for these elements would not be affected by any uncertainty.

But this is no longer true when we come to H, and still more when we come to D.

To clear our ideas, let θ_h and θ_c denote the inclinations to astronomical south of the magnetic meridians in the hut and the cave respectively. We have*

$$\begin{aligned} \text{in the hut } \Delta H_h &= \Delta S \cos\theta_h + \Delta E \sin\theta_h, \\ \Delta D_h &= (-\Delta S \sin\theta_h + \Delta E \cos\theta_h) / H_h ; \\ \text{in the cave } \Delta H_c &= \Delta S \cos\theta_c + \Delta E \sin\theta_c, \\ \Delta D_c &= (-\Delta S \sin\theta_c + \Delta E \cos\theta_c) / H_c. \end{aligned}$$

In the present case we have no conclusive evidence that θ_h and θ_c were unequal, and we are certain that the difference between them, if existent, was small. Thus we have every reason to believe that the diurnal variation of H was practically the same for the hut and the cave. It is otherwise, however, with D. For, supposing θ_h and θ_c identical, we have at any the same instant

$$\Delta D_h / \Delta D_c = H_c / H_h = 0{\cdot}95.$$

In the calculations made here of the D diurnal inequality we have assigned to H the values given by the absolute observations, *i.e.*, the hut values. Thus the inequality figures given here (Tables XXVI and XXVII) really apply to declination in the hut. For declination in the cave, if we assume H to have had the same value in the positions occupied by the magnets of the magnetograph as at the spot where vibrations were taken in January, 1911, we should have to add approximately 5 per cent. to every hourly entry. This would entail a 5 per cent. increase of every D range, and a 5 per cent. increase in every *a*, *b* or *c* Fourier coefficient for D. Hours of maximum and minimum and phase angles in Fourier "waves" would, however, be unaffected. Considering the extremely local nature of the disturbance, and the fact that the ice observations point to the cave rather than the hut as representative of undisturbed conditions, there is considerable reason to think that the diurnal variation in the cave would have been more truly representative than that in the hut. In view, however, of the incomplete information as to the general magnetic state of the cave, it seemed best on the whole to accept for H and D the results of the careful observations made in the hut. It is easy for any one who thinks a 5 per cent. correction necessary to apply it.

The inclination diurnal inequality is also affected, but hardly to an appreciable extent. This is easily seen by reference to the relation

$$\Delta I = (1/2) \sin 2\,I\,(\Delta V/V - \Delta H/H)$$

connecting the inequality in I with those in V and H. If we assign to I for the hut and sea ice 86° 23′ and 86° 33′, the values to the nearest minute obtained in the comparison of the two sites, and employ the suffixes *h* and *i* as before, we find

$$\begin{aligned} \Delta I_h &= {\cdot}0630\,(\Delta V_h/V_h - \Delta H_h/H_h), \\ \Delta I_i &= {\cdot}0601\,(\Delta V_i/V_i - \Delta H_i/H_i). \end{aligned}$$

But, as we have already seen, V_h and V_i were at least approximately equal, and

* The sign taken here for ΔD regards D as increasing when the angle in Table IV increases.

there is strong reason to believe the same of ΔV_h and ΔV_i, as well as of ΔH_h and ΔH_i. Also we found

$$H_h/H_i = 1{\cdot}05 \text{ approximately,}$$

while also $630/601 = 1{\cdot}05$.

Thus the terms depending upon H in ΔI_h and ΔI_i are closely identical. Any difference between ΔI_h and ΔI_i must come in almost entirely through V, and represent only about 5 per cent. of the contribution from V. Now V/H was about 16, while the average hourly value of ΔH was largely in excess of that of ΔV. Thus, for the average hour, the contribution from V is very small compared with that from H, and a 5 per cent. correction to the contribution from V would be of exceedingly little importance. There is thus strong reason to believe that D is the only element the diurnal inequality in which could be sensibly influenced by the local disturbance in the hut, and even in the case of D the uncertainty is probably only of the order of 5 per cent.

CHAPTER IV.

RESULTS OF CURVE MEASUREMENTS. MEAN MONTHLY VALUES. NON-CYCLIC CHANGES. DIURNAL INEQUALITIES.

Section 14.—The previous discussion, it is hoped, will have served to explain exactly the amount of uncertainty that inevitably prevails in the results deduced from the curve measurements. The first of these results which we shall consider are the mean monthly values. The mean value of a magnetic element for a day is $(1/24)\{\frac{1}{2}(0+24)+1+..+23\}$ where 0 means the value for 0 h. (the first midnight), 1 the value for 1 h. and so on. If instead of one single day we take the average of all the days of a month, the formula gives us the mean value of the element for the month in question.

TABLE VIIA.—Mean Values Derived from Curve Measurements.

Month or Season.	E′	S′	E	S	D	H	V
1911.	γ	γ	γ	γ	° ′	γ	γ
February	2271	3490	1789	3760	25 27·0	4164	68591
March	2263	3530	1776	3798	25 4·1	4193	68322
April	2276	3519	1791	3789	25 17·7	4191	68371
May	2277	3523	1791	3793	25 16·6	4195	68019
June	2276	3539	1788	3809	25 8·9	4208	68211
July	2281	3540	1793	3811	25 11·9	4211	68177
August	2291	3540	1803	3812	25 18·7	4217	68156
September	2295	3545	1806	3817	25 19·2	4223	68162
October	2294	3549	1805	3821	25 16·7	4226	68167
November	2288	3550	1799	3821	25 12·2	4223	68099
December	2296	3562	1805	3834	25 12·4	4238	68082
1912.							
January	2297	3562	1806	3835	25 13·0	4238	68059
February	2301	3573	1808	3846	25 10·9	4250	68066
March	2306	3551	1816	3825	25 23·9	4234	67984
April	2294	3565	1802	3837	25 9·7	4239	68014
May	2297	3572	1804	3844	25 8·6	4247	68038
June	2299	3572	1806	3845	25 10·0	4248	68122
July	2301	3571	1808	3844	25 11·8	4248	68123
August	2293	3577	1800	3849	25 3·7	4249	68125
September	2304	3581	1810	3854	25 9·5	4258	68121
October	2307	3570	1815	3844	25 16·3	4250	68104
November	2305	3566	1813	3840	25 16·8	4246	68099
Mean	2291	3552	1801	3824	25 13·6	4227	68146
Midwinter, 1911	2281	3536	1794	3806	25 14·0	4208	68141
„ 1912	2297	3573	1804	3845	25 8·5	4248	68102
Equinox, 1911	2282	3536	1794	3806	25 14·4	4208	68255
„ 1912	2303	3567	1811	3840	25 14·8	4245	68056
Midsummer, 1911–12	2296	3562	1804	3834	25 12·1	4237	68077

From the curve measurements we obtain directly the mean values of E′, S′ and V. These appear in Table VIIA along with the corresponding calculated values of E, S, D and H.

The means in the sixth line from the foot of Table VIIA are derived from the 22 months. The means in the five lowest lines refer to the same seasons as the corresponding data in Table IV.

As results for D and H appear in both tables it is expedient to consider them first. In the case of D there cannot be said to be any close parallelism between either of the two sets of results in Table IV and the corresponding results in Table VIIA. The midwinter results in Table VIIA and the uncorrected midwinter results in Table IV both show a considerable decline of D in 1912. But the corrected midwinter results in Table IV show a difference between the two years in the opposite direction, and the differences between 1911 and 1912 shown by all three sets of equinoctial values are small. Thus no safe conclusion can be drawn as to the secular change. In the case of H it seems to be otherwise, the following being the values obtained for the year's increase from 1911 to 1912.

—	From Table IV.		From Table VIIA.
	Uncorrected values.	Corrected values.	
	γ	γ	γ
Midwinter data	+ 33	+ 44	+ 40
Equinoctial data	+ 15	+ 30	+ 37

The individual monthly values of H in both tables show irregularities. But in the cases of Table VIIA and the corrected data of Table IV these are little if at all larger than the irregularities ordinarily encountered at European stations, and there is an obvious tendency in the value to rise.

One of the most exceptional features in the results obtained in 1902–03 was the appearance of a large annual inequality.* In the present notation the following results were obtained :—

	D.	H.
midwinter value ..	27° 23′·5	6682γ
midsummer value ..	27° 9′·7	6436γ
Excess of midwinter value ..	13′·8	246γ

These values were obtained when the curves had their base line values assigned month by month from the observations of the particular month. The base line values thus obtained for D varied largely, whereas there was no *a priori* reason to expect any

* National Antarctic Expedition, 1901–04. Magnetic Observations, p. 82.

but the smallest change. In view of this and other suspicious features the only conclusion drawn was as follows : " It is, perhaps, unwise to say more than that it is desirable that the attention of the observers of the next Antarctic Expedition should be called to the importance of making a careful study of the annual inequality. If an inequality with a range of the order suggested by Table VIII (*i.e.*, the results just quoted) should be established, it would be a most important result, strongly suggestive of an annual oscillation in the position of the S. magnetic pole."

If we compare the midsummer values in Tables IV and VIIA with the corresponding means from the midwinter values of 1911 and 1912 we get midsummer and midwinter values answering to the common epoch January 1, 1912. The values thus obtained are as follows :—

Season.	From Table IV.				From Table VIIA.	
	Uncorrected values.		Corrected values.			
	D	H	D	H	D	H
	° ′	γ	° ′	γ	° ′	γ
Midwinter	25 17·1	4244	25 4·7	4225	15 11·3	4228
Midsummer	25 30·5	4291	25 11·8	4247	15 12·1	4237
Excess in Midwinter ...	−13·4	−47	−7·1	−22	−0·8	−9

The sign is in each case the opposite of that observed in 1902–03. Also the differences between midwinter and midsummer derived from Table VIIA—to which most weight would naturally be attached—are too small to rely on, and they might well be accidental. We thus seem driven to the conclusion that the large difference between midwinter and midsummer D and H values, especially the latter, observed in 1902–03 was not a real natural phenomenon. It is far too large a difference to be ascribed to any change in the unifilar magnetometer. The most probable explanation would seem to be movement of iron or other magnetic material in the immediate neighbourhood of the absolute hut.

Returning to our discussion of Tables IV and VIIA it will be seen that both the midwinter and the equinoctial values of I in Table IV suggest that a fall was in progress at a rate of about $2\frac{1}{2}'$ per annum. A rise in H and fall in I would be consistent with a movement of the S. magnetic pole away from Cape Evans, *i.e.*, in a N.W. direction.

The monthly and seasonal values in Table VIIA agree in indicating a rise in progress in both E′ and S′, and in both E and S. The annual increase would seem to be larger in S than in E. It is obvious that no conclusion can safely be drawn as to change in V.

Section 15.—As will be explained more fully in connection with the diurnal inequalities, data were derived not merely from all days of complete registration within the month, but also from certain groups of selected days. There were three such groups of days. In each month 10 days—reduced to 6 in November, 1912, owing to scarcity of days—were selected as specially quiet, and diurnal inequalities were calculated for them month by month. In their case, as with the ordinary inequalities, " day " meant a period of 24 hours commencing at 0 h. in the time of 180° E. There were two other groups of days commencing at Greenwich midnight. The first group consisted of the international quiet days, five a month, selected at De Bilt. The second consisted of the five days a month which according to the international " character " figures issued from De Bilt were the most disturbed days of the month. As we shall see later, these two groups of days proved good representatives of quiet conditions and of highly disturbed conditions in the Antarctic. Diurnal inequalities based on them were not got out for individual months, but for the three seasons, midwinter, equinox and midsummer. The process of getting out the diurnal inequalities involved the calculation of the corresponding mean values. Thus mean values were obtained for each month from the 10 quieter days, and for each of the three seasons for the five international quiet days and the five highly disturbed days. The algebraic excess of these three sets of means over the all-day mean appears in Table VIIB for E′, S′ and V. In the case of the 10

TABLE VIIB.—Algebraic Excess of Mean Value from Quiet and Disturbed Days over All Day Mean.

Season.	E′			S′			V		
	5 *q*	10 *q*	5 *d*	5 *q*	10 *q*	5 *d*	5 *q*	10 *q*	5 *d*
	γ	γ	γ	γ	γ	γ	γ	γ	γ
Midwinter, 1911	+3	+1	−3	+1	−2	0	−10	−8	+10
,, 1912	+2	+2	−4	−2	−2	+3	− 1	−4	+16
Equinox, 1911	+2	+3	−7	−3	−6	+7	− 9	−8	+22
,, 1912	+1	+2	−6	0	−1	+2	− 2	−2	+ 6
Midsummer, 1911–12 ...	+7	0	−7	−6	−4	−4	− 5	−1	+ 8
Mean	+3·0	+1·7	−5·4	−2·0	−2·0	+1·6	− 5·4	−4·5	+12·4

quieter days the figure appearing in the table for any particular season is the arithmetic mean of the figures from the four included months. The means in the last line represent in the case of the 10 quieter days the arithmetic mean of the figures for the whole 22 months. In the case of the five quiet and five disturbed days they are means from the seasonal values. Except in the last line the results are given only to the nearest 1γ.

There is obviously a decided difference between the quiet day and disturbed day means. They differ from the all-day means in opposite directions. The difference is especially large in the case of V. The differences, however, are not in the same direction in the different elements. The disturbed day mean is the larger in V and S′, but the smaller in E′.

Taking the results in the last line of Table VIIB we get for the algebraic excess of the mean value of the element from the species of day indicated over the mean value derived from all days of the month the following values :—

—	E	S	D	H
	γ	γ	γ	γ
5 international quiet days	+3·2	−1·6	+2·9	0·0
10 Antarctic quiet days	+1·9	−1·8	+2·0	−0·8
5 international disturbed days	−5·6	+0·9	−4·4	−1·6

In the case of D, 1γ represents $0'\cdot8$ in angular measure. Here the + sign in D means a larger angle between the needle and astronomical *South.*

These results differ notably from those shown at stations in temperate latitudes. A difference is usually found between all-day means and either quiet day or disturbed day means, but H is the element in which the difference is usually most decided, and it is usually very small in D. It is usual for the quiet day H mean to be in excess of the all day mean. In the case of the international quiet days the average excess at Kew and Greenwich is about $+3\gamma$. On the other hand, the mean declination for the average international quiet day between 1890 and 1900 at Kew differed from the all day mean by only $0'\cdot02$.

Section 16. The magnetographs, as has been already explained, came into operation at the beginning of February, 1911, but the records obtained in the earlier days of that month were only partly successful. It was an exceptionally disturbed period, and the curves from the different elements crossed and recrossed to such an extent that it was impossible to say with certainty to which element particular portions of trace belonged. After a little, this difficulty was surmounted by Dr. Simpson. The positions of the dots of light from the three instruments were adjusted to reduce the intercrossing of traces to a minimum without bringing any one dot unduly near either margin of the sheet. Also by slight manipulation of the light and focussing arrangements, sufficient difference was introduced between the appearance of the different traces to enable the element to be identified with certainty, even when considerable intercrossing occurred. After February 10 there were not many days during 1911 for which a practically complete record was not available. The magnetographs remained in action until the end of November, 1912, but failure of the trace was more frequent towards the end of the period, especially during the last month.

At an early stage of the reduction work it was decided to have at least two sets of diurnal inequalities, as in 1902–04, the first based on all days, quiet or disturbed, during which the record was complete, the second on selected quiet days only. A day was considered complete if only a small break intervened which could satisfactorily be bridged over by interpolation or otherwise. The same quiet days were used for all the elements. These numbered 10 in each month except November, 1912, when only six comparatively quiet days were available. Few of these selected days, except those occurring near midwinter, would have been considered quiet at a European station.

They represented simply the 10 days in each month which appeared most free from irregular oscillations. In most months some difficulty was experienced in filling the last two or three places in the quiet day list, several days appearing much on a par. In such a case preference was given to days immediately preceding or succeeding the most conspicuously quiet days, rather than to an isolated quiet day. The object was to reduce to a minimum the uncertainties connected with the n.c. (non-cyclic) daily changes.

Table VIIIA contains a complete list of what we may call for brevity the monthly "10 quieter days." These, it should be remembered, are days of 180° E. longitude, *i.e.*, periods of 24 hours commencing 12 hours earlier than the Greenwich day, bearing the same number. In their selection no attention was paid to anything but the amount of disturbance prevailing in the Antarctic.

TABLE VIIIA.—The 10 Quieter Days a Month (of 180° E.).

1911.										
February	10	11	12	13	17	18	19	20	21	25
March	3	7	10	11	13	15	17	18	19	31
April	1	4	5	6	7	15	16	26	27	30
May	3	4	5	6	9	13	14	25	29	30
June	4	9	16	17	18	19	25	26	27	30
July	4	6	14	15	16	21	23	24	26	27
August	8	9	10	11	12	19	21	22	29	30
September	3	4	6	8	9	15	25	26	28	29
October...	1	4	5	6	10	16	28	29	30	31
November	2	7	8	11	18	19	22	25	27	29
December	5	8	9	10	16	22	24	25	29	30
1912.										
January	4	7	9	11	16	21	24	26	27	30
February	5	6	7	9	14	16	20	21	22	23
March	3	5	12	14	17	18	19	20	28	31
April	1	2	9	14	21	23	24	25	26	28
May	11	16	18	19	21	22	23	24	25	27
June	4	5	13	14	18	19	20	21	22	23
July	10	11	12	13	14	15	19	22	24	25
August	2	4	5	8	9	12	13	16	20	26
September	2	3	7	10	11	21	26	28	29	30
October...	3	6	7	19	20	22	24	26	30	31
November	1	3	4	5	8	13	—	—	—	—

The other two sets of selected days are given in Table VIIIB. Both sets are Greenwich days, and in their selection no attention whatever was paid to the Antarctic curves. With the exception of seven days, to which asterisks are attached, the quiet days in Table VIIIB are the international quiet days selected at De Bilt. Amongst the 100 international quiet days of the 20 months there were seven for which the Antarctic records were wholly or partly lacking. The seven days thus ruled out were replaced by the seven distinguished by asterisks. These were chosen solely by regard to the international "character" figures. The days substituted in April, July, and September,

TABLE VIIIB.—The Selected Quiet and Disturbed Days (G.M.T.).

Date.	International quiet days.					Days of largest "character" figure.				
1911.										
March	10	11	12	17	18	20	21	23	25	26
April	5	6*	14	15	26	8	9	16	17	30
May	1	4	13	22	24	7	14	15	16	31
June	3	17	18	19	25	1	9	13	14	21
July	13	14	15	25*	26	1	17	19	28	29
August	7	8	10	11	29	19	23	24	25	26
September	3	4*	14	25	26	16	20	21	22	23
October...	1	5	15	23	28	10	11	17	18	19
November	1	7	18*	22	24	8	9	13	14	15
December	2	9	21	22	23	6	11	17	26	31
1912.										
January	2	15	16	26	27	11	12	13	17	22
February	5	6	15	20	21	10	12	13	16	23
March	4	17	18	19	24	7	8	9	21	29
April	1	8	11	21	28	5	6	10	15	16
May	1	16	22	23	26	5	6	12	13	14
June	4*	13*	18*	19	20	1	8	9	10	28
July	10	11	12	15	24	3	4	5	27	31
August	4	8	12	13	26	17	18	19	22	23
September	2	15	16	27	28	4	17	18	23	24
October...	2	5	18	19	31	13	14	15	16	17

1911, and one of the days substituted in June, 1912, had identically the same " character " figure as the international quiet days which they replaced. The " character " figures on the remaining three days exceeded those on the international quiet days for which they were substituted only by 0·1, 0·1 and 0·2 respectively. Thus while the term " international quiet day " is not an absolutely perfect description of the selected quiet days in Table VIIIB, it is correct for all practical purposes.

The disturbed days in Table VIIIB are the five days a month with the largest international " character " figures. Just as with the quiet days, there were a few of the days thus selected for which the Antarctic records were imperfect. In such a case the day of the month having the next highest " character " figure was substituted. These substituted days have not been distinguished individually, because there was no selection at De Bilt of five disturbed days a month for 1911 and 1912, so that none of the selected disturbed days in Table VIIIB can claim to be officially selected.

In the meantime it must be taken for granted that the international " character " figures—based on returns from observatories the great majority of which are in the northern hemisphere—really serve to discriminate between quiet, ordinary and disturbed conditions in the Antarctic. The evidence bearing on the point will be found in Chapter VII.

The non-cyclic change, *i.e.*, the excess of the value of an element derived from the mean value of the ordinate for 24 h. over the corresponding mean for 0 h., may arise in a variety of ways. If we are dealing with all days of a month of 30 days, the n.c.

change represents one-thirtieth of the excess of the ordinate for the last midnight of the month over that for the first midnight. This excess may be due to a short disturbance, affecting either the first or the last midnight, whose incidence we must regard as largely accidental. It may represent a real secular change. If, for instance, $\dot{H}$ is increasing at the rate of 120γ in a year, the rise in the average month will be 10γ, and the corresponding n.c. change in the average day $+0\cdot3\gamma$. It may arise, however, from an instrumental drift affecting the base line value. This can be distinguished from a true secular change, or annual inequality, only with the aid of the absolute observations.

When we are dealing not with all the days of a month but only with selected days, n.c. change may arise in all the ways indicated above, but it may also arise from some special peculiarity in the type of day selected. Thus it has been found at a number of stations that on quiet days there is a special tendency for H to increase. At Kew, for instance, there is in the average quiet day a rise of about 3γ.

The n.c. element is usually eliminated in the way that has been adopted here, which assumes the change to have come in at a uniform rate throughout the 24 hours. This

TABLE IXA.—Non-cyclic Changes.

Month.	E′		S′		V	
	All days.	Quiet days.	All days.	Quiet days.	All days.	Quiet days.
1911.	γ	γ	γ	γ	γ	γ
February	−2·8	− 1·7	−3·6	−11·0	−0·8	− 5·5
March	−0·6	+ 5·0	+1·8	− 7·1	−0·1	+ 4·3
April	+0·2	− 4·1	+0·4	+ 4·5	+3·5	+ 1·6
May	+0·8	+ 2·6	−4·3	− 9·7	+0·9	+ 0·9
June	−0·1	− 1·1	+1·5	+ 0·4	+0·5	− 1·1
July	−0·5	− 1·3	+0·5	+ 1·6	−0·3	− 7·1
August	0·0	+ 1·9	−0·8	+ 0·3	−0·6	− 0·4
September	+0·3	+ 1·2	−1·3	+ 5·2	+0·4	− 5·2
October	−0·1	+ 2·9	−0·1	− 6·5	+0·4	+ 0·7
November	−1·0	+ 7·7	+1·0	+ 4·4	+0·5	−12·9
December	−0·6	+ 3·6	+0·1	− 4·9	+0·8	+ 7·7
1912.						
January	−0·1	+13·4	+0·5	− 0·1	−0·7	−2·4
February	+0·6	− 0·1	−5·5	+ 3·1	−0·3	−5·7
March	+0·2	+ 1·0	+1·4	− 0·8	+0·8	−0·5
April	+0·3	− 7·9	−1·3	+ 1·9	+1·3	−7·4
May	−0·5	+ 2·9	+0·7	+ 1·9	+1·0	−3·5
June	+0·1	− 0·4	+0·8	+ 2·4	+0·8	−0·9
July	−0·3	+ 1·7	+0·6	+ 2·0	+0·2	−1·4
August	+0·3	+ 4·1	+0·6	+ 0·8	−1·3	−3·3
September	−0·1	+ 0·3	−0·2	+ 4·3	+0·5	−1·7
October	−0·2	+ 0·3	+1·4	− 1·0	−2·7	−3·3
November	−7·6	+ 0·1	+6·3	+ 4·2	−9·9	−1·7
Means from 21 months ...	−0·2	+ 1·5	−0·4	− 0·4	+0·2	−2·2
Number of months + ...	8	15	14	14	13	5
,, ,, − ...	13	7	8	8	9	17

obviously should eliminate a uniform secular change or instrumental drift. But the consequences of the n.c. correction in individual months are necessarily uncertain. This makes it all the more desirable that the n.c. corrections should be indicated. This has accordingly been done in Table IXA, both for the all-day inequalities and for the inequalities derived from the 10 quieter days. In obtaining the mean values given at the foot of the table November, 1912, was omitted, because the number of days available was small, so that accident might be expected to play a larger part than usual.

The fluctuation in the magnitude and even in the sign of the results for consecutive months in Table IXA suggests that accidental causes play a large part. In the case of all days the final mean results are all small. This is undoubtedly a satisfactory feature, implying as it probably does that there was no large drift in any of the instruments. In the case of S′ the mean results from all and from quiet days are identical, and we should naturally infer that quiet days have no special tendency to an n.c. change of one definite sign. In the case of E′ and V there is a decided though not very large difference between the all day and quiet day means. The natural inference from the figures is that on quiet days there is a special tendency for E′ to rise and V to fall.

As already explained in connection with daily mean values, inequalities were got out for the five international quiet days of each month and the five days having the largest "character" figures in the De Bilt monthly lists. These inequalities were confined, however, to the three seasons, midwinter, equinox and midsummer.

Table IXB gives the n.c. change for these two groups of days under the respective headings $5q$ (*i.e.* quiet) and $5d$ (*i.e.* disturbed). For comparison, corresponding n.c. changes are given for all days and the 10 days selected as quiet from inspection of the

TABLE IXB.—Mean Values of Non-cyclic Change.

Season.	E′				S′				V			
	$5q$	$10q$	a	$5d$	$5q$	$10q$	a	$5d$	$5q$	$10q$	a	$5d$
Midwinter—												
1911 ...	+10·0	+0·5	0·0	−12·0	−8·9	−1·8	−0·8	+13·0	−0·5	−1·9	+0·1	+8·4
1912 ...	+ 0·2	+2·1	−0·1	+ 6·1	+0·7	+1·8	+0·7	− 3·4	−1·0	−2·3	+0·2	+3·7
Equinox—												
1911 ...	+ 7·7	+1·2	0·0	+10·6	−3·5	−1·0	+0·2	+ 7·3	−1·2	+0·3	+1·0	+8·8
1912 ...	+ 1·4	−1·6	0·0	+ 0·2	−1·5	+1·1	+0·3	+ 2·4	−0·5	−3·2	0·0	+2·7
Midsummer—												
1911–12 ...	+ 3·0	+6·2	−0·3	− 2·1	−0·2	+0·6	−1·0	+ 3·6	+1·0	−3·3	+0·1	−4·2

Antarctic curves. These appear respectively under the headings a (for all) and $10q$. The figures appearing for any element under the several headings $5q$, $10q$, a and $5d$ naturally answer to a gradually increasing amount of disturbance. Thus in any case where the n.c. change is not of an accidental or instrumental character, but is essentially dependent on the magnetic character of the day, we should expect to see a systematic change in the figure as we pass from the column headed $5q$ to that headed $5d$.

In the case of E′ the figures from the two years 1911 and 1912 and from the three seasons differ so much that accident must be allowed to play a large part in the results for the five quiet and five disturbed days. It seems fairly clear, however, that on the international quiet days there is a decided tendency in the n.c. change to be positive, The mean from the five seasons $+ 4\cdot 5\gamma$ is substantially larger than the corresponding mean from the $10\,q$ days, while the mean from the a days is slightly negative as in Table IXA.

In the case of S′ four seasons out of the five make the n.c. change negative for the $5\,q$ days and positive for the $5\,d$ days, and the means from the five seasons, viz. $-2\cdot 7\gamma$ in the one case and $+ 4\cdot 6\gamma$ in the other, seem fairly decisive.

Similarly in the case of V four seasons give a negative value for the $5\,q$ days and a positive value for the $5\,d$ days, and the respective means from the five seasons are $-\,0\cdot 4\gamma$ and $+\,3\cdot 9\gamma$.

Comparing Tables IXB and VIIB we should infer that there is a tendency for the n.c. change to be positive or negative according as the mean value from the type of day concerned is greater or less than the all-day mean.

Section 17.—Tables X, XI, XII and XIII, pp. 68 to 71, give diurnal inequalities for E′, *i.e.*, the component of horizontal force inclined 7° 36′ South of Astronomical East. The time is that of 180° E., and so $54\frac{1}{2}$ minutes in advance of true local mean time. Tables X and XI give the "all" day, and Tables XII and XIII the "quiet" day inequalities. Table X gives inequalities for each individual month from February, 1911, to November, 1912. This period included only one December and one January, with two representatives of each of the other 10 months. Table XI gives the arithmetic means of the results for the 10 pairs of months, and ascribes to January and December the values already given in the previous table for January, 1912, and December, 1911. As these two months came near the middle of the period, the absence of a second January and December is less serious than would otherwise have been the case. The last four lines of Table XI give under the headings year, winter, equinox and summer the mean inequalities derived respectively from the whole 12 months—the four months May to August, the four months March, April, September and October, and finally the four months November, December, January and February. The sun was continuously below the horizon during nearly the whole of "winter," and continuously above the horizon during nearly the whole of "summer." Thus the division of the year into three seasons—on the whole a very convenient arrangement even in temperate latitudes—has special points in its favour. The algebraically highest and lowest hourly values in each inequality are in heavy type, ~~and~~ the corresponding range appears in the table. A final column in each case gives the A.D. (average departure from the mean), *i.e.*, the arithmetic mean of the 24 hourly differences forming the inequality taken irrespective of sign. Tables XII and XIII for the quiet days correspond respectively with Tables X and XI for all days.

The next four Tables XIV, XV, XVI and XVII, pp. 72 to 75, relate to S′, *i.e.*, the component of horizontal force inclined 7° 36′ West of Astronomical South. It might have been more orthodox to have regarded the positive direction of this element as 7° 36′ East of North. But the perhaps greater orthodoxy of this view seemed more than counterbalanced by the convenience of attaching the + sign to a numerical increase of the element.

Tables XIV and XV for the "all" days S′ inequalities correspond exactly with Tables X and XI for E′, and similarly Tables XVI and XVII for the "quiet" day S′ inequalities correspond with Tables XII and XIII for E′.

The next four Tables XVIII, XIX, XX and XXI, pp. 76 to 79, relate to the vertical force V. Here, too, the + sign denotes a numerical (as well as algebraic) excess above the mean value for the day, the downward direction being taken as positive for the dipping pole (in this case, however, a south pole). Tables XVIII and XIX refer to the "all" day, Tables XX and XXI to the "quiet" day inequalities.

As Tables X, XII, XIV, XVI, XVIII and XX are the only ones giving inequalities for the individual 22 months during which registration took place, it is desirable before considering the further inequality tables to draw attention to one feature they all disclose.

If we compare the results from corresponding months in 1911 and 1912 we notice a marked tendency for the values of the range and A.D. to be greater in 1911 than in 1912. In the case of E′ and S′ this greater amplitude in 1911 is especially prominent in February. The decline in amplitude would seem to have been especially characteristic of the earlier months of 1911. If we had had data for January, 1911, for combination with those of January, 1912, in Tables XI and XV there is every reason to suppose that the relative amplitudes of the inequalities for the months of January and February would have been considerably different from those actually found. We must thus regard the prominence of February in these tables as compared with January and December as probably in part at least an accidental feature, which would likely disappear if data were available from a large number of years.

The reduction in the amplitude of magnetic changes, irregular as well as regular, from 1911 to 1912 was by no means peculiar to the Antarctic. It represented presumably the normal consequences of an approach to the period of sunspot minimum.

Section 18.—The diurnal variations for E′, S′ and V formed the material from which the other diurnal inequalities were calculated. Employing ΔE to denote the departure of E (the component to Astronomical East) at any hour from the mean value for the day, and similarly for the other elements, we have

$$\Delta E = \Delta E' \cos(7^\circ 36') - \Delta S' \sin(7^\circ 36') = 0{\cdot}991\,\Delta E' - 0{\cdot}132\,\Delta S' \quad . \quad (9),$$

$$\Delta S = \Delta S' \cos(7^\circ 36') + \Delta E' \sin(7^\circ 36') = 0{\cdot}991\,\Delta S' + 0{\cdot}132\,\Delta E' \quad . \quad (10).$$

For the mean position of the magnetic meridian we may take 25° 20′ East of true South, or 32° 56′ East of the direction to which S′ refers. Thus we have for the calculation of the D* and H inequalities

$$\Delta D = (1/H)\{\Delta S' \sin(32^\circ 56') - \Delta E' \cos(32^\circ 56')\} \quad . \quad . \quad (11),$$

$$\Delta H = \Delta S' \cos(32^\circ 56') + \Delta E' \sin(32^\circ 56') \quad . \quad . \quad (12).$$

* In (11) and (11′) and in the inequalities D is supposed measured from Astronomical North through East and so diminishes when the angle in Tables IV and VIIIA increases.

Accepting $\cdot 0426$ C.G.S. as a sufficiently approximate value for H (in the hut). we thence find—$\varDelta$D being in minutes of arc, $\varDelta$H, $\varDelta$E′ and $\varDelta$S′ having 1γ for unit—

$$\varDelta D = 0\cdot439\ \varDelta S' - 0\cdot677\ \varDelta E' \quad . \quad . \quad . \quad . \quad (11'),$$
$$\varDelta H = 0\cdot839\ \varDelta S' + 0\cdot544\ \varDelta E' \quad . \quad . \quad . \quad . \quad (12').$$

If I denote the inclination, and T total force, we have

$$\varDelta I = \tfrac{1}{2} \sin 2\,I\,(\varDelta V/V - \varDelta\,H/H) \quad . \quad . \quad . \quad . \quad (13),$$
$$\varDelta T = \cos I\ \varDelta H + \sin I\ \varDelta V \quad . \quad . \quad . \quad . \quad (14).$$

The corresponding numerical relations, with $\varDelta$I in minutes of arc, are

$$\varDelta I = 0\cdot00315\ \varDelta V - 0\cdot0503\ \varDelta H \quad . \quad . \quad . \quad . \quad (13'),$$
$$\varDelta T = 0\cdot063\ \varDelta H + 0\cdot998\ \varDelta V \quad . \quad . \quad . \quad . \quad (14').$$

The inequalities calculated for E, S, D, H, I and T refer only to the mean results from the two years. They are included in the 12 Tables XXII to XXXIII, pp. 80 to 91, results being given for the 10 quiet days a month (20 days in the normal combined month of the two years) as well as for all complete days.

The time employed in these tables is the same as for the previous tables, *i.e.*, refers to 180° E. Thus 12 h., for instance, anticipates true noon by some 54 minutes.

Section 19.—The enormous difference disclosed by the tables already enumerated between the all day and quieter day inequalities suggested an inter-comparison of days of still greater and less disturbance. To ensure that the choice made would be recognised as representative and unprejudiced, recourse was had to the international lists issued from De Bilt. "Character" figures from 0·0 to 2·0 are there assigned to individual days, 0·0 representing the quietest and 2·0 the most disturbed of conditions. Five of the quietest days of each month are selected at De Bilt as representative quiet days, and these have been employed for the diurnal inequalities given in Table XXXIV, p. 92. As opposed to these the five days of largest "character" figure in the De Bilt lists were accepted as representative of disturbed conditions. The diurnal inequalities derived from these are given in Table XXXV, p. 92. A few of the international quiet days and of the days of largest international "character" figures did not possess complete traces. In the former case the days of next lowest "character" figure in the De Bilt list, and in the latter case the days of next highest "character" figure were substituted, as it seemed desirable to have in each month not less than five days of each kind. Only seasonal diurnal inequalities were calculated. The diurnal inequalities for winter and equinox are each based on 5×4 or 20 days from both 1911 and 1912, or 40 days in all; but the summer inequalities are based on only 20 days, derived from November and December, 1911, and January and February, 1912. The international lists refer to days beginning and ending at Greenwich midnight. Thus the days employed in Tables XXXIV and XXXV were Greenwich days, and G.M.T. has accordingly been employed in these tables. In any comparison with the other inequalities 1 h. G.M.T. must be taken as equivalent to 13 h. of the time of 180° E.

Section 20.—Plates I to VI show side by side on the same scale the diurnal inequalities derived from all complete days and from the 10 quieter days, for the 12 months in E, S, D, I, H and V. Corresponding diurnal inequalities for the three seasons and the year are given in Plates VII, VIII and IX. The diurnal inequalities for total force from all and the 10 quieter days in Plate X are limited to the three seasons and the year. The inequalities of the horizontal components for the seasons and the year from all and the 10 quieter days are shown as vector diagrams in Plate XI, the corresponding all day and quieter day diagrams being drawn from a common origin. Plate XI also shows vector diagrams for the whole year from all and the 10 quieter days in two vertical planes, respectively in and perpendicular to the geographical meridian. The time employed in Plates I to XI is the same as in the corresponding inequality tables, *i.e.*, is the time of 180° E.

The diurnal inequalities from the five international quiet days and the five days of largest international "character" figure for the three seasons and the year appear side by side in Plates XII and XIII. Plate XIV gives vector diagrams for these two sets of days, corresponding quiet and disturbed day diagrams having a common origin. The four upper pairs of diagrams refer to the horizontal plane and include the three seasons as well as the year. The two lower pairs of diagrams, dealing with the forces in the two fundamental vertical planes, are confined to the year. The time used in Plates XII, XIII and XIV is G.M.T., just as in the corresponding tables.

In all cases the scale of force or of angular measurement is shown. At the same time the curves and diagrams are primarily intended to give merely a general idea of the phenomena. For any exact numerical purpose recourse should be had to the tables.

The 12 Tables X to XXI dealing with E′, S′ and V are in one respect exposed to less uncertainty than the others. A 20 per cent. error, for example, in the scale value assigned to the S′ instrument would be without effect on the E′ and V inequalities, and would simply introduce a 20 per cent. error into each hourly value in Tables XIV to XVII, leaving the times of maximum and minimum and the general character of the diurnal inequality unaltered. It would, however, affect differently each hourly values of the E, S, D, I and T inequalities, according to the extent to which the value in question depended on ΔS′.

As already stated, the S′ magnetograph showed some changes of scale value prior to August, 1911, and the V magnetograph showed minor changes at a somewhat uncertain date, the exact time and cause of the changes not being fully ascertained in either case. E′ is thus undoubtedly the element which gives the most reliable information as to the changes during 1911 and 1912 in the amplitude of the forces to which the diurnal inequality is due. It must, at the same time, be remembered that the amplitude of the diurnal inequality in the Antarctic is largely dependent on the amount of disturbance present. Thus a specially large diurnal range in the inequality from all days for a particular month may only mean an exceptional proportion of highly disturbed days. If, however, the range from the 10 quieter days is also exceptionally large, it is reasonable to suppose that the phenomenon is at least partly due to an all round enhancement of the diurnal inequality forces.

If we compare corresponding months of 1911 and 1912 in Tables X and XII we find that the ranges and A.D.'s in 1911 were invariably larger than those in 1912. This was especially so in the case of the 10 quieter days, the ranges for February, April, May and July, 1911, being more than double those for the corresponding months of 1912. Wolfer's sunspot frequencies were 5·6 for 1911 and 3·6 for 1912, so that a slight excess in amplitude in the former year would be natural, but the excess actually shown is quite out of proportion with that shown in temperate regions. The great difference between the two years introduces some uncertainty into any inferences we may draw as to seasonal variation in the amplitude of the diurnal inequality. It is undoubtedly largest near midsummer and least near midwinter, but the months in which the maximum and minimum naturally occur cannot safely be deduced. The outstanding amplitude in February, 1911, is undoubtedly largely due to the exceptionally disturbed character of that month. This applies to the quieter days as well as the all days inequalities, because owing to the restricted number of days on which the trace was complete and decipherable, the choice of quieter days was very restricted.

The ranges in the S′ inequalities in Tables XIV and XVI also show a conspicuously larger amplitude in 1911 than in 1912. The only case in which the 1912 range exceeds the 1911 range is the quieter day inequality for October, and even in that month the A.D. is decidedly greater in 1911 than in 1912.

The excess of the 1911 over the 1912 ranges is also in general clearly apparent in V, but the excess is by no means so marked as in the case of the horizontal components. There are, however, only two exceptions to the general rule, viz., November in the case of the all day inequalities, and October in the case of the quieter day inequalities. In the latter case the excess in 1912 extends to the A.D.

The general parallelism between the variations of range and of A.D. shown by E′ and S′ encourages the hope that the settlement of scale values for the latter element was satisfactory.

Intercomparison of the inequalities for the three seasons in Tables XI, XIII, XV, XVII, XIX and XXI shows at once that the type of the diurnal inequality varies but little throughout the year, the differences being mainly a matter of amplitude. We thus infer that the differences between successive months in Tables X to XXI as regards the times of maximum and minimum represent in the main accidental effects of disturbance. In this respect the much less average disturbance of the 10 selected quiet days seems neutralised by the reduced elimination of what is accidental owing to the diminished number of days. As between the range and the A.D., the former is the more likely to be influenced by accidental features. At stations where the diurnal inequality has a large 12-hour component the A.D. is in general the better index of the activity of the forces to which the inequality is due, but this hardly applies to the Antarctic where, as we shall presently see, the 24-hour term is largely dominant.

Section 21.—The nature of the diurnal inequality in different elements is best studied in connection with the tables which give the combined results of the two years, as accident enters less into these. A point to bear in mind in any comparison with data for other stations is the difference, 54 minutes, between the local time and that of 180° E. employed in all the tables except the two which use G.M.T.

Taking first the east component, a glance at Plate I suffices to show that the inequalities reached for the 12 months are not wholly free, especially in the summer months, from " accidental " irregularities. Obvious irregularities are much less apparent in the seasonal inequalities in Plate VII. Apart from irregularities there is clearly, the whole year round, only a single maximum and minimum, and the hours of their occurrence show little if any seasonal variation. Another unusual feature is the smallness of the difference between day and night as regards the rapidity of the diurnal changes. This peculiarity is not confined to the summer months when the sun never sets and the winter months when it never rises, but seems just as true of the equinoctial months. February has the largest range and A.D. in both Table XXII and Table XXIII, but this pre-eminence is not unlikely due to the fact that disturbance greatly diminished between February and November, 1911. June and July show decidedly smaller ranges and A.D.'s than the other winter months in Table XXII, but May has a smaller range, though a larger A.D. than either, in Table XXIII. As at most stations, the equinoctial months occupy a half-way house between the summer and winter months. In the case of the seasonal inequalities the range and A.D. for equinox are slightly in excess of those for the year in Table XXII, but slightly in defect in Table XXIII. The equinoctial months, in fact, by themselves give a very good idea of the average state of things during the year.

The difference in amplitude between the inequalities from all days and from the 10 quieter days is much more striking in winter than in summer. This, no doubt, arises from the much greater prevalence of large disturbances at the latter season. A considerable number of the selected quiet days in winter would have passed as quiet days at most places, but the selected quiet days in summer would at the ordinary station have been considered somewhat highly disturbed.

The inequality in S shows the same general features as that in E. There is only one maximum and minimum. The type is nearly constant throughout the year, and the rates of change during night and day are similar. In fact the fall from the afternoon maximum to the early morning minimum is usually more rapid than the rise to the maximum, though it is the latter that is in progress near noon. The pre-eminence of February as regards range is even greater than in the case of E, and similar remarks apply. In Tables XXIV and XXV June gives a less range and a less A.D. than any other month. As with E, the difference as regards amplitude between all days and quieter days is specially conspicuous in winter. The ranges and A.D.'s in the inequality for equinox are again very similar to those in the inequality for the year.

The amplitudes in the E and S inequalities are closely alike. If we take the all day seasonal inequalities we find the E ranges the larger, but the excess is only about 1½ per cent. in summer. E has also the larger A.D., except in winter, but the excess in its case is microscopic. In the case of the seasonal diurnal inequalities for the 10 quieter days E has the larger range, but S the larger A.D.

As already explained, the D inequalities given in Tables XXVI and XXVII, and shown graphically in Plates III and VIII, have been calculated for the hut value of H. In these tables and figures D has been counted positive from North to East, but the mean value being in excess of 90° the + sign means movement of the N-end of the magnet towards West, and the maximum occurring about 11 h.—*i.e.*, near 10 a.m. L.M.T.—represents the extreme westerly position. The turning points in D occur usually from one to two hours later than those in E. The change in amplitude with the season of the year is naturally similar to that already described in E and S. H being about four times as large at Kew as at the Antarctic station, disturbing forces of given amplitude would cause four times as large a D range at the latter station as at the former. The excess in the Antarctic D ranges for the all day inequality is considerably greater than the difference of force would account for, and relatively considered this excess is greatest in winter. On the quieter days, however, the ratio of the summer to the winter range seems larger in the Antarctic than at Kew.

Considered simply as angular changes, the Antarctic declination ranges appear enormous. A range as large as 60′ occurs in this country only during a large magnetic storm, but in Table XXVI the range exceeds 60′ in seven months out of the twelve. The reduced utility of the compass in high magnetic latitudes can be readily imagined.

V in the Antarctic being some 15 times larger than H, we infer from (13) that the diurnal variation in I is mainly determined by that in H. The times of occurrence of the maximum and minimum in individual months in Tables XXVIII and XXIX vary irregularly.

There is no clear difference of type between the inequalities at different seasons. The seasonal inequalities in I in Plate VIII show only small irregularities, the maximum occurring about 5 h. (4 a.m. L.M.T.) and the minimum about 16 h. The rates of change in passing from the maximum to the minimum and from the minimum to the maximum are very similar. As with the elements already discussed, the February ranges are considerably the largest. On the whole June shows the smallest movements. The all day January and November ranges in Table XXVIII do not show the marked excess over those for March and April which presented itself in the case of E, S and D.

The range in the mean diurnal inequality for the year in Table XXVIII is some two and a half times as large as the corresponding I range at Kew. Its large size adds weight to the criticism already passed on the large uncertainty in base line values of V curves determined from combined absolute observations of I and H. As we see by reference to (13′), while a change of 1′ in I can be produced by a change of 20γ in H, it requires a change of fully 315γ in V to produce it. Thus if a V base line value were assigned on a single observation in H and one in I, it would be in error to the extent of 100γ if there were an observational error of 5γ in H, or of $0'{\cdot}3$ in I.

Tables XXX and XXXI and Plates V and IX give the diurnal variation in H. The H inequality shows a considerable resemblance to that in S both in type and amplitude, and the values of the A.D. in the two elements are closely alike in most months and seasons. The times of occurrence of the maximum and minimum are, however, an hour or two later in H than in S, and the ranges for the former element are in most months somewhat the larger. From what has been already said as to the dependence of the I inequality in changes in H, it follows that the H inequality curves inverted should closely resemble the corresponding curves for I. On comparing Plates IV and V it is readily seen that such is the case.

The V diurnal inequalities for the months, year and seasons are given in Tables XIX and XXI and are illustrated in Plates VI and IX. Irregularities are more in evidence in the V inequalities than in those of the other elements, especially during the morning hours. There is in particular a remarkable kink in the all and quieter day curves for January, the all day curves for November and December, and the quieter day curves for March. A kink even appears in the inequality curve for summer, and its influence is recognisable in the inequality for the whole year. The phenomenon is presumably a consequence of the specially disturbed conditions which, as will appear later, were characteristic of the morning hours.

The hours of maximum and minimum in V approach closely to local midnight and noon respectively. The seasonal variation in the amplitude of the diurnal inequality is much the same as in the horizontal components, and as in their case the range for the year from the 10 quieter days does not differ much from that for winter given by all days.

As the range of the diurnal inequality in V was on the average about two-thirds of that in H, it is obvious from (14′) that the influence of changes in H on the diurnal inequality in T must be insignificant. Thus we know *a priori* that the diurnal inequality in T must very closely resemble in type that in V. Only the seasonal inequalities in T are shown graphically, see Plate X. The close resemblance of the curves in Plate X to those for V in Plate IX appeals to the eye. A comparison of Tables XIX and XXI with Tables XXXII and XXXIII shows that with the exception of the range in June from all days, the range and A.D. in every month and season, alike for all and for the quieter days, are a trifle larger for V than for T.

Section 22.—Allowing for the 12-hours difference in the times used, the inequalities from the international quiet days in Table XXXIV and Plates XII and XIII are easily seen to very closely resemble those derived from the 10 quieter days. In the case of E and S the range and A.D. from the international quiet days are the smaller, except in the winter inequality in E. The excess in the values for E from the 10 quieter days is small, except in summer when it is considerable. It is also considerable in summer in S, and very appreciable in the other seasons. In the case of V the international days give decidedly the larger range and A.D. in summer, and slightly the larger A.D. in the year; with these exceptions the international quiet day values are the smaller. It follows that the international quiet days selected at De Bilt from the returns of some 40 stations, nine-tenths of which are situated in the northern hemisphere, represented on the whole more quiet conditions in the Antarctic than did the quiet days selected from special consideration of the Antarctic curves. The phenomenon is due of course primarily to the smaller number of the international days. If these had been 10 a month instead of 5, the difference would probably have been in the other direction. But making every allowance for the smaller number of the international days, the result is a remarkable one. Disturbances special to the Antarctic must have been very few or very insignificant on the international quiet days.

The highly disturbed day inequalities for winter and equinox in Table XXXV and the corresponding curves in Plates XII and XIII depend on the curves of 40 days, but the summer inequalities depend on 20 days only. The traces, especially in summer, were many of them disturbed to an extent rarely seen in temperate latitudes, and no one I think after inspecting the curves would have anticipated the smoothness shown by the inequalities. There are admittedly some irregularities, especially in the E curves about 18 h.–22 h. G.M.T.—*i.e.*, about the time of the irregularities visible in the V curves in Plate VI—but the curves are very similar in smoothness to the all day seasonal curves. If we compare the corresponding inequalities in Tables XXXIV and XXXV, or the curves illustrating them, no difference in type catches the eye. In amplitude, however, the difference is immense, as will perhaps be best appreciated by consulting Table XXXVI, p. 94, giving the ratio borne by the range (R) and A.D. of the 5-disturbed day inequality to the corresponding quantity for the international quiet days.

In E the ratio is larger for the A.D. than the range, which suggests a somewhat more rounded type of curve on the disturbed day. In S the ratio is on the whole slightly larger for the range. In V the ratio is in all cases identical for the range and A.D., suggesting great similarity of type in the inequalities. The ratio is greatest in winter and least in summer. This agrees with what we already found as between the all day inequality and that from the 10 quieter days, but the phenomenon is even more prominent in the present case, especially in V. In that element the ratios in summer, equinox and winter are to one another as 1 : 2 : 3. The comparatively small size of the ratio in summer for V is partly due to the small effect of disturbance in increasing the amplitude of the inequality, and partly to the comparatively large size of the amplitude on the international quiet days. When the quiet day system was first introduced, it seems to have been expected that the resulting inequalities would show a close agreement with those from all days, except in so far as accidental features due to disturbance affected the latter. This anticipation is exceptionally wide of the mark in the case of the Antarctic. In any comparison of Antarctic inequalities with others, or in any theoretical work in which Antarctic data are employed, the choice of days is obviously all important.

The diminished amplitude on ordinary days of the inequalities in equinox and especially in winter as compared with summer suggests that direct sunlight has a potent influence on the phenomena. If, as is generally supposed, the inequality is due to electrical currents in the upper atmosphere, the influence might equally well consist in an increase in the electromotive forces to which the currents are due, or in a decrease in the electrical resistance of the atmosphere such as is produced by ionising agents, or it might mean a lowering of the level at which the currents are found. The fact that the inequality is increased by disturbance, and especially in winter, when direct solar influence is much reduced or totally absent, suggests that the presence of disturbance has a similar effect to that of direct sunlight. In the Antarctic on highly disturbed days, the influence of disturbance is of the same order as that of direct sunlight, for the E and S ranges in winter in Table XXXV are fully as large as the corresponding ranges derived from all days in summer.

Section 23.—As already explained, Plate XI gives vector diagrams based on the diurnal inequalities for all days and for the 10 quieter days a month. In the case of the forces in the horizontal plane there are diagrams for the three seasons as well as the year. The common origin for the two sets of days is at the centre of the cross on which the cardinal directions are shown, and each arm of the cross represents 5γ.

The points representing the 24 hours are marked in the curves, and each third hour is numbered, according to the time of 180° E.

The line from the origin to any hour mark indicates the direction and magnitude at that hour of the component in the plane of the diagram of the force system to which the diurnal inequality is due. Each diagram is described in the course of 24 hours, and the enclosed area may be regarded as a rough measure of the energy expended in the regular diurnal changes.

The diagrams relating to the horizontal field are described counter-clockwise. It is natural to suppose that the irregularities apparent in the diagrams would disappear if data were available from a number of years. Even then, however, we have no reason to suppose that we should get a perfect circle, with the origin at the centre. If we suppose a radius vector drawn from the origin to travel with its free end on the diagram, the area described between 13 h. (*i.e.*, roughly local noon) and 1 h. (local midnight) is in all cases visibly larger than that described between 1 h. and 13 h.; in other words, the afternoon contributes more than the forenoon to the area within the diagram. The line joining the points answering to 4 h. and 16 h. seems very nearly to bisect the area in all cases. Corresponding points on the all day and quieter day diagrams lie approximately on the same radius vector; the departures from co-linearity seem to the eye mainly accidental. Both the all day and the quieter day summer diagrams have a perceptible bulge near 10 h., while the all day diagrams for winter seems a little compressed between 6 h. and 11 h. Both features may, however, be accidental. Even if they are real, the resemblance between the winter and summer diagrams for the Antarctic is immensely closer than it is at ordinary European stations, in spite of the outstanding nature of the difference in the conditions of solar radiation at the two seasons in the Antarctic.

The vector diagrams in the two vertical planes respectively in and perpendicular to the local meridian are confined to the whole year. In both, up the sheet answers to an increase in the vertical force acting on the dipping pole of the needle. There are very sensible irregularities presumably of an accidental character, but the all day and quieter day diagrams are clearly of very similar form. The shape, especially of the

VS diagram, is decidedly less circular than that of the diagram for the horizontal plane. In fact between 17 h. and 0 h. (or from 4 p.m. to 11 p.m. local time) the VS diagram does not differ much from a straight line.

Plate XIV gives vector diagrams for the five disturbed and five quiet days. These include ES or horizontal plane diagrams for the three seasons and the year, but VS and VE diagrams for the year only. The times shown are G.M.T. as in the corresponding inequality tables. The scale has only half the openness of that employed in Plate XI. The centre of the cross serves for the common origin of the disturbed and quiet day diagrams. Parts of the quiet day diagrams could not be shown clearly owing to the hour points lying too close together. The hour points are, however, shown so far as possible. Allowing for the 12-hour difference in time, the diagrams are similar to the all day diagrams, but are naturally rather less regular in outline.

Section 24.—The base stations of the Antarctic Expeditions of 1902–04 and 1911–12 were only some 16 miles apart, their accepted positions being :—

1902–04	..	77° 51′ S.	166° 45′ E.
1911–12	..	77° 38′ S.	166° 24′ E.

Two stations as adjacent as this in temperate latitudes would naturally possess nearly identical diurnal variations, but we should expect a small difference in geographical position to have an increased influence as we approach a magnetic pole. Thus, even if both stations had been free from local disturbance, we should hardly have known what to expect. In reality, local disturbance was observed at both stations. As we have seen, sensible local disturbance existed in the observation hut in 1911–12 and possibly in the magnetograph cave, an uncertainty of the order of 5 per cent. resulting therefrom in the diurnal range of declination. In 1902–04 the local disturbance was larger. The value obtained for H in the absolute hut stood roughly in the ratio of 3 : 2 to the value obtained about $1\frac{3}{4}$ miles away on the ice in McMurdo Sound. The dip observed on the ice exceeded that in the hut by 1° 49′. Combined with the corresponding value of H, this indicated a comparatively small disturbance of V in the hut, amounting to only about ·035 C.G.S. As to declination, there was only one comparison on the ice, taken at a time when the magnetographs were not in action. The declination observed on that occasion was about 5° less (measured from North through East) than the mean value in the observation hut. The observation was taken at a season, January, when disturbances were specially large. Thus the local disturbance of D in the hut may have been very sensibly greater or very sensibly less than 5°, but in any case it would seem to have been comparatively trifling compared with the disturbance in H.

In 1902–04 no inter-comparison was made of the absolute and magnetograph huts. They were only about 25 yards apart. Thus, unless the disturbance in the absolute hut was due to building material or some purely superficial rock, we must suppose that the magnetograph hut was also seriously disturbed. While the same magnetograph was used in the two expeditions, the elements recorded were different.

In 1902–04, D and H were directly recorded. Thus the uncertainties connected with the presence of local disturbance entered differently into the results. If the field in the magnetograph hut in 1902–04 was the same as that in the absolute hut, the range shown by the D magnetograph was probably only about two-thirds of that natural to an undisturbed site on the ice of McMurdo Sound. If, on the other hand, the field in the magnetograph hut in 1902–04 was different from that in the absolute hut, the equivalent in force of 1′ change in D was not the same for it as for the absolute hut, and the inequalities calculated for the South and West components on that hypothesis were in error. One phenomenon observed in 1902–03 is at least consistent with the hypothesis that the absolute hut was exposed to some very local source of disturbance. This phenomenon was an apparent large annual variation in H, the mean values for the midwinter and midsummer months being respectively 6650γ and 6469γ. No similar phenomenon, as we shall see, presented itself in 1911–12, and no such large difference between winter and summer has, so far as I know, been observed elsewhere.

The comparison of the results from the two expeditions is affected by another serious source of uncertainty. In 1902–04 the D and H instruments, especially the latter, were unduly sensitive. The consequence was a considerable loss of trace, especially H trace, more particularly in summer. The sensitiveness of the V instrument was not excessive, but it possessed a very large temperature co-efficient, and the variations of temperature in the magnetograph hut were large. Thus, the application of a temperature correction was absolutely necessary.

The thermograph had an unduly open scale for the conditions prevailing, and the consequence was that a good deal of trace was lost, from the record going off the sheet. When this happened, the V trace could not be corrected for temperature, and so was useless. In some months, to get anything like a satisfactory number of complete "days" of V record, use had to be made of periods of 24 consecutive hours not starting at midnight.

The outcome of these instrumental weaknesses was that the days used for deducing D, H and V inequalities was not the same, the number of days available for D inequalities being the greater, especially in summer. As restriction in the number of days used for the V inequalities arose mainly through default of temperature trace, the days employed were presumably fairly representative of average magnetic conditions. But in the case of H, especially in summer, it was only on the quieter days that the trace kept within the limits of registration. Thus the H diurnal inequalities obtained in 1902–03 referred undoubtedly to a less disturbed average state of matters than did the D inequalities. This almost certainly meant that the range of the H inequality was less than it would have been if derived from the same days as the D inequality.

There was, as a matter of fact, a second set of D diurnal inequalities got out for selected quiet days in 1902–03. But the days so selected varied much in number from month to month and, the special features of the Antarctic being then unknown, the extent to which the days selected were identical with the days used for the H inequalities was purely a matter of accident.

The type of the diurnal inequality in 1911–12 certainly depended but little on the amount of disturbance prevailing, and so far as our evidence goes the same was equally true of 1902–03. Thus the D, H and V inequalities obtained for that epoch probably represent the type satisfactorily enough, even if not properly representative as regards the amplitude of the diurnal inequalities. But the same cannot be expected of the derived inequalities including those for I, S and E, especially the two latter. This will be recognised on reflecting that if the contributions of D and E were all altered in the ratio $m : n$, the contributions from H remaining unaltered, the entire character of the inequality might be altered.

The seasonal diurnal inequalities will suffice for the comparison of the new results with the old. For brevity, N.A.E. (National Antarctic Expedition) will be used for the publication dealing with the 1902–03 results.

Comparing the D curves in Plate VIII with those in Fig. 9, p. 112 of N.A.E., the similarity of type at once appeals to the eye. A like similarity prevails between the H curves in Plate IX and those in Fig. 10, p. 113 of N.A.E., and between the V curves in Plate IX and those in Fig. 11, p. 115. In the case of the V curves we have even similar slight irregularities in the two cases in the forenoon hours in the summer season.

A point to be noticed is that while equinox meant the same months in the two cases, a three-month midsummer (November, December and January), and a three-month midwinter (May, June and July) were employed for 1902–03, instead of the four-month summer and winter seasons employed for 1911–12. The choice made in 1902–03 was decided by the wish to include in midsummer only days in which the sun did not set, and in midwinter only days in which the sun did not rise. This ruled out February and August. There was not the same reason for this curtailment of the two seasons in dealing with 1911–12, because it was then known in advance that the type of the diurnal inequality was unlikely to differ much throughout the year.

The exclusion of August and February would naturally reduce the range of the midwinter inequality in 1902–03, and increase that of the midsummer inequality, but the effect should be trifling.

Perhaps the only difference between the older and newer curves immediately obvious is in the times of occurrence of the daily maximum and minimum. There ought, of course, to be an apparent difference of nearly an hour, as the 1902–03 curves refer to local time. This accounts satisfactorily for the difference shown in the V curves between the times of appearance of the minimum near noon, the most regular and conspicuous turning point in that element. In the case, however, of H, the times of maximum and minimum in the curve for the whole year are respectively 14 h. and 5 h. in 1902–03, as compared with 16 h. and 5 h. in 1911–12. This gives on the average of the two events the difference of one hour, which was to be expected, but it makes the rise from minimum to maximum take two hours longer in the one case than in the other. In the case of D, where both maximum and minimum are well marked, their hours of occurrence in the curves for the whole year were maximum 9 h., minimum

18 h., or 19 h. in 1902–03, as compared with maximum at 11 h., minimum 20 h., or 21 h. in 1911–12. Allowing for the difference of time, this leaves an unexplained retardation of one hour in the later as compared with the earlier data.

The curves are, however, so rounded near the turning points that the difference is not of a striking character.

A notable difference does, however, present itself when we pass to the vector diagrams for the forces in the horizontal plane. The regular curve suggested by the diagrams in Plate XI is the circle, whereas the diagrams in Fig. 13, p. 116 of N.A.E., suggest ellipses, with the major axis at least double the minor, the latter lying roughly in the magnetic meridian.

The difference is partly explained by the omission of the more disturbed days from the H inequalities for 1902–03 referred to above. If we take midsummer, the season when this cause was most in evidence, the number of days employed in the inequalities for H, D all days and D quieter days were respectively 42, 73 and 31. Thus the standard of disturbance in the diurnal inequality for H probably approached much nearer that of the quieter day than that of the all-day D inequality. The ranges of these two latter inequalities were respectively $34'\cdot0$ and $45'\cdot5$, and so were roughly in the ratio 3 : 4. Supposing the true natural shape of the diagram to have been circular, we could in this way explain its becoming an ellipse in which the minor axis was only about three-fourths of the major. But in the midsummer diagram for 1902–03 the minor axis is barely half the major. If the outstanding difference is to be fully explained by the other acting cause mentioned above, we must suppose that the magnetograph hut in 1902–03 was practically undisturbed. If this were the case, H in the magnetograph hut, like H at the ice station, was only about two-thirds of H in the absolute hut, and the transformation actually made of D changes into changes of force gave values too large in the ratio 3 : 2. If we replaced the all day by the quieter day D inequality and the value of H in the magnetic hut by that for the ice station, we should reduce the major axis of the midsummer vector diagram roughly in the ratio $(\frac{3}{4}) \times (\frac{2}{3}) : 1$, or 1 : 2. This would bring the form of the vector diagram for 1902–03 into fair agreement with that for 1911–12.

The fact that the midwinter diagram in p. 116, N.A.E. is less elliptical than that for midsummer, could be explained in accordance with the explanations given above by the fact that the H days employed numbered $82\frac{1}{2}$ per cent. of the D days employed, instead of only $57\frac{1}{2}$ per cent. as at midsummer. There was thus a considerably closer approach to a common standard of disturbance in the case of midwinter.

Section 25.—A more detailed comparison of the data from the older and newer epochs is attempted in Table XXXVII, p. 94. It should be remembered that " summer " and " winter," " all " and " quieter " do not bear exactly the same significance in the two cases.

There were several causes of loss of trace in 1902–03, but the days when there was loss from causes other than the limits of registration being exceeded may fairly be regarded as days of average disturbance. Thus particulars of the percentage which the number of days when the limit of registration was exceeded formed of the total number of days when there was no loss of trace from other causes should give a good idea as to the reduced extent to which disturbance entered into the inequalities of 1902–03 as compared with 1911–12. Taking the year and the three seasons as defined in 1902–03, we find the percentages of days omitted for excessive disturbance to be as follows :—

	Year.	Midwinter.	Equinox.	Midsummer.
D (all days)	14	4	17	27
H	49	20	61	71

Thus in a midsummer month of 30 days we may regard the ordinary day 1902–03 inequalities as representative of the nine quietest days in H, and the 22 quietest days in D. The corresponding figures for a representative month of 30 days, for the other seasons and the year, are for midwinter D 29, H 24 ; for equinox D 25, H 12 ; for the year D 25, H 15.

On a comparative basis the quieter day D inequalities of 1902–03 may be regarded as representative of the n quietest days of the month, where n has the following values :—

13 for the year, 17 for midwinter, 13 for equinox and 9 for midsummer.

On this basis if 1902–03 and 1911–12 had been equally quiet epochs, and both magnetograph chambers had been undisturbed, the following phenomena might have been expected to present themselves :—

in Year and Equinox,

in D, range from all days 1902–03 slightly less than range from all days 1911–12 ;
in D, range from quieter days 1902–03 slightly greater than range from quieter days 1911–12 ;
in H, range for 1902–03 somewhat in excess of range from quieter days 1911–12 ;

in Winter,

in D, range from all days 1902–03 approximately equal range from all days 1911–12 ;
in D, range from quieter days 1902–03 distinctly greater than range from quieter days 1911–12 ;
in H, range for 1902–03 nearer to range from all days than that from quieter days 1911–12 ;

in Summer,

in D, range from all days 1902–03 about midway between ranges from all and quieter days 1911–12;

in D, range from quieter days 1902–03 closely similar to range from quieter days 1911–12;

in H, range for 1902–03 closely similar to range from quieter days 1911–12.

The previous remarks will have sufficiently explained why in Table XXXVII the older H data are regarded as belonging to quieter rather than to all days, and why the opposite view is taken of the older V data. As E depends more on D than on H, while S depends more on H than on D, the older E ranges are entered in the "all" day line, and the older S ranges in the "quieter" day line, though the calculations leading up to them employed in each case the all day D inequalities. It would perhaps have been more correct to have regarded both the E and the S ranges as intermediate.

Consider first the H data in Table XXXVII, because these should not be seriously affected whatever view we take as to disturbance in the magnetograph hut. The anticipations we reached on the hypothesis that the older and newer epochs had a similar amount of natural disturbance, were that the ranges for the older epoch for the year, equinox and summer would approach closely to the quieter day ranges of the newer epoch, while in winter the ranges for the older epoch would be intermediate between the all day and quieter day ranges of the newer epoch. We find, however, in each case that the range for the older epoch is less than the quieter day range for the newer epoch, and the deficiency is substantial except in winter. This suggests that the epochs were not alike as regards disturbance in the Antarctic, 1902–03 being decidedly the quieter epoch of the two. This conclusion is supported by the results obtained for the V ranges; the older ranges are conspicuously less than the all day newer ranges. The deficiency in the older V ranges is very similar to the deficiency we have just described in the older H ranges as compared with the newer quieter day ranges. In Europe 1911 was a much more disturbed year than 1902 or 1903, so the difference between the H and V ranges for the two epochs is in the direction we should naturally have expected.

Coming now to the D ranges, on the hypotheses that the natural disturbance in the two epochs was the same and that there was no local disturbance, our anticipations were that the all day ranges in 1902–03 for the year and equinox would be slightly less than the all day ranges in 1911–12, while the quieter day ranges in 1902–03 for the year and equinox would exceed the corresponding quieter day ranges for the later epoch. In each case, however, according to Table XXXVII, the 1902–03 range falls short of our anticipations. The same result follows for winter. For summer, on the other hand, our anticipations are fairly fulfilled. The all day range for 1902–03 is intermediate between the all day and quieter day ranges for 1911–12, and the quieter day range for the earlier epoch does not differ very much from that for the later epoch.

Thus on the whole the deficiency in the older as compared with the newer D ranges is not more but rather less marked than in the case of the H and V ranges.

If we put 50 per cent. on to the D ranges for 1902–03, as we naturally should do for comparison with 1911–12 if we supposed the magnetograph hut in the earlier epoch to be equally disturbed with the absolute hut, we should, except in one case—that of the all day winter range—find the older ranges to be in excess of the newer. In short, the D phenomena fall better into line with the H and V phenomena if we suppose that the magnetograph hut of 1902–03, unlike the absolute hut, was no more disturbed than the cave of 1911–12. The E and S data in Table XXXVII point in the same direction. If we took one-third off the older E ranges—representing, roughly, the correction required if H in the magnetograph hut in 1902–03 was really ·043 instead of ·066—we should get results much more in harmony with those we reached in the case of H and V.

Table X.—Diurnal Inequality in E′ in

—	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	12 h.
1911—	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
Feb. ...	+20·2	− 4·4	− 7·8	−21·2	−40·4	−58·0	−63·9	**−85·1**	−71·1	−65·6	−72·2	−42·7
Mar. ...	+ 4·2	− 1·6	− 9·4	−21·3	−30·4	−36·4	−40·7	−53·7	**−56·6**	−55·0	−49·8	−49·2
April ...	+ 1·2	− 3·8	−14·2	−10·9	−20·2	−33·9	−35·1	−35·1	**−49·0**	−46·3	−48·4	−36·4
May ...	+ 5·7	− 1·1	− 6·3	−13·4	−22·8	−23·3	−23·6	−26·7	−26·3	−26·8	**−32·2**	−23·0
June ...	− 2·1	− 4·1	− 3·2	−10·9	−13·1	−16·2	−19·2	−23·4	−19·3	−19·3	**−23·5**	−17·6
July ...	+ 5·4	− 1·7	− 4·7	− 9·4	−18·6	−21·6	−21·8	−22·4	−20·7	−23·3	**−23·8**	−22·2
Aug. ...	+ 1·8	− 2·1	−12·7	−13·0	−16·7	−22·3	−22·4	−18·7	−21·1	−22·1	**−30·5**	−16·8
Sept. ...	+ 0·8	− 2·6	−12·3	−15·8	−17·8	−24·8	−24·2	−30·0	−28·2	−35·9	**−37·1**	−24·9
Oct. ...	− 0·5	− 5·2	−12·2	−18·5	−23·2	−32·3	−42·2	−38·9	**−42·5**	−39·4	−32·4	−20·3
Nov. ...	+ 7·3	− 0·5	− 5·7	− 9·3	−21·9	−29·1	−34·0	−52·5	−64·7	**−65·8**	−46·7	−36·1
Dec. ...	+ 8·4	+ 2·3	− 5·5	−11·0	−21·6	−29·9	**−45·1**	−28·2	−43·7	−33·0	−34·9	−29·6
1912—												
Jan. ...	+ 8·2	− 2·3	−10·2	−13·0	−23·1	−20·8	−13·1	−16·1	−30·1	**−60·1**	−46·4	−40·5
Feb. ...	+ 0·3	− 6·8	−10·5	−16·9	−21·1	−22·5	−24·0	−28·7	−30·0	−37·6	**−39·3**	−25·5
Mar. ...	+ 3·7	− 4·9	− 8·7	−14·9	−18·3	−22·2	−21·1	−23·3	−27·2	−27·1	**−30·0**	−21·8
April ...	− 2·4	− 3·3	− 5·6	−12·3	−20·7	−19·6	−25·3	**−26·8**	−25·9	−21·1	−18·4	−16·7
May ...	− 0·2	− 1·0	− 3·5	− 8·3	− 7·5	−13·8	−11·7	**−19·4**	−16·6	−18·2	−14·0	−11·9
June ...	− 0·6	− 2·1	− 6·1	− 5·4	− 5·4	−11·6	−12·7	−13·5	**−17·0**	−13·7	−13·6	−14·4
July ...	− 0·3	− 4·5	− 2·8	− 6·3	− 9·0	−13·0	−11·9	−14·5	**−14·9**	−12·6	−13·6	−11·0
Aug. ...	+ 3·6	+ 0·8	− 4·5	− 6·7	−11·3	−17·8	−18·5	−24·1	−19·1	**−25·2**	−23·3	−21·8
Sept. ...	− 0·1	− 1·2	− 2·3	− 7·4	−14·5	−21·5	−23·6	−26·8	**−36·9**	−22·3	−18·0	−16·3
Oct. ...	+ 3·4	− 2·9	−11·1	−16·5	−21·8	−23·6	−21·1	−27·8	−31·3	**−34·9**	−32·8	−32·1
Nov. ...	− 6·1	−10·5	−10·2	−14·2	−15·2	−16·9	**−45·3**	−40·0	−32·1	−35·9	−20·9	−20·0

Table XI.—Diurnal Inequality in E′ for the 12 Months,

—	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	12 h.
	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
Jan. ...	+ 8·2	− 2·3	−10·2	−13·0	−23·1	−20·8	−13·1	−16·1	−30·1	**−60·1**	−46·4	−40·5
Feb. ...	+10·2	− 5·6	− 9·2	−19·1	−30·8	−40·2	−43·9	**−56·9**	−50·6	−51·6	−55·7	−34·1
Mar. ...	+ 3·9	− 3·2	− 9·0	−18·1	−24·3	−29·3	−30·9	−38·5	**−41·9**	−41·1	−39·9	−35·5
April ...	− 0·6	− 3·6	− 9·9	−11·6	−20·4	−26·8	−30·2	−30·9	**−37·4**	−33·7	−33·4	−26·5
May ...	+ 2·7	− 1·0	− 4·9	−10·9	−15·1	−18·6	−17·7	**−23·1**	−21·4	−22·5	**−23·1**	−17·4
June ...	− 1·4	− 3·1	− 4·7	− 8·1	− 9·2	−13·9	−16·0	**−18·5**	−18·2	−16·5	**−18·5**	−16·0
July ...	+ 2·5	− 3·1	− 3·7	− 7·8	−13·8	−17·3	−16·9	−18·5	−17·8	−17·9	**−18·7**	−16·6
Aug. ...	+ 2·7	− 0·7	− 8·5	− 9·9	−14·0	−20·1	−20·5	−21·4	−20·1	−23·6	**−26·9**	−19·3
Sept. ...	+ 0·3	− 1·9	− 7·3	−11·6	−16·2	−23·2	−23·9	−28·4	**−32·5**	−29·1	−27·6	−20·6
Oct. ...	+ 1·4	− 4·1	−11·7	−17·5	−22·5	−27·9	−31·7	−33·4	−36·9	**−37·1**	−32·6	−26·2
Nov. ...	+ 0·6	− 5·5	− 7·9	−11·8	−18·6	−23·0	−39·7	−46·3	−48·4	**−50·8**	−33·8	−28·1
Dec. ...	+ 8·4	+ 2·3	− 5·5	−11·0	−21·6	−29·9	**−45·1**	−28·2	−43·7	−33·0	−34·9	−29·6
Year ...	+ 3·2	− 2·6	− 7·7	−12·5	−19·1	−24·2	−27·5	−30·0	−33·2	**−34·7**	−32·6	−25·9
Winter ...	+ 1·6	− 2·0	− 5·5	− 9·2	−13·0	−17·5	−17·8	−20·4	−19·4	−20·1	**−21·8**	−17·3
Equinox ...	+ 1·3	− 3·2	− 9·5	−14·7	−20·8	−26·8	−29·2	−32·8	**−37·2**	−35·2	−33·4	−27·2
Summer ...	+ 6·9	− 2·8	− 8·2	−13·7	−23·5	−28·5	−35·4	−36·9	−43·2	**−48·9**	−42·7	−33·1

Individual Months from all Complete Days.

13 h.	14 h.	15 h.	16 h.	17 h.	18 h.	19 h.	20 h.	21 h.	22 h.	23 h.	24 h.	Range.	A.D.
γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
−34·5	−18·7	+10·5	+50·3	+56·2	+60·5	+73·1	**+81·3**	+76·4	+74·0	+52·1	+30·6	166·4	48·78
−26·6	− 7·4	+12·2	+28·7	+49·7	+57·6	**+65·8**	+63·4	+55·4	+43·3	+32·2	+25·8	122·4	36·52
−24·9	− 9·3	+ 7·7	+29·5	+44·6	+50·8	+55·4	**+55·5**	+43·9	+34·6	+26·6	+17·1	104·5	30·60
−12·6	− 8·4	+ 3·7	+14·7	+26·6	+38·8	+35·3	**+39·8**	+34·4	+20·5	+15·2	+11·2	72·0	20·52
−11·2	− 5·2	+ 2·4	+14·0	+24·1	+24·4	**+36·2**	+30·9	+22·5	+18·3	+10·7	+ 5·6	59·7	15·73
−19·2	− 6·1	− 1·0	+11·7	+19·5	+24·3	**+37·7**	+35·9	+34·0	+28·9	+10·2	+ 9·2	61·5	18·05
−12·9	− 7·8	+ 3·2	+17·5	+20·9	+33·5	**+37·9**	+34·4	+33·5	+20·9	+12·5	+ 2·5	68·4	18·23
−18·0	− 3·0	+12·7	+24·6	**+42·2**	+38·3	+39·9	+35·5	+30·6	+30·0	+16·1	+ 3·0	79·3	22·85
−12·0	+ 3·6	+14·8	+25·9	+43·4	**+49·9**	+48·8	+45·2	+36·5	+27·6	+16·4	+ 7·9	92·4	26·65
−27·3	+ 2·1	+20·4	+37·4	+48·1	**+58·9**	+55·9	+48·1	+39·7	+37·0	+25·0	+13·5	124·7	32·79
−29·5	−17·3	+ 1·2	+14·5	+36·2	+42·8	+47·3	**+49·6**	+48·1	+41·8	+21·9	+14·3	94·7	27·40
−28·1	−14·7	+11·6	+26·6	+40·8	+43·0	**+47·5**	+37·8	+30·3	+28·2	+25·1	+19·7	107·6	26·55
−10·3	− 1·4	+13·1	+28·5	+34·9	+35·3	**+41·5**	+40·3	+36·3	+21·7	+12·5	+10·3	80·8	22·89
−16·5	+ 1·2	+13·8	+19·5	+27·1	+31·8	**+36·4**	+30·0	+29·1	+23·3	+13·1	+ 6·8	66·4	19·66
− 6·7	+ 4·1	+11·0	+19·3	+21·4	+28·8	**+31·7**	+27·3	+26·1	+22·0	+10·3	+ 2·5	58·5	17·05
− 9·0	− 6·0	+ 5·4	+12·4	+19·6	+21·3	**+21·8**	+21·4	+16·5	+12·7	+ 7·8	+ 1·9	41·2	11·75
− 5·7	− 1·9	+ 0·1	+ 7·4	+13·7	+21·0	**+24·4**	+21·5	+20·0	+ 7·9	+ 7·1	+ 1·2	41·4	10·33
−10·3	− 1·1	+ 3·2	+11·6	+15·0	+17·4	+21·2	**+22·0**	+13·8	+10·8	+ 7·2	+ 3·2	36·9	10·47
−13·8	− 1·0	+10·5	+23·1	+23·3	+23·6	**+27·9**	+23·4	+18·1	+15·4	+11·9	+ 5·8	53·1	15·57
−11·2	− 1·9	+ 9·8	+18·9	+27·0	+28·5	**+30·7**	+29·1	+27·2	+20·0	+10·4	+ 2·6	67·6	17·01
−16·7	− 2·7	+15·7	+29·4	+38·8	**+40·7**	+36·8	+38·3	+31·4	+21·7	+12·1	+ 7·2	75·6	22·95
−25·3	−17·9	+ 1·9	+28·6	+37·5	+41·9	+46·1	**+51·4**	+43·2	+32·1	+20·9	+ 6·3	96·7	25·85

3 Seasons and the Year from all Complete Days.

13 h.	14 h.	15 h.	16 h.	17 h.	18 h.	19 h.	20 h.	21 h.	22 h.	23 h.	24 h.	Range.	A.D.
γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
−28·1	−14·7	+11·6	+26·6	+40·8	+43·0	**+47·6**	+37·8	+30·3	+28·2	+25·1	+19·7	107·7	25·56
−22·4	−10·0	+11·8	+39·4	+45·6	+47·9	+57·3	**+60·8**	+56·3	+47·8	+32·3	+20·5	117·7	35·83
−21·6	− 3·1	+13·0	+24·1	+38·4	+44·7	**+51·1**	+46·7	+42·3	+33·3	+22·6	+16·3	93·0	28·03
−15·8	− 2·6	+ 9·3	+24·4	+33·0	+39·8	**+43·5**	+41·4	+35·0	+28·3	+18·4	+ 9·8	80·9	23·60
−10·8	− 7·2	+ 4·5	+13·6	+23·1	+30·0	+28·5	**+30·6**	+25·4	+16·6	+11·5	+ 6·6	53·7	16·12
− 8·4	− 3·6	+ 1·3	+10·7	+18·9	+22·7	**+30·3**	+26·2	+21·2	+13·1	+ 8·9	+ 3·4	48·8	13·03
−14·7	− 3·6	+ 1·1	+11·7	+17·3	+20·8	**+29·5**	+29·0	+23·9	+19·8	+ 8·7	+ 6·2	48·2	14·20
−13·4	− 4·4	+ 6·9	+20·3	+22·1	+28·5	**+32·9**	+28·9	+25·8	+18·2	+12·2	+ 4·1	59·8	16·89
−14·6	− 2·5	+11·2	+21·7	+34·6	+33·4	**+35·3**	+32·3	+28·9	+25·0	+13·3	+ 2·8	67·8	19·92
−14·3	+ 0·5	+15·2	+27·6	+41·1	**+45·3**	+42·8	+41·8	+34·0	+24·7	+14·2	+ 7·6	82·4	24·67
−26·3	− 7·9	+11·1	+33·0	+42·8	+50·4	**+51·0**	+49·7	+41·5	+34·6	+22·9	+ 9·9	101·8	28·98
−29·5	−17·3	+ 1·2	+14·5	+36·2	+42·8	+47·3	**+49·6**	+48·1	+41·8	+21·9	+14·3	93·3	27·40
−18·3	− 6·4	+ 8·2	+22·3	+32·8	+37·4	**+41·4**	+39·6	+34·4	+27·6	+17·7	+10·1	76·1	22·89
−11·8	− 4·7	+ 3·5	+14·1	+20·4	+25·5	**+30·3**	+28·7	+24·1	+16·9	+10·3	+ 5·1	52·1	15·04
−16·6	− 1·9	+12·2	+24·5	+36·8	+40·8	**+43·2**	+40·6	+35·1	+27·8	+17·1	+ 9·1	80·4	24·04
−26·6	−12·5	+ 8·9	+28·4	+41·4	+46·0	**+50·8**	+49·5	+44·1	+38·1	+25·6	+16·1	99·7	29·66

Table XII.—Diurnal Inequality in E′ in Individual

—	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	12 h.
1911—	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
Feb. ...	+14·8	+ 5·0	− 2·5	−15·5	−45·8	−39·8	−45·5	−52·6	**−65·2**	−60·2	−51·0	−35·3
Mar. ...	+13·8	+ 9·4	+ 1·9	− 5·0	−16·0	−14·9	−25·7	−20·9	−31·9	−33·7	**−39·9**	−30·7
April ...	− 1·1	− 6·2	− 5·7	− 6·8	−15·2	−21·5	−27·9	−23·6	**−30·2**	−22·9	−22·4	−12·9
May ...	+ 3·3	+ 0·7	− 3·9	− 2·4	− 5·9	− 6·6	−15·6	**−16·1**	−14·9	−13·7	−13·2	−11·0
June ...	− 2·3	0·0	− 0·5	− 6·1	− 4·5	− 9·8	−11·2	**−19·5**	−14·0	− 9·7	− 9·5	− 6·9
July ...	+ 0·3	+ 0·2	− 2·8	− 2·7	−15·0	−16·3	**−19·4**	−14·0	−10·0	− 9·6	− 7·6	− 4·8
Aug. ...	− 2·2	− 0·1	− 5·9	−14·0	− 6·7	− 8·7	− 9·5	−14·1	**−15·1**	− 8·2	− 9·7	− 2·5
Sept. ...	− 4·8	− 3·1	− 4·1	− 4·6	− 8·8	−10·5	−11·9	−16·8	−17·9	**−21·9**	−16·5	− 9·6
Oct. ...	− 3·8	− 5·0	−11·8	−12·5	−10·6	−18·7	−20·7	−26·5	−24·4	**−27·5**	−17·6	− 8·2
Nov. ...	+ 6·9	− 1·9	− 1·1	− 4·8	−16·5	−30·2	−39·0	−43·0	−39·8	**−44·1**	−27·2	−15·7
Dec. ...	− 0·3	+ 5·0	+ 3·0	− 3·5	−12·3	−17·2	−15·9	−20·1	−31·0	−40·1	**−42·5**	−28·4
1912—												
Jan. ...	+ 7·9	+ 8·0	+ 2·5	− 3·9	−15·4	−18·0	−28·4	−25·1	−36·7	**−41·1**	−37·8	−29·7
Feb. ...	− 0·6	− 5·6	−11·7	−10·5	−18·8	−17·0	−19·9	−24·5	−21·3	−25·0	**−27·3**	−17·6
Mar. ...	− 2·8	− 7·5	− 8·7	− 8·1	−10·7	−11·8	−12·2	−13·1	−16·7	**−19·8**	−16·5	−10·8
April ...	− 4·5	− 3·1	− 7·4	− 8·6	− 9·8	− 9·5	−12·9	**−13·5**	−11·5	− 9·4	− 3·4	− 6·8
May ...	− 0·2	+ 1·8	− 1·7	− 4·1	− 3·9	**− 7·9**	− 4·2	− 5·1	− 5·7	− 4·2	− 4·5	− 3·2
June ...	− 1·0	− 1·9	− 4·3	− 5·0	− 4·9	**− 9·7**	− 8·8	− 3·9	− 4·3	− 5·4	− 7·9	− 5·1
July ...	− 2·4	− 2·1	+ 0·5	− 1·2	− 1·4	− 2·4	− 5·3	**− 7·3**	− 5·1	− 6·1	− 4·8	− 3·9
Aug. ...	+ 3·2	+ 2·2	+ 0·2	− 1·8	− 7·9	− 8·9	− 9·0	−11·4	− 8·9	− 9·8	**−12·8**	− 7·7
Sept. ...	− 3·6	− 2·9	− 4·0	− 6·9	−10·3	−11·5	−10·4	− 9·6	−12·1	**−14·5**	−13·9	−10·9
Oct. ...	− 0·8	− 8·6	−11·2	−10·5	−14·3	−18·1	−13·1	−13·4	−14·6	−20·9	**−24·7**	−16·4
Nov. ...	− 4·8	−11·8	− 5·2	− 5·7	− 2·0	− 5·2	−34·8	−29·7	−33·5	**−40·7**	−28·0	−14·0

Table XIII.—Diurnal Inequality in E′ for the 12 Months,

—	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	12 h.
	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
Jan. ...	+ 7·9	+ 8·0	+ 2·5	− 3·9	−15·4	−18·0	−28·4	−25·1	−36·7	**−41·1**	−37·8	−29·7
Feb. ...	+ 7·1	− 0·3	− 7·1	−13·0	−32·3	−28·4	−32·7	−38·6	**−43·3**	−42·6	−39·2	−26·5
Mar. ...	+ 5·5	+ 1·0	− 3·4	− 6·5	−13·4	−13·3	−19·0	−17·0	−24·3	−26·7	**−28·2**	−20·7
April ...	− 2·8	− 4·7	− 6·6	− 7·7	−12·5	−15·5	−20·4	−18·6	**−20·9**	−16·2	−12·9	− 9·9
May ...	+ 1·6	+ 1·3	− 2·8	− 3·3	− 4·9	− 7·3	− 9·9	**−10·6**	−10·3	− 9·0	− 8·9	− 7·1
June ...	− 1·7	− 1·0	− 2·4	− 5·6	− 4·7	− 9·8	−10·0	**−11·7**	− 9·2	− 7·6	− 8·7	− 6·0
July ...	− 1·0	− 1·0	− 1·1	− 1·9	− 8·2	− 9·4	**−12·3**	−10·6	− 7·6	− 7·8	− 6·2	− 4·3
Aug. ...	+ 0·5	+ 1·1	− 2·8	− 7·9	− 7·3	− 8·8	− 9·3	**−12·7**	−12·0	− 9·0	−11·2	− 5·1
Sept. ...	− 4·2	− 3·0	− 4·1	− 5·8	− 9·6	−11·0	−11·2	−13·2	−15·0	**−18·2**	−15·2	−10·3
Oct. ...	− 2·3	− 6·8	−11·5	−11·5	−12·5	−18·4	−16·9	−20·0	−19·5	**−24·2**	−21·2	−12·3
Nov. ...	+ 1·1	− 6·9	− 3·2	− 5·3	− 9·3	−17·7	−36·9	−36·4	−36·7	**−42·4**	−27·6	−14·9
Dec. ...	− 0·3	+ 5·0	+ 3·0	− 3·5	−12·3	−17·2	−15·9	−20·1	−31·0	−40·1	**−42·5**	−28·4
Year ...	+ 1·0	− 0·6	− 3·3	− 6·3	−11·9	−14·6	−18·6	−19·6	−22·2	**−23·7**	−21·6	−14·6
Winter ...	− 0·1	+ 0·1	− 2·3	− 4·7	− 6·3	− 8·8	−10·4	**−11·4**	− 9·8	− 8·3	− 8·7	− 5·6
Equinox ...	− 1·0	− 3·4	− 6·4	− 7·9	−12·0	−14·6	−16·9	−17·2	−19·9	**−21·3**	−19·4	−13·3
Summer ...	+ 4·0	+ 1·5	− 1·2	− 6·4	−17·3	−20·3	−28·5	−30·1	−36·9	**−41·6**	−36·8	−24·9

Months from 10 Quieter Days a Month.

13 h.	14 h.	15 h.	16 h.	17 h.	18 h.	19 h.	20 h.	21 h.	22 h.	23 h.	24 h.	Range.	A.D.
γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
−24·7	−15·6	+ 8·6	+30·7	+40·8	+45·5	+55·5	+61·7	+65·8	**+67·4**	+39·1	+20·3	132·6	37·85
−16·9	−14·3	− 3·9	+10·8	+20·2	+25·2	+34·6	**+39·8**	+37·4	+21·7	+18·3	+19·5	79·7	21·10
−10·2	− 3·9	+ 3·9	+13·9	+21·8	+24·4	+35·0	**+47·2**	+27·0	+17·0	+11·8	+ 9·5	77·4	17·58
− 8·6	− 6·1	+ 1·8	+ 5·3	+10·0	+13·7	**+20·9**	+19·2	+15·4	+13·7	+ 6·9	+ 6·8	37·0	9·82
− 3·5	− 0·8	+ 2·4	+ 4·8	+ 9·7	+14·8	**+16·3**	+13·4	+14·4	+10·7	+ 7·8	+ 6·6	35·8	8·18
− 3·1	+ 0·5	− 0·6	+ 5·4	+ 8·8	+15·4	+16·3	**+20·8**	+14·1	+12·1	+ 6·6	+ 4·5	40·2	8·79
− 3·3	− 1·5	+ 2·2	+ 9·3	+11·1	+12·3	+17·3	**+18·3**	+14·4	+ 9·6	+ 6·0	− 0·1	33·4	8·42
− 6·1	+ 0·2	+ 8·7	+19·2	**+26·0**	+24·7	+23·9	+14·3	+10·1	+ 5·3	+ 5·3	− 0·5	47·9	11·45
+ 4·2	+15·7	+15·4	+20·8	**+31·4**	+25·3	+22·8	+20·6	+14·1	+10·0	+ 3·9	+ 4·0	58·9	15·65
− 9·0	+ 7·9	+20·4	+27·8	+34·0	**+42·7**	+41·5	+36·1	+26·5	+15·0	+ 5·7	+ 7·7	86·8	22·69
−12·7	− 4·6	+ 8·6	+13·4	+30·1	**+36·3**	+30·6	+29·6	+27·7	+25·2	+14·3	+ 5·6	78·8	19·08
−15·8	− 9·9	+ 5·7	+22·5	+30·4	**+33·6**	+32·4	+31·3	+23·5	+23·5	+23·0	+17·1	74·7	21·80
− 5·9	+ 4·5	+11·4	+17·5	+18·5	+25·4	**+35·5**	+30·2	+26·5	+17·0	+10·9	+ 8·9	62·8	17·17
− 5·5	+ 7·0	+ 9·1	+11·7	+15·0	+18·6	**+21·1**	+18·2	+18·4	+14·7	+ 6·7	+ 3·1	40·9	11·99
− 1·5	+ 5·3	+ 3·3	+ 7·8	+11·1	+14·4	**+15·7**	+13·9	+12·1	+10·0	+ 6·5	+ 2·1	29·2	8·50
− 2·6	− 1·4	+ 3·2	+ 7·3	**+ 7·7**	**+ 7·7**	+ 5·8	+ 5·5	+ 7·6	+ 1·8	+ 0·3	+ 0·8	15·6	4·09
− 2·0	− 0·3	− 0·8	+ 3·3	+ 7·1	+ 9·5	**+12·6**	+11·7	+ 8·2	+ 6·3	+ 5·5	+ 1·8	22·3	5·47
− 2·8	− 1·2	+ 2·0	+ 7·2	+ 6·2	+ 6·9	**+ 8·9**	+ 6·1	+ 4·1	+ 2·6	+ 1·5	− 0·9	16·2	3·87
− 4·7	− 1·7	+ 6·4	+ 9·9	**+12·5**	+11·6	+11·1	+ 6·5	+ 9·2	+ 5·8	+ 3·5	+ 1·7	25·3	7·02
− 6·1	+ 2·6	+ 7·8	+11·5	**+17·7**	+17·4	+17·2	+17·3	+12·6	+ 8·5	+ 3·9	+ 0·7	32·2	9·75
− 4·1	+ 3·7	+15·9	+28·1	**+30·2**	+26·0	+23·0	+18·3	+14·7	+ 6·9	+ 2·8	+ 0·3	54·9	14·19
−12·8	0·0	+11·2	+25·3	+33·5	+34·2	+33·7	**+38·2**	+20·8	+16·3	+12·0	+ 2·0	78·9	18·98

3 Seasons and the Year from 10 Quieter Days a Month.

13 h.	14 h.	15 h.	16 h.	17 h.	18 h.	19 h.	20 h.	21 h.	22 h.	23 h.	24 h.	Range.	A.D.
γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
−15·8	− 9·9	+ 5·7	+22·5	+30·4	**+33·6**	+32·4	+31·3	+23·5	+23·5	+23·0	+17·1	74·7	21·80
−15·3	− 5·6	+10·0	+24·1	+29·7	+35·5	+45·5	**+46·0**	+46·0	+42·2	+25·0	+14·6	89·3	27·11
−11·2	− 3·7	+ 2·6	+11·3	+17·6	+21·9	+27·9	**+29·0**	+27·9	+18·2	+12·5	+11·3	57·2	15·59
− 5·9	+ 0·7	+ 3·6	+10·9	+16·5	+19·4	+25·4	**+30·6**	+19·6	+13·5	+ 9·2	+ 5·8	51·5	12·91
− 5·6	− 3·8	+ 2·5	+ 6·3	+ 8·9	+10·7	**+13·4**	+12·3	+11·5	+ 7·8	+ 3·6	+ 3·8	24·0	6·97
− 2·8	− 0·6	+ 0·8	+ 4·1	+ 8·4	+12·2	**+14·5**	+12·6	+11·3	+ 8·5	+ 6·7	+ 2·7	26·2	6·82
− 3·0	− 0·3	+ 0·7	+ 6·3	+ 7·5	+11·2	+12·6	**+13·5**	+ 9·1	+ 7·4	+ 4·1	+ 1·8	25·8	6·20
− 4·0	− 1·6	+ 4·3	+ 9·6	+11·8	+12·0	**+14·2**	+12·4	+11·8	+ 7·7	+ 4·8	+ 0·8	26·9	7·61
− 6·1	+ 1·4	+ 8·3	+15·4	**+21·9**	+21·0	+20·6	+15·8	+11·4	+ 6·9	+ 4·6	+ 0·1	40·1	10·60
0·0	+ 9·7	+15·7	+24·4	**+30·8**	+25·7	+22·9	+19·5	+14·4	+ 8·4	+ 3·4	+ 2·2	55·0	14·76
−10·9	+ 4·0	+15·8	+26·6	+33·8	**+38·5**	+37·6	+37·2	+23·7	+15·7	+ 8·9	+ 4·9	80·9	20·67
−12·7	− 4·6	+ 8·6	+13·4	+30·1	**+36·3**	+30·6	+29·6	+27·7	+25·2	+14·3	+ 5·6	78·8	19·08
− 7·8	− 1·2	+ 6·6	+14·6	+20·6	+23·2	**+24·8**	+24·2	+19·8	+15·4	+10·0	+ 5·9	48·5	13·84
− 3·8	− 1·6	+ 2·1	+ 6·6	+ 9·2	+11·5	**+13·7**	+12·7	+10·9	+ 7·9	+ 4·8	+ 2·3	25·1	6·82
− 5·8	+ 2·0	+ 7·6	+15·5	+21·7	+22·0	**+24·2**	+23·7	+18·3	+11·8	+ 7·4	+ 4·9	45·5	13·26
−13·7	− 4·0	+10·0	+21·6	+31·0	+36·0	**+36·5**	+36·0	+30·2	+26·6	+17·8	+10·6	78·1	21·81

TABLE XIV.—Diurnal Inequality in S′ in

—	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	12 h.
1911—	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
Feb. ...	−63·1	**−71·2**	−70·4	−60·1	−56·2	−48·7	−30·9	−21·4	+ 2·4	+21·9	+45·2	+44·1
Mar. ...	−53·1	−47·7	−43·3	−44·4	−31·2	−30·8	−15·8	− 3·4	+ 7·5	+19·6	+31·0	+46·6
April ...	−52·7	**−66·3**	−41·3	−33·6	−35·4	−23·1	−15·8	− 4·3	+10·9	+19·1	+40·5	+43·4
May ...	−31·2	**−36·8**	−31·4	−26·8	−21·5	−17·2	− 9·1	− 3·1	+ 7·6	+ 9·5	+21·2	+19·7
June ...	−19·6	−16·0	−17·5	−16·3	−16·2	−11·0	− 8·0	− 1·1	+ 3·4	+ 9·0	+15·3	+22·8
July ...	−23·5	−28·5	−26·0	**−29·2**	−27·5	−21·2	−12·4	− 5·8	+ 3·4	+10·7	+18·2	+29·6
Aug. ...	−21·6	−20·6	**−24·6**	−21·5	−18·4	−11·9	− 7·2	− 1·8	+ 5·1	+ 9·6	+20·5	+19·7
Sept. ...	−27·6	−25·5	−28·0	−27·1	−16·4	−12·6	− 6·1	− 1·5	+ 4·4	+11·7	+18·2	+22·5
Oct. ...	−33·2	**−35·2**	−33·8	−28·2	−21·4	−14·0	− 9·0	− 0·3	+ 8·5	+13·5	+21·6	+28·8
Nov. ...	−34·0	−39·1	**−39·6**	−35·9	−27·5	−21·6	−12·2	− 5·8	+ 2·6	+ 9·8	+18·3	+31·4
Dec. ...	−33·6	−37·4	−39·4	−42·4	**−42·6**	−36·1	−21·0	− 7·2	−10·2	− 0·8	+16·3	+30·8
1912—												
Jan. ...	−37·4	**−39·4**	−35·8	−35·3	−26·7	−25·0	−19·4	−14·7	− 8·5	+ 7·0	+17·3	+32·5
Feb. ...	−25·6	−27·5	−29·4	**−31·8**	−29·0	−26·1	−16·0	−15·8	− 7·5	− 0·5	+11·4	+15·5
Mar. ...	−22·8	**−26·2**	−25·9	−21·4	−19·4	−13·1	− 7·7	− 0·6	+ 5·1	+ 9·5	+24·5	+21·9
April ...	−20·1	−18·7	−18·9	−16·3	−17·9	−11·2	− 8·5	+ 0·4	+ 5·4	+10·3	+15·5	+22·2
May ...	−11·0	− 9·3	− 9·1	−11·7	− 9·7	−10·0	− 4·4	− 0·1	+ 4·2	+ 8·0	+13·0	+17·9
June ...	−16·7	**−17·4**	−14·4	−10·5	− 9·2	− 7·2	− 5·6	+ 0·3	+ 2·3	+ 3·5	+ 8·1	+15·0
July ...	−14·6	−13·8	−14·3	−13·4	−10·4	− 8·4	− 5·5	− 0·3	+ 4·0	+ 5·4	+10·0	+16·1
Aug. ...	−13·8	−14·5	−16·4	−14·9	−17·1	−13·0	− 7·5	− 1·2	+ 3·5	+ 8·7	+11·3	+22·3
Sept. ...	−17·8	−15·2	−14·9	−17·8	−15·8	−15·3	−10·8	− 3·2	+ 4·8	+ 7·2	+16·6	+17·9
Oct. ...	−24·3	−24·4	−24·6	**−25·0**	−24·2	−14·7	− 7·6	− 2·1	+ 4·7	+13·2	+18·3	+30·3
Nov. ...	**−31·1**	−26·7	−29·1	−26·9	−24·6	−18·6	−21·1	− 9·3	+ 8·5	+ 9·4	**+12·0**	+23·9

TABLE XV.—Diurnal Inequality in S′ for the 12 Months,

—	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	12 h.
	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
Jan. ...	−37·4	**−39·4**	−35·8	−35·3	−26·7	−25·0	−19·4	−14·7	− 8·5	+ 7·0	+17·3	+32·5
Feb. ...	−44·4	−49·3	**−49·9**	−46·0	−42·6	−37·4	−23·4	−18·6	− 2·6	+10·7	+28·3	+29·8
Mar.... ...	**−38·0**	−36·9	−34·6	−32·9	−25·3	−21·9	−11·7	− 2·0	+ 6·3	+14·6	+27·7	+34·2
April ...	−36·4	**−42·5**	−30·1	−25·0	−26·6	−17·1	−12·1	− 2·0	+ 8·2	+14·7	+28·0	+32·8
May ...	−21·1	−23·1	−20·3	−19·2	−15·6	−13·6	− 6·7	− 1·6	+ 5·9	+ 8·7	+17·1	+18·8
June ...	−18·2	−16·7	−15·9	−13·4	−12·7	− 9·1	− 6·8	− 0·4	+ 2·9	+ 6·3	+11·7	+18·9
July... ...	−19·0	−21·1	−20·2	**−21·3**	−18·9	−14·8	− 8·9	− 3·1	+ 3·7	+ 8·0	+14·1	+22·9
Aug.... ...	−17·7	−17·5	**−20·5**	−18·2	−17·7	−12·5	− 7·3	− 1·5	+ 4·3	+ 9·2	+15·9	+21·0
Sept. ...	−22·7	−20·4	−21·5	−22·5	−16·1	−14·0	− 8·4	− 2·4	+ 4·6	+ 9·4	+17·4	+20·2
Oct.... ...	−28·8	**−29·8**	−29·2	−26·6	−22·8	−14·3	− 8·3	− 1·2	+ 6·6	+13·3	+20·0	+29·6
Nov. ...	−32·6	−32·9	**−34·3**	−31·4	−26·0	−20·1	−16·7	− 7·6	+ 5·5	+ 9·6	+15·2	+27·7
Dec. ...	−33·6	−37·4	−39·4	−42·4	**−42·6**	−36·1	−21·0	− 7·2	−10·2	− 0·8	+16·3	+30·8
Year ...	−29·2	**−30·6**	−29·3	−27·8	−24·5	−19·7	−12·6	− 5·2	+ 2·2	+ 9·2	+19·1	+26·6
Winter ...	−19·0	−19·6	−19·2	−18·0	−16·2	−12·5	− 7·4	− 1·7	+ 4·2	+ 8·0	+14·7	+20·4
Equinox ...	−31·5	**−32·4**	−28·9	−26·8	−22·7	−16·8	−10·1	− 1·9	+ 6·4	+13·0	+23·3	+29·2
Summer ...	−37·0	−39·7	**−39·8**	−38·8	−34·5	−29·6	−20·1	−12·0	− 4·0	+ 6·6	+19·3	+30·2

Individual Months from all Complete Days.

13 h.	14 h.	15 h.	16 h.	17 h.	18 h.	19 h.	20 h.	21 h.	22 h.	23 h.	24 h.	Range.	A.D.
γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
+67·8	+89·9	+88·4	**+91·3**	+58·7	+30·6	+13·4	+ 3·4	−19·5	−30·1	−38·1	−47·2	162·5	46·42
+49·8	**+64·1**	+58·6	+56·1	+58·9	+37·1	+11·6	− 7·1	−27·2	−37·3	−44·9	**−54·4**	118·5	36·73
+49·0	+59·8	**+66·6**	+64·0	+42·7	+38·9	+ 8·7	− 8·4	−23·8	−31·7	−50·6	−57·3	132·9	37·00
+26·8	+34·0	**+40·7**	+30·8	+23·3	+21·2	+12·6	− 1·7	− 4·8	−16·5	−21·7	−25·8	77·5	20·63
+29·4	+28·7	+23·1	+27·3	+28·8	+14·3	− 0·2	− 3·9	−10·4	−24·0	**−30·4**	−26·5	59·8	16·80
+33·0	+31·6	**+38·9**	+29·0	+26·9	+21·8	+ 5·8	+ 0·6	−13·4	−19·2	−18·2	−24·1	68·1	20·77
+25·7	**+34·9**	+30·1	+25·3	+22·8	+14·5	+ 3·8	− 6·9	−16·4	−18·9	−21·8	−20·0	59·5	17·65
+28·4	+35·3	+35·7	**+39·6**	+30·8	+20·0	− 0·7	− 7·3	−16·8	**−28·9**	−23·9	−24·8	68·5	20·58
+40·2	+38·8	+37·0	+35·3	+29·5	+21·8	+ 8·4	− 5·5	−17·3	−32·3	−24·1	−28·9	75·4	23·61
+39·9	+42·5	**+54·5**	+50·3	+38·8	+22·6	+ 7·8	− 2·2	−14·9	−28·4	−25·6	−32·2	94·1	26·56
+41·5	+49·2	**+56·4**	+50·3	+46·0	+35·2	+18·1	+ 7·3	− 6·9	−20·3	−23·9	−29·8	99·0	29·28
+40·3	**+44·4**	**+44·4**	+41·1	+31·3	+25·5	+11·8	+ 6·2	− 1·4	−12·3	−20·8	−25·1	83·8	25·15
+27·2	+38·2	+46·2	**+51·4**	+37·3	+26·7	+18·0	+ 6·0	− 8·0	−17·5	−20·8	−22·4	83·2	23·16
+26·2	**+34·4**	+30·5	+26·3	+20·5	+14·5	+ 6·3	− 3·8	−12·5	−22·3	−24·2	−19·3	60·6	18·29
+22·8	**+27·9**	+26·9	+26·9	+20·3	+11·8	+ 4·0	− 3·3	−14·2	−22·3	**−22·4**	−21·5	50·3	16·24
+23·6	**+25·0**	+18·1	+14·7	+11·9	+ 6·8	− 0·8	− 9·5	−12·5	−13·3	−19·1	**−22·5**	47·5	11·93
+13·6	+17·2	**+19·0**	+17·9	+14·3	+10·2	+ 4·7	− 0·4	− 6·4	− 8·7	−14·3	−16·1	36·4	10·54
+16·4	**+19·0**	+17·1	+14·8	+17·3	+12·0	+ 3·1	− 2·6	− 7·9	−12·4	−15·5	**−15·7**	34·7	11·25
+22·0	**+26·7**	+25·4	+24·8	+18·1	+ 9·3	− 0·5	− 7·0	−11·7	−17·2	**−19·0**	−18·4	45·7	14·35
+27·0	+31·4	**+33·0**	+28·7	+20·3	+ 9·3	+ 2·1	− 7·3	−14·3	−18·3	**−23·6**	−23·5	56·6	16·50
+32·5	+32·3	**+33·6**	+30·1	+22·2	+10·8	+ 4·2	− 7·5	−13·2	−24·1	−19·9	−20·8	58·6	19·36
+34·4	+45·7	**+47·3**	+46·1	+33·5	+20·1	+ 8·9	−10·2	−12·5	−26·3	−26·6	−27·2	78·4	24·17

3 Seasons and the Year from all Complete Days.

13 h.	14 h.	15 h.	16 h.	17 h.	18 h.	19 h.	20 h.	21 h.	22 h.	23 h.	24 h.	Range.	A.D.
γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
+40·3	**+44·4**	**+44·4**	+41·1	+31·3	+25·5	+11·8	+ 6·2	− 1·4	−12·3	−20·8	−25·1	83·8	25·15
+47·5	+64·1	+67·3	**+71·4**	+48·0	+28·7	+15·7	+ 4·7	−13·8	−23·8	−29·5	−34·8	121·3	34·68
+38·0	**+49·3**	+44·6	+41·2	+39·7	+25·8	+ 8·9	− 5·4	−19·9	−29·8	−34·5	−36·8	87·3	27·50
+35·9	+43·8	**+46·8**	+45·5	+31·5	+25·4	+ 6·4	− 5·9	−19·0	−27·0	−36·5	−39·4	89·3	26·61
+25·2	**+29·5**	+29·4	+22·8	+17·6	+14·0	+ 5·9	− 5·6	− 8·7	−14·9	−20·4	**−24·1**	53·6	16·24
+21·5	**+22·9**	+21·1	+22·6	+21·6	+12·3	+ 2·2	− 2·2	− 8·4	−16·4	**−22·3**	−21·3	45·2	13·66
+24·7	+25·3	**+28·0**	+21·9	+22·1	+16·9	+ 4·4	− 1·0	−10·7	−15·8	−16·9	−19·9	49·3	15·98
+23·9	**+30·8**	+27·8	+25·1	+20·5	+11·9	+ 1·6	− 7·0	−14·1	−18·0	−20·4	−19·2	51·3	15·98
+27·7	+33·4	**+34·3**	+34·1	+25·5	+14·7	+ 0·7	− 7·3	−15·5	−23·6	−23·7	**−24·1**	58·4	18·51
+36·3	+35·5	+35·3	+32·7	+25·9	+16·3	+ 6·3	− 6·5	−15·2	−28·2	−22·0	−24·9	66·1	21·48
+37·1	+44·1	**+50·9**	+48·2	+36·2	+21·3	+ 8·4	− 6·2	−13·7	−27·4	−26·1	−29·7	85·2	25·37
+41·5	+49·2	**+56·4**	+50·3	+46·0	+35·2	+18·1	+ 7·3	− 6·9	−20·3	−23·9	−29·8	99·0	29·28
+33·3	+39·4	**+40·5**	+38·1	+30·5	+20·7	+ 7·5	− 2·4	−12·3	−21·5	−24·7	−27·4	71·1	22·26
+23·8	**+27·1**	+26·6	+23·1	+20·4	+13·8	+ 3·5	− 4·0	−10·5	−16·3	−20·0	**−21·1**	48·2	15·46
+34·5	**+40·5**	+40·3	+38·4	+30·7	+20·6	+ 5·6	− 6·3	−17·4	−27·2	−29·2	−31·3	72·9	23·54
+41·6	+50·5	**+54·8**	+52·8	+40·4	+27·7	+13·5	+ 3·0	− 9·0	−21·0	−25·1	−29·8	94·6	28·37

TABLE XVI.—Diurnal Inequality in S′ in

—	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	12 h.
1911—	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
Feb. ...	—46·0	—53·5	—49·2	**—65·8**	—54·0	—41·6	—16·6	—10·8	+ 2·9	+20·9	+30·8	+38·3
Mar. ...	—31·1	—29·8	—32·9	**—33·7**	—26·7	—19·9	—11·9	— 1·6	+ 3·2	+ 8·2	+11·4	+17·1
April ...	**—27·6**	—20·6	—20·5	—14·5	—20·3	—17·2	—14·1	— 0·5	+ 9·8	+10·1	+17·5	+14·8
May ...	**—15·1**	—13·6	—15·0	—10·9	— 8·1	— 7·8	— 7·2	— 2·1	+ 4·7	+ 4·1	+ 8·6	+10·1
June ...	— 6·8	— 7·3	— 8·9	— 8·5	— 7·5	—10·5	— 6·6	+ 0·8	+ 5·9	+ 7·0	+ 7·4	+ 8·9
July ...	—10·8	—13·5	—10·8	**—18·0**	—17·4	—17·3	—10·5	— 4·8	+ 3·5	+ 6·6	+ 9·7	+ 8·4
Aug. ...	—11·2	—11·4	**—12·9**	—11·6	— 9·1	— 4·3	— 3·1	+ 0·1	+ 6·9	+ 6·3	+10·6	+10·7
Sept. ...	—16·6	—13·1	—10·3	—10·2	— 5·5	— 6·7	+ 1·6	+ 0·6	+ 6·1	+ 7·7	+12·2	+12·1
Oct. ...	—20·7	**—22·8**	—19·7	—19·2	—16·9	—14·6	— 9·6	— 3·2	+ 5·3	+13·6	+16·3	+22·7
Nov. ...	—21·6	—23·5	—22·6	**—26·2**	—23·7	—18·2	— 3·8	— 0·4	+10·1	+13·1	+17·0	+19·7
Dec. ...	—19·8	—22·5	—26·5	**—30·4**	—30·0	—27·2	—21·9	—10·8	— 1·0	+ 5·8	+18·7	+24·6
1912—												
Jan. ...	—27·1	—27·8	—28·4	**—29·7**	—26·9	—22·8	—20·2	—19·0	— 3·0	+ 5·6	+17·8	+28·1
Feb. ...	—18·4	—21·3	**—23·4**	—21·2	—20·8	—19·8	—11·3	—19·1	— 1·2	+ 1·4	+13·7	+14·4
Mar. ...	—13·9	—15·9	—12·1	—11·3	— 8·9	— 6·4	— 1·3	+ 1·9	+ 5·1	+ 9·4	+10·6	+12·4
April ...	**—18·7**	—15·4	—10·6	— 9·4	— 8·1	— 6·1	— 3·8	+ 0·6	+ 4·9	+ 8·7	+11·7	**+16·4**
May ...	— 5·9	— 4·9	— 8·3	— 8·2	— 5·2	— 5·3	— 2·2	+ 1·9	+ 3·8	+ 2·7	+ 7·0	+ 7·2
June ...	— 6·3	— 5·0	— 5·9	— 7·0	— 5·1	— 4·0	— 2·3	+ 1·3	+ 1·7	+ 3·3	+ 5·4	+ 5·3
July ...	— 5·9	— 3·5	— 5·9	— 6·4	— 4·5	— 3·8	— 2·9	— 1·3	+ 2·8	+ 3·5	+ 5·1	+ 7·1
Aug. ...	— 6·5	— 5·9	— 6·7	— 6·2	— 9·1	**— 9·8**	— 5·5	— 0·6	+ 3·3	+ 3·0	+ 7·5	+10·7
Sept. ...	—12·6	— 8·1	— 9·0	— 9·9	— 8·9	— 6·2	— 2·8	— 1·7	+ 5·1	+ 6·3	+10·9	+15·1
Oct. ...	—17·6	—14·5	—16·4	**—20·1**	—15·5	—11·0	— 3·8	+ 3·8	+ 3·8	+11·5	+15·9	+20·3
Nov. ...	—18·5	—14·5	—16·0	—13·4	—18·4	—14·5	—20·2	— 7·7	+ 7·4	+12·5	+13·9	+23·4

TABLE XVII.—Diurnal Inequality in S′ for the 12 Months,

—	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	12 h.
	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
Jan. ...	—27·1	—27·8	—28·4	**—29·7**	—26·9	—22·8	—20·2	—19·0	— 3·0	+ 5·6	+17·8	+28·1
Feb. ...	—32·2	—37·4	—36·3	**—43·5**	—37·4	—30·7	—13·9	—14·9	+ 0·8	+11·1	+22·2	+26·3
Mar. ...	—22·5	—22·8	—22·5	—22·5	—17·8	—13·1	— 6·6	+ 0·1	+ 4·1	+ 8·8	+11·0	+14·7
April ...	**—23·1**	—18·0	—15·5	—11·9	—14·2	—11·6	— 8·9	0·0	+ 7·3	+ 9·4	+14·6	+15·6
May ...	—10·5	— 9·2	**—11·6**	— 9·5	— 6·6	— 6·5	— 4·7	— 0·1	+ 4·2	+ 3·4	+ 7·8	+ 8·6
June ...	— 6·5	— 6·1	— 7·4	— 7·7	— 6·3	— 7·2	— 4·4	+ 1·0	+ 3·8	+ 5·1	+ 6·4	+ 7·1
July ...	— 8·3	— 8·5	— 8·3	**—12·2**	—10·9	—10·5	— 6·7	— 3·0	+ 3·1	+ 5·0	+ 7·4	+ 7·7
Aug. ...	— 8·8	— 8·6	— 9·8	— 8·9	— 9·1	— 7·0	— 4·3	— 0·2	+ 5·1	+ 4·6	+ 9·0	+10·7
Sept. ...	—14·6	—10·6	— 9·6	—10·0	— 7·2	— 6·4	— 0·6	— 0·5	+ 5·6	+ 7·0	+11·5	+13·6
Oct. ...	—19·1	—18·6	—18·0	**—19·6**	—16·2	—12·8	— 6·7	+ 0·3	+ 4·5	+12·5	+16·1	+21·5
Nov. ...	—20·0	—19·0	—19·3	—19·8	—21·0	—16·3	—12·0	— 4·0	+ 8·7	+12·8	+15·4	+21·5
Dec. ...	—19·8	—22·5	—26·5	**—30·4**	—30·0	—27·2	—21·9	—10·8	— 1·0	+ 5·8	+18·7	+24·6
Year ...	—17·7	—17·4	—17·8	**—18·8**	—17·0	—14·3	— 9·2	— 4·3	+ 3·6	+ 7·6	+13·2	+16·7
Winter ...	— 8·5	— 8·1	— 9·3	— 9·6	— 8·2	— 7·8	— 5·0	— 0·6	+ 4·1	+ 4·5	+ 7·7	+ 8·5
Equinox ...	**—19·8**	—17·5	—16·4	—16·0	—13·8	—11·0	— 5·7	0·0	+ 5·4	+ 9·4	+13·0	+16·4
Summer ...	—24·8	—26·7	—27·6	**—30·8**	—28·8	—24·2	—17·0	—12·2	+ 1·4	+ 8·8	+18·5	+25·1

Individual Months from 10 Quieter Days a Month.

13 h.	14 h.	15 h.	16 h.	17 h.	18 h.	19 h.	20 h.	21 h.	22 h.	23 h.	24 h.	Range.	A.D.
γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
+53·6	+65·8	+68·9	**+79·0**	+43·3	+20·6	+16·8	+11·1	−22·1	−28·5	−28·1	−36·2	144·8	37·68
+27·0	+34·7	+43·6	**+46·7**	+39·5	+21·1	+ 5·4	+ 3·7	− 7·8	−15·0	−22·8	−29·0	80·4	21·83
+23·5	+29·3	**+35·7**	+28·8	+25·8	+22·6	+ 6·3	− 4·8	−11·6	−21·4	−24·2	−26·5	63·3	18·67
+12·1	+14·0	+13·3	**+14·1**	+12·6	+ 7·8	+ 9·3	+ 0·9	− 3·5	− 6·3	− 9·2	−13·5	29·2	9·33
+12·0	**+13·7**	+13·6	+13·2	+12·8	+ 6·7	+ 1·6	− 2·0	− 9·1	**−12·5**	−11·2	−12·1	26·2	8·61
+14·0	+15·9	**+28·7**	+24·2	+19·4	+14·4	+ 4·7	− 2·1	− 9·1	−11·0	−13·2	−10·0	46·7	12·42
+16·2	**+17·1**	+12·3	+11·5	+11·5	+ 5·7	+ 1·5	− 5·1	− 7·3	−11·2	−11·5	−12·2	30·0	9·22
+18·2	**+20·0**	+16·6	+15·5	+12·4	+ 5·9	− 2·6	− 7·2	−11·1	−14·5	−15·1	**−17·0**	37·0	10·78
+24·0	+23·1	**+25·1**	+24·2	+18·4	+ 8·6	+ 3·6	− 2·5	− 9·8	−11·6	−13·4	−20·1	47·9	15·38
+25·2	+28·1	+33·0	**+35·1**	+25·3	+13·3	+ 1·3	− 6·2	−14·0	−19·6	−21·3	−19·7	61·3	18·42
+21·3	+28·0	**+32·2**	**+32·2**	+31·1	+21·9	+11·1	+ 8·5	+ 0·6	− 8·9	−15·6	−22·3	62·6	19·70
+27·7	+31·7	**+36·3**	+34·9	+33·6	+23·3	+13·1	+ 2·9	− 5·0	− 6·0	−17·9	−21·7	66·0	21·27
+23·0	+30·7	+31·6	**+42·0**	+31·9	+20·4	+12·0	+ 0·2	−10·3	−14·3	−19·5	−19·8	65·4	18·40
+12·9	+14·5	+15·5	**+20·6**	+17·1	+ 9·4	+ 4·4	− 1·8	−12·2	−14·3	**−19·6**	−17·0	40·2	11·19
+14·3	+14·4	+13·7	+11·5	+10·4	+ 7·9	+ 2·1	− 3·1	− 5·0	−11·0	−13·2	−12·8	35·1	9·74
+ 9·4	**+11·6**	+10·4	+ 8·6	+ 5·0	+ 2·4	+ 0·4	− 5·4	**− 8·7**	− 5·5	− 5·6	− 6·1	20·3	5·90
+ 5·6	+ 7·7	+ 7·9	+ 8·4	**+ 9·0**	+ 6·2	+ 4·4	− 2·7	− 4·8	− 7·1	− 8·4	**− 8·5**	17·5	5·55
+10·1	**+12·5**	+ 7·1	+10·8	+ 5·7	+ 2·5	− 0·2	− 4·2	− 5·6	− 6·9	**− 8·3**	**− 8·3**	20·8	5·62
+11·3	+10·6	**+14·2**	+13·1	+10·3	+ 5·6	+ 0·8	− 3·9	− 8·0	− 9·2	− 8·9	− 9·3	24·0	7·50
+18·3	+18·9	**+19·8**	+13·3	+11·5	+ 3·4	− 0·3	− 7·3	−12·7	−13·8	−14·2	**−15·8**	35·6	10·25
+27·2	**+28·8**	+23·0	+15·0	+11·1	+ 6·1	− 0·3	−12·4	−12·8	−13·1	−14·7	−15·0	48·9	13·90
+28·2	**+35·7**	+29·2	+21·0	+20·0	+ 8·1	+ 4·7	− 7·5	−14·7	−19·4	**−22·2**	−17·2	57·9	17·01

3 Seasons and the Year from 10 Quieter Days a Month.

13 h.	14 h.	15 h.	16 h.	17 h.	18 h.	19 h.	20 h.	21 h.	22 h.	23 h.	24 h.	Range.	A.D.
γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
+27·7	+31·7	**+36·3**	+34·9	+33·6	+23·3	+13·1	+ 2·9	− 5·0	− 6·0	−17·9	−21·7	66·0	21·27
+38·3	+48·2	+50·2	**+60·5**	+37·6	+20·5	+14·4	+ 5·6	−16·2	−21·4	−23·8	−28·0	104·0	27·98
+19·9	+24·6	+29·5	**+33·6**	+28·3	+15·2	+ 4·9	+ 0·9	−10·0	−14·6	−21·2	**−23·0**	56·6	16·34
+18·9	+21·8	**+24·7**	+20·1	+18·1	+15·2	+ 4·2	− 3·9	− 8·3	−16·2	−18·7	−19·6	47·8	14·16
+10·7	**+12·8**	+11·8	+11·3	+ 8·8	+ 5·1	+ 4·8	− 2·2	− 6·1	− 5·9	− 7·4	− 9·8	24·4	7·48
+ 8·8	+10·7	+10·7	+10·8	**+10·9**	+ 6·4	+ 3·0	− 2·3	− 6·9	− 9·8	− 9·8	**−10·3**	21·2	7·06
+12·0	+14·2	**+17·9**	+17·5	+12·5	+ 8·4	+ 2·2	− 3·1	− 7·3	− 8·9	−10·7	− 9·1	30·1	8·98
+13·7	**+13·8**	+13·2	+12·3	+10·9	+ 5·6	+ 1·1	− 4·5	− 7·6	−10·2	−10·2	**−10·7**	24·5	8·33
+18·2	**+19·4**	+18·2	+14·4	+11·9	+ 4·6	− 1·4	− 7·2	−11·9	−14·1	−14·6	**−16·4**	35·8	10·40
+25·6	**+25·9**	+24·0	+19·6	+14·7	+ 7·3	+ 1·6	− 7·4	−11·3	−12·3	−14·0	−17·5	45·5	14·46
+26·7	**+31·9**	+31·1	+28·0	+22·6	+10·7	+ 3·0	− 6·8	−14·3	−19·5	**−21·7**	−18·4	53·6	17·69
+21·3	+28·0	**+32·2**	**+32·2**	+31·1	+21·9	+11·1	+ 8·5	+ 0·6	− 8·9	−15·6	−22·3	62·6	19·70
+20·2	+23·6	**+25·0**	+24·6	+20·1	+12·0	+ 5·2	− 1·6	− 8·7	−12·3	−15·5	−17·2	43·8	14·32
+11·3	+12·9	**+13·4**	+13·0	+10·8	+ 6·4	+ 2·8	− 3·0	− 7·0	− 8·7	− 9·5	**−10·0**	23·4	7·95
+20·7	+22·9	**+24·1**	+21·9	+18·3	+10·6	+ 2·3	− 4·4	−10·4	−14·3	−17·1	−19·1	43·9	13·77
+28·5	+35·0	+37·5	**+38·9**	+31·2	+19·1	+10·4	+ 2·6	− 8·7	−13·9	−19·7	−22·6	69·7	21·42

Table XVIII.—Diurnal Inequality in Vertical Force in

—	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	12 h.
1911—	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
Feb. ...	+35·3	**+37·1**	+30·3	+26·6	+13·6	+ 2·3	− 2·4	− 4·0	−14·3	−13·5	−28·3	−37·9
Mar. ...	+24·9	+22·5	+13·7	+12·7	+ 4·0	− 7·7	−14·6	−14·5	− 8·0	− 7·7	−19·3	−27·0
April ...	**+30·4**	+21·4	+11·6	+ 3·1	+ 0·4	− 2·4	− 6·5	−10·4	−15·1	−18·0	−24·4	−27·9
May ...	+13·9	**+17·7**	+16·4	+ 8·4	+ 0·4	− 5·3	− 5·9	−11·3	−12·1	−13·2	−18·8	−19·8
June ...	+14·5	+11·6	+ 6·0	+ 2·7	− 0·8	− 5·6	−10·2	−11·1	−14·4	−14·8	**−17·4**	**−17·4**
July ...	+15·1	+11·9	+10·4	+ 7·0	+ 1·8	− 3·5	−10·6	−16·4	−15·0	**−19·1**	−18·5	−17·7
Aug. ...	+11·5	+13·5	+10·3	+ 7·5	+ 0·3	− 3·7	− 6·1	− 8·4	−11·3	−12·8	−13·3	**−17·0**
Sept. ...	+14·0	+14·2	+10·6	+ 6·4	+ 1·1	− 3·3	− 5·3	− 7·8	− 9·1	− 8·8	−12·8	−14·7
Oct. ...	+18·9	**+20·2**	+18·0	+16·7	+ 7·7	+ 5·9	+ 3·7	+ 0·2	− 7·2	−10·5	−18·4	−25·5
Nov. ...	**+29·9**	+28·2	+23·5	+17·7	+ 9·1	+ 0·5	+ 1·4	+ 9·5	+ 2·4	−13·3	−23·5	−29·0
Dec. ...	+34·5	+33·7	+30·5	+21·2	+20·9	+12·0	− 0·3	− 8·4	− 7·3	−16·5	−34·1	−43·8
1912—												
Jan. ...	+30·2	**+34·2**	+30·1	+23·3	+13·0	+ 5·3	− 2·1	− 6·5	+ 2·5	− 7·8	−23·7	−27·6
Feb. ...	+25·1	+26·5	**+27·0**	+23·1	+20·5	+12·5	+ 2·3	− 2·4	− 7·8	−19·7	−28·6	−35·7
Mar. ...	+16·2	+14·0	+15·4	+14·3	+ 8·1	+ 4·7	+ 1·7	− 1·8	− 5·1	−10·1	−14·4	−22·7
April ...	+14·3	+12·8	+10·9	+ 6·0	+ 1·5	− 1·0	− 4·6	− 7·3	−10·1	−12·3	−15·3	**−18·8**
May ...	+10·0	+ 7·8	+ 4·5	+ 0·7	− 1·7	− 4·5	− 6·8	− 8·0	− 9·7	− 9·9	−11·5	**−14·6**
June ...	+ 6·6	+ 9·0	+ 8·9	+ 3·4	− 1·8	− 3·6	− 5·2	− 8·0	− 9·3	−11·2	**−13·5**	−13·0
July ...	+ 8·6	+ 8·4	+ 7·3	+ 5·5	+ 1·7	− 2·8	− 4·8	− 6·3	− 8·5	− 9·4	**−10·8**	− 9·4
Aug. ...	+ 9·4	+ 7·7	+ 7·4	+ 6·5	+ 3·4	+ 0·8	− 3·8	− 4·8	− 7·9	−10·0	−11·6	−12·1
Sept. ...	+12·5	+10·2	+ 8·5	+ 5·1	+ 3·5	+ 2·2	− 0·7	− 0·6	− 2·8	−11·8	−14·4	−15·8
Oct. ...	+18·5	**+21·4**	+16·3	+11·2	+ 6·3	− 2·8	− 2·2	− 3·6	− 3·9	− 9·4	−11·1	−19·8
Nov. ...	+31·2	**+37·9**	+24·8	+12·2	+ 0·6	− 9·1	− 2·8	− 8·5	+ 0·6	− 4·1	**−31·2**	−26·3

Table XIX.—Diurnal Inequality in Vertical Force for the

—	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h	11 h.	12 h.
	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
Jan. ...	+30·2	**+34·2**	+30·1	+23·3	+13·0	+ 5·3	− 2·1	− 6·5	+ 2·5	− 7·8	−23·7	−27·6
Feb. ...	+30·2	**+31·8**	+28·7	+24·8	+17·1	+ 7·4	0·0	− 3·2	−11·0	−16·6	−28·5	−36·8
Mar. ...	+20·5	+18·3	+14·6	+13·5	+ 6·1	− 1·5	− 6·5	− 8·1	− 6·5	− 8·9	−16·9	−24·8
April ...	+22·3	+17·1	+11·2	+ 4·6	+ 0·9	− 1·7	− 5·6	− 8·9	−12·6	−15·1	−19·9	**−23·4**
May ...	+11·9	+12·7	+10·4	+ 4·5	− 0·6	− 4·9	− 6·3	− 9·6	−10·9	−11·5	−15·1	**−17·2**
June ...	+10·5	+10·3	+ 7·5	+ 3·1	− 1·3	− 4·6	− 7·7	− 9·6	−11·9	−13·0	**−15·4**	−15·2
July ...	+11·8	+10·1	+ 8·9	+ 6·2	+ 1·8	− 3·1	− 7·7	−11·4	−11·7	−14·3	**−14·6**	−13·6
Aug. ...	+10·5	+10·6	+ 8·9	+ 7·0	+ 1·9	− 1·4	− 4·9	− 6·6	− 9·6	−11·4	−12·4	**−14·5**
Sept. ...	+13·3	+12·2	+ 9·5	+ 5·8	+ 2·3	− 0·6	− 3·0	− 4·2	− 5·9	−10·3	−13·6	−15·3
Oct. ...	+18·7	**+20·8**	+17·1	+13·9	+ 7·0	+ 1·5	+ 0·8	− 1·7	− 5·6	−10·0	−14·8	−22·6
Nov. ...	+30·6	**+33·0**	+24·2	+15·0	+ 4·8	− 4·3	− 0·7	+ 0·5	+ 1·5	− 8·7	−27·4	−27·6
Dec. ...	+34·5	+33·7	+30·5	+21·2	+20·9	+12·0	− 0·3	− 8·4	− 7·3	−16·5	−34·1	−43·8
Year ...	+20·4	+20·4	+16·8	+11·9	+ 6·2	+ 0·3	− 3·7	− 6·5	− 7·4	−12·0	−19·7	−23·5
Winter ...	+11·2	+10·9	+ 8·9	+ 5·2	+ 0·5	− 3·5	− 6·6	− 9·3	−11·0	−12·5	−14·4	**−15·1**
Equinox ...	+18·7	+17·1	+13·1	+ 9·5	+ 4·1	− 0·6	− 3·6	− 5·7	− 7·7	−11·1	−16·3	−21·5
Summer ...	+31·4	**+33·2**	+28·4	+21·1	+14·0	+ 5·1	− 0·8	− 4·4	− 3·6	−12·4	−28·4	−34·0

Individual Months from all Complete Days.

13 h.	14 h.	15 h.	16 h.	17 h.	18 h.	19 h.	20 h.	21 h.	22 h.	23 h.	24 h.	Range.	A.D.
γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
−35·9	**−42·5**	−38·1	−31·1	−15·0	− 8·9	− 0·6	+ 7·2	+18·8	+29·8	+37·0	+35·2	79·6	22·74
−30·1	−24·9	−24·4	−21·8	− 7·8	− 0·2	+ 7·6	+16·1	+19·9	+26·9	+28·9	**+29·8**	59·9	17·31
−29·0	−25·5	−19·6	−14·0	− 4·0	+ 5·6	+10·2	+17·5	+23·4	+21·8	+23·1	+27·9	59·4	16·38
−21·7	−20·0	− 9·4	− 7·0	− 4·3	− 7·9	+11·0	+ 7·8	+17·2	+14·0	+17·4	+16·2	39·4	12·38
−15·0	−11·6	− 9·2	− 6·5	+ 2·1	+ 7·1	+ 6·9	+13·4	+15·8	+17·0	+16·1	**+20·9**	38·3	11·17
−16·7	−14·6	−10·0	− 9·1	− 5·3	− 0·1	+ 5·2	+16·5	+19·9	**+27·7**	+21·8	+18·9	46·8	13·03
−15·1	−14·7	−10·5	− 7·5	− 4·0	− 1·5	+ 4·9	+11·0	+15·5	**+18·6**	+17·1	+14·9	35·6	10·46
−17·7	−17·4	**−19·3**	−11·6	− 6·1	− 0·5	+ 6·6	+ 8·7	+12·0	+16·5	**+25·0**	+18·6	44·3	11·17
−27·2	−24·5	−21·2	−17·0	−12·6	− 5·6	+ 0·5	+ 8·1	+12·7	+17·2	+19·6	+19·5	47·4	14·11
−27·8	**−35·4**	−32·3	−25·8	−19·3	− 9·2	− 0·2	+ 5·5	+13·5	+20·5	+25·2	+29·1	65·3	17·99
−46·0	−45·9	−37·1	−25·4	−14·2	− 4·6	+ 3·3	+ 8·0	+19·8	+27·4	**+36·4**	+35·8	82·4	23·63
−38·0	−32·5	−30·1	−22·6	−14·5	−10·7	− 2·2	+ 3·6	+10·7	+16·4	+21·5	+27·4	72·2	18·19
−42·5	−39·4	−33·2	−24·5	−12·9	− 3·6	+ 3·7	+12·1	+20·0	+25·2	+26·3	+26·0	69·5	20·56
−22·3	**−23·4**	−20·9	−13·9	− 5·7	− 1·7	+ 3·3	+ 7·8	+11·0	+13·4	**+16·3**	**+16·3**	39·7	11·85
−17·6	−16·7	−13·8	− 7·6	− 1·7	+ 0·1	+ 5·9	+ 8·2	+14·1	+15·8	**+18·7**	+18·2	37·5	10·55
−10·9	− 8·1	− 7·6	− 4·9	− 3·2	+ 4·0	+ 5·9	+10·5	+12·8	+16·2	+12·5	**+17·5**	32·1	8·49
−13·1	−10·5	− 6·2	− 4·0	+ 0·4	+ 3·8	+ 9·2	+11·2	**+15·4**	+14·2	+ 9·4	+ 7·1	28·9	8·25
− 8·2	− 9·7	− 7·8	− 4·8	+ 2·2	+ 3·6	+ 3·7	+ 7·0	**+ 9·7**	+ 9·2	+ 7·3	+ 8·6	20·5	6·89
−13·6	**−13·6**	−10·5	− 5·9	+ 4·8	+ 3·1	+ 4·6	+ 7·8	+ 7·8	+ 8·7	+ 9·8	**+12·0**	25·6	7·82
−17·9	−16·1	−13·7	− 8·5	− 6·4	− 1·2	+ 4·0	+ 7·9	+11·8	+14·1	**+14·8**	+14·6	32·7	9·13
−23·1	−20·9	−20·3	−14·8	−11·2	− 4·1	+ 1·7	+ 6·4	+12·7	+15·8	+19·2	+18·5	44·5	12·30
−27·7	−29·9	−25·5	−20·8	−11·2	− 4·9	− 1·3	+ 9·0	+16·3	+19·6	+24·0	+27·2	69·1	16·95

12 Months, 3 Seasons and the Year from all Complete Days.

13 h.	14 h.	15 h.	16 h.	17 h.	18 h.	19 h.	20 h.	21 h.	22 h.	23 h.	24 h.	Range.	A.D.
γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
−38·0	−32·5	−30·1	−22·6	−14·5	−10·7	− 2·2	+ 3·6	+10·7	+16·4	+21·5	+27·4	72·2	18·19
−39·2	**−41·0**	−35·7	−27·8	−14·0	− 6·2	+ 1·6	+ 9·6	+19·4	+27·5	+31·6	+30·6	72·8	21·68
−26·2	−24·1	−22·6	−17·9	− 6·8	− 0·9	+ 5·5	+12·2	+15·4	+20·1	+22·6	**+23·0**	49·2	14·32
−23·3	−21·1	−16·7	−10·8	− 2·9	+ 2·8	+ 8·0	+12·9	+18·8	+18·8	+20·9	**+23·0**	46·4	13·47
−16·3	−14·0	− 8·5	− 6·0	− 3·8	+ 5·9	+ 8·4	+ 9·1	+15·0	+15·1	+15·0	**+16·9**	34·1	10·40
−14·1	−11·0	− 7·7	− 5·3	+ 1·2	+ 5·4	+ 8·1	+12·3	**+15·6**	**+15·6**	+12·7	+14·0	31·0	9·71
−12·4	−12·2	− 8·9	− 7·0	− 1·6	+ 1·3	+ 4·4	+11·7	+14·8	**+18·4**	+14·5	+13·8	33·0	9·84
−14·4	−14·2	−10·5	− 6·7	+ 0·4	+ 0·8	+ 4·7	+ 9·4	+11·6	**+13·6**	+13·5	+13·4	28·1	8·87
−17·8	−16·7	−16·5	−10·0	− 6·3	− 0·8	+ 5·3	+ 8·3	+11·9	+15·3	**+19·9**	+16·6	37·7	10·06
−25·2	−22·7	−20·8	−15·9	−11·9	− 4·8	+ 1·1	+ 7·2	+12·7	+16·5	+19·4	+19·0	46·0	12·99
−27·8	**−32·7**	−28·9	−23·3	−15·3	− 7·1	− 0·8	+ 7·3	+14·9	+20·1	+24·6	+28·2	65·7	17·05
−46·0	−45·9	−37·1	−25·4	−14·2	− 4·6	+ 3·3	+ 8·0	+19·8	+27·4	**+36·4**	+35·8	82·4	23·63
−25·1	−24·0	−20·3	−14·9	− 7·5	− 1·6	+ 4·0	+ 9·3	+15·1	+18·7	+21·1	**+21·8**	46·9	13·84
−14·3	−12·8	− 8·9	− 6·2	− 0·9	+ 3·4	+ 6·4	+10·6	+14·3	**+15·7**	+13·9	+14·5	30·8	9·62
−23·1	−21·1	−19·1	−13·6	− 7·0	− 0·9	+ 5·0	+10·2	+14·7	+17·7	**+20·7**	+20·4	43·8	12·61
−37·7	**−38·0**	−33·0	−24·8	−14·5	− 7·2	+ 0·5	+ 7·1	+16·2	+22·8	+28·5	+30·5	71·2	19·90

Table XX.—Diurnal Inequality in Vertical Force in

—	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	12 h.
	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
1911—												
Feb. ...	+28·1	+28·7	+26·6	**+31·2**	+22·1	+11·5	− 1·9	− 8·9	−10·6	− 6·4	−25·7	**−32·9**
Mar. ...	+ 9·6	+11·1	+ 6·8	+10·2	+ 6·6	+ 0·3	− 7·8	+ 2·7	+ 4·6	+10·1	+ 1·2	−11·6
April ...	+14·3	+ 8·0	+ 3·9	+ 5·3	+ 2·7	+ 3·3	− 1·8	− 0·7	− 2·6	− 5·2	−13·9	**−21·9**
May ...	+ 7·3	+ 8·5	+ 9·2	+ 3·1	+ 0·2	− 1·5	− 0·1	− 1·8	− 2·1	− 4·3	− 7·4	− 7·8
June ...	+ 6·0	+ 3·2	+ 1·6	+ 2·0	+ 1·3	− 1·0	− 4·7	− 5·5	− 9·2	− 7·4	**− 9·2**	− 8·2
July ...	+ 5·8	+ 5·4	+ 6·2	+ 3·8	+ 3·2	− 1·3	− 4·2	− 5·3	− 7·7	− 9·8	**−10·3**	− 9·8
Aug. ...	+ 7·5	+ 7·7	+ 8·7	+ 6·4	+ 1·5	− 0·8	− 4·9	− 5·0	− 6·7	− 7·6	− 5·8	**− 8·5**
Sept. ...	+10·4	**+19·3**	+ 7·4	+ 3·4	+ 0·9	− 2·1	− 6·1	− 5·9	− 7·6	− 6·1	−10·1	− 9·1
Oct. ...	+14·5	+14·4	+14·7	+ 9·8	+ 5·3	+ 2·6	− 0·4	− 1·4	− 9·7	− 7·5	−11·6	**−23·2**
Nov. ...	+24·5	+22·5	+15·6	+18·1	+15·4	+10·4	+ 6·0	+ 0·9	− 9·4	−23·9	−27·5	−30·9
Dec. ...	+26·8	+26·9	+27·6	+20·6	+16·3	+ 7·5	+ 5·6	+ 4·6	+ 2·0	−22·5	−24·8	−28·9
1912—												
Jan. ...	+23·3	+25·5	**+25·6**	+20·5	+16·4	+ 9·0	+ 0·1	− 7·7	+ 1·9	− 9·8	−15·7	−24·9
Feb. ...	+21·9	+22·4	+23·0	+18·5	+17·2	+ 9·1	+ 2·5	+ 0·1	− 8·3	−19·9	−30·6	−30·4
Mar. ...	**+11·8**	+ 9·4	+ 9·3	+ 9·6	+ 5·1	+ 1·2	+ 1·1	+ 3·8	+ 4·9	+ 1·0	− 8·1	−16·9
April ...	+ 9·2	+ 9·0	+10·6	+ 5·5	+ 0·8	− 1·8	− 5·9	− 5·5	− 5·6	− 7·8	−13·6	**−13·9**
May ...	+ 3·6	+ 3·0	+ 3·5	+ 2·4	− 0·4	− 1·9	− 4·1	− 3·1	− 4·3	− 3·9	− 4·7	**− 5·5**
June ...	+ 5·8	+ 4·5	+ 5·4	+ 3·2	+ 0·1	− 1·0	− 3·5	− 3·6	− 4·9	− 6·6	**− 7·1**	− 6·5
July ...	+ 4·5	+ 4·5	**+ 5·5**	+ 3·5	+ 0·7	− 1·5	− 1·9	− 3·8	− 3·5	− 4·4	**− 5·1**	− 4·7
Aug. ...	+ 6·2	+ 6·4	+ 4·9	+ 4·4	+ 4·3	+ 1·0	− 2·0	− 3·3	− 4·2	− 6·4	− 7·2	**− 9·4**
Sept. ...	+ 8·4	+ 6·5	+ 7·5	+ 5·0	+ 2·7	+ 0·3	− 1·9	+ 0·1	+ 0·7	− 5·8	− 9·6	−10·9
Oct. ...	+15·6	**+17·6**	+14·8	+12·3	+ 6·2	+ 0·5	− 1·5	− 0·9	− 4·7	− 5·7	−12·9	−20·4
Nov. ...	**+27·4**	+26·4	+17·3	+11·3	+ 4·8	− 2·6	− 0·7	− 6·6	− 1·9	− 9·6	−24·1	−20·2

Table XXI.—Diurnal Inequality in Vertical Force for the 12 Months,

—	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	12 h.
	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
Jan. ...	+23·3	+25·5	**+25·6**	+20·5	+16·4	+ 9·0	+ 0·1	− 7·7	+ 1·9	− 9·8	−15·7	−24·9
Feb. ...	+25·0	+25·6	+24·8	+24·9	+19·7	+10·3	+ 0·3	− 4·4	− 9·4	−13·1	−28·1	−31·6
Mar. ...	+10·7	+10·3	+ 8·1	+ 9·9	+ 5·8	+ 0·7	− 3·4	+ 3·2	+ 4·7	+ 5·5	− 3·5	−14·3
April ...	+11·8	+ 8·5	+ 7·3	+ 5·4	+ 1·8	+ 0·8	− 3·8	− 3·1	− 4·1	− 6·5	−13·7	**−17·9**
May ...	+ 5·5	+ 5·8	+ 6·4	+ 2·8	− 0·1	− 1·7	− 2·1	− 2·5	− 3·2	− 4·1	− 6·1	− 6·7
June ...	+ 5·9	+ 3·8	+ 3·5	+ 2·6	+ 0·7	− 1·0	− 4·1	− 4·6	− 7·1	− 7·0	**− 8·2**	− 7·4
July ...	+ 5·2	+ 5·0	+ 5·8	+ 3·6	+ 1·9	− 1·4	− 3·1	− 4·6	− 5·6	− 7·1	**− 7·7**	− 7·3
Aug. ...	+ 6·8	+ 7·1	+ 6·8	+ 5·4	+ 2·9	+ 0·1	− 3·5	− 4·2	− 5·5	− 7·0	− 6·5	**− 9·0**
Sept. ...	+ 9·4	**+12·9**	+ 7·5	+ 4·2	+ 1·8	− 0·9	− 4·0	− 2·9	− 3·5	− 5·9	− 9·8	−10·0
Oct. ...	+15·0	**+16·0**	+14·8	+11·1	+ 5·8	+ 1·6	− 1·0	− 1·2	− 7·2	− 6·6	−12·2	−21·8
Nov. ...	**+25·9**	+24·5	+16·5	+14·7	+10·1	+ 3·9	+ 2·7	− 2·9	− 5·7	−16·8	−25·8	−25·6
Dec. ...	+26·8	+26·9	+27·6	+20·6	+16·3	+ 7·5	+ 5·6	+ 4·6	+ 2·0	−22·5	−24·8	−28·9
Year ...	+14·3	+14·3	+12·9	+10·5	+ 6·9	+ 2·4	− 1·4	− 2·5	− 3·6	− 8·4	−13·5	−17·1
Winter ...	+ 5·8	+ 5·4	+ 5·6	+ 3·6	+ 1·3	− 1·0	− 3·2	− 4·0	− 5·4	− 6·3	− 7·1	**− 7·6**
Equinox ...	+11·7	+11·9	+ 9·4	+ 7·7	+ 3·8	+ 0·6	− 3·1	− 1·0	− 2·5	− 3·4	− 9·8	−16·0
Summer ...	+25·3	+25·6	+23·6	+20·2	+15·6	+ 7·7	+ 2·2	− 2·6	− 2·8	−15·5	−23·6	**−27·7**

Individual Months from 10 Quieter Days a Month.

13 h.	14 h.	15 h.	16 h.	17 h.	18 h.	19 h.	20 h.	21 h.	22 h.	23 h.	24 h.	Range.	A.D.
γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
−32·4	−29·9	−32·0	−25·7	−18·6	−11·0	− 1·9	− 2·7	+11·5	+23·1	+26·5	+30·1	64·1	20·00
−16·9	−20·2	**−20·8**	−18·2	−11·3	− 6·9	− 1·3	+ 4·7	+ 9·7	**+14·0**	+10·1	+12·9	34·8	9·57
−21·5	−19·5	−17·9	−14·9	− 6·9	− 0·6	+ 2·7	+16·1	**+25·8**	+17·0	+14·5	+13·2	47·7	10·59
− 9·0	− 8·1	− 7·8	− 6·8	− 5·4	− 3·0	+ 4·6	+ 4·8	+ 3·8	+ 6·2	+ 8·1	**+10·0**	19·0	5·45
− 6·5	− 3·7	− 2·4	− 1·0	− 0·2	+ 2·1	+ 5·7	+ 6·9	+ 5·5	**+ 8·8**	+ 7·8	+ 8·2	18·0	4·92
− 9·6	− 9·1	− 4·6	− 3·1	− 0·6	+ 3·2	+ 4·9	+ 6·0	+ 7·5	+ 9·9	+ 9·5	**+10·7**	21·0	6·31
− 6·1	− 6·7	− 4·8	− 4·2	− 1·5	− 1·5	− 0·5	+ 3·0	+ 6·6	+ 5·9	**+10·3**	+ 8·1	18·8	5·43
−13·0	−10·9	−10·2	− 7·2	− 2·1	+ 3·1	+ 6·3	+ 4·4	+ 4·8	+ 6·2	+10·7	+12·4	32·3	7·49
−20·5	−14·5	−12·7	− 8·4	− 6·8	− 1·7	+ 2·3	+ 5·6	+ 9·5	+10·9	+12·4	**+15·7**	38·9	9·84
−27·6	**−32·3**	−25·3	−17·2	−10·6	− 2·4	+ 3·3	+ 7·0	+14·8	+19·9	+22·3	**+25·7**	58·0	17·23
−33·9	**−37·4**	−35·4	−25·8	−14·1	− 6·4	+ 1·7	+ 3·4	+12·1	+18·1	**+27·7**	+27·2	65·1	19·05
−32·1	−29·5	−31·2	−19·8	−12·8	− 7·1	− 0·9	+ 7·2	+ 8·2	+12·2	+17·3	+23·4	57·7	15·92
−35·9	**−35·9**	−29·0	−21·4	− 8·1	+ 0·9	+ 5·8	+11·9	+17·6	+21·9	+22·4	**+23·4**	59·3	18·25
−17·5	**−19·4**	−19·1	−12·0	− 4·1	− 1·5	+ 0·5	+ 4·1	+ 7·5	+10·0	+ 9·5	+10·9	31·2	8·26
−12·1	−10·8	− 6·8	− 3·1	− 1·4	+ 2·5	+ 4·5	+ 7·3	+ 8·6	+ 8·7	**+11·2**	+ 9·3	25·1	7·31
− 5·0	− 4·3	− 2·9	− 1·2	+ 0·4	+ 1·3	+ 3·6	+ 4·0	**+ 5·6**	+ 5·4	+ 3·5	+ 4·3	11·1	3·41
− 6·9	− 5·8	− 5·4	− 3·4	0·0	+ 1·6	+ 5·4	+ 4·5	+ 5·9	+ 6·4	**+ 6·7**	+ 6·1	13·8	4·60
− 5·0	**− 5·1**	− 3·1	− 2·0	− 0·5	+ 1·6	+ 2·7	+ 3·1	+ 3·7	+ 2·9	+ 3·7	+ 4·3	10·6	3·39
− 8·9	− 7·6	− 6·5	− 3·2	+ 0·7	+ 1·8	+ 3·3	+ 2·6	+ 3·6	+ 5·7	+ 5·9	**+ 7·6**	17·0	4·88
−14·3	−12·1	− 9·3	− 5·3	− 5·0	− 0·2	+ 2·7	+ 4·7	+ 8·0	+ 8·2	+ 9·4	**+10·3**	24·6	6·20
−24·3	−18·9	−16·5	−12·6	− 7·5	+ 0·2	+ 5·9	+ 8·5	+ 9·8	+12·1	+10·9	+11·8	41·9	10·50
−23·9	**−29·9**	−24·4	−19·1	−10·4	− 2·1	+ 0·6	+ 9·9	+17·1	+18·1	+18·8	+24·9	57·3	14·67

3 Seasons and the Year from 10 Quieter Days a Month.

13 h.	14 h.	15 h.	16 h.	17 h.	18 h.	19 h.	20 h.	21 h.	22 h.	23 h.	24 h.	Range.	A.D.
γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
−32·1	−29·5	−31·2	−19·8	−12·8	− 7·1	− 0·9	+ 7·2	+ 8·2	+12·2	+17·3	+23·4	57·7	15·92
−34·1	−32·9	−30·5	−23·5	−13·3	− 5·0	+ 2·0	+ 4·6	+14·6	+22·5	+24·5	**+26·8**	60·9	18·81
−17·2	−19·8	**−20·0**	−15·1	− 7·7	− 4·2	− 0·4	+ 4·4	+ 8·6	**+12·0**	+ 9·8	+11·9	32·0	8·80
−16·8	−15·1	−12·3	− 9·0	− 4·1	+ 1·0	+ 3·6	+11·7	**+17·2**	+12·9	+12·9	+11·3	35·1	8·86
− 7·0	− 6·2	− 5·4	− 4·0	− 2·5	− 0·9	+ 4·1	+ 4·4	+ 4·7	+ 5·8	+ 5·8	**+ 7·2**	14·2	4·38
− 6·7	− 4·8	− 3·9	− 2·2	− 0·1	+ 1·8	+ 5·5	+ 5·7	+ 5·7	**+ 7·6**	+ 7·2	+ 7·1	15·8	4·76
− 7·3	− 7·1	− 3·9	− 2·6	− 0·6	+ 2·4	+ 3·8	+ 4·5	+ 5·6	+ 6·4	+ 6·6	**+ 7·5**	15·2	4·86
− 7·5	− 7·2	− 5·7	− 3·7	− 0·4	+ 0·1	+ 1·4	+ 2·8	+ 5·1	+ 5·8	**+ 8·1**	+ 7·8	17·1	5·02
−13·6	−11·5	− 9·7	− 6·2	− 3·5	+ 1·5	+ 4·5	+ 4·6	+ 6·4	+ 7·2	+10·1	+11·4	26·5	6·79
−22·4	−16·7	−14·6	−10·5	− 7·2	− 0·7	+ 4·1	+ 7·1	+ 9·6	+11·5	+11·7	+13·8	38·4	10·18
−25·8	**−31·1**	−24·9	−18·2	−10·5	− 2·3	+ 1·9	+ 8·5	+16·0	+19·0	+20·6	+25·3	57·0	15·80
−33·9	**−37·4**	−35·4	−25·8	−14·1	− 6·4	+ 1·7	+ 3·4	+12·1	+18·1	**+27·7**	+27·2	65·1	19·05
−18·7	−18·3	−16·5	−11·7	− 6·4	− 1·7	+ 2·6	+ 5·7	+ 9·5	+11·8	+13·5	**+15·1**	33·8	9·97
− 7·1	− 6·3	− 4·7	− 3·1	− 0·9	+ 0·9	+ 3·7	+ 4·4	+ 5·3	+ 6·4	+ 6·9	**+ 7·4**	15·0	4·73
−17·5	−15·8	−14·1	−10·2	− 5·6	− 0·6	+ 3·0	+ 7·0	+10·4	+10·9	+11·1	**+12·1**	29·6	8·30
−31·5	**−32·7**	−30·5	−21·8	−12·7	− 5·2	+ 1·2	+ 5·9	+12·7	+18·0	+22·5	**+25·7**	58·4	17·20

TABLE XXII.—Diurnal Inequality in East Component for the

—	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	12 h.
	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
Jan. ...	+13·0	+ 2·9	− 5·4	− 8·2	−19·4	−17·3	−10·4	−14·1	−28·7	**−60·5**	−48·3	−44·4
Feb. ...	+16·0	+ 0·9	− 2·4	−12·8	−24·9	−35·0	−40·5	−53·9	−49·7	−52·6	**−59·0**	−37·7
Mar. ...	+ 9·0	+ 1·7	− 4·4	−13·6	−20·8	−26·2	−29·0	−37·9	−42·4	−42·6	**−43·2**	−39·7
April ...	+ 4·3	+ 2·1	− 5·8	− 8·2	−16·7	−24·3	−28·3	−30·4	**−38·2**	−35·4	−36·7	−30·6
May ...	+ 5·5	+ 2·0	− 2·2	− 8·2	−12·9	−16·6	−16·6	−22·6	−22·1	−23·5	**−25·1**	−19·8
June ...	+ 1·0	− 0·9	− 2·5	− 6·3	− 7·6	−12·6	−14·9	−18·3	−18·3	−17·2	**−20·0**	−18·4
July ...	+ 5·1	− 0·3	− 1·1	− 4·9	−11·2	−15·2	−15·5	−17·9	−18·1	−18·8	**−20·4**	−19·4
Aug. ...	+ 5·1	+ 1·6	− 5·8	− 7·4	−11·5	−18·2	−19·2	−21·0	−20·5	−24·7	**−28·8**	−21·8
Sept. ...	+ 3·3	+ 0·8	− 4·4	− 8·5	−13·8	−21·1	−22·6	−27·8	**−32·8**	−30·1	−29·6	−23·1
Oct. ...	+ 5·2	− 0·2	− 7·7	−13·9	−19·3	−25·8	−30·3	−32·9	−37·4	**−38·6**	−35·0	−29·9
Nov. ...	+ 4·9	− 1·1	− 3·3	− 7·5	−15·0	−20·1	−37·1	−44·8	−48·6	**−51·7**	−35·5	−31·5
Dec. ...	+12·7	+ 7·2	− 0·3	− 5·3	−15·8	−24·8	−41·9	−26·9	**−42·0**	−32·6	−36·8	−33·4
Year ...	+ 7·1	+ 1·4	− 3·8	− 8·7	−15·7	−21·4	−25·5	−29·0	−33·2	**−35·7**	−34·9	−29·1
Winter ...	+ 4·2	+ 0·6	− 2·9	− 6·7	−10·8	−15·7	−16·6	−19·9	−19·8	−21·1	**−23·6**	−19·8
Equinox ...	+ 5·5	+ 1·1	− 5·6	−11·1	−17·7	−24·3	−27·6	−32·2	**−37·7**	−36·7	−36·1	−30·8
Summer ...	+11·7	+ 2·5	− 2·9	− 8·5	−18·8	−24·3	−32·5	−34·9	−42·3	**−49·4**	−44·9	−36·8

TABLE XXIII.—Diurnal Inequality in East Component for the

—	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	12 h.
	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
Jan. ...	+11·4	+11·6	+ 6·2	0·0	−11·7	−14·8	−25·4	−22·4	−36·0	**−41·4**	−39·8	−33·1
Feb. ...	+11·3	+ 4·7	− 2·3	− 7·2	−27·1	−24·1	−30·6	−36·3	−43·0	**−43·8**	−41·8	−29·7
Mar. ...	+ 8·4	+ 4·0	− 0·4	− 3·5	−10·9	−11·5	−17·9	−16·9	−24·6	−27·6	**−29·4**	−22·5
April ...	+ 0·2	− 2·3	− 4·4	− 6·1	−10·5	−13·8	−19·0	−18·4	**−21·6**	−17·2	−14·7	−11·9
May ...	+ 2·9	+ 2·5	− 1·3	− 2·0	− 4·0	− 6·3	− 9·2	−10·6	**−10·8**	− 9·4	− 9·8	− 8·2
June ...	− 0·8	− 0·1	− 1·4	− 4·5	− 3·9	− 8·7	− 9·3	**−11·8**	− 9·6	− 8·2	− 9·5	− 6·9
July ...	+ 0·1	+ 0·2	0·0	− 0·3	− 6·7	− 7·9	**−11·3**	−10·1	− 7·9	− 8·4	− 7·1	− 5·3
Aug. ...	+ 1·7	+ 2·2	− 1·5	− 6·7	− 6·0	− 7·7	− 8·6	**−12·6**	−12·5	− 9·5	−12·3	− 6·4
Sept. ...	− 2·3	− 1·6	− 2·8	− 4·4	− 8·5	−10·1	−11·0	−13·0	−15·6	**−19·0**	−16·6	−12·0
Oct. ...	+ 0·2	− 4·3	− 9·0	− 8·8	−10·2	−16·5	−15·9	−19·9	−20·0	**−25·7**	−23·1	−15·0
Nov. ...	+ 3·7	− 4·3	− 0·6	− 2·5	− 6·4	−15·4	−34·9	−35·4	−37·4	**−43·7**	−29·3	−17·6
Dec. ...	+ 2·3	+ 8·0	+ 6·5	+ 0·5	− 8·2	−13·4	−12·9	−18·5	−30·6	−40·5	**−44·6**	−31·3
Year ...	+ 3·3	+ 1·7	− 0·9	− 3·8	− 9·5	−12·5	−17·2	−18·8	−22·5	**−24·5**	−23·2	−16·7
Winter ...	+ 1·0	+ 1·2	− 1·0	− 3·4	− 5·1	− 7·6	− 9·6	**−11·3**	−10·2	− 8·9	− 9·7	− 6·7
Equinox ...	+ 1·6	− 1·1	− 4·2	− 5·7	−10·0	−13·0	−15·9	−17·0	−20·5	**−22·4**	−20·9	−15·4
Summer ...	+ 7·2	+ 5·0	+ 2·5	− 2·3	−13·4	−16·9	−26·0	−28·2	−36·8	**−42·4**	−38·9	−27·9

12 Months, 3 Seasons and the Year from all Complete Days.

13 h.	14 h.	15 h.	16 h.	17 h.	18 h.	19 h.	20 h.	21 h.	22 h.	23 h.	24 h.	Range.	A.D.
γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
−33·1	−20·5	+ 5·6	+21·0	+36·3	+39·2	**+45·5**	+36·7	+30·2	+29·5	+27·6	+22·8	106·0	25·86
−28·5	−18·4	+ 2·8	+29·6	+38·9	+43·8	+54·7	**+59·7**	+57·7	+50·6	+35·9	+24·8	118·7	34·62
−26·5	− 9·6	+ 7·1	+18·4	+32·9	+40·9	**+49·5**	+47·0	+44·5	+36·9	+27·0	+21·0	92·7	27·99
−20·4	− 8·4	+ 3·1	+18·2	+28·5	+36·1	**+42·4**	+41·8	+37·2	+31·6	+23·2	+14·9	80·6	23·62
−14·0	−11·0	+ 0·7	+10·5	+20·6	+28·0	+27·5	**+31·1**	+26·4	+18·5	+14·1	+ 9·7	56·2	16·22
−11·2	− 6·6	− 1·5	+ 7·6	+15·9	+20·9	**+29·7**	+26·2	+22·1	+15·1	+11·7	+ 6·1	49·7	13·03
−17·9	− 6·9	− 2·6	+ 8·7	+14·2	+18·4	+28·6	**+28·8**	+25·1	+21·7	+10·8	+ 8·8	49·2	14·18
−16·4	− 8·4	+ 3·1	+16·8	+19·2	+26·7	**+32·4**	+29·6	+27·4	+20·4	+14·8	+ 6·6	61·2	16·98
−18·1	− 6·8	+ 6·6	+17·1	+30·9	+31·2	**+34·9**	+33·0	+30·7	+27·9	+16·3	+ 6·0	67·7	19·89
−19·0	− 4·3	+10·5	+23·0	+37·3	**+42·7**	+41·6	+42·3	+35·7	+28·2	+17·1	+10·7	81·3	24·53
−31·0	−13·6	+ 4·4	+26·4	+37·7	+47·1	+49·5	**+50·1**	+42·9	+37·8	+26·2	+13·8	101·8	28·40
−34·7	−23·6	− 6·2	+ 7·8	+29·8	+37·8	+44·5	+48·2	**+48·6**	+44·1	+24·9	+18·1	90·6	27·00
−22·6	−11·5	+ 2·8	+17·1	+28·5	+34·4	**+40·1**	+39·5	+35·7	+30·2	+20·8	+13·6	75·8	22·60
−14·9	− 8·2	− 0·1	+10·9	+17·5	+23·5	**+29·6**	+28·9	+25·3	+18·9	+12·9	+ 7·8	53·2	15·01
−21·0	− 7·3	+ 6·8	+19·2	+32·4	+37·7	**+42·1**	+41·0	+37·0	+31·2	+20·9	+13·2	79·8	24·01
−31·8	−19·0	+ 1·7	+21·2	+35·7	+42·0	+48·6	**+48·7**	+44·9	+40·5	+28·7	+19·9	98·1	28·84

12 Months, 3 Seasons and the Year from 10 Quieter Days a Month.

13 h.	14 h.	15 h.	16 h.	17 h.	18 h.	19 h.	20 h.	21 h.	22 h.	23 h.	24 h.	Range.	A.D.
γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
−19·4	−14·0	+ 0·8	+17·7	+25·7	+30·2	+30·4	**+30·6**	+24·0	+24·1	+25·2	+19·8	72·0	21·49
−20·2	−11·9	+ 3·2	+15·9	+24·4	+32·4	+43·2	+44·7	**+47·9**	+44·6	+27·9	+18·1	91·7	26·51
−13·7	− 6·9	− 1·3	+ 6·7	+13·7	+19·7	+27·0	+28·6	**+29·0**	+20·0	+15·2	+14·2	58·4	15·57
− 8·3	− 2·2	+ 0·3	+ 8·1	+13·9	+17·2	+24·6	**+30·8**	+20·5	+15·5	+11·5	+ 8·3	52·4	12·55
− 7·0	− 5·4	+ 0·9	+ 4·8	+ 7·6	+ 9·9	+12·5	**+12·6**	+12·2	+ 8·5	+ 4·5	+ 5·1	23·4	7·00
− 3·9	− 2·0	− 0·6	+ 2·7	+ 6·8	+11·2	**+13·9**	+12·8	+12·1	+ 9·7	+ 7·9	+ 4·1	25·7	6·77
− 4·5	− 2·2	− 1·6	+ 4·0	+ 5·7	+10·0	+12·2	**+13·8**	+10·0	+ 8·5	+ 5·4	+ 3·0	25·1	6·09
− 5·8	− 3·4	+ 2·5	+ 7·9	+10·3	+11·1	**+13·9**	+12·9	+12·8	+ 9·0	+ 6·1	+ 2·2	26·5	7·73
− 8·4	− 1·2	+ 5·7	+13·3	+20·1	+20·2	**+20·5**	+16·6	+12·8	+ 8·7	+ 6·5	+ 2·2	39·5	10·55
− 3·4	+ 6·3	+12·4	+21·6	**+28·6**	+24·5	+22·5	+20·2	+15·8	+10·0	+ 5·2	+ 4·5	54·3	14·32
−14·3	− 0·3	+11·5	+22·6	+30·5	+36·7	+36·9	**+37·8**	+25·3	+18·2	+11·6	+ 7·3	81·5	20·18
−15·4	− 8·3	+ 4·2	+ 9·0	+25·7	**+33·1**	+28·8	+28·2	+27·4	+26·2	+16·3	+ 8·4	77·7	18·68
−10·4	− 4·3	+ 3·2	+11·2	+17·8	+21·4	+23·9	**+24·1**	+20·8	+16·9	+11·9	+ 8·1	48·6	13·73
− 5·3	− 3·2	+ 0·3	+ 4·9	+ 7·6	+10·6	**+13·1**	+13·0	+11·8	+ 8·9	+ 6·0	+ 3·6	24·4	6·83
− 8·5	− 1·0	+ 4·3	+12·4	+19·1	+20·4	+23·7	**+24·1**	+19·5	+13·6	+ 9·6	+ 7·3	46·5	12·97
−17·3	− 8·6	+ 4·9	+16·3	+26·6	+33·1	+34·8	**+35·3**	+31·1	+28·3	+20·2	+13·4	77·7	21·56

Table XXIV.—Diurnal Inequality in South Component for the

—	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	12 h.
	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
Jan. ...	−36·0	**−39·3**	−36·8	−36·7	−29·5	−27·5	−20·9	−16·7	−12·4	+ 1·0	+11·0	+26·9
Feb. ...	−42·6	−49·7	**−50·7**	−48·1	−46·3	−42·4	−29·1	−25·9	− 9·2	+ 3·8	+20·7	+25·1
Mar. ...	**−37·1**	**−37·1**	−35·5	−35·0	−28·3	−25·6	−15·8	− 7·1	+ 0·7	+ 8·9	+22·2	+29·2
April ...	−36·1	**−42·5**	−31·1	−26·2	−29·1	−20·5	−16·0	− 6·0	+ 3·2	+10·1	+23·4	+29·0
May ...	−20·5	−23·0	−20·7	−20·6	−17·4	−15·9	− 9·0	− 4·6	+ 3·0	+ 5·7	+13·9	+16·3
June ...	−18·2	−17·0	−16·4	−14·4	−13·8	−10·8	− 8·8	− 2·9	+ 0·5	+ 4·0	+ 9·1	+16·6
July ...	−18·6	−21·4	−20·5	**−22·1**	−20·7	−17·0	−11·2	− 5·5	+ 1·4	+ 5·6	+11·5	+20·5
Aug. ...	−17·2	−17·5	**−21·5**	−19·4	−19·4	−15·0	−10·0	− 4·4	+ 1·7	+ 6·0	+12·2	+18·3
Sept. ...	−22·4	−20·5	−22·2	**−23·8**	−18·1	−16·9	−11·5	− 6·1	+ 0·3	+ 5·6	+13·6	+17·3
Oct. ...	−28·4	−30·1	**−30·5**	−28·7	−25·6	−18·0	−12·4	− 5·6	+ 1·7	+ 8·4	+15·5	+25·8
Nov. ...	−32·1	−33·3	**−35·1**	−32·7	−28·3	−22·9	−21·7	−13·5	− 0·8	+ 2·8	+10·5	+23·7
Dec. ...	−32·2	−38·8	−39·7	−43·5	**−45·1**	−39·7	−26·8	−10·8	−15·9	− 5·2	+11·6	+26·6
Year ...	−28·5	**−30·7**	−30·1	−29·3	−26·8	−22·7	−16·1	− 9·1	− 2·2	+ 4·6	+14·6	+22·9
Winter ...	−18·6	−19·7	−19·8	−19·1	−17·8	−14·7	− 9·8	− 4·4	+ 1·7	+ 5·3	+11·7	+17·9
Equinox ...	−31·0	**−32·6**	−29·8	−28·4	−25·3	−20·3	−13·9	− 6·2	+ 1·5	+ 8·3	+18·7	+25·3
Summer ...	−35·7	−39·8	**−40·6**	−40·2	−37·3	−33·1	−24·6	−16·7	− 9·6	+ 0·1	+13·5	+25·6

Table XXV.—Diurnal Inequality in South Component for the

—	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	12 h.
	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
Jan. ...	−25·9	−26·4	−27·8	**−29·9**	−28·7	−25·0	−23·7	−22·1	− 7·8	+ 0·1	+12·6	+23·9
Feb. ...	−31·0	−37·1	−36·9	**−44·8**	−41·3	−34·2	−18·2	−19·5	− 4·9	+ 5·4	+16·9	+22·6
Mar. ...	−21·6	−22·5	−22·7	**−23·2**	−19·4	−14·8	− 9·0	− 2·1	+ 1·0	+ 5·2	+ 7·2	+11·9
April ...	**−23·3**	−18·4	−16·3	−12·8	−15·7	−13·6	−11·6	− 2·4	+ 4·6	+ 7·2	+12·8	+14·2
May ...	−10·2	− 9·0	**−11·9**	− 9·8	− 7·2	− 7·4	− 6·0	− 1·5	+ 2·9	+ 2·2	+ 6·6	+ 7·5
June ...	− 6·6	− 6·2	− 7·7	− 8·4	− 6·8	− 8·5	− 5·7	− 0·5	+ 2·6	+ 4·1	+ 5·2	+ 6·3
July ...	− 8·4	− 8·6	− 8·4	**−12·4**	−12·0	−11·7	− 8·3	− 4·5	+ 2·2	+ 4·0	+ 6·5	+ 7·1
Aug. ...	− 8·7	− 8·4	−10·1	− 9·8	−10·0	− 8·2	− 5·6	− 2·0	+ 3·4	+ 3·4	+ 7·4	+ 9·9
Sept. ...	−15·0	−10·9	−10·0	−10·7	− 8·4	− 7·8	− 2·1	− 2·3	+ 3·6	+ 4·5	+ 9·5	+12·2
Oct. ...	−19·2	−19·4	−19·4	**−21·0**	−17·7	−15·2	− 8·8	− 2·4	+ 2·0	+ 9·2	+13·2	+19·6
Nov. ...	−19·7	−19·8	−19·6	−20·3	**−22·1**	−18·5	−16·8	− 8·8	+ 3·8	+ 7·1	+11·6	+19·4
Dec. ...	−19·6	−21·6	−25·9	−30·6	**−31·3**	−29·3	−23·8	−13·4	− 5·1	+ 0·4	+12·9	+20·7
Year ...	−17·4	−17·4	−18·1	**−19·5**	−18·4	−16·2	−11·6	− 6·8	+ 0·7	+ 4·4	+10·2	+14·6
Winter ...	− 8·5	− 8·1	− 9·5	**−10·1**	− 9·0	− 8·9	− 6·4	− 2·1	+ 2·8	+ 3·4	+ 6·4	+ 7·7
Equinox ...	**−19·8**	−17·8	−17·1	−16·9	−15·3	−12·8	− 7·9	− 2·3	+ 2·8	+ 6·5	+10·7	+14·5
Summer ...	−24·0	−26·2	−27·5	**−31·4**	−30·8	−26·8	−20·6	−16·0	− 3·5	+ 3·3	+13·5	+21·7

12 Months, 3 Seasons and the Year from all Complete Days.

13 h.	14 h.	15 h.	16 h.	17 h.	18 h.	19 h.	20 h.	21 h.	22 h.	23 h.	24 h.	Range.	A.D.
γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
+36·2	+42·1	**+45·5**	+44·2	+36·4	+31·0	+18·0	+11·1	+ 2·6	− 8·5	−17·3	−22·3	84·8	25·41
+44·1	+62·2	+68·1	**+75·9**	+53·6	+34·8	+23·1	+12·7	− 6·2	−17·2	−24·9	−31·8	126·6	35·34
+34·9	**+48·4**	+45·8	+44·1	+44·5	+31·5	+15·6	+ 0·8	−14·2	−25·2	−31·3	−34·4	85·5	27·22
+33·5	+43·1	+47·6	**+48·3**	+35·6	+30·4	+12·1	− 0·3	−14·2	−23·0	−33·7	−37·7	90·8	26·36
+23·6	+28·3	**+29·7**	+24·3	+20·5	+17·8	+ 9·7	− 1·5	− 5·2	−12·6	−18·7	**−23·1**	52·8	16·07
+20·1	+22·2	+21·0	+23·8	**+23·9**	+15·2	+ 6·3	+ 1·3	− 5·5	−14·5	**−21·0**	−20·7	44·9	13·67
+22·6	+24·6	**+27·9**	+23·2	+24·2	+19·5	+ 8·3	+ 2·8	− 7·4	−13·1	−15·6	−19·0	50·0	16·01
+21·9	**+30·0**	+28·4	+27·5	+23·2	+15·5	+ 6·0	− 3·1	−10·6	−15·5	−18·6	−18·5	51·5	15·89
+25·5	+32·7	+35·6	**+36·7**	+29·9	+19·0	+ 5·4	− 3·0	−11·6	−20·1	−21·8	−23·6	60·5	18·47
+34·1	+35·3	**+37·1**	+36·1	+31·0	+22·2	+11·9	− 0·9	−10·7	−24·7	−19·9	−23·6	67·6	21·59
+33·4	+42·7	+52·0	**+52·1**	+41·5	+27·8	+15·0	+ 0·4	− 8·1	−22·5	−22·8	−28·1	87·2	25·16
+37·2	+46·5	**+56·1**	+51·7	+50·4	+40·5	+24·1	+13·7	− 0·5	−14·6	−20·8	−27·6	101·2	29·90
+30·6	+38·2	**+41·2**	+40·7	+34·6	+25·4	+13·0	+ 2·8	− 7·6	−17·6	−22·2	−25·9	71·9	22·39
+22·1	+26·3	**+26·7**	+24·7	+22·9	+17·0	+ 7·6	− 0·1	− 7·2	−13·9	−18·5	**−20·3**	47·0	15·33
+32·0	+39·9	**+41·5**	+41·3	+35·3	+25·8	+11·3	− 0·9	−12·7	−23·3	−26·7	−29·8	74·1	23·41
+37·7	+48·4	+55·4	**+56·0**	+45·5	+33·5	+20·1	+ 9·5	− 3·0	−15·7	−21·5	−27·5	96·6	28·78

12 Months, 3 Seasons and the Year from 10 Quieter Days a Month.

13 h.	14 h.	15 h.	16 h.	17 h.	18 h.	19 h.	20 h.	21 h.	22 h.	23 h.	24 h.	Range.	A.D.
γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
+25·4	+30·1	+36·8	**+37·6**	+37·3	+27·5	+17·3	+ 7·0	− 1·9	− 2·8	−14·7	−19·2	67·5	21·31
+35·9	+47·0	+51·1	**+63·1**	+41·4	+25·0	+20·2	+11·6	−10·0	−15·7	−20·3	−25·8	107·9	28·32
+18·4	+23·9	+29·7	**+34·8**	+30·4	+18·0	+ 8·6	+ 4·8	− 6·2	−12·1	−19·3	−21·2	58·0	16·17
+18·0	+21·8	**+25·0**	+21·3	+20·1	+17·6	+ 7·5	0·0	− 5·7	−14·3	−17·3	−18·7	48·3	14·18
+10·0	**+12·2**	+12·1	+12·1	+ 9·9	+ 6·5	+ 6·6	− 0·6	− 4·5	− 4·8	− 6·8	− 9·2	24·1	7·40
+ 8·3	+10·6	+10·7	+11·2	**+11·9**	+ 8·0	+ 4·9	− 0·7	− 5·4	− 8·6	− 8·8	**− 9·9**	21·8	6·98
+11·6	+14·0	+17·8	**+18·2**	+13·4	+ 9·9	+ 3·9	− 1·4	− 6·1	− 7·9	−10·1	− 8·8	30·6	9·05
+13·1	+13·5	**+13·7**	+13·5	+12·4	+ 7·3	+ 3·1	− 2·9	− 6·0	− 9·0	− 9·5	**−10·5**	24·2	8·39
+17·3	**+19·4**	+19·1	+16·3	+14·7	+ 7·4	+ 1·3	− 5·0	−10·3	−13·1	−13·9	**−16·2**	35·6	10·46
+25·4	**+27·0**	+25·9	+22·7	+18·7	+10·6	+ 4·7	− 4·8	− 9·3	−11·1	−13·5	−17·2	48·0	14·92
+25·0	+32·1	**+32·9**	+31·3	+26·9	+15·6	+ 8·0	− 1·8	−11·2	−17·2	−20·3	−17·6	55·0	17·81
+19·4	+27·1	+33·0	+33·7	**+34·8**	+26·5	+15·0	+12·3	+ 4·3	− 5·5	−13·6	−21·4	66·1	20·05
+19·0	+23·2	+25·7	**+26·3**	+22·6	+15·0	+ 8·4	+ 1·5	− 6·0	−10·2	−14·0	−16·3	45·8	14·31
+10·8	+12·6	+13·6	**+13·8**	+11·9	+ 7·9	+ 4·6	− 1·4	− 5·5	− 7·6	− 8·8	− 9·6	23·9	7·96
+19·8	+23·0	**+24·9**	+23·8	+21·0	+13·4	+ 5·5	− 1·2	− 7·9	−12·6	−16·0	−18·3	44·7	13·83
+26·4	+34·1	+38·5	**+41·4**	+35·0	+23·7	+15·1	+ 7·3	− 4·7	−10·3	−17·2	−21·0	72·8	21·67

TABLE XXVI.—Diurnal Inequality in Declination for the

—	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	12 h.
	′	′	′	′	′	′	′	′	′	′	′	′
Jan. ...	−22·0	−15·7	− 8·8	− 6·7	+ 3·9	+ 3·1	+ 0·4	+ 4·5	+16·7	**+43·8**	+39·0	+41·7
Feb. ...	−26·4	−17·9	−15·7	− 7·3	+ 2·2	+10·9	+19·5	+30·3	+33·1	+39·6	**+50·2**	+36·2
Mar. ...	−19·4	−14·1	− 9·1	− 2·2	+ 5·4	+10·2	+15·8	+25·2	+31·2	+34·2	**+39·2**	+39·1
April ...	−15·6	−16·3	− 6·5	− 3·1	+ 2·1	+10·6	+15·1	+20·1	+28·9	+29·2	**+35·0**	+32·4
May ...	−11·2	− 9·4	− 5·6	− 1·1	+ 3·4	+ 6·6	+ 9·0	+14·9	+17·2	+19·1	**+23·2**	+20·1
June ...	− 7·1	− 5·2	− 3·8	− 0·4	+ 0·7	+ 5·4	+ 7·8	+12·4	+13·6	+13·9	+17·7	**+19·1**
July ...	−10·2	− 7·2	− 6·3	− 4·1	+ 1·0	+ 5·2	+ 7·5	+11·2	+13·7	+15·7	+18·8	**+21·3**
Aug. ...	− 9·6	− 7·2	− 3·2	− 1·3	+ 1·2	+ 8·1	+10·6	+13·8	+15·5	+20·1	**+25·2**	+22·3
Sept. ...	−10·2	− 7·7	− 4·5	− 2·0	+ 3·9	+ 9·6	+12·5	+18·2	+24·1	+23·8	**+26·3**	+22·8
Oct. ...	−13·6	−10·3	− 5·0	+ 0·2	+ 5·2	+12·6	+17·8	+22·1	+27·9	**+31·0**	+30·8	+30·7
Nov. ...	−14·7	−10·7	− 9·7	− 5·9	+ 1·2	+ 6·8	+19·6	+28·0	+35·2	**+38·6**	+29·6	+31·1
Dec. ...	−20·4	−18·0	−13·6	−11·2	− 4·1	+ 4·4	+21·3	+15·9	+25·1	+22·0	+30·8	+33·6
Year ...	−15·0	−11·6	− 7·7	− 3·8	+ 2·2	+ 7·8	+13·1	+18·1	+23·5	+27·6	**+30·5**	+29·2
Winter ...	− 9·5	− 7·3	− 4·7	− 1·7	+ 1·6	+ 6·3	+ 8·7	+13·1	+15·0	+17·2	**+21·2**	+20·7
Equinox ...	−14·7	−12·1	− 6·3	− 1·8	+ 4·2	+10·8	+15·3	+21·4	+28·0	+29·6	**+32·8**	+31·2
Summer ...	−20·9	−15·6	−12·0	− 7·8	+ 0·8	+ 6·3	+15·2	+19·7	+27·5	+36·0	**+37·4**	+35·7

TABLE XXVII.—Diurnal Inequality in Declination for the

—	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	12 h.
	′	′	′	′	′	′	′	′	′	′	′	′
Jan. ...	−17·2	−17·6	−14·2	−10·4	− 1·4	+ 2·2	+10·3	+ 8·7	+23·5	+30·3	**+33·4**	+32·4
Feb. ...	−18·9	−16·2	−11·1	−10·3	+ 5·5	+ 5·7	+16·0	+19·6	+29·7	+33·8	**+36·3**	+29·5
Mar. ...	−13·6	−10·7	− 7·6	− 5·5	+ 1·2	+ 3·2	+10·0	+11·6	+18·3	+22·0	**+23·9**	+20·5
April ...	− 8·3	− 4·7	− 2·4	0·0	+ 2·2	+ 5·4	+ 9·9	+12·6	**+17·4**	+15·1	+15·2	+13·5
May ...	− 5·6	− 4·9	− 3·2	− 2·0	+ 0·3	+ 2·1	+ 4·6	+ 7·2	+ 8·9	+ 7·6	**+ 9·4**	+ 8·6
June ...	− 1·8	− 2·1	− 1·7	+ 0·4	+ 0·4	+ 3·4	+ 4·9	+ 8·4	+ 7·9	+ 7·4	**+ 8·7**	+ 7·2
July ...	− 3·0	− 3·1	− 2·9	− 4·1	+ 0·8	+ 1·6	+ 5·4	+ 5·8	+ 6·5	**+ 7·5**	+ 7·4	+ 6·3
Aug. ...	− 4·3	− 4·5	− 2·4	+ 1·4	+ 0·9	+ 2·8	+ 4·3	+ 8·4	+10·3	+ 8·1	**+11·6**	+ 8·1
Sept. ...	− 3·6	− 2·7	− 1·5	− 0·5	+ 3·3	+ 4·6	+ 7·3	+ 8·7	+12·6	+15·4	**+15·4**	+12·9
Oct. ...	− 6·9	− 3·6	− 0·1	− 0·8	+ 1·4	+ 6·9	+ 8·5	+13·7	+15·2	**+21·9**	+21·4	+17·8
Nov. ...	− 9·6	− 3·7	− 6·4	− 5·2	− 3·0	+ 4·8	+19·7	+22·8	+28·6	**+34·4**	+25·5	+19·5
Dec. ...	− 8·5	−13·3	−13·6	−10·9	− 4·9	− 0·3	+ 1·2	+ 8·9	+20·6	+29·6	**+37·0**	+30·0
Year ...	− 8·4	− 7·3	− 5·6	− 4·0	+ 0·6	+ 3·5	+ 8·5	+11·4	+16·6	+19·4	**+20·4**	+17·2
Winter ...	− 3·7	− 3·7	− 2·6	− 1·1	+ 0·6	+ 2·5	+ 4·8	+ 7·5	+ 8·4	+ 7·7	**+ 9·3**	+ 7·6
Equinox ...	− 8·1	− 5·4	− 2·9	− 1·7	+ 2·0	+ 5·1	+ 8·9	+11·7	+15·9	+18·6	**+19·0**	+16·2
Summer ...	−13·6	−12·7	−11·3	− 9·2	− 0·9	+ 3·1	+11·8	+15·0	+25·6	+32·0	**+33·1**	+27·9

12 Months, 3 Seasons and the Year from all Complete Days.

13 h.	14 h.	15 h.	16 h.	17 h.	18 h.	19 h.	20 h.	21 h.	22 h.	23 h.	24 h.	Range.	A.D.
′	′	′	′	′	′	′	′	′	′	′	′	′	′
+36·7	+29·4	+11·6	0·0	−13·9	−17·9	**−27·0**	−22·9	−21·1	−24·5	−26·1	−24·4	70·8	19·24
+36·0	+34·9	+21·5	+ 4·7	− 9·8	−19·9	−31·9	−39·2	**−44·2**	−42·9	−34·8	−29·1	94·4	26·59
+31·3	+23·8	+10·8	+ 1·8	− 8·6	−19·0	−30·7	−34·0	**−37·4**	−35·7	−30·5	−27·3	76·6	22·33
+26·5	+21·1	+14·2	+ 3·4	− 8·5	−15·8	−26·7	−30·6	**−32·1**	−31·0	−28·5	−23·9	67·1	19·88
+18·4	+17·8	+ 9·8	+ 0·8	− 8·0	−14·2	−16·8	**−23·2**	−21·1	−17·8	−16·8	−15·1	46·4	13·36
+15·2	+12·5	+ 8·4	+ 2·7	− 3·3	− 9·9	**−19·6**	−18·6	−18·1	−16·0	−15·8	−11·6	38·7	10·78
+20·9	+13·5	+11·6	+ 1·7	− 2·0	− 6·7	−18·0	−20·0	**−20·9**	−20·4	−13·3	−13·0	42·2	11·84
+19·5	+16·5	+ 7·5	− 2·7	− 5·9	−14·1	−21·5	−22·6	**−23·7**	−20·2	−17·2	−11·2	48·9	13·36
+22·0	+16·3	+ 7·5	+ 0·2	−12·3	−16·2	−23·6	−25·1	−26·4	**−27·3**	−19·4	−12·5	53·6	15·60
+25·7	+15·3	+ 5·2	− 4·3	−16·4	−23·5	−26·2	**−31·1**	−29·7	−29·1	−19·3	−16·0	62·1	18·71
+34·1	+24·7	+14·8	− 1·2	−13·1	−24·8	−30·9	**−36·4**	−34·1	−35·4	−27·0	−19·8	75·0	21·98
+38·2	+33·3	+24·0	+12·3	− 4·3	−13·5	−24·1	−30·4	−35·6	**−37·2**	−25·3	−22·8	75·4	21·73
+27·0	+21·6	+12·2	+ 1·6	− 8·8	−16·3	−24·8	−27·8	**−28·7**	−28·1	−22·8	−18·9	59·2	17·86
+18·5	+15·1	+ 9·3	+ 0·6	− 4·8	−11·2	−19·0	**−21·1**	−20·9	−18·6	−15·8	−12·7	42·3	12·28
+26·4	+19·1	+ 9·4	+ 0·3	−11·5	−18·6	−26·8	−30·2	**−31·4**	−30·8	−24·4	−19·9	64·2	19·04
+36·3	+30·6	+18·0	+ 3·9	−10·3	−19·0	−28·5	−32·2	−33·8	**−35·0**	−28·3	−24·0	72·4	22·28

12 Months, 3 Seasons and the Year from 10 Quieter Days a Month.

13 h.	14 h.	15 h.	16 h.	17 h.	18 h.	19 h.	20 h.	21 h.	22 h.	23 h.	24 h.	Range.	A.D.
′	′	′	′	′	′	′	′	′	′	′	′	′	′
+22·9	+20·6	+12·0	+ 0·1	− 5·8	−12·5	−16·1	−19·9	−18·1	−18·5	**−23·5**	−21·1	56·9	16·36
+27·1	+25·0	+15·3	+10·2	− 3·5	−15·0	−24·4	−28·6	**−38·3**	−37·9	−27·4	−22·1	74·6	21·14
+16·3	+13·3	+11·1	+ 7·2	+ 0·5	− 8·2	−16·7	−19·2	**−23·3**	−18·8	−17·8	−17·8	47·2	13·27
+12·3	+ 9·1	+ 8·5	+ 1·5	− 3·2	− 6·4	−15·3	**−22·4**	−16·9	−16·2	−14·4	−12·5	39·8	10·23
+ 8·5	+ 8·1	+ 3·5	+ 0·8	− 2·1	− 5·0	− 6·8	− 9·3	**−10·4**	− 7·8	− 5·7	− 6·8	19·8	5·80
+ 5·8	+ 5·1	+ 4·2	+ 2·1	− 0·9	− 5·4	− 8·5	− 9·6	**−10·7**	−10·1	− 8·8	− 6·3	19·4	5·49
+ 7·2	+ 6·5	+ 7·3	+ 3·3	+ 0·4	− 3·9	− 7·5	**−10·5**	− 9·4	− 8·9	− 7·5	− 5·2	18·0	5·50
+ 8·7	+ 7·2	+ 2·9	− 1·1	− 3·3	− 5·6	− 9·1	−10·4	**−11·3**	− 9·7	− 7·7	− 5·3	22·9	6·23
+12·1	+ 7·6	+ 2·4	− 4·1	− 9·6	−11·2	**−14·5**	−13·9	−12·9	−11·0	− 9·5	− 7·3	29·9	8·53
+11·2	+ 4·8	− 0·1	− 8·0	−14·4	−14·1	−14·8	**−16·4**	−14·7	−11·2	− 8·5	− 9·2	38·3	10·23
+19·1	+11·3	+ 3·0	− 5·7	−12·9	−21·4	−24·1	**−28·2**	−22·3	−19·2	−15·6	−11·4	62·6	15·73
+18·0	+15·4	+ 8·3	+ 5·0	− 6·7	−15·0	−15·8	−16·3	−18·5	**−21·0**	−16·5	−13·6	58·0	14·54
+14·1	+11·2	+ 6·5	+ 0·9	− 5·1	−10·3	−14·5	−17·1	**−17·2**	−15·9	−13·6	−11·6	37·6	10·87
+ 7·6	+ 6·7	+ 4·5	+ 1·3	− 1·5	− 5·0	− 8·0	−10·0	**−10·5**	− 9·1	− 7·4	− 5·9	19·8	5·71
+13·0	+ 8·7	+ 5·5	− 0·9	− 6·7	−10·0	−15·3	**−18·0**	−17·0	−14·3	−12·6	−11·7	37·0	10·38
+21·8	+18·1	+ 9·7	+ 2·4	− 7·2	−16·0	−20·1	−23·2	**−24·3**	−24·2	−20·7	−17·1	57·4	16·71

Table XXVIII.—Diurnal Inequality in Inclination for the

—	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	12 h.
	′	′	′	′	′	′	′	′	′	′	′	′
Jan. ...	+1·45	+1·83	+1·89	**+1·92**	+1·80	+1·64	+1·17	+1·04	+1·19	+1·32	+0·46	−0·35
Feb. ...	+1·69	+2·34	+2·45	+2·54	+2·69	**+2·70**	+2·19	+2·33	+1·46	+0·91	+0·24	−0·44
Mar. ...	+1·56	+1·71	+1·76	**+1·93**	+1·75	+1·73	+1·32	+1·12	+0·86	+0·48	−0·13	−0·55
April ...	+1·62	**+1·94**	+1·57	+1·38	+1·69	+1·45	+1·32	+0·90	+0·64	+0·25	−0·34	−0·73
May ...	+0·85	+1·04	+1·02	**+1·13**	+1·07	+1·07	+0·75	+0·66	+0·30	+0·21	−0·14	−0·37
June ...	+0·84	+0·82	+0·82	+0·80	+0·79	+0·75	+0·70	+0·49	+0·34	+0·15	−0·03	−0·41
July ...	+0·77	+1·01	+0·98	+1·14	**+1·18**	+1·09	+0·82	+0·60	+0·29	+0·11	−0·13	−0·55
Aug. ...	+0·71	+0·79	+1·12	+1·06	**+1·14**	+1·07	+0·86	+0·63	+0·34	+0·23	+0·03	−0·41
Sept. ...	+0·99	+0·95	+1·14	**+1·28**	+1·13	+1·22	+1·00	+0·86	+0·68	+0·37	−0·02	−0·34
Oct. ...	+1·23	+1·43	+1·60	**+1·65**	+1·60	+1·38	+1·22	+0·96	+0·72	+0·42	0·00	−0·60
Nov. ...	+1·45	+1·64	+1·74	+1·69	+1·62	+1·46	**+1·78**	+1·59	+1·09	+0·96	+0·20	−0·49
Dec. ...	+1·30	+1·62	+1·91	+2·16	**+2·45**	+2·38	+2·12	+1·05	+1·60	+0·88	+0·16	−0·63
Year ...	+1·20	+1·43	+1·50	+1·56	**+1·58**	+1·50	+1·27	+1·02	+0·79	+0·52	+0·03	−0·49
Winter ...	+0·79	+0·92	+0·99	+1·03	**+1·04**	+0·99	+0·78	+0·60	+0·32	+0·17	−0·07	−0·44
Equinox ...	+1·35	+1·51	+1·52	**+1·56**	+1·54	+1·44	+1·22	+0·96	+0·72	+0·38	−0·12	−0·56
Summer ...	+1·47	+1·86	+2·00	+2·08	**+2·14**	+2·05	+1·82	+1·50	+1·33	+1·02	+0·27	−0·48

Table XXIX.—Diurnal Inequality in Inclination for the

—	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	12 h.
	′	′	′	′	′	′	′	′	′	′	′	′
Jan. ...	+1·00	+1·03	+1·21	+1·42	+1·61	+1·48	**+1·62**	+1·46	+1·14	+0·86	+0·24	−0·45
Feb. ...	+1·24	+1·67	+1·81	+2·27	**+2·53**	+2·10	+1·49	+1·67	+1·12	+0·65	+0·05	−0·49
Mar. ...	+0·83	+0·97	+1·07	**+1·16**	+1·14	+0·92	+0·78	+0·47	+0·50	+0·37	+0·30	−0·10
April ...	**+1·09**	+0·92	+0·86	+0·74	+0·95	+0·92	+0·92	+0·49	+0·25	+0·02	−0·31	−0·44
May ...	+0·42	+0·37	**+0·59**	+0·50	+0·41	+0·47	+0·46	+0·29	+0·09	+0·09	−0·11	−0·19
June ...	+0·34	+0·30	+0·39	+0·49	+0·40	**+0·57**	+0·45	+0·26	+0·07	−0·04	−0·06	−0·15
July ...	+0·40	+0·40	+0·40	+0·58	+0·69	**+0·70**	+0·61	+0·40	+0·06	−0·02	−0·17	−0·23
Aug. ...	+0·38	+0·36	+0·51	**+0·61**	+0·59	+0·53	+0·43	+0·35	+0·09	+0·03	−0·09	−0·34
Sept. ...	**+0·76**	+0·57	+0·54	+0·60	+0·57	+0·57	+0·32	+0·37	+0·16	+0·18	−0·10	−0·33
Oct. ...	+0·92	+1·02	+1·12	**+1·18**	+1·04	+1·05	+0·74	+0·53	+0·32	+0·12	−0·14	−0·64
Nov. ...	+0·90	+1·07	+0·95	+1·03	+1·17	+1·19	**+1·52**	+1·16	+0·62	+0·54	+0·02	−0·58
Dec. ...	+0·93	+0·90	+1·12	+1·44	**+1·66**	+1·64	+1·38	+1·02	+0·90	+0·78	+0·29	−0·35
Year ...	+0·77	+0·80	+0·88	+1·00	**+1·06**	+1·01	+0·89	+0·71	+0·44	+0·30	−0·01	−0·36
Winter ...	+0·39	+0·36	+0·47	+0·54	+0·52	**+0·57**	+0·49	+0·33	+0·08	+0·01	−0·11	−0·23
Equinox ...	+0·90	+0·87	+0·90	+0·92	**+0·92**	+0·86	+0·69	+0·47	+0·31	+0·17	−0·06	−0·38
Summer ...	+1·02	+1·17	+1·27	+1·54	**+1·74**	+1·60	+1·50	+1·33	+0·94	+0·71	+0·15	−0·47

12 Months, 3 Seasons and the Year from all Complete Days.

13 h.	14 h.	15 h.	16 h.	17 h.	18 h.	19 h.	20 h.	21 h.	22 h.	23 h.	24 h.	Range.	A.D.
′	′	′	′	′	′	′	′	′	′	′	′	′	′
−1·05	−1·58	−2·29	**−2·54**	−2·49	−2·29	−1·80	−1·29	−0·74	−0·20	+0·26	+0·60	4·46	1·383
−1·52	−2·56	−3·28	**−4·18**	−3·32	−2·54	−2·23	−1·84	−0·90	−0·22	+0·46	+1·01	6·88	1·918
−1·10	−2·07	−2·31	−2·46	**−2·75**	−2·32	−1·76	−1·01	−0·27	+0·41	+0·91	+1·18	4·68	1·394
−1·16	−1·85	−2·29	**−2·62**	−2·24	−2·15	−1·43	−0·84	−0·10	+0·42	+1·10	+1·47	4·56	1·313
−0·82	−1·09	**−1·40**	−1·35	−1·38	−1·39	−1·01	−0·57	−0·28	+0·22	+0·60	+0·90	2·53	0·818
−0·72	−0·90	−0·94	−1·26	**−1·43**	−1·12	−0·89	−0·59	−0·18	+0·38	+0·74	**+0·85**	2·28	0·706
−0·68	−1·00	−1·24	−1·26	**−1·41**	−1·28	−0·98	−0·71	−0·16	+0·18	+0·52	+0·71	2·59	0·783
−0·69	−1·22	−1·39	**−1·64**	−1·47	−1·28	−0·96	−0·47	−0·07	+0·31	+0·57	+0·74	2·78	0·800
−0·83	−1·40	−1·81	**−2·07**	−2·05	−1·54	−0·98	−0·55	−0·10	+0·36	+0·70	+0·99	3·35	0·973
−1·22	−1·59	−1·97	−2·19	**−2·25**	−1·94	−1·44	−0·85	−0·25	+0·57	+0·60	+0·91	3·90	1·191
−0·94	−1·75	−2·55	**−3·01**	−2·74	−2·31	−1·75	−1·08	−0·51	+0·27	+0·55	+1·07	4·79	1·427
−1·09	−1·75	−2·53	−2·60	**−2·98**	−2·67	−2·05	−1·64	−0·96	−0·20	+0·52	+0·98	5·43	1·593
−0·98	−1·56	−2·00	**−2·26**	−2·21	−1·90	−1·44	−0·95	−0·38	+0·21	+0·63	+0·95	3·84	1·182
−0·73	−1·06	−1·24	−1·38	**−1·42**	−1·27	−0·96	−0·58	−0·17	+0·27	+0·61	+0·80	2·46	0·776
−1·08	−1·72	−2·10	**−2·33**	−2·32	−1·99	−1·40	−0·81	−0·18	+0·44	+0·83	+1·14	3·89	1·218
−1·15	−1·91	−2·66	**−3·08**	−2·88	−2·45	−1·96	−1·46	−0·78	−0·09	+0·45	+0·91	5·22	1·575

12 Months, 3 Seasons and the Year from 10 Quieter Days a Month.

13 h.	14 h.	15 h.	16 h.	17 h.	18 h.	19 h.	20 h.	21 h.	22 h.	23 h.	24 h.	Range.	A.D.
′	′	′	′	′	′	′	′	′	′	′	′	′	′
−0·83	−1·16	−1·79	−2·15	**−2·29**	−1·92	−1·44	−1·00	−0·41	−0·35	+0·18	+0·52	3·91	1·148
−1·30	−1·98	−2·49	**−3·28**	−2·44	−1·85	−1·84	−1·48	−0·53	−0·18	+0·40	+0·87	5·81	1·489
−0·59	−1·00	−1·39	**−1·78**	−1·70	−1·25	−0·97	−0·82	−0·31	+0·16	+0·58	+0·70	2·94	0·828
−0·69	−0·99	−1·18	−1·17	**−1·22**	−1·17	−0·86	−0·63	−0·13	+0·36	+0·58	+0·70	2·31	0·733
−0·32	−0·45	−0·59	**−0·67**	−0·62	−0·51	−0·56	−0·23	−0·04	+0·05	+0·23	+0·33	1·26	0·358
−0·32	−0·45	−0·49	−0·58	**−0·69**	−0·60	−0·51	−0·23	0·00	+0·21	+0·25	+0·38	1·26	0·343
−0·45	−0·61	−0·79	**−0·92**	−0·74	−0·66	−0·43	−0·22	+0·08	+0·20	+0·37	+0·37	1·62	0·438
−0·50	−0·57	−0·70	**−0·80**	−0·78	−0·57	−0·43	−0·14	+0·02	+0·24	+0·33	+0·46	1·41	0·410
−0·65	−0·90	−1·02	−1·05	**−1·11**	−0·77	−0·49	−0·12	+0·21	+0·43	+0·53	+0·73	1·87	0·545
−1·15	−1·42	−1·49	**−1·53**	−1·49	−1·01	−0·68	−0·20	+0·11	+0·33	+0·54	+0·73	2·71	0·813
−0·91	−1·55	−1·82	**−1·96**	−1·91	−1·51	−1·15	−0·70	+0·01	+0·45	+0·74	+0·72	3·48	1·008
−0·66	−1·17	−1·71	−1·81	**−2·18**	−1·94	−1·30	−1·16	−0·75	−0·26	+0·35	+0·88	3·84	1·108
−0·70	−1·02	−1·29	**−1·48**	−1·43	−1·15	−0·89	−0·58	−0·15	+0·14	+0·42	+0·62	2·54	0·754
−0·40	−0·52	−0·64	**−0·74**	−0·71	−0·58	−0·48	−0·21	+0·01	+0·17	+0·29	+0·39	1·31	0·385
−0·77	−1·08	−1·27	**−1·38**	**−1·38**	−1·05	−0·75	−0·44	−0·03	+0·32	+0·56	+0·71	2·30	0·716
−0·93	−1·47	−1·95	**−2·30**	−2·20	−1·80	−1·43	−1·08	−0·42	−0·08	+0·42	+0·75	4·04	1·178

TABLE XXX.—Diurnal Inequality in Horizontal Force for the

—	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	12 h.
	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
Jan. ...	−26·9	−34·3	−35·6	**−36·7**	−35·0	−32·3	−23·4	−21·1	−23·5	−26·8	−10·7	+ 5·2
Feb. ...	−31·7	−44·5	−46·9	−49·0	−52·5	**−53·3**	−43·6	−46·6	−29·7	−19·1	− 6·6	+ 6·5
Mar. ...	−29·7	−32·8	−34·0	**−37·5**	−34·5	−34·4	−26·7	−22·7	−17·5	−10·2	+ 1·6	+ 9·4
April ...	−30·9	**−37·6**	−30·6	−27·2	−33·5	−28·9	−26·6	−18·4	−13·5	− 6·0	+ 5·4	+13·1
May ...	−16·2	−19·9	−19·6	**−22·1**	−21·3	−21·5	−15·3	−13·8	− 6·7	− 4·9	+ 1·8	+ 6·3
June ...	−16·0	−15·7	−15·9	−15·7	−15·7	−15·2	−14·4	−10·4	− 7·5	− 3·8	− 0·3	+ 7·2
July ...	−14·6	−19·4	−19·0	−22·2	**−23·4**	−21·8	−16·7	−12·6	− 6·6	− 3·0	+ 1·6	+10·1
Aug. ...	−13·4	−15·1	−21·8	−20·6	**−22·5**	−21·4	−17·3	−12·9	− 7·4	− 5·2	− 1·3	+ 7·2
Sept. ...	−18·9	−18·1	−22·0	**−25·1**	−22·3	−24·3	−20·1	−17·4	−13·8	− 7·9	− 0·4	+ 5·8
Oct. ...	−23·3	−27·2	−30·8	**−31·9**	−31·4	−27·3	−24·2	−19·2	−14·6	− 9·0	− 1·0	+10·6
Nov. ...	−27·0	−30·6	−33·1	−32·7	−31·9	−29·4	**−35·5**	−31·5	−21·6	−19·6	− 5·7	+ 8·0
Dec. ...	−23·6	−30·1	−36·1	−41·6	**−47·5**	−46·6	−42·2	−21·4	−32·3	−18·6	− 5·3	+ 9·7
Year ...	−22·7	−27·1	−28·8	−30·2	**−31·0**	−29·7	−25·5	−20·7	−16·2	−11·2	− 1·7	+ 8·3
Winter ...	−15·1	−17·5	−19·1	−20·2	**−20·7**	−20·0	−15·9	−12·4	− 7·1	− 4·2	+ 0·5	+ 7·7
Equinox ...	−25·7	−28·9	−29·4	**−30·4**	**−30·4**	−28·7	−24·4	−19·4	−14·9	− 8·3	+ 1·4	+ 9·7
Summer ...	−27·3	−34·9	−37·9	−40·0	**−41·7**	−40·4	−36·2	−30·1	−26·8	−21·0	− 7·1	+ 7·3

TABLE XXXI.—Diurnal Inequality in Horizontal Force for the

—	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	12 h.
	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
Jan. ...	−18·4	−18·9	−22·4	−27·0	−31·0	−28·9	**−32·3**	−29·6	−22·5	−17·7	− 5·7	+ 7·4
Feb. ...	−23·1	−31·6	−34·4	−43·6	**−49·0**	−41·2	−29·5	−33·5	−22·9	−13·8	− 2·7	+ 7·7
Mar. ...	−15·9	−18·6	−20·7	**−22·4**	−22·2	−18·3	−15·8	− 9·1	− 9·7	− 7·1	− 6·1	+ 1·1
April ...	**−21·0**	−17·7	−16·6	−14·3	−18·7	−18·2	−18·6	−10·0	− 5·2	− 0·9	+ 5·3	+ 7·7
May ...	− 8·0	− 7·0	**−11·3**	− 9·7	− 8·2	− 9·4	− 9·3	− 5·9	− 2·0	− 2·0	+ 1·8	+ 3·4
June ...	− 6·4	− 5·7	− 7·6	− 9·5	− 7·9	**−11·4**	− 9·2	− 5·5	− 1·8	+ 0·3	+ 0·6	+ 2·6
July ...	− 7·6	− 7·6	− 7·6	−11·3	−13·7	**−13·9**	−12·3	− 8·3	− 1·5	0·0	+ 2·9	+ 4·2
Aug. ...	− 7·2	− 6·7	− 9·7	**−11·7**	−11·5	−10·6	− 8·7	− 7·2	− 2·2	− 1·0	+ 1·5	+ 6·2
Sept. ...	**−14·6**	−10·5	−10·3	−11·6	−11·2	−11·4	− 6·6	− 7·6	− 3·4	− 4·0	+ 1·4	+ 5·9
Oct. ...	−17·4	−19·3	−21·4	**−22·7**	−20·4	−20·7	−14·8	−10·6	− 6·8	− 2·7	+ 2·0	+11·3
Nov. ...	−16·2	−19·7	−17·9	−19·5	−22·7	−23·4	**−30·1**	−23·2	−12·6	−11·8	− 2·0	+10·0
Dec. ...	−16·8	−16·2	−20·6	−27·4	−31·9	**−32·2**	−27·0	−20·0	−17·7	−16·9	− 7·4	+ 5·2
Year ...	−14·4	−15·0	−16·7	−19·2	**−20·7**	−19·9	−17·9	−14·2	− 9·0	− 6·5	− 0·7	+ 6·1
Winter ...	− 7·3	− 6·8	− 9·1	−10·6	−10·3	**−11·3**	− 9·9	− 6·7	− 1·9	− 0·7	+ 1·7	+ 4·1
Equinox ...	−17·2	−16·5	−17·3	−17·8	**−18·1**	−17·2	−14·0	− 9·3	− 6·3	− 3·7	+ 0·7	+ 6·5
Summer ...	−18·6	−21·6	−23·8	−29·4	**−33·7**	−31·4	−29·7	−26·6	−18·9	−15·1	− 4·5	+ 7·6

12 Months, 3 Seasons and the Year from all Complete Days.

13 h.	14 h.	15 h.	16 h.	17 h.	18 h.	19 h.	20 h.	21 h.	22 h.	23 h.	24 h.	Range.	A.D.
γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
+18·5	+29·3	+43·6	**+49·0**	+48·5	+44·8	+35·7	+25·8	+15·3	+ 5·0	− 3·8	−10·3	85·7	26·71
+27·7	+48·3	+62·9	**+81·3**	+65·1	+50·1	+44·4	+37·1	+19·1	+ 6·1	− 7·1	−18·1	134·6	37·39
+20·2	+39·7	+44·5	+47·7	**+54·2**	+46·0	+35·3	+20·8	+ 6·3	− 6·9	−16·7	−22·1	91·7	27·14
+21·6	+35·4	+44·4	**+51·5**	+44·4	+43·0	+29·0	+17·6	+ 3·1	− 7·2	−20·6	−27·8	89·1	25·72
+15·3	+20·9	+27·2	+26·5	+27·3	**+28·1**	+20·5	+12·0	+ 6·6	− 3·5	−10·8	−16·8	50·2	16·04
+13·4	+17·3	+18·3	+24·8	**+28·4**	+22·6	+18·3	+12·4	+ 4·5	− 6·6	−13·9	**−16·1**	44·5	13·93
+12·7	+19·2	+24·1	+24·7	**+27·9**	+25·5	+19·7	+14·9	+ 4·1	− 2·5	− 9·4	−13·3	51·3	15·38
+12·8	+23·4	+27·0	**+32·1**	+29·2	+25·5	+19·3	+ 9·9	+ 2·2	− 5·3	−10·5	−13·9	54·6	15·72
+15·3	+26·7	+35·0	**+40·5**	+40·3	+30·5	+19·8	+11·5	+ 2·7	− 6·2	−12·7	−18·7	65·6	19·00
+22·7	+30·1	+37·9	+42·5	**+44·1**	+38·3	+28·6	+17·3	+ 5·7	−10·3	−10·7	−16·8	76·0	23·15
+16·9	+32·7	+48·8	**+58·4**	+53·6	+45·4	+34·8	+21·9	+11·1	− 4·1	− 9·4	−19·5	93·9	27·63
+18·8	+31·9	+48·0	+50·1	**+58·3**	+52·8	+40·9	+33·1	+20·4	+ 5·7	− 8·1	−17·2	105·8	30·85
+18·0	+29·6	+38·5	**+44·1**	+43·4	+37·7	+28·9	+19·5	+ 8·4	− 3·0	−11·1	−17·6	75·1	23·04
+13·5	+20·2	+24·2	+27·0	**+28·2**	+25·4	+19·5	+12·3	+ 4·4	− 4·5	−11·2	−15·0	48·9	15·24
+19·9	+33·0	+40·4	+45·6	**+45·8**	+39·5	+28·2	+16·8	+ 4·5	− 7·7	−15·2	−21·4	76·2	23·73
+20·5	+35·6	+50·8	**+59·7**	+56·4	+48·3	+39·0	+29·5	+16·5	+ 3·2	− 7·1	−16·3	101·4	30·57

12 Months, 3 Seasons and the Year from 10 Quieter Days a Month.

13 h.	14 h.	15 h.	16 h.	17 h.	18 h.	19 h.	20 h.	21 h.	22 h.	23 h.	24 h.	Range.	A.D.
γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
+14·6	+21·2	+33·6	+41·5	**+44·7**	+37·8	+28·6	+20·4	+ 8·6	+ 7·8	− 2·5	− 8·9	77·0	22·17
+23·8	+37·4	+47·6	**+63·8**	+47·7	+36·5	+36·8	+29·7	+11·5	+ 5·0	− 6·4	−15·6	112·8	28·95
+10·7	+18·7	+26·3	**+34·4**	+33·3	+24·7	+19·3	+16·6	+ 6·8	− 2·4	−10·9	−13·1	56·8	16·01
+12·7	+18·7	+22·7	+22·8	**+24·1**	+23·3	+17·3	+13·3	+ 3·7	− 6·3	−10·8	−13·3	45·1	14·30
+ 6·0	+ 8·6	+11·3	**+13·0**	+12·2	+10·1	+11·4	+ 4·9	+ 1·2	− 0·7	− 4·2	− 6·2	24·3	6·99
+ 5·9	+ 8·7	+ 9·5	+11·3	**+13·8**	+12·1	+10·4	+ 4·9	+ 0·4	− 3·7	− 4·6	− 7·2	25·2	6·71
+ 8·5	+11·7	+15·5	**+18·1**	+14·7	+13·2	+ 8·7	+ 4·7	− 1·2	− 3·5	− 6·9	− 6·8	32·0	8·52
+ 9·4	+10·8	+13·5	**+15·6**	+15·5	+11·3	+ 8·7	+ 3·0	0·0	− 4·4	− 6·0	− 8·6	27·3	7·96
+12·1	+17·1	+19·7	+20·5	**+21·9**	+15·4	+10·0	+ 2·6	− 3·8	− 8·1	− 9·8	−13·7	36·5	10·55
+21·5	+27·1	+28·7	**+29·8**	+29·1	+20·1	+13·8	+ 4·4	− 1·6	− 5·8	−10·0	−13·6	52·5	15·65
+16·4	+28·9	+34·7	**+37·9**	+37·3	+29·9	+22·9	+14·4	+ 0·8	− 7·8	−13·5	−12·8	68·0	19·43
+11·0	+21·0	+31·7	+34·3	**+42·5**	+38·1	+25·9	+23·2	+15·6	+ 6·2	− 5·3	−15·7	74·7	21·24
+12·7	+19·2	+24·6	**+28·6**	+28·1	+22·7	+17·8	+11·8	+ 3·5	− 2·0	− 7·6	−11·3	49·3	14·18
+ 7·5	+10·0	+12·4	**+14·5**	+14·1	+11·7	+ 9·8	+ 4·4	+ 0·1	− 3·1	− 5·4	− 7·2	25·8	7·53
+14·3	+20·4	+24·4	+26·9	**+27·1**	+20·9	+15·1	+ 9·2	+ 1·3	− 5·7	−10·3	−13·4	45·2	13·48
+16·5	+27·1	+36·9	**+44·4**	+43·0	+35·6	+28·6	+21·9	+ 9·1	+ 2·8	− 6·9	−13·3	78·1	22·79

Table XXXII.—Diurnal Inequality in Total Force for the

—	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	12 h.
	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
Jan. ...	+28·4	**+31·9**	+27·8	+21·0	+10·8	+ 3·3	− 3·6	− 7·8	+ 1·0	− 9·5	−24·4	−27·2
Feb. ...	+28·1	+28·9	+25·3	+21·7	+13·8	+ 4·0	− 2·7	− 6·1	−12·9	−17·8	−28·8	−36·3
Mar. ...	+18·6	+16·2	+12·5	+11·1	+ 3·9	− 3·7	− 8·2	− 9·5	− 7·6	− 9·5	−16·8	−24·2
April ...	+20·4	+14·7	+ 9·3	+ 2·9	− 1·2	− 3·5	− 7·3	−10·1	−13·5	−15·5	−19·6	**−22·6**
May ...	+10·9	+11·4	+ 9·2	+ 3·1	− 1·9	− 6·3	− 7·3	−10·5	−11·3	−11·8	−15·0	**−16·8**
June ...	+ 9·5	+ 9·3	+ 6·5	+ 2·1	− 2·3	− 5·6	− 8·6	−10·3	−12·4	−13·2	**−15·4**	−14·7
July ...	+10·9	+ 8·9	+ 7·7	+ 4·8	+ 0·3	− 4·5	− 8·8	−12·2	−12·1	**−14·5**	**−14·5**	−13·0
Aug. ...	+ 9·7	+ 9·6	+ 7·5	+ 5·7	+ 0·5	− 2·7	− 6·0	− 7·4	−10·1	−11·7	−12·5	**−14·0**
Sept. ...	+12·1	+11·1	+ 8·1	+ 4·2	+ 0·9	− 2·1	− 4·3	− 5·3	− 6·8	−10·8	−13·6	−14·9
Oct. ...	+17·2	**+19·1**	+15·2	+11·9	+ 5·0	− 0·2	− 0·7	− 2·9	− 6·5	−10·6	−14·9	−21·9
Nov. ...	+28·8	**+31·0**	+22·1	+12·9	+ 2·8	− 6·2	− 2·9	− 1·5	+ 0·1	− 9·9	−27·7	−27·0
Dec. ...	+32·9	+31·7	+28·1	+18·6	+17·9	+ 9·1	− 3·0	− 9·7	− 9·3	−17·7	−34·3	−43·1
Year ...	+19·0	+18·7	+14·9	+10·0	+ 4·2	− 1·5	− 5·3	− 7·8	− 8·5	−12·7	−19·8	−23·0
Winter ...	+10·3	+ 9·8	+ 7·7	+ 3·9	− 0·8	− 4·8	− 7·7	−10·1	−11·5	−12·8	−14·3	**−14·6**
Equinox ...	+17·1	+15·3	+11·3	+ 7·5	+ 2·2	− 2·4	− 5·1	− 6·9	− 8·6	−11·6	−16·2	−20·9
Summer ...	+29·5	**+30·9**	+25·8	+18·5	+11·3	+ 2·5	− 3·1	− 6·3	− 5·3	−13·7	−28·8	−33·4

Table XXXIII.—Diurnal Inequality in Total Force for the

—	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	12 h.
	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
Jan. ...	+22·1	**+24·2**	+24·1	+18·8	+14·4	+ 7·2	− 1·9	− 9·6	+ 0·5	−10·9	−16·1	−24·4
Feb. ...	+23·5	+23·5	+22·6	+22·2	+16·6	+ 7·7	− 1·6	− 6·5	−10·8	−14·0	−28·2	−31·0
Mar. ...	+ 9·7	+ 9·1	+ 6·8	+ 8·5	+ 4·4	− 0·5	− 4·4	+ 2·6	+ 4·1	+ 5·1	− 3·9	−14·2
April ...	+10·5	+ 7·4	+ 6·3	+ 4·5	+ 0·6	− 0·3	− 5·0	− 3·7	− 4·4	− 6·6	−13·4	**−17·4**
May ...	+ 5·0	+ 5·4	+ 5·7	+ 2·2	− 0·6	− 2·3	− 2·7	− 2·9	− 3·3	− 4·2	− 6·0	− 6·5
June ...	+ 5·5	+ 3·4	+ 3·0	+ 2·0	+ 0·2	− 1·7	− 4·7	− 4·9	− 7·2	− 7·0	**− 8·2**	− 7·2
July ...	+ 4·7	+ 4·5	+ 5·3	+ 2·9	+ 1·0	− 2·3	− 3·9	− 5·1	− 5·7	− 7·1	**− 7·5**	− 7·0
Aug. ...	+ 6·3	+ 6·7	+ 6·2	+ 4·7	+ 2·2	− 0·6	− 4·0	− 4·7	− 5·6	− 7·1	− 6·4	**− 8·6**
Sept. ...	+ 8·5	**+12·2**	+ 6·9	+ 3·5	+ 1·1	− 1·6	− 4·4	− 3·4	− 3·7	− 6·2	− 9·7	− 9·6
Oct. ...	+13·9	**+14·8**	+13·5	+ 9·7	+ 4·5	+ 0·3	− 1·9	− 1·9	− 7·6	− 6·8	−12·1	**−21·1**
Nov. ...	**+24·8**	+23·3	+15·4	+13·5	+ 8·7	+ 2·4	+ 0·8	− 4·4	− 6·5	−17·5	−25·8	−24·9
Dec. ...	+25·6	+25·8	+26·2	+18·9	+14·3	+ 5·5	+ 3·9	+ 3·3	+ 0·9	−23·6	−25·3	−28·5
Year ...	+13·3	+13·4	+11·8	+ 9·3	+ 5·6	+ 1·2	− 2·5	− 3·4	− 4·1	− 8·8	−13·6	−16·7
Winter ...	+ 5·4	+ 5·0	+ 5·0	+ 2·9	+ 0·7	− 1·7	− 3·8	− 4·4	− 5·5	− 6·4	− 7·0	**− 7·3**
Equinox ...	+10·6	+10·9	+ 8·4	+ 6·5	+ 2·6	− 0·5	− 3·9	− 1·6	− 2·9	− 3·6	− 9·8	−15·6
Summer ...	+24·0	+24·2	+22·1	+18·4	+13·5	+ 5·7	+ 0·3	− 4·3	− 4·0	−16·5	−23·8	**−27·2**

12 Months, 3 Seasons and the Year from all Complete Days.

13 h.	14 h.	15 h.	16 h.	17 h.	18 h.	19 h.	20 h.	21 h.	22 h.	23 h.	24 h.	Range.	A.D.
γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
−36·7	−30·6	−27·3	−19·5	−11·4	− 7·9	0·0	+ 5·2	+11·7	+16·7	+21·3	+26·7	68·6	17·15
−37·4	**−37·9**	−31·6	−22·6	− 9·9	− 3·0	+ 4·4	+11·9	+20·6	+27·8	**+31·1**	+29·4	69·0	20·58
−24·8	−21·6	−19·8	−14·9	− 3·4	+ 2·0	+ 7·7	+13·5	+15·8	+19·7	+21·5	**+21·6**	46·4	13·67
−21·9	−18·9	−13·9	− 7·6	− 0·1	+ 5·5	+ 9·8	+14·0	+19·0	+18·3	+19·6	**+21·2**	43·8	12·93
−15·3	−12·7	− 6·8	− 4·3	− 2·1	+ 7·7	+ 9·7	+ 9·9	+15·4	+14·9	+14·3	**+15·8**	32·6	10·18
−13·3	− 9·9	− 6·5	− 3·7	+ 3·0	+ 6·8	+ 9·3	+13·1	**+15·9**	+15·2	+11·8	+13·0	31·3	9·64
−11·6	−11·0	− 7·4	− 5·4	+ 0·2	+ 2·9	+ 5·6	+12·6	+15·1	**+18·2**	+13·9	+13·0	32·7	9·55
−13·6	−12·7	− 8·8	− 4·7	+ 2·2	+ 2·4	+ 5·9	+10·0	+11·7	**+13·3**	+12·8	+12·5	27·3	8·67
−16·8	−15·0	−14·3	− 7·4	− 3·8	+ 1·1	+ 6·5	+ 9·0	+12·1	+14·9	**+19·1**	+15·4	35·9	9·57
−23·7	−20·8	−18·4	−13·2	− 9·1	− 2·4	+ 2·9	+ 8·3	+13·1	+15·9	+18·7	+17·9	42·8	12·10
−26·6	**−30·5**	−25·7	−19·6	−11·9	− 4·2	+ 1·4	+ 8·7	+15·6	+19·8	+24·0	+26·9	61·5	16·16
−44·7	−43·8	−34·0	−22·1	−10·5	− 1·3	+ 5·9	+10·1	+21·1	+27·7	**+35·8**	+34·6	80·5	22·79
−23·9	−22·1	−17·9	−12·1	− 4·7	+ 0·8	+ 5·8	+10·5	+15·6	+18·5	+20·3	**+20·7**	44·6	13·26
−13·4	−11·6	− 7·4	− 4·5	+ 0·8	+ 5·0	+ 7·6	+11·4	+14·5	**+15·4**	+13·2	+13·6	30·0	9·45
−21·8	−19·1	−16·6	−10·8	− 4·1	+ 1·6	+ 6·7	+11·2	+15·0	+17·2	**+19·7**	+19·0	41·5	12·00
−36·4	−35·7	−29·6	−20·9	−10·9	− 4·1	+ 2·9	+ 9·0	+17·3	+23·0	+28·1	+29·4	67·3	19·02

12 Months, 3 Seasons and the Year from 10 Quieter Days a Month.

13 h.	14 h.	15 h.	16 h.	17 h.	18 h.	19 h.	20 h.	21 h.	22 h.	23 h.	24 h.	Range.	A.D.
γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
−31·1	−28·1	−29·0	−17·2	−10·0	**− 4·7**	+ 0·9	+ 8·5	+ 8·7	+12·7	+17·1	+22·8	55·3	15·21
−32·5	−30·4	−27·4	−19·5	−10·3	− 2·7	+ 4·3	+ 6·5	+15·3	+22·8	+24·1	**+25·7**	58·2	17·90
−16·5	**−18·6**	−18·3	−12·9	− 5·6	− 2·6	+ 0·8	+ 5·4	+ 9·0	**+11·8**	+ 9·1	+11·1	30·4	8·13
−16·0	−13·9	−10·9	− 7·6	− 2·6	+ 2·5	+ 4·7	+12·5	**+17·4**	+12·5	+12·2	+10·5	34·8	8·48
− 6·6	− 5·7	− 4·7	− 3·2	− 1·7	− 0·3	+ 4·8	+ 4·7	+ 4·8	+ 5·8	+ 5·5	**+ 6·8**	13·4	4·23
− 6·3	− 4·3	− 3·3	− 1·5	+ 0·8	+ 2·6	+ 6·2	+ 6·0	+ 5·7	**+ 7·4**	+ 6·9	+ 6·6	15·6	4·69
− 6·8	− 6·4	− 2·9	− 1·5	+ 0·3	+ 3·2	+ 4·3	+ 4·8	+ 5·5	+ 6·2	+ 6·2	**+ 7·1**	14·6	4·68
− 6·9	− 6·5	− 4·8	− 2·7	+ 0·6	+ 0·8	+ 1·9	+ 3·0	+ 5·1	+ 5·5	**+ 7·7**	+ 7·3	16·3	4·83
−12·8	−10·4	− 8·5	− 4·9	− 2·1	+ 2·5	+ 5·1	+ 4·8	+ 6·2	+ 6·7	+ 9·5	+10·5	25·0	6·45
−21·0	−15·0	−12·8	− 8·6	− 5·4	+ 0·6	+ 5·0	+ 7·4	+ 9·5	+11·1	+11·1	+12·9	35·9	9·52
−24·7	**−29·2**	−22·7	−15·8	− 8·2	− 0·4	+ 3·3	+ 9·4	+16·1	+18·5	+19·7	+24·4	54·0	15·02
−33·1	**−36·0**	−33·3	−23·5	−11·4	− 4·0	+ 3·3	+ 4·9	+13·1	+18·5	**+27·3**	+26·1	63·3	18·18
−17·9	−17·0	−14·9	− 9·9	− 4·6	− 0·2	+ 3·7	+ 6·5	+ 9·7	+11·6	+13·0	**+14·3**	32·2	9·46
− 6·7	− 5·7	− 3·9	− 2·2	0·0	+ 1·6	+ 4·3	+ 4·6	+ 5·3	+ 6·2	+ 6·6	**+ 7·0**	14·3	4·55
−16·6	−14·5	−12·6	− 8·5	− 3·9	+ 0·8	+ 3·9	+ 7·5	+10·5	+10·5	+10·5	**+11·3**	27·9	7·83
−30·3	**−30·9**	−28·1	−19·0	−10·0	− 2·9	+ 3·0	+ 7·3	+13·3	+18·1	+22·1	**+24·8**	55·7	16·41

TABLE XXXIV.—Diurnal Inequalities from

—		1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	12 h.
		γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
E	Year ...	−11·0	− 5·4	+ 3·4	+12·9	+16·4	+22·3	**+22·4**	+21·7	+18·1	+11·6	+ 7·1	+ 4·6
	Winter	− 3·0	− 0·8	+ 2·4	+ 7·5	+ 9·4	+13·3	**+13·9**	+13·8	+12·0	+ 7·7	+ 4·3	+ 1·7
	Equinox	−11·2	− 1·8	+ 4·2	+13·0	+17·9	+22·0	**+22·1**	+21·7	+18·4	+12·7	+ 9·5	+ 5·4
	Summer	−18·8	−13·5	+ 3·5	+18·3	+21·9	**+31·7**	+31·2	+29·7	+24·0	+14·5	+ 7·5	+ 6·7
S	Year ...	+17·8	+21·2	+23·5	**+24·4**	+20·6	+15·5	+ 7·0	+ 0·1	− 7·2	−11·4	−11·8	−13·1
	Winter	+ 8·8	+11·9	+12·2	**+13·7**	+11·3	+ 6·4	+ 2·1	− 3·0	− 7·4	− 8·1	− 8·5	**− 9·1**
	Equinox	+18·5	+19·4	**+22·4**	+22·2	+16·3	+11·3	+ 3·7	− 0·6	− 9·0	−14·3	**−15·4**	−14·2
	Summer	+26·1	+32·4	+35·9	**+37·3**	+34·3	+28·7	+15·3	+ 3·9	− 5·2	−11·7	−11·6	−16·0
V	Year ...	−18·2	**−18·7**	−16·2	−11·6	− 5·8	+ 0·3	+ 4·7	+ 7·2	+10·2	+11·6	+13·1	+12·9
	Winter	− 6·7	− 6·3	− 3·9	− 1·7	+ 0·3	+ 2·7	+ 4·9	+ 5·2	+ 6·2	+ 6·7	**+ 6·8**	+ 5·4
	Equinox	**−16·8**	−14·5	−13·2	−10·1	− 6·2	− 0·7	+ 3·0	+ 6·2	+ 8·8	+ 9·5	**+10·0**	+ 9·6
	Summer	−31·2	**−35·3**	−31·4	−22·9	−11·5	− 1·1	+ 6·2	+10·2	+15·6	+18·6	+22·6	+23·7

TABLE XXXV.—Diurnal Inequalities from Days of largest

—		1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	12 h.
		γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
E	Year ...	−34·7	−17·5	− 0·2	+23·3	+43·9	+55·6	**+72·3**	+67·3	+64·0	+55·6	+39·7	+28·4
	Winter	−31·2	−14·3	− 1·4	+24·1	+34·8	+45·8	**+54·0**	+53·2	+50·5	+39·3	+29·3	+18·0
	Equinox	−32·7	−14·4	+13·6	+32·5	+55·7	+66·5	**+83·0**	+80·4	+71·9	+66·5	+40·3	+24·8
	Summer	−40·1	−23·8	−12·9	+13·4	+41·1	+54·6	**+80·0**	+68·2	+69·7	+61·1	+49·5	+42·3
S	Year ...	+44·6	+61·1	**+73·6**	+69·9	+58·4	+48·0	+26·6	+ 9·4	−10·3	−30·6	−37·7	−45·6
	Winter	+38·0	+51·5	**+54·2**	+46·6	+44·5	+35·5	+13·7	− 1·5	−14·4	−26·7	−36·4	**−43·0**
	Equinox	+47·6	+69·1	**+76·6**	**+76·6**	+60·6	+50·3	+23·3	+ 3·7	−18·8	−44·2	−47·0	−49·1
	Summer	+48·3	+62·7	**+90·0**	+86·6	+70·2	+58·1	+42·9	+26·1	+ 2·2	−21·0	−29·6	−44·8
V	Year ...	**−34·0**	−32·8	−26·1	−20·4	−11·4	− 2·8	+ 5·8	+15·1	+25·3	+32·5	+37·4	**+38·4**
	Winter	−25·8	−24·5	−15·2	−13·6	− 1·7	+ 8·5	+ 9·2	+15·8	+24·8	+33·1	+28·6	**+33·3**
	Equinox	**−31·1**	−30·3	−28·9	−19·1	−12·6	− 4·3	+ 7·6	+20·9	+30·2	+33·0	**+43·5**	+36·8
	Summer	**−45·0**	−43·6	−34·1	−28·4	−20·0	−12·6	+ 0·7	+ 8·5	+21·0	+31·5	+40·0	**+45·2**

International Quiet Days, 5 a Month (using G.M.T.).

13 h.	14 h.	15 h.	16 h.	17 h.	18 h.	19 h.	20 h.	21 h.	22 h.	23 h.	24 h.	Range.	A.D.
γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
+ 0·3	− 1·4	− 4·0	− 4·0	− 6·1	− 7·1	−10·5	−14·0	−17·7	**−23·1**	−22·4	−14·3	45·5	11·74
− 1·5	− 0·7	− 2·4	− 4·1	− 5·7	− 7·5	− 8·7	−10·7	−10·1	−10·9	**−11·5**	− 8·4	25·4	7·17
+ 1·7	− 0·1	− 2·7	− 4·5	− 5·8	−10·7	−12·5	−16·0	−21·3	**−24·1**	−22·8	−15·1	46·2	12·38
+ 0·6	− 3·3	− 6·8	− 3·3	− 6·9	− 3·0	−10·2	−15·3	−21·6	**−34·4**	−33·0	−19·5	66·1	15·80
−13·5	−14·5	−14·6	**−15·1**	−14·7	−13·2	− 9·6	− 7·6	− 2·8	+ 0·6	+ 7·4	+10·9	39·5	12·42
− 7·7	− 7·0	− 6·7	− 7·2	− 6·9	− 7·3	− 3·8	− 2·0	+ 2·6	+ 3·1	+ 6·0	+ 6·6	22·8	7·06
−14·4	−14·4	−14·8	−13·8	−13·5	−10·2	− 6·5	− 2·2	+ 2·0	+ 5·5	+ 9·8	+12·2	37·8	11·94
−18·3	−22·2	−22·4	**−24·3**	−23·7	−22·1	−18·4	−18·6	−13·1	− 6·7	+ 6·4	+13·9	61·6	19·52
+13·9	+13·1	+11·9	+ 9·9	+ 7·4	+ 3·4	+ 0·9	− 1·1	− 4·1	−10·9	−15·5	−18·3	32·6	10·04
+ 4·8	+ 3·8	+ 3·6	+ 1·7	+ 0·4	− 1·5	− 3·1	− 3·9	− 4·9	− 5·6	**− 7·6**	− 7·3	14·4	4·38
+ 8·9	+ 8·9	+ 8·8	+ 7·8	+ 5·0	+ 3·4	+ 1·2	− 0·5	− 2·2	− 5·0	− 7·8	−14·1	26·8	7·59
+28·1	+26·7	+23·2	+20·1	+16·9	+ 8·2	+ 4·5	+ 1·1	− 5·3	−22·2	−31·2	−33·6	63·4	18·81

International "Character" Figure, 5 a Month (using G.M.T.).

13 h.	14 h.	15 h.	16 h.	17 h.	18 h.	19 h.	20 h.	21 h.	22 h.	23 h.	24 h.	Range.	A.D.
γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
+16·3	+ 6·7	− 6·3	−19·2	−32·6	−44·8	−42·1	−47·5	−60·1	−59·2	**−61·3**	−47·7	133·6	39·43
+13·5	+ 2·0	− 6·6	−10·6	−17·9	−28·0	−34·2	−38·2	−40·7	−46·9	**−51·0**	−43·5	105·0	30·38
+ 9·4	+ 2·0	−13·8	−23·8	−41·7	−58·0	−53·2	−60·4	**−74·9**	−62·1	−65·0	−46·6	157·9	45·55
+26·0	+16·1	+ 1·5	−23·1	−38·1	−48·5	−38·9	−44·0	−64·6	**−68·6**	−67·9	−53·0	148·6	43·63
−52·5	−53·2	**−54·7**	−51·5	−43·9	−36·1	−25·3	−15·3	− 4·8	+ 6·7	+25·0	+38·2	128·3	38·46
−36·4	−39·9	−42·9	−39·6	−32·2	−25·4	−16·2	− 6·9	+ 3·1	+11·2	+23·6	+39·6	97·2	30·12
−56·5	−51·7	−52·8	−53·0	−46·0	−33·3	−24·6	−13·0	+ 2·4	+12·6	+32·3	+34·9	133·1	40·83
−64·5	−68·1	**−68·3**	−61·9	−53·6	−49·5	−35·0	−26·0	−20·0	− 3·7	+19·2	+40·0	158·3	45·51
+32·0	+30·9	+22·3	+14·0	+ 5·3	− 0·4	− 8·4	−16·7	−21·3	−22·4	−28·7	−33·7	72·4	21·59
+21·9	+21·1	+16·0	+10·0	− 0·2	− 7·2	−14·0	−19·3	−22·5	−24·7	−26·6	**−27·0**	60·3	18·52
+32·1	+26·5	+14·7	+ 8·9	+ 1·0	− 3·6	− 6·3	−15·9	−20·8	−23·6	−28·1	−30·6	74·6	21·27
+42·1	**+45·2**	+36·1	+23·1	+15·0	+ 9·5	− 5·0	−14·9	−20·5	−18·9	−31·3	−43·6	90·2	26·49

TABLE XXXVI.—Ratio of disturbed day R or A.D. to quiet day R or A.D.

Element.	Year.		Winter.		Equinox.		Summer.	
	R.	A.D.	R.	A.D.	R.	A.D.	R.	A.D.
E	2·9	3·4	4·1	4·2	3·4	3·7	2·2	2·8
S...	3·2	3·1	4·3	4·3	3·5	3·4	2·6	2·3
V	2·2	2·2	4·2	4·2	2·8	2·8	1·4	1·4

TABLE XXXVII.—Diurnal Inequality Ranges, 1902–03 and 1911–12.

—	Year.		Winter.		Equinox.		Summer.	
	1902–03.	1911–12.	1902–03.	1911–12.	1902–03.	1911–12	1902–03.	1911–12.
	′	′	′	′	′	′	′	′
D All	45·5	59·2	26·8	42·3	44·6	64·2	64·1	72·4
„ Quieter	34·0	37·6	14·0	19·8	30·0	37·0	62·2	57·4
I All	—	3·84	—	2·46	—	3·89	—	5·22
„ Quieter	1·74	2·54	1·23	1·31	1·50	2·30	2·87	4·04
	γ	γ	γ	γ	γ	γ	γ	γ
H All	—	75·1	—	48·9	—	76·2	—	101·4
„ Quieter	34·5	49·3	25·2	25·8	28·6	45·2	57·3	78·1
V All	33·0	46·9	18·0	30·8	36·0	43·8	58·0	71·2
„ Quieter	—	33·8	—	15·0	—	29·6	—	58·4
E All	83·9	75·8	49·4	53·2	79·5	79·8	120·0	98·1
„ Quieter	—	48·6	—	24·4	—	46·5	—	77·7
S All	—	71·9	—	47·0	—	74·1	—	96·6
„ Quieter	38·6	45·8	30·3	23·9	41·8	44·7	43·5	72·8

CHAPTER V.

DIURNAL INEQUALITIES. FOURIER COEFFICIENTS.*

Section 26.—Calculations were made of the Fourier coefficients answering to the 24, 12, 8 and 6-hour terms. The analysis of the diurnal inequality may be presented in either of the equivalent series :—

$$\left.\begin{array}{l} a_1 \cos t + b_1 \sin t + a_2 \cos 2t + b_2 \sin 2t + \ldots \\ c_1 \sin (t + \alpha_1) + c_2 \sin (2t + \alpha_2) + \ldots \end{array}\right\} \qquad (15).$$

Here t represents the angular equivalent of the time elapsed since midnight, 15° being the equivalent of 1 hour. The constants with the suffixes 1, 2, 3, 4 refer respectively to the 24, 12, 8 and 6-hour terms. The a and b constants were calculated directly from the data in the inequality tables and so refer to the time of 180° E. The c and α (amplitude and phase angle) constants were in the first instance calculated from the corresponding a and b constants, through the formulæ

$$\alpha = \tan^{-1} (a/b),\ c = a/\sin \alpha = b/\cos \alpha \qquad (16).$$

The α constants thus deduced, if left uncorrected, would refer to the same time as the a and b constants. The c constants do not involve time. As it appeared desirable to give values of the phase angles relating to the true local time, the necessary corrections were applied, viz., $+ 13° 36'$ to α_1, $+ 27° 12'$ to α_2, $+ 40° 48'$ to α_3 and $+ 54° 24'$ to α_4.

The a and b constants for a season or the year may be derived either by taking the arithmetic mean of the corresponding constants for the included months, or by direct calculation from the seasonal or yearly inequality. They were in reality calculated in both these ways as a check on the calculations. The c and α constants for a particular season or the year are not arithmetic means of the corresponding constants for the included months, but have to be derived from the a and b constants.

Tables XXXVIII to XLIII, pp. 102 to 104, give the a and b coefficients for the E, S and V inequalities derived from all complete days and from 10 quieter days.

Tables XLIV to XLIX, pp. 105 to 107, give the c and α coefficients calculated from Tables XXXVIII to XLIII, the corrections specified above having been applied to reduce the α constants to local time. The angles were all calculated to the nearest minute, but α_3 and α_4 are given only to the nearest degree, and α_2 only to the nearest 0°·1. The minutes are retained in α_1, that being the usual practice, though they suggest a higher order of accuracy than is really reached.

* The ordinary formulæ for the calculation of Fourier Coefficients, which were employed for all the results given here, assume the hourly values to be derived from single ordinates answering exactly to the hour. When, as in the present case, the value ascribed to an hour represents the mean of 3 ordinates answering respectively to the exact hour and to 20 minutes before and after, the values of the a, b, c coefficients derived from the ordinary formulæ require small correction factors as follows : 24-hour wave, 1·002 ; 12-hour wave, 1·010 ; 8-hour wave, 1·023 ; 6-hour wave, 1·042. The α coefficients, or phase angles, are unaffected. The necessity for these corrections was not realised until all the tables had been printed. As the corrections are trifling, the expense of reprinting the tables did not seem justified. The same corrections are necessary to the a, b, c coefficients given in Chapter IV of the "National Antarctic Expedition, 1901—1904, Magnetic Observations."

The arithmetic means of the 12 monthly values of the c constants are included in the tables, because they are from some points of view a better measure than the corresponding values from the mean diurnal inequality for the year of the average amplitude of the forces to which the respective terms are due. The arithmetic mean necessarily exceeds the value from the corresponding mean diurnal inequality, unless the phase angle is invariable throughout the year, and the excess increases with the variability of the phase angle.

Tables LII and LIII, p. 109, refer to the inequalities found for the international quiet days and the five days a month of largest character figure. They are confined to the mean diurnal inequality for the year. The letters q and d attached to the force components indicate quiet and disturbed days respectively.

Table LIV, p. 110, compares the c and a constants obtained from the mean diurnal inequality for the year from all the different types of days.

Tables LV, LVI and LVII, pp. 110 and 111, give Fourier coefficients for the D and H diurnal inequalities. They are limited to the seasons and the year. These were not really calculated direct from the D and H inequalities but from the a and b Fourier coefficients already calculated for E and S.

The a and b coefficients are the fundamental ones from a computational point of view. Thus it appeared desirable to put them on record. But the physical aspects are most easily recognised through a study of the amplitude and phase angle.

Section 27.—Before proceeding to this study it is well to consider the degree of accuracy with which the diurnal inequalities are represented by the Fourier series, Unless the insertion of the calculated values of the constants in the series gives a close approach to the observed inequalities, the value of our analysis and of any conclusion based thereon is doubtful. By taking a very large number of Fourier terms we can in almost any case secure practical identity between observed and calculated inequalities, but if a very large number of terms are required to give a close approach to an observed inequality, it is at least open to doubt whether the proceeding is not rather a mathematical exercise than a step towards results of real physical significance. The comparison was confined to the mean all day inequality for the year in E and S. The algebraical excesses of the observed (O) over the calculated (C) values were as follows, the unit being 1γ :—

Hour.	1	2	3	4	5	6	7	8	9	10	11	12
E O–C ...	+0·1	0·0	0·0	+0·6	−0·5	−0·5	+0·3	+0·9	−0·2	−0·8	−0·4	+1·5
S ,, ...	+0·1	−0·7	+0·3	+0·2	0·0	−0·4	+0·2	+0·3	0·0	−0·9	−0·2	+0·3
Hour.	13	14	15	16	17	18	19	20	21	22	23	24
E O–C ...	−0·2	−0·8	−0·3	+0·6	+0·8	−1·2	+0·5	−0·2	−0·2	+0·8	−0·6	0·0
S ,, ...	−0·6	+0·2	−0·2	+0·4	0·0	+0·1	−0·8	+0·6	+0·6	−1·1	+0·2	+0·3

The standard deviations are $0 \cdot 46\gamma$ for E and $0 \cdot 63\gamma$ for S, representing respectively $0 \cdot 6$ and $0 \cdot 8$ per cent. of the range of the inequality. The natural inference is that the first four Fourier waves suffice to account pretty satisfactorily for the diurnal inequality. There are, as the graphical representation of the inequalities readily discloses to the eye, minor irregularities, and these we cannot expect to reproduce exactly with a Fourier series limited to the 24, 12, 8 and 6-hour waves.

While a small number of Fourier waves cannot be expected to reproduce accidental irregularities exactly, these accidental deviations inevitably influence the values calculated for the coefficients. This influence is especially likely to prejudice the higher terms, on account of the smallness of c_3 and c_4 as compared with c_1 and c_2. The phase angle not infrequently shows a large annual variation, even in cases where so many years' data have been combined that accidental features must be almost entirely absent, but in all such cases with which I am familiar the variation shows a regular progression. When we have only one or two years' data, and the variations in the phase angle from month to month are irregular, there is a strong presumption that accident is playing a considerable part, especially when the amplitude is small. Again, while there is no reason to expect identically the same form of annual variation in the coefficients derived from all and from quieter days, a conspicuous difference between the annual variation in all day and quieter day amplitudes or phase angles is a legitimate ground for suspicion.

Section 28.—The 24-hour term coefficients in Tables XLIV to XLIX show less trace of accidental features than the others. In all cases the amplitude is largest in summer and least in winter, and the values obtained for the equinoctial season do not differ much from those for the year. The largest value of c_1 is found in December for V, but in February for E and S, the latter phenomenon arising probably from the specially disturbed condition of February, 1911. The smallest value of c_1 appears more often in June than in any other month. Speaking roughly, the winter, equinoctial, and summer values of c_1 in E and S stand to one another in the ratio 2 : 3 : 4 on all days, but in the ratio 1 : 2 : 3 on quieter days. Thus, relatively considered, the difference between winter and summer values of c_1 is greater for the quieter days than for all days. The relation between the winter and equinoctial values of c_1 is much the same for V as for E and S, but the excess of the summer value is especially prominent in V.

The variation shown by the 12 monthly values of the phase angle is somewhat irregular, even in the case of a_1. We should infer that in the case of E and S the true annual variation of a_1 must be small. In the case of E, Tables XLIV and XLV agree in making the winter angle larger than the summer, and the equinoctial angle larger than the winter angle. The latter phenomenon is largely due to the October inequality, and may be accidental.

In the case of S the equinoctial value slightly exceeds the winter value, and both decidedly exceed the summer value.

The annual variation of a_1 is more decided in V than in the other two elements, there being a pretty regular fall in the monthly values as we pass from midwinter to midsummer. The difference between winter and summer represents some two hours of time.

When the annual variation in a phase angle is large, the contributions from different months tend considerably to neutralise one another, the natural consequence being that the value found for the amplitude from the mean diurnal inequality for the year is markedly less than the arithmetic mean of the amplitudes for the 12 months. It is seldom that the excess of the arithmetic mean value is as small as it is in the case of c_1 in Tables XLIV to XLVII.

The amplitude c_2 of the 12-hour term has an annual variation similar to that of c_1, but less regular and so presumably more affected by accidents. The largest value occurs in November, December, or January, except in Table XLIX, where it occurs in March.

The smallness of the winter value of c_2 in Tables XLV, XLVII, XLVIII and XLIX is remarkable. As each of the four winter months gives a very low value, the phenomenon can hardly be accidental.

In studying the variations of a_2 it should be remembered that angles differing by 360° are really the same angle. For instance, the change in Table XLVI from 21°·3 to 359°·2 really represents not a rise of 337°·9, but a fall of 22°·1 from 381°·3 to 359°·2 (or from + 21°·3 to − 0°·8). The irregularities, though considerable, are not so large as might be thought at first sight.

Tables XLIV and XLV agree in making a_2 decidedly less in winter than in the other seasons, but they differ rather conspicuously as between equinox and summer. Tables XLVI and XLVII agree in making a_2 least in equinox and greatest in summer. In their case the winter value comes nearest to that for the year. Tables XLVIII and XLIX agree in making a_2 least in equinox and greatest in winter, but the amplitude c_2 in winter is so small that no great accuracy can be expected in the phase angle.

In the case of the 8-hour wave the phenomena suggest that accident played a considerable part, especially in E. The great variability in phase in that element is responsible for the small size of the amplitude for the year as compared with the arithmetic mean of the monthly amplitudes. c_3 is largest in one or other of the summer months, but the phase angle varies so much in these months that the winter season shows the largest amplitude. The equinoctial value of c_3 suffers even more than the summer one through variability in the phase angle, and is in consequence exceedingly small. The phase angles in equinox and summer are almost opposite in phase in Tables XLIV and XLV and there is little if any parallelism between the values of c_3 in corresponding months.

More regularity is apparent in the data for the 8-hour wave in S. Tables XLVI and XLVII agree in making the amplitude largest in summer. The variations in the phase angles are much less than in the case of E, and the excess of the arithmetic mean value of c_3 over that for the year is much less striking.

V shows a still greater regularity of variation in the 8-hour term. Tables XLVIII and XLIX agree in making the amplitude greatest in summer and least in winter, as was the case with the 24 and 12-hour terms. They also show the same seasonal variation in the phase angle, the equinoctial value resembling that for the year and being intermediate between the winter and summer angles, the latter of which is the largest. July in Table XLVIII and June in Table XLIX are the only months in which the phase angles appear notably abnormal. The excess of the arithmetic mean value of c_3 over the value for the year is comparatively small.

The data for the 6-hour wave present considerable irregularities in all the elements. The amplitudes are so small that it would naturally require the combination of a large number of years to eliminate accidental features. The excess of the arithmetic mean value of c_4 over the value for the year is considerable in all cases, especially in Table XLVI. The all day and quiet day results do not in general point the same way. Table XLVI, for instance, makes c_4 greatest in winter and least in equinox, while Table XLVII makes it greatest in summer and least in winter.

Section 29.—The relative importance of the different Fourier waves is illustrated in Table L, p. 108, giving the ratios which the amplitudes of the 12, 8 and 6-hour waves bear to the amplitude of the 24-hour wave. The data are confined to the year and the three seasons. The mean of the E, S and V ratios is added and for comparison the corresponding means from the all ordinary day inequalities at Kew Observatory, as derived from the 11 years 1890 to 1900. This last line is intended to emphasise what is perhaps the most remarkable feature of the Antarctic diurnal variation, viz., the overwhelming importance of the 24-hour term. At Kew the relative importance of the 24-hour term rises markedly with increasing disturbance. The figures in Table L show no clear evidence of this phenomenon in the Antarctic. Again there is no very decided seasonal variation in the relative importance of the several terms in the Antarctic, while at Kew the 8 and 6-hour terms diminish markedly in relative importance in summer.

As between the different elements in the Antarctic, the relative importance of the 12-hour term seems greatest in E and least in V; but the 8 and 6-hour terms seem relatively more important in V than in either horizontal component.

The phase angle difference between the all and quieter day inequalities can be studied in Table LI, p. 108, which gives the excess of the quieter day angle for the year and three seasons. Data for individual months are too erratic to merit close examination. The angle equivalent to one hour it should be remembered is 15° for a_1, 30° for a_2, 45° for a_3 and 60° for a_4. In the case of a_1 the differences are all small, especially for S, where they practically vanish except at the equinoctial season. The differences for E, though small, indicate with considerable probability an increase of phase angle in the quieter days, *i.e.*, an acceleration of the hours of maximum and minimum. The reverse is true of V. In both these elements the difference of angle is distinctly less in summer than in the other seasons. This seems reasonable, because summer was the season when it was least possible to obtain days free from large disturbances.

In the case of a_2 the differences shown by Table LI vary somewhat erratically with the season; but as the signs are all plus we may infer with considerable assurance an increase of phase angle in all the elements as disturbance diminishes. The differences for a_3 and a_4 vary so much from season to season that little confidence can be felt in them.

In the case of the earlier Scott Expedition of 1902–03 the only element for which all and quieter day Fourier coefficients were calculated was D. The phenomena were similar to those now described in the case of E; the quieter day values of a_1 and still more those of a_2 exceeded the all day values, while the results for a_3 and a_4 were contradictory.

Section 30.—The inequalities for the five international quiet days and the five days of largest "character" figure were referred to G.M.T., so the corresponding Fourier coefficients are also referred to G.M.T. in Tables LII and LIII. These contain results only for the mean diurnal inequality of the year. The c and a constants are also given in L.M.T. in Table LIV, with, for comparison, the corresponding results from the 10 quieter days and all days. In the case of the 24-hour term, Table LIV shows in each case a rise in amplitude as we pass from the five quiet to the 10 quiet days, from the 10 quiet to the all days, and from the all days to the five disturbed days. The difference in this respect between the five quiet and 10 quiet days is small, but the difference between all days and five disturbed days is very large. The influence of disturbance is almost identical in the case of E and S, being decidedly less in the case of V. As regards the phase angle a_1 we have in the case of E a regular fall as disturbance increases. In S the apparent differences are very small, and the five quiet and five disturbed days differ in the same direction from the all days, which hardly seems a natural phenomenon. In V there seems little doubt that disturbance increases a_1. The five quiet day angle seems an exception to this rule, but its difference from the 10 quiet day angle is not large.

In the case of the 12-hour term the amplitude in Table LIV rises in all cases as we pass from the 10 quiet days to all days, and from all days to the five disturbed days. The rise is so considerable as to suggest a marked influence of disturbance in raising the amplitude. But curiously enough the amplitude from the five quiet days is in all cases decidedly larger than that from the 10 quiet days.

The 12-hour phase angle in Table LIV shows a distinct fall—most decided in the case of V—as we pass from the 10 quiet days to all days, and from all days to the five disturbed days. The five quiet days support this law in the case of V, but not in the case of E or S.

The results in Table LIV for the 8 and 6-hour terms are irregular. In the case of E and S the five disturbed day value of c_3 is decidedly the largest, and the five quiet day value is the least; but in the case of V the value from the five disturbed days is the least of all. The same phenomenon is exhibited in the case of c_4 in S, the value from the five disturbed days nearly vanishing. Indeed beyond the fact that c_3 and c_4 are very small in all cases, whether the day is quiet or disturbed, there seems nothing altogether certain.

D and H are the elements in the horizontal plane usually recorded, and harmonic data for them are much the most numerous. Thus D and H Fourier coefficients were calculated for the seasonal Antarctic inequalities. Tables LV and LVI gives the results obtained from all days and 10 quieter days for the year and the three seasons. In the case of c_1 and c_2 the annual variation is as clearly exhibited in Table LVI as it was in

E and S in Tables XLIV to XLVII, the summer value being always the greatest and the winter value the least. The all day value is also invariably in excess of the 10 quieter day value. In the case of c_3 and c_4 the phenomena, as with E and S, are somewhat irregular.

As regards the phase angles in Table LVI the summer value of a_1 is decidedly the smallest in the case of both D and H ; but the seasonal variation is not large. As with E, the winter value of a_2 in D is decidedly the smallest.

Section 31.—For comparison with the harmonic coefficients calculated from the 1902–03 data, it will suffice to consider the results for the year. These are given in Table LVII, results derived from all complete days and the 10 quieter days from 1911–12 being contrasted with the results from 1902–03. The quieter days, however, it should be remembered, in 1902–03 were more numerous in winter than the quieter days of 1911–12, while D trace was lost in an appreciable number of days in 1902–03 through the limits of registration being exceeded. Thus the 1902–03 all day results answer to conditions somewhat less disturbed than the 1911–12 all day results, while the 1902–03 quieter day results would naturally represent somewhat more of disturbance than the 1911–12 quieter day results. The H results for 1902–03 answered much more nearly to the quieter day than the all day results for 1911–12.

The uncertainties affecting the 8 and 6-hour terms render it difficult to say what weight attaches to apparent agreements or differences between the two epochs. The resemblance is on the whole closer than might have been anticipated.

In the case of the 24-hour term the excess in amplitude in 1911–12 shown in Table LVII is considerable. It is, however, no greater, rather less in fact, in D than it is in H and V, a phenomenon difficult to explain if we suppose the amplitude in 1902–03 to have been reduced by local disturbance.

The 12-hour term in Table LVII has also on the whole a larger amplitude in 1911–12 than in 1902–03, but the quieter day values for D from the two epochs are practically equal, while the 1902–03 value is the larger for V.

In the case of D and H, especially D, the values of a_1 and a_2 for the two epochs differ rather markedly, the values for the earlier epoch being the larger. In the case of D the difference in a_1 represents about two hours of time and is mainly responsible for the difference between the diurnal inequalities for the two epochs which has been already commented on.

TABLE XXXVIII.—E. Fourier Coefficients, all Complete Days (Time of 180° E. Long.)

—	a_1	b_1	a_2	b_2	a_3	b_3	a_4	b_4
	γ	γ	γ	γ	γ	γ	γ	γ
January	+27·33	−27·00	−13·82	−0·58	+8·15	−0·14	+0·90	+3·03
February ...	+34·94	−41·84	− 8·17	−0·52	−0·38	−0·66	−1·48	−1·13
March	+27·30	−34·06	− 8·71	−0·82	+0·97	−0·14	−0·79	+0·66
April	+22·57	−29·56	− 7·61	−0·63	−0·46	+0·11	−0·64	−0·10
May	+15·53	−19·85	− 5·57	−1·25	−0·31	+1·68	−0·03	+0·57
June	+12·37	−16·46	− 5·50	−1·87	−1·49	+1·00	−0·11	+0·42
July	+14·53	−16·79	− 4·72	−2·69	−0·95	+1·13	−1·59	+0·28
August	+15·43	−21·05	− 6·52	−1·04	+0·47	+1·02	−1·38	+0·35
September ...	+17·41	−25·84	− 7·33	+0·47	−0·39	+0·35	−0·77	−0·97
October	+19·80	−32·74	− 8·80	+1·23	+0·55	+1·03	−0·53	+0·26
November ...	+27·20	−35·72	−11·01	+1·22	−2·49	+0·03	+1·33	−3·00
December ...	+29·98	−29·42	− 7·20	−4·41	−2·54	+3·34	−1·71	−2·21
Year	+22·03	−27·53	− 7·92	−0·91	+0·10	+0·73	−0·57	−0·15
Winter	+14·46	−18·54	− 5·58	−1·71	−0·57	+1·21	−0·78	+0·41
Equinox ...	+21·77	−30·55	− 8·11	+0·06	+0·17	+0·34	−0·68	−0·04
Summer	+29·86	−33·50	−10·05	−1·07	+0·69	+0·64	−0·24	−0·83

TABLE XXXIX.—E. Fourier Coefficients, 10 Quieter Days (Time of 180° E. Long.).

—	a_1	b_1	a_2	b_2	a_3	b_3	a_4	b_4
	γ	γ	γ	γ	γ	γ	γ	γ
January	+24·42	−21·97	− 7·29	+3·99	+2·17	+0·68	+0·18	+0·22
February ...	+27·63	−31·80	− 5·00	−1·32	−1·23	−1·82	−1·74	+0·87
March	+17·77	−17·33	− 4·70	−0·67	−0·36	−0·79	−0·73	+2·05
April	+10·91	−17·14	− 2·91	−1·50	−2·52	+0·06	−0·02	+0·35
May	+ 7·05	− 8·19	− 2·09	−0·17	−0·65	+0·73	−0·19	−0·14
June	+ 6·22	− 8·98	− 1·43	−1·04	−1·29	+0·15	+0·04	−0·16
July	+ 5·67	− 8·15	− 1·19	−0·65	−1·74	+0·97	−0·55	−0·21
August	+ 6·38	−10·08	− 2·20	+0·12	−0·29	+0·41	−0·20	+0·11
September ...	+ 7·23	−14·49	− 5·75	+1·46	+0·57	+0·55	+0·05	−0·04
October	+ 7·26	−20·55	− 5·99	+3·92	+1·87	−0·72	+0·05	+0·58
November ...	+16·73	−27·83	− 8·75	+5·92	−3·50	−0·50	+1·24	−0·85
December ...	+20·94	−20·26	−10·36	+2·85	+0·74	−1·70	−1·42	+2·01
Year	+13·18	−17·23	− 4·80	+1·08	−0·52	−0·16	−0·27	+0·40
Winter	+ 6·33	− 8·85	− 1·73	−0·44	−0·99	+0·57	−0·22	−0·10
Equinox ...	+10·79	−17·38	− 4·84	+0·80	−0·11	−0·23	−0·16	+0·74
Summer	+22·43	−25·47	− 7·85	+2·86	−0·45	−0·83	−0·43	+0·56

TABLE XL.—S. Fourier Coefficients, all Complete Days (Time of 180° E. Long.).

—	a_1	b_1	a_2	b_2	a_3	b_3	a_4	b_4
	γ	γ	γ	γ	γ	γ	γ	γ
January	−25·37	−30·92	−1·00	+4·05	−0·04	−3·43	+0·88	−0·30
February ...	−36·39	−42·26	−0·86	+8·35	+4·21	−1·78	−2·00	−1·64
March	−33·56	−25·88	−3·22	+6·06	+1·35	+1·61	+0·61	+0·19
April	−33·64	−23·57	−3·84	+6·07	+0·53	+0·99	−0·93	−1·27
May	−20·09	−14·94	−1·09	+2·95	+0·26	+0·23	−0·72	+0·57
June	−17·24	−12·37	−2·52	+3·83	−0·42	+1·22	−0·15	+0·43
July	−18·92	−15·87	−0·25	+2·77	+0·63	+1·40	+0·48	+0·62
August	−19·81	−14·22	−0·07	+4·82	+1·85	+1·12	−0·04	+0·70
September ...	−22·98	−16·93	−1·73	+6·79	+2·41	+1·08	−0·56	−0·14
October	−27·02	−20·06	−0·93	+4·52	+1·74	+0·58	+1·42	+0·85
November ...	−28·81	−27·43	−2·73	+7·99	+3·28	−0·32	−0·65	−0·70
December ...	−28·05	−37·54	−1·52	+6·17	+2·74	+0·42	−0·13	+2·19
Year	−25·99	−23·50	−1·65	+5·36	+1·55	+0·26	−0·15	+0·13
Winter	−19·01	−14·35	−0·98	+3·59	+0·58	+0·99	−0·10	+0·58
Equinox ...	−29·30	−21·61	−2·43	+5·86	+1·51	+1·06	+0·13	−0·09
Summer	−29·65	−34·54	−1·53	+6·64	+2·55	−1·28	−0·47	−0·11

TABLE XLI.—S. Fourier Coefficients, 10 Quieter Days (Time of 180° E. Long.).

—	a_1	b_1	a_2	b_2	a_3	b_3	a_4	b_4
	γ	γ	γ	γ	γ	γ	γ	γ
January	−19·80	−26·86	+0·19	+4·36	−0·09	+0·65	+0·91	−2·15
February ...	−29·64	−32·84	+0·03	+6·03	+4·31	+0·17	−1·25	+0·32
March	−19·04	−17·01	−3·74	+3·10	+2·99	+0·82	−1·22	−0·22
April	−17·66	−12·50	−1·85	+2·68	−0·28	+1·79	−1·17	−0·70
May	− 8·95	− 6·91	−0·32	+0·97	+0·49	+0·35	−0·01	−0·05
June	− 8·36	− 5·94	−0·78	+1·88	+0·63	+2·09	−0·32	+0·31
July	−10·22	− 8·83	+0·26	+3·15	+1·62	+1·87	−0·95	−0·10
August	−10·55	− 6·76	+0·23	+2·38	+0·80	+1·20	−0·05	+0·27
September ...	−14·50	− 6·77	−0·78	+4·06	+0·52	+0·35	−0·35	+0·27
October	−19·37	−12·62	+1·70	+2·96	+1·26	−0·14	−0·01	+0·14
November ...	−21·11	−16·65	+0·51	+6·05	+1·52	+1·93	−1·00	+0·09
December ...	−17·83	−25·67	+0·43	+2·26	+0·37	+2·50	−1·18	−0·39
Year	−16·42	−14·95	−0·34	+3·32	+1·18	+1·13	−0·55	−0·18
Winter	− 9·52	− 7·11	−0·15	+2·10	+0·89	+1·38	−0·33	+0·11
Equinox ...	−17·64	−12·23	−1·17	+3·20	+1·12	+0·70	−0·69	−0·13
Summer	−22·10	−25·50	+0·29	+4·67	+1·53	+1·31	−0·63	−0·53

TABLE XLII.—V. Fourier Coefficients, all Complete Days (Time of 180° E. Long.).

—	a_1	b_1	a_2	b_2	a_3	b_3	a_4	b_4
	γ	γ	γ	γ	γ	γ	γ	γ
January	+27·23	+11·47	+0·65	−1·45	+0·95	+5·00	−2·56	−1·36
February ...	+33·49	+ 9·78	−1·45	−3·85	+0·28	+2·07	−0·80	−1·75
March	+22·25	+ 2·44	+0·41	−3·71	−0·20	+2·44	−0·71	−1·46
April	+21·44	− 1·55	−0·08	−2·53	+1·34	+1·39	+0·12	+0·35
May	+15·62	− 2·87	−0·09	−1·06	+0·15	+1·06	−0·74	−0·12
June	+14·34	− 4·39	−0·59	−0·98	−0·29	+0·37	−0·67	+0·09
July	+15·00	− 2·83	+0·44	−0·66	−1·12	−0·79	−0·61	−0·66
August	+13·88	− 1·14	−0·58	−1·00	−0·20	+0·48	−0·28	−0·78
September ...	+15·92	+ 0·85	+0·50	−3·08	+0·53	+0·58	+0·06	−0·41
October	+20·14	+ 5·60	+0·10	−2·79	+0·40	+1·52	−1·40	−0·37
November ...	+26·59	+ 8·15	+2·37	−3·86	+2·30	+4·37	−2·84	+1·41
December ...	+36·74	+10·19	−2·51	−3·95	+2·42	+2·71	−0·27	−2·66
Year	+21·89	+ 2·97	−0·07	−2·41	+0·55	+1·77	−0·89	−0·64
Winter	+14·71	− 2·81	−0·20	−0·92	−0·37	+0·28	−0·57	−0·37
Equinox ...	+19·94	+ 1·83	+0·23	−3·03	+0·52	+1·48	−0·48	−0·47
Summer	+31·01	+ 9·90	−0·23	−3·28	+1·49	+3·54	−1·62	−1·09

TABLE XLIII.—V. Fourier Coefficients, 10 Quieter Days (Time of 180° E. Long.).

—	a_1	b_1	a_2	b_2	a_3	b_3	a_4	b_4
	γ	γ	γ	γ	γ	γ	γ	γ
January	+23·32	+10·44	−1·08	−1·93	−0·75	+3·92	−0·47	−1·62
February ...	+28·46	+ 9·58	−2·36	−2·09	−0·05	+1·02	−0·24	−1·99
March	+11·47	+ 5·70	+0·72	−5·43	−0·43	+3·23	−1·29	−2·09
April	+13·89	− 0·05	−1·16	−3·59	+0·06	+0·47	−1·62	−0·21
May	+ 6·62	− 0·05	+0·20	−0·66	−0·21	+0·73	−0·57	+0·32
June	+ 7·18	− 1·97	−0·45	−0·11	−0·20	−0·23	+0·15	+0·01
July	+ 7·31	− 1·05	−0·60	+0·12	−0·25	+0·26	−0·03	−0·30
August	+ 7·89	+ 0·19	−0·15	+0·52	−0·08	+0·31	−0·05	−0·64
September ...	+10·58	+ 0·72	0·00	−0·96	+0·41	+1·94	−0·20	+0·11
October	+15·93	+ 3·43	−1·53	−1·44	+0·30	+2·10	−1·51	−0·20
November ...	+24·73	+ 5·89	−1·10	−2·84	+1·45	+1·35	+0·01	+0·76
December ...	+28·12	+11·64	−1·96	−3·85	+1·71	+2·40	+0·15	+0·16
Year	+15·46	+ 3·71	−0·79	−1·85	+0·16	+1·46	−0·47	−0·47
Winter	+ 7·25	− 0·72	−0·25	−0·03	−0·19	+0·27	−0·12	−0·15
Equinox ...	+12·97	+ 2·45	−0·49	−2·86	+0·08	+1·94	−1·16	−0·60
Summer	+26·16	+ 9·39	−1·63	−2·68	+0·59	+2·17	−0·14	−0·67

TABLE XLIV.—E. Fourier Coefficients, all Complete Days (L.M.T.).

—	c_1	α_1	c_2	α_2	c_3	α_3	c_4	α_4
	γ	° ′	γ	°	γ	°	γ	°
January	38·42	148 15	13·84	294·8	8·16	132	3·16	71
February	54·50	153 44	8·18	293·5	0·76	251	1·86	287
March	43·65	154 53	8·75	291·8	0·98	139	1·03	5
April	37·19	156 14	7·63	292·5	0·47	325	0·65	316
May	25·20	155 34	5·71	284·6	1·71	30	0·57	52
June	20·59	156 40	5·81	278·5	1·79	345	0·43	40
July	22·21	152 44	5·43	267·6	1·48	1	1·61	335
August	26·10	157 21	6·60	288·1	1·12	66	1·42	339
September	31·15	159 37	7·35	300·9	0·52	353	1·24	273
October	38·26	162 26	8·89	305·1	1·17	69	0·59	351
November	44·89	156 18	11·08	303·5	2·49	312	3·28	211
December	42·00	158 3	8·44	265·7	4·19	4	2·79	272
Arithmetic mean ...	35·35	—	8·14	—	2·07	—	1·55	—
Year	35·26	154 56	7·97	290·6	0·73	48	0·59	309
Winter	23·51	155 38	5·84	280·2	1·33	16	0·88	352
Equinox	37·51	158 7	8·11	297·6	0·38	68	0·68	321
Summer	44·88	151 53	10·11	291·1	0·94	88	0·86	251

TABLE XLV.—E. Fourier Coefficients, 10 Quieter Days (L.M.T.).

—	c_1	α_1	c_2	α_2	c_3	α_3	c_4	α_4
	γ	° ′	γ	°	γ	°	γ	°
January	32·85	145 35	8·32	325·9	2·28	114	0·28	95
February	42·13	152 37	5·17	282·4	2·20	255	1·95	351
March	24·82	147 53	4·75	289·0	0·87	245	2·18	35
April	20·32	161 8	3·27	269·9	2·52	312	0·35	51
May	10·80	152 54	2·10	292·4	0·98	359	0·23	288
June	10·92	158 53	1·77	261·2	1·30	318	0·16	220
July	9·93	158 48	1·35	268·4	1·99	340	0·58	304
August	11·94	161 16	2·21	300·3	0·50	6	0·22	353
September	16·20	167 4	5·93	311·5	0·79	87	0·06	178
October	21·79	174 9	7·15	330·4	2·00	290	0·59	59
November	32·48	162 35	10·57	331·3	3·54	303	1·51	179
December	29·13	147 39	10·74	312·6	1·85	17	2·46	19
Arithmetic mean ...	21·94	—	5·28	—	1·73	—	0·88	—
Year	21·70	156 11	4·92	309·8	0·54	293	0·48	20
Winter	10·88	158 2	1·78	283·0	1·14	341	0·24	301
Equinox	20·46	161 46	4·90	306·6	0·25	247	0·76	42
Summer	33·94	152 14	8·35	317·2	0·95	249	0·71	17

Table XLVI.—S. Fourier Coefficients, all Complete Days (L.M.T.).

—	c_1	a_1		c_2	a_2	c_3	a_3	c_4	a_4
	γ	°	′	γ	°	γ	°	γ	°
January	39·99	232	58	4·18	13·4	3·43	222	0·93	163
February	55·77	234	20	8·40	21·3	4·57	154	2·58	285
March	42·38	245	58	6·86	359·2	2·10	81	0·64	127
April	41·08	248	35	7·18	354·9	1·12	69	1·58	271
May	25·03	246	58	3·14	6·9	0·35	90	0·92	3
June	21·22	247	57	4·58	353·8	1·29	22	0·45	36
July	24·63	243	37	2·78	22·1	1·53	65	0·79	92
August	24·39	247	56	4·82	26·4	2·16	100	0·70	51
September	28·54	247	13	7·01	12·9	2·64	107	0·58	311
October	33·65	247	1	4·61	15·6	1·83	113	1·65	114
November	39·79	240	0	8·44	8·3	3·30	137	0·95	277
December	46·86	230	22	6·36	13·3	2·77	122	2·20	51
Arithmetic mean ...	35·28	—		5·70	—	2·26	—	1·16	—
Year	35·04	241	29	5·61	10·1	1·57	121	0·19	5
Winter	23·82	246	34	3·72	11·9	1·15	71	0·59	44
Equinox	36·40	247	12	6·35	4·7	1·84	96	0·16	179
Summer	45·52	234	15	6·82	14·2	2·85	158	0·48	311

Table XLVII.—S. Fourier Coefficients, 10 Quieter Days (L.M.T.).

—	c_1	a_1		c_2	a_2	c_3	a_3	c_4	a_4
	γ	°	′	γ	°	γ	°	γ	°
January	33·37	230	0	4·36	29·6	0·65	33	2·34	212
February	44·24	235	40	6·03	27·5	4·31	129	1·30	339
March	25·53	241	50	4·86	336·9	3·10	116	1·24	314
April	21·64	248	19	3·26	352·7	1·81	32	1·36	294
May	11·31	245	56	1·02	9·2	0·60	96	0·05	249
June	10·26	248	13	2·03	4·8	2·19	58	0·45	9
July	13·51	242	47	3·16	32·0	2·47	82	0·96	318
August	12·53	250	57	2·39	32·6	1·44	75	0·27	45
September	16·00	258	35	4·13	16·3	0·63	97	0·44	3
October	23·12	250	30	3·41	57·1	1·27	137	0·14	51
November	26·88	245	20	6·07	32·0	2·46	79	1·00	330
December	31·25	228	24	2·30	37·9	2·53	49	1·24	306
Arithmetic mean ...	22·47	—		3·58	—	1·96	—	0·90	—
Year	22·21	241	17	3·34	21·3	1·63	87	0·58	306
Winter	11·88	246	51	2·10	23·1	1·64	74	0·35	342
Equinox	21·47	248	53	3·41	7·2	1·32	99	0·70	314
Summer	33·75	234	30	4·68	30·7	2·01	90	0·82	284

TABLE XLVIII.—V. Fourier Coefficients, all Complete Days (L.M.T.).

—	c_1	α_1	c_2	α_2	c_3	α_3	c_4	α_4
	γ	° ′	γ	°	γ	°	γ	°
January	29·55	80 45	1·59	183·1	5·09	52	2·90	297
February	34·89	87 19	4·12	227·8	2·09	49	1·93	259
March	22·38	97 21	3·73	200·9	2·45	36	1·62	260
April	21·50	107 44	2·53	208·9	1·93	85	0·37	73
May	15·88	114 0	1·06	212·0	1·07	49	0·75	315
June	15·00	120 36	1·14	238·2	0·47	3	0·68	332
July	15·27	114 18	0·80	173·3	1·37	276	0·90	278
August	13·92	108 17	1·16	237·4	0·52	18	0·83	254
September	15·94	100 33	3·12	197·9	0·79	83	0·42	226
October	20·91	88 3	2·80	205·1	1·57	56	1·45	310
November	27·81	86 34	4·53	175·6	4·94	69	3·17	351
December	38·13	88 6	4·68	239·6	3·63	83	2·67	240
Arithmetic mean ...	22·60	—	2·60	—	2·16	—	1·47	—
Year	22·09	95 52	2·41	208·8	1·85	58	1·10	289
Winter	14·98	114 24	0·95	219·6	0·46	348	0·68	292
Equinox	20·02	98 20	3·04	202·8	1·57	60	0·67	280
Summer	32·55	85 54	3·29	211·3	3·84	64	1·95	291

TABLE XLIX.—V. Fourier Coefficients, 10 Quieter Days (L.M.T.).

—	c_1	α_1	c_2	α_2	c_3	α_3	c_4	α_4
	γ	° ′	γ	°	γ	°	γ	°
January	25·55	79 29	2·21	236·4	3·99	30	1·68	251
February	30·03	85 0	3·15	255·8	1·02	38	2·00	241
March	12·81	77 12	5·47	199·6	3·25	33	2·45	266
April	13·89	103 48	3·77	225·0	0·48	48	1·63	317
May	6·62	104 2	0·69	190·6	0·76	25	0·65	354
June	7·44	118 55	0·46	283·6	0·31	262	0·15	142
July	7·38	111 46	0·61	308·6	0·36	358	0·30	240
August	7·89	102 13	0·54	11·5	0·32	26	0·64	239
September	10·61	99 42	0·96	207·4	1·99	53	0·23	352
October	16·29	91 27	2·10	253·8	2·12	49	1·52	317
November	25·42	90 12	3·04	228·4	1·97	88	0·77	55
December	30·43	81 7	4·32	234·2	2·94	76	0·22	98
Arithmetic mean ...	16·20	—	2·28	—	1·63	—	1·02	—
Year	15·90	90 7	2·01	230·2	1·47	47	0·67	279
Winter	7·29	109 16	0·25	290·1	0·33	6	0·20	273
Equinox	13·20	92 54	2·90	217·0	1·94	43	1·30	297
Summer	27·79	83 52	3·13	238·5	2·25	56	0·68	246

TABLE L.—Ratios of Amplitudes of Fourier Waves.

Element	c_2/c_1				c_3/c_1				c_4/c_1			
	Year.	Winter.	Equinox.	Summer.	Year.	Winter.	Equinox.	Summer.	Year.	Winter.	Equinox.	Summer.
E All days ...	·226	·249	·216	·225	·021	·057	·010	·021	·017	·037	·018	·019
E Quieter days	·227	·164	·239	·246	·025	·105	·012	·028	·022	·022	·037	·021
S All days ...	·160	·156	·174	·150	·045	·048	·051	·063	·005	·025	·004	·011
S Quieter days	·150	·177	·159	·139	·073	·138	·061	·060	·026	·030	·033	·024
V All days ...	·109	·063	·152	·101	·084	·031	·078	·118	·050	·045	·033	·060
V Quieter days	·126	·034	·220	·113	·092	·045	·147	·081	·042	·027	·098	·024
Mean—												
All days ...	·165	·156	·181	·159	·050	·045	·046	·067	·024	·036	·018	·030
Quieter days	·168	·125	·206	·166	·063	·096	·073	·056	·030	·026	·056	·023
Mean—Kew ...	·607	·540	·640	·587	·247	·277	·320	·170	·093	·133	·130	·040

TABLE LI.—Phase Angle Differences. 10 Quieter Days—All Days.

Element.	a_1				a_2				a_3				a_4			
	Year.	Winter.	Equinox.	Summer.	Year.	Winter.	Equinox.	Summer.	Year.	Winter.	Equinox.	Summer.	Year.	Winter.	Equinox.	Summer.
	° ′	° ′	° ′	° ′	°	°	°	°	°	°	°	°	°	°	°	°
E	+1 15	+2 24	+3 39	+0 21	+19·2	+ 2·8	+ 9·0	+26·1	−115	−35	−181	−199	+71	−51	+ 81	+126
S	−0 12	+0 17	+1 41	+0 15	+11·2	+11·2	+ 2·5	+16·5	− 34	+ 3	+ 3	− 68	−59	−62	+135	− 27
V	−5 45	−5 8	−5 26	−2 2	+21·4	+70·5	+14·2	+27·2	− 11	+18	− 17	− 8	−10	−19	+ 17	− 45

TABLE LII.—Fourier Coefficients for Five Quiet (q) and Five Disturbed (d) Days (G.M.T.).

—	a_1	b_1	a_2	b_2	a_3	b_3	a_4	b_4
	γ	γ	γ	γ	γ	γ	γ	γ
E (q)	−10·33	+14·92	−7·01	−0·47	−0·13	+0·46	+0·39	+0·70
E (d)	−39·39	+47·61	−9·99	−3·17	−0·09	−1·45	−0·82	+2·21
S (q)	+13·74	+13·21	−0·87	+4·77	−1·28	−0·78	+0·33	+0·07
S (d)	+43·79	+41·15	−5·42	+7·63	−2·51	−0·42	0·00	−0·06
V (q)	−15·51	− 3·24	−2·15	−2·13	−0·19	−0·98	−0·25	+0·26
V (d)	−34·22	− 1·06	+2·44	−2·45	−0·86	−0·49	+0·02	−1·04

TABLE LIII.—Fourier Coefficients for Five Quiet (q) and Five Disturbed (d) Days (G.M.T.).

—	c_1	α_1	c_2	α_2	c_3	α_3	c_4	α_4
	γ	° ′	γ	°	γ	°	γ	°
E (q)	18·15	325 18	7·03	266·2	0·48	344	0·80	29
E (d)	61·80	320 24	10·48	252·4	1·45	184	2·36	340
S (q)	19·05	46 8	4·85	349·7	1·50	239	0·34	79
S (d)	60·09	46 47	9·36	324·6	2·54	261	0·07	180
V (q)	15·84	258 12	3·03	225·3	1·00	191	0·36	316
V (d)	34·24	268 14	3·46	135·1	0·99	240	1·06	169

Table LIV.—Fourier Coefficients for Different Types of Days (L.M.T.).

—		c_1	α_1	c_2	α_2	c_3	α_3	c_4	α_4
		γ	° ′	γ	°	γ	°	γ	°
E	5 quiet	18·15	158 54	7·03	293·4	0·48	205	0·80	84
	10 quiet	21·70	156 11	4·92	309·8	0·54	293	0·48	20
	All	35·26	154 56	7·97	290·6	0·73	48	0·59	309
	5 disturbed... ...	61·80	154 0	10·48	279·6	1·45	44	2·36	34
S	5 quiet	19·05	239 44	4·85	16·9	1·50	99	0·34	133
	10 quiet	22·21	241 17	3·34	21·3	1·63	87	0·58	306
	All	35·04	241 29	5·61	10·1	1·57	121	0·19	5
	5 disturbed... ...	60·09	240 23	9·36	351·8	2·54	121	0·07	234
V	5 quiet	15·84	91 48	3·03	252·5	1·00	52	0·36	11
	10 quiet	15·90	90 7	2·01	230·2	1·47	47	0·67	279
	All	22·09	95 52	2·41	208·8	1·85	58	1·10	289
	5 disturbed... ...	34·24	101 50	3·46	162·3	0·99	101	1·06	224

Table LV.—D and H. Fourier Coefficients (Time of 180° E. Long.).

—		a_1	b_1	a_2	b_2	a_3	b_3	a_4	b_4
		′	′	′	′	′	′	′	′
Declination. All complete days.	Year ...	−25·03	+11·96	+5·20	+2·51	+0·46	−0·44	+0·36	+0·16
	Winter ...	−17·10	+ 8·56	+3·73	+2·49	+0·62	−0·54	+0·53	−0·10
	Equinox	−25·98	+14·81	+5·08	+1·98	+0·40	+0·12	+0·54	0·00
	Summer	−32·00	+12·50	+6·80	+3·07	+0·38	−0·91	+0·01	+0·56
Declination. 10 quieter days.	Year ...	−15·28	+ 7·40	+3·38	+0·36	+0·78	+0·51	+0·01	−0·35
	Winter ...	− 7·90	+ 4·00	+1·21	+1·04	+1·03	+0·06	+0·05	+0·11
	Equinox	−13·96	+ 8·45	+3·12	+0·52	+0·47	+0·41	−0·12	−0·58
	Summer	−23·97	+ 9·77	+5·82	−0·47	+0·86	+1·06	+0·10	−0·59
		γ	γ	γ	γ	γ	γ	γ	γ
Horizontal Force. All complete days.	Year ...	−14·07	−33·02	−4·88	+4·46	+1·44	+0·55	−0·38	+0·05
	Winter ...	−11·00	−20·90	−3·28	+2·51	+0·28	+1·41	−0·43	+0·70
	Equinox	−17·17	−32·61	−5·67	+5·32	+1·43	+1·11	−0·17	−0·10
	Summer	−14·03	−45·56	−5·68	+5·54	+2·60	−0·88	−0·53	−0·45
Horizontal Force. 10 quieter days.	Year ...	− 9·20	−20·89	−2·37	+3·47	+0·84	+0·95	−0·61	+0·01
	Winter ...	− 5·90	−10·22	−0·88	+1·71	+0·38	+1·49	−0·40	+0·05
	Equinox	−11·33	−18·49	−3·12	+3·24	+0·97	+0·54	−0·69	+0·20
	Summer	−10·38	−33·96	−3·10	+5·45	+1·19	+0·83	−0·76	−0·24

TABLE LVI.—D and H. Fourier Coefficients (L.M.T.).

—		c_1	a_1	c_2	a_2	c_3	a_3	c_4	a_4
		′	° ′	′	°	′	°	′	°
Declination. All complete days.	Year ...	27·74	309 9	5·78	91·4	0·64	174	0·39	121
	Winter ...	19·13	310 12	4·48	83·5	0·82	172	0·54	155
	Equinox	29·91	313 17	5·45	95·9	0·41	114	0·55	145
	Summer	34·36	304 56	7·46	92·9	0·98	198	0·56	56
Declination. 10 quieter days.	Year ...	16·98	309 28	3·40	111·1	0·94	98	0·35	233
	Winter ...	8·85	310 28	1·59	76·5	1·03	127	0·11	57
	Equinox	16·31	314 48	3·17	107·8	0·62	90	0·59	246
	Summer	25·89	305 46	5·84	121·8	1·36	80	0·60	225
		γ	° ′	γ	°	γ	°	γ	°
Horizontal Force. All complete days.	Year ...	35·90	213 40	6·61	339·6	1·54	110	0·38	332
	Winter ...	23·61	221 18	4·13	334·7	1·44	52	0·82	23
	Equinox	36·86	221 22	7·78	340·4	1·81	93	0·20	295
	Summer	47·66	210 43	7·94	341·5	2·74	150	0·70	284
Horizontal Force. 10 quieter days.	Year ...	22·82	217 23	4·20	352·9	1·27	82	0·61	325
	Winter ...	11·80	223 36	1·92	360·0	1·53	55	0·40	332
	Equinox	21·69	225 6	4·50	343·2	1·11	102	0·72	341
	Summer	35·51	210 35	6·27	357·6	1·45	96	0·79	307

TABLE LVII.—Fourier Coefficients from Mean Diurnal Inequality for the year. 1911–12 and 1902–03.

Element.	Epoch.	c_1	a_1	c_2	a_2	c_3	a_3	c_4	a_4
		′	° ′	′	°	′	°	′	°
D All complete days	1911–12	27·74	309 9	5·78	91·4	0·64	174	0·39	121
D „ „ „	1902–03	20·36	338 29	4·43	133·4	0·34	66	0·65	217
D Quieter days	1911–12	16·98	309 28	3·40	111·1	0·94	98	0·35	233
D „ „	1902–03	15·22	341 36	3·45	150·9	0·96	70	0·57	230
		γ	° ′	γ	°	γ	°	γ	°
H All complete days	1911–12	35·90	213 40	6·61	339·6	1·54	110	0·38	332
H Quieter days	1911–12	22·82	217 23	4·20	352·9	1·27	82	0·61	325
H	1902–03	16·72	226 54	3·14	375·5	0·49	93	0·39	400
V All complete days	1911–12	22·09	95 52	2·41	208·8	1·85	58	1·10	289
V „ „ „	1902–03	15·34	86 52	3·49	240·6	1·89	45	1·00	287

CHAPTER VI.

DAILY MAXIMA AND MINIMA. ABSOLUTE RANGES.

Section 32.—By the absolute diurnal or daily range is meant the excess of the largest over the least value recorded during the 24 hours. The absolute ranges for E′, S′ and V are given for every day available in Tables LVIII, LIX and LX, pp. 118 to 123. Owing to the necessity of changing the photographic paper, there is unavoidably a short daily loss of trace, and there is a possibility that one if not both of the extreme values for the day may occur during the changing interval, and so fail to be recorded. Such a possibility is naturally greatest where disturbance is most prevalent, supposing the changing time to avoid the ordinary hour of maximum or minimum, and so is a less unlikely contingency in the Antarctic than at the average station. But even in the Antarctic, supposing the change of papers to occupy as usual only a few minutes, the chance of an extreme value occurring during the changing interval is trifling, and if it should occur, unless an unusually rapid change were in progress at the time, the underestimate in the daily range due to the loss of trace could not be large. There were, however, a certain number of days, especially in November, 1912, when the interruptions or imperfections of trace were such that there is a considerable chance or even a practical certainty that there was loss of one or both of the extreme values of the day. In these cases the range given is enclosed in parentheses; it represents the difference between the greatest and least ordinates actually recorded. Such ranges are probably underestimates, in some cases probably only a little short in other cases. however, a great deal short of the true range.

Table LXI, p. 124, gives for each month the mean of the absolute ranges, and the largest and least of them. Only complete days were employed for the calculation of the mean or for the minimum range, because the inclusion of days of curtailed range would obviously have been misleading. But in two or three instances these presumably curtailed ranges included the largest of the month, which has been accepted as the maximum, being inclosed in parentheses to indicate that it is probably an underestimate.

Table LXI also gives in the last line the mean of the monthly means for the 11 months of 1911 and 1912. On the average the S′ and V ranges are respectively about 88 and 60 per cent. of the E′ ranges, the ratios between the ranges being closely the same for 1911 and 1912.

There is a large reduction in the absolute ranges, just as there was in the inequality ranges, in 1912 as compared with 1911. The difference between the two years in the Antarctic is greater than it was in temperate European latitudes—at Kew Observatory, for instance. Also, as with the inequality ranges, there is a large annual variation in the absolute ranges, the maximum occurring near midsummer, the minimum near midwinter, and the equinoctial months occupying an intermediate position. The minimum range in Table LXI shows an annual variation of the same type as in the mean range but relatively even larger. In February, 1911, no day had a range less than 163γ in E′, 170γ in S′, or 129γ in V; whereas the smallest ranges for the three elements in June, 1911, were respectively only 31γ, 34γ and 22γ. The maximum monthly ranges in Table LXI show much less regularity in their annual variation. The absolutely largest ranges recorded were 727γ in E′ during December, 1911, 652γ in S′ during April, 1911, and 453γ in V during July, 1911. In 1912 the largest S′ range, 438γ, and the argest V range, 372γ, occurred in May. Thus while notably large disturbances were most numerous in the summer and equinoctial months, they were not confined to these months. The presence of the sun above the horizon during part of the 24 hours is clearly not an essential condition for large disturbances.

Table LXII, p. 124, gives the ratio borne by the mean absolute range for each month to the corresponding inequality range. The fourth and eighth columns give the mean of the ratios derived from E′, S′ and V for the individual months, and the last column gives the mean of the corresponding results for the two years. The figures in this last column show a very decided annual variation, the mean ratio tending to be largest towards midwinter and least in summer. The size of the inequality range is largely dependent, as we have seen, on the presence of disturbance, and this dependence is especially marked at midwinter. The values of the ratio for any one element in Table LXII show irregular fluctuations of a presumably accidental character. In 1911 the final mean value of the ratio is appreciably less for S′ than for the other two elements. But this is not improbably accidental, as the final mean values of the ratio for the three elements in 1912 are almost identical, and the final means from the three elements are very nearly the same for the two years.

Section 33.—Tables LXIII, LXIV and LXV, pp. 125 and 126, show the frequency of occurrence of ranges of different sizes in the three elements. The total number of days available for each month or season from the two years combined is given in parentheses. The absence of January data for 1911 and of December data for 1912, and the incompleteness of so many days of November, 1912, lead to a large reduction in the number of summer days, which should be borne in mind when comparing the different seasons.

Considering first the E′ data in Table LXIII we see that ranges less than 50γ were almost entirely confined to winter months. In summer ranges less than 100γ were very rare. In winter half the total number of ranges lay between 50γ and 150γ, while in summer 83 per cent. of the ranges exceeded 150γ, and 41 per cent. exceeded 250γ. Of the 11 ranges exceeding 500γ only one occurred in 1912, and ranges exceeding 250γ were nearly thrice as numerous in 1911 as in 1912.

Table LXIV gives for S′ in summer no range less than 50γ, and in equinox only 1 day in 32 had a range as small as this, as compared with 1 day in 7 in winter. The percentage of days having ranges as low as 100γ was much greater for equinox than for summer, but ranges exceeding 250γ were relatively as numerous in the former season as the latter.

Coming to V ranges in Table LXV we see that four-fifths of the days had ranges exceeding 50γ, and no range as small as this was encountered in summer. The percentage number of days having ranges less than 100γ was 71 for winter and 61 for equinox, but only 14 for summer; while the percentage number of days having ranges in excess of 200γ was 19 in summer, but only 9 in equinox and 8 in winter. Ranges less than 100γ were one and a half times as numerous in 1912 as in 1911, while ranges exceeding 200γ were three and a half times as numerous in 1911 as in 1912.

To give a general idea of how very large ranges in the Antarctic really are, it may be mentioned that on the average of the 11 years 1890–1900 the mean absolute daily ranges at Kew Observatory were 72γ in D, 61γ in H and 33γ in V. For the mean absolute ranges in the Antarctic from February, 1911, to November, 1912, we have 187γ in E′, 163γ in S′ and 113γ in V. Thus we find

$$(\text{Range in E}' \text{ in Antarctic})/(\text{Range in D at Kew}) = 2\cdot 6.$$
$$(\text{Range in S}' \text{ in Antarctic})/(\text{Range in H at Kew}) = 2\cdot 7.$$
$$(\text{Range in V in Antarctic})/(\text{Range in V at Kew}) = 3\cdot 4.$$

Relatively considered, the Antarctic V ranges are thus more outstanding than the ranges in the horizontal components. The percentages of the total number supplied by ranges exceeding 100γ were at Kew 14·6 in D, 9·5 in H and 2·3 in V, whereas they were in the Antarctic 75·2 in E′, 68·1 in S′ and 46·4 in V.

Section 34.—The fact that E′ and S′ refer to rectangular axes arbitrarily oriented reduces the interest attaching to the incidence of the daily maximum and minimum, because any results we may obtain will not be directly comparable with data from any other station. At the same time the smallness of the angle, 7° 36′, between these axes and Geographical East and South, and the great similarity of the diurnal inequalities of E′ and E on the one hand, and of S′ and S on the other, render it unlikely that the results obtained for E′ and S′ differ much from those that would have been obtained for E and S. Also the way in which maxima and minima occur is calculated to throw light on the nature of the diurnal changes. It has accordingly appeared worth while to find the frequency of occurrence throughout the 24 hours of the maximum and minimum in E′ and S′ as well as in V. The results appear in the six Tables LXVI to LXXI, pp. 127 to 132. The time employed is that of the 180th meridian. The last column in each table shows the number of days used. No day was employed in which incompleteness of trace seemed likely to have led to the loss of the true maximum or minimum. The results from all the 22 months, and from the combination of the months which belonged to the same season of the year, are given in the four lowest lines. The absence of record for January, 1911, and December, 1912, reduces of course the number of summer days.

Referring to Table XI it will be seen that the maximum value in the diurnal inequality of E′ occurred at 19 h. in the case of all the seasons and the year; while according to Table LXVI the absolute daily maximum occurred most frequently either between 19 h. and 20 h. (year, equinox and summer), or between 18 h. and 19 h.

(winter). At the same time a large majority of individual maxima occurred outside these hours. In fact, if we take the whole year, no single hour of the day failed to show at least one maximum ; but there is only one occurrence between 10 h. and 11 h., 10h. being the hour when the minimum appeared in the mean diurnal inequality for the year. Taking the whole 22 months, the 12 hours 2 h. to 14 h. contribute only 45 occurrences or $7\frac{1}{2}$ per cent. of the whole, and of these, 27 are due to the summer months.

In the case of minima in E′ we see from Table LXVII that 9–10 h. showed the greatest frequency, and 10 h. gave the minimum in the diurnal inequality for the year in Table XI. Even in the case of the 22 months, four hours show no single occurrence, and the 12 hours 14 h. (2 p.m.) to 2 h. contribute between them only 25 occurrences, or about 4 per cent. of the total. In this instance, somewhat curiously, summer shows the greatest concentration of minima, no single occurrence presenting itself in the 11 hours 16 h. (4 p.m.) to 3 h.

The maximum in the diurnal inequality of S′ in Table XV presented itself at 15 h. in the case of the whole year and summer, but at 14 h. in the case of winter and equinox. In Table LXVIII the greatest frequency of occurrence of the maximum presented itself between 13 h. and 14 h. in winter, but between 14 h. and 15 h. in the other groups of months. In the whole 22 months six hours show no maximum, and in the equinoctial and summer groups there are respectively 12 and 11 hours without an occurrence. The 12 hours 19 h. (7 p.m.) to 7 h. show between them only 12 occurrences, or but 2 per cent. of the whole.

The hour of minimum in the diurnal inequality of S′ in Table XV was less constant, varying from midnight in winter to 3 h. in summer. The succession of figures in Table LXIX is decidedly less regular than in the case of the maxima, especially in summer, where the greatest frequency of occurrence of the minima is found between 6 h. and 7 h. But in the other groups of months the greatest frequency is found between 23 h. and 24 h. (all months and equinoctial months), or between 0 h. and 1 h. (winter). In the twelve hours 8 h. to 20 h. there are only 23 occurrences, or less than 4 per cent. of the total, and in the summer months there is no single occurrence between 10 h. and 21 h.

The maximum in the diurnal inequality of V in Table XIX occurs at 24 h. for the year as a whole, but the hour for the separate seasons varies from 10 p.m. in winter to 2 a.m. in summer.

In Table LXX the greatest frequency of occurrence of the maximum is found between midnight and 1 a.m. in all the groups of months. A small but decided secondary maximum of frequency will be noticed between 8 h. and 10 h. The 12 successive hours giving the smallest total are 6 h. to 18 h., and this total 111 is fully 18 per cent. of the whole number.

The hour of minimum in the seasonal diurnal inequalities of V in Table XIX varies from 12 h. in winter to 14 h. in summer, being 13 h. for the year as a whole. In Table LXXI the greatest frequency of occurrence of the minima is found at a decidedly earlier hour, viz., 10 h.–11 h., in the case of the year and the winter months. The minima are decidedly more concentrated than the maxima in their daily incidence. The twelve hours 17 h. (5 p.m.) to 5 h. show only nine occurrences of the minimum, *i.e.*, only $1\frac{1}{2}$ per cent. of the total. In the summer months there is no occurrence between 16 h. and 24 h., and only three occurrences between midnight and 6 h.

When dealing with the incidence of maxima and minima in the Antarctic in 1902–3, I defined the *concentration* of the frequency as "the percentage which the occurrences during the three consecutive hours which, combined, give the greatest number of occurrences bear to the total number." It may be of interest to compare the following figures for the concentration thus defined in the different elements at the two epochs. The elements put in the same line are those most nearly equivalent to one another. There is identity between them only in the case of V.

1911–12.			1902–03.		
E′	Maxima	44	D	Minima	44
E′	Minima	48	D	Maxima	54
S′	Maxima	51	H	Maxima	45
S′	Minima	30	H	Minima	31
V	Maxima	38	V	Maxima	40
V	Minima	52	V	Minima	35

The figures in the same line for the "concentration" show a considerable resemblance, except in the case of V minima. In 1902–03 the hours showing the greatest frequency of V minima differed for the different seasons in a somewhat irregular way.

Section 35.—Table LXXII, p. 133, presents the results as to the incidence of maxima and minima in a different way, enabling a more direct comparison to be made with the hourly values in the diurnal inequalities. The figures relate to the year as a whole. A numerical illustration will best serve to explain how the figures were got and what they mean. According to Tables LXX and LXXI, if we take the two hours 3 h.–4 h. and 4 h.–5 h. we have in the first, 39 occurrences of maximum and 3 of minimum, and in the second, 31 occurrences of maximum and 1 of minimum. If we count one maximum as $+1$, and one minimum as -1, the entries under these two successive hours become $+39-3$ or $+36$, and $+31-1$ or $+30$. Doing this for all hours of the 24 we get a series of quantities whose numerical sum is 988, giving an arithmetic mean of $41 \cdot 2$. Of this, 36 and 30 represent respectively 87 and 73 per cent. Thus we get a new set of 24 hourly values having $+87$ for 3 h.– 4 h. and $+73$ for 4 h.–5 h. The arithmetic mean of these two values, *i.e.*, $+80$, appears in Table LXXII at 4 h. in the column headed "max.—min." in V. The corresponding entry in the column headed "Inequality" in V is got as follows: The entry under 4 h. in Table XIX in the diurnal inequality for the year in V is $+11 \cdot 9\gamma$. The A.D. (arithmetic mean of the 24 hourly entries) is $13 \cdot 84\gamma$, and $+(11 \cdot 9/13 \cdot 84) \times 100 = +86$. In this way we get a diurnal inequality which is independent of the unit of force employed, and which is not without advantages when we wish to consider the type as distinct from the amplitude of the diurnal variation.

If the absolute daily maximum and minimum always presented themselves within an hour or two of the times of occurrence of the maximum and minimum in the ordinary diurnal inequality and if, as is the case in the Antarctic, there were little seasonal variation in the type of the diurnal inequality, then the max.—min. figures would show a very peaked type of diurnal variation. The diurnal variation in the max.—min. figures in Table LXXII is in fact distinctly more peaked than that of the inequality figures, especially in the case of V. Still the resemblances between the two are striking, especially in the case of E′ and S′.

As we shall see later, the incidence of disturbance in the Antarctic showed a conspicuous diurnal variation, the maximum of disturbance occurring between 8 h. and 10 h. and the minimum towards midnight. This has no doubt something to do with the incidence of the daily maximum and minimum. For instance, it probably explains the secondary maximum between 8 h. and 10 h. shown by Table LXX in the incidence of the daily maximum in V. That is not a time of the day at which the diurnal inequality would lead us to expect any appreciable number of maxima, but large oscillations were particularly frequent during these hours, and large oscillations naturally supply high values even though the mean value for the hour is low.

Day.	1911.										
	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
1	—	519	199	302	191	229	106	132	68	204	243
2	—	254	243	173	139	247	88	(113)	139	139	273
3	—	206	174	125	109	622	161	63	107	356	265
4	—	253	173	75	48	140	168	29	119	360	212
5	—	389	192	127	326	142	142	106	122	228	155
6	327	323	81	154	181	100	240	106	140	207	313
7	379	257	122	261	136	184	133	89	153	193	468
8	400	291	207	266	150	281	53	93	177	113	215
9	268	207	518	102	63	180	67	96	208	308	132
10	378	147	238	147	375	94	75	109	155	397	103
11	163	87	248	226	(156)	304	68	139	467	232	727
12	205	156	254	347	(179)	234	82	197	265	207	390
13	277	102	(165)	105	258	129	151	186	171	452	232
14	481	264	(88)	99	204	93	88	127	161	363	144
15	(322)	262	58	484	186	57	82	172	238	413	261
16	(212)	279	222	502	195	78	198	294	89	261	195
17	345	230	456	256	173	128	122	(170)	332	298	318
18	267	117	325	200	42	318	76	(38)	313	161	326
19	267	89	323	216	68	332	62	(55)	334	134	318
20	226	232	339	250	123	253	236	345	307	429	229
21	293	488	510	372	177	109	77	297	180	272	203
22	604	409	379	218	250	211	53	442	201	188	165
23	586	491	277	126	178	127	181	364	196	129	179
24	525	341	184	118	(119)	47	523	198	234	159	179
25	299	427	219	59	57	123	291	103	179	156	168
26	438	407	225	148	31	60	223	104	204	305	335
27	275	492	165	231	40	71	240	164	106	186	381
28	448	447	(254)	204	63	223	294	137	201	216	323
29	—	308	(231)	146	144	311	148	113	121	154	186
30	—	214	316	61	36	197	126	(41)	134	204	146
31	—	218	—	268	—	213	266	—	108	—	246

Absolute E′ Ranges.

1912.										
Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
(413)	182	165	64	84	232	124	323	106	(288)	206
213	233	164	77	127	215	(63)	94	56	(102)	203
242	241	93	130	187	252	(35)	123	66	134	133
123	149	165	117	(76)	66	209	52	100	(139)	90
297	130	98	168	299	99	321	30	116	(124)	158
278	127	139	311	156	67	175	(53)	184	63	(215)
118	114	150	185	136	26	112	(136)	102	84	(140)
202	202	187	122	189	252	87	74	128	181	215
141	139	293	84	80	232	121	66	105	222	(173)
179	198	173	178	116	256	37	66	83	(74)	(241)
255	294	187	123	28	216	44	103	123	(197)	306
323	287	110	86	226	92	31	36	160	227	194
622	259	166	99	379	80	25	39	144	246	223
321	223	79	92	306	89	28	59	192	270	(104)
260	213	173	275	144	81	50	80	90	365	(53)
153	126	154	231	59	(23)	127	43	60	259	361
260	338	90	270	74	(48)	71	294	76	199	(279)
292	(281)	86	208	44	58	93	97	386	146	(199)
149	191	87	110	68	60	45	352	179	79	(274)
244	112	61	203	96	26	137	97	208	88	—
150	89	144	40	70	57	110	139	105	110	—
174	139	186	153	58	46	64	252	151	98	—
327	166	(107)	76	24	45	83	228	158	114	—
219	184	(94)	131	27	110	38	243	290	113	—
184	(183)	78	98	47	57	45	150	210	135	—
173	—	(95)	84	69	37	123	126	82	122	—
168	—	126	73	38	160	128	133	132	(161)	—
143	—	107	53	84	179	57	136	76	155	—
373	(164)	121	39	35	164	74	117	66	171	—
179	—	232	57	48	145	84	128	95	107	—
163	—	57	—	121	—	103	93	—	131	—

TABLE LIX.—

Day.	1911.										
	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
1	—	323	112	297	**298**	200	81	158	**43**	88	196
2	—	215	245	115	247	314	73	(51)	152	103	175
3	—	210	258	122	112	245	176	83	152	176	177
4	—	231	198	63	61	124	166	**23**	81	236	164
5	374	255	154	71	(229)	82	181	101	92	179	83
6	332	285	99	116	192	72	180	71	99	217	149
7	357	198	114	290	199	267	95	128	147	99	341
8	210	339	236	**344**	141	**466**	50	90	186	84	129
9	247	260	**652**	64	61	215	49	71	194	324	90
10	316	134	445	167	258	118	57	169	162	280	**68**
11	174	**54**	408	198	(119)	229	59	121	330	104	**434**
12	202	94	178	213	(259)	183	**37**	210	131	189	295
13	233	83	(203)	64	260	174	126	263	125	255	130
14	579	198	(59)	68	211	143	117	166	134	**471**	179
15	(361)	198	**48**	237	190	132	107	89	182	332	212
16	(208)	204	238	326	115	89	158	179	90	200	138
17	261	185	418	187	128	96	117	(262)	301	191	146
18	259	105	410	238	45	158	142	(32)	**341**	124	340
19	304	93	467	165	80	294	56	(53)	217	89	179
20	**170**	405	328	201	141	152	181	**440**	212	236	187
21	279	339	303	254	185	146	85	230	180	155	199
22	507	516	411	169	263	186	47	372	161	138	132
23	417	358	342	**57**	169	186	130	181	126	97	185
24	**594**	350	284	79	217	47	**454**	147	170	108	141
25	325	**567**	295	65	42	96	294	101	225	**75**	110
26	418	308	208	183	**34**	**44**	212	67	157	150	249
27	449	479	123	199	**34**	46	303	165	84	123	321
28	441	299	(151)	137	135	213	184	126	94	145	265
29	—	305	(220)	59	203	342	127	82	96	113	108
30	—	311	186	78	56	188	150	(47)	130	182	100
31	—	210	—	242	—	191	195	—	103	—	241

Absolute S′ Ranges.

1912.										
Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
(198)	119	127	72	101	145	126	221	114	(210)	174
191	135	102	55	62	131	(50)	63	45	(139)	202
136	141	85	111	110	130	(43)	116	**32**	127	76
131	116	112	112	(51)	65	149	73	198	(83)	108
161	156	72	171	**438**	44	**312**	31	127	(55)	**71**
233	139	111	270	186	(22)	200	(67)	110	58	(163)
109	**58**	170	225	162	(15)	116	(94)	70	74	(128)
164	199	**371**	96	143	195	112	59	101	147	145
130	136	199	65	68	**412**	115	65	154	109	(125)
172	235	175	269	105	229	57	76	127	(44)	(208)
142	220	235	60	35	157	70	53	90	(109)	**338**
266	160	131	97	300	126	29	**24**	157	77	217
337	188	107	102	382	51	**24**	45	85	(216)	155
253	202	68	55	184	69	32	102	102	187	(62)
207	175	109	**317**	150	78	48	92	75	**336**	(82)
145	109	93	258	61	(17)	68	44	109	210	219
151	234	75	208	85	(54)	40	257	56	177	(137)
249	(**237**)	52	232	72	38	151	107	264	106	(120)
178	123	**43**	90	49	58	70	243	209	**51**	(172)
140	90	68	281	88	**19**	64	97	159	82	—
122	99	107	60	41	30	103	143	88	180	—
176	87	325	81	81	34	62	192	125	92	—
211	174	(51)	94	**16**	68	53	**273**	125	142	—
129	229	(65)	114	23	116	48	111	**351**	118	—
174	(212)	68	96	28	111	46	135	265	125	—
91	—	(147)	118	63	69	70	91	74	99	—
82	—	111	69	61	153	141	146	85	(131)	—
102	—	82	61	55	96	76	109	59	142	—
135	(82)	(70)	**42**	54	125	41	148	55	119	—
95	—	147	89	73	88	52	98	93	69	—
119	—	61	—	72	—	126	92	—	128	—

TABLE LX.—

Day.	1911.										
	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
1	—	214	125	112	145	134	91	86	36	79	173
2	—	148	114	130	106	127	41	(61)	75	82	176
3	—	136	108	49	52	453	90	54	108	130	188
4	—	167	84	63	43	86	94	17	48	(153)	227
5	—	247	110	48	261	58	80	50	63	133	100
6	252	146	55	68	208	44	95	49	69	138	156
7	251	124	69	208	152	159	66	47	85	87	317
8	167	293	83	189	84	252	20	52	97	101	147
9	213	330	271	44	38	103	23	34	—	210	127
10	148	84	277	74	184	87	54	58	94	231	108
11	165	57	96	46	(85)	313	37	65	143	130	331
12	150	48	111	131	(299)	133	33	(90)	122	130	264
13	129	49	(145)	39	152	74	90	126	99	207	155
14	244	149	(47)	66	135	48	48	115	98	188	188
15	171	120	48	236	76	53	61	48	75	217	210
16	(141)	154	87	427	52	45	92	165	52	120	99
17	148	91	179	147	55	(61)	53	(139)	109	131	230
18	172	72	251	119	36	92	46	(34)	130	111	361
19	183	50	394	225	53	169	32	(45)	130	112	160
20	118	363	160	117	79	191	86	257	148	194	154
21	156	197	125	419	58	54	52	219	124	175	133
22	255	209	188	103	129	139	45	215	119	132	126
23	188	190	118	45	152	70	119	110	92	79	196
24	259	165	183	43	(145)	32	338	88	125	116	159
25	194	259	200	53	32	35	148	61	148	105	89
26	240	157	79	124	22	32	133	57	(163)	116	190
27	188	339	81	108	23	33	86	54	(66)	109	213
28	178	254	(175)	68	51	286	155	65	96	107	169
29	—	171	(135)	42	75	140	55	75	67	122	135
30	—	145	310	36	40	128	67	(60)	105	153	97
31	—	108	—	124	—	264	146	—	64	—	275

Absolute V Ranges.

1912.										
Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
—	153	97	38	39	137	79	324	43	(172)	111
144	117	61	49	62	168	(28)	33	44	(148)	91
128	182	73	62	72	145	(28)	79	38	61	112
133	135	151	81	(38)	24	134	39	81	(85)	71
178	126	54	73	372	30	305	26	77	(58)	91
167	71	90	117	328	35	106	(55)	79	57	(118)
85	101	96	108	109	20	111	(59)	47	62	(107)
150	170	183	81	109	126	39	37	51	63	135
115	115	173	72	56	170	53	40	61	79	(87)
110	87	123	166	51	110	40	46	46	(46)	(223)
132	206	144	89	23	82	31	38	69	—	275
165	107	103	44	119	80	16	13	83	113	190
226	191	90	65	311	40	17	23	65	109	108
217	153	79	60	198	47	10	42	91	149	(47)
194	122	71	163	65	44	30	44	55	162	(32)
159	129	82	356	39	(15)	104	25	43	99	308
167	119	73	192	51	(35)	28	95	56	103	(140)
165	(173)	44	130	33	40	61	80	119	85	(174)
130	105	26	119	39	35	24	106	92	52	(176)
101	93	56	79	43	12	67	65	80	83	—
110	111	76	36	22	27	62	90	63	122	—
136	64	103	93	35	35	39	95	81	87	—
228	87	—	63	15	41	43	105	109	140	—
97	168	—	54	17	53	26	92	210	57	—
184	—	—	76	25	58	30	69	138	86	—
84	—	(95)	55	49	24	55	65	67	83	—
72	—	73	50	29	162	63	89	56	(76)	—
85	—	56	53	29	95	52	99	45	100	—
229	—	63	67	25	83	30	53	52	91	—
117	—	73	25	42	73	38	56	59	83	—
135	—	46	—	47	—	56	41	—	94	—

Table LXI.—Absolute Daily Ranges.

Month.	1911.									1912.								
	E′			S′			V			E′			S′			V		
	Mean.	Largest.	Least.	Mean.	Largest.	Least.	Mean.	Largest.	Least.	Mean.	Largest.	Least.	Mean.	Largest.	Least.	Mean.	Largest.	Least.
	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
January	—	—	—	—	—	—	—	—	—	231	622	118	164	337	82	145	229	72
February	355	604	163	335	594	170	190	259	129	189	338	89	153	(237)	58	127	206	64
March	287	519	87	262	567	54	169	363	48	138	293	57	126	371	43	86	183	26
April....	256	518	58	275	652	48	150	394	48	131	311	39	132	317	42	91	356	25
May	205	502	59	163	344	57	119	427	36	114	379	24	112	438	16	82	372	15
June	146	375	31	149	298	34	92	(299)	22	121	256	26	109	412	19	71	170	12
July	188	622	47	175	466	44	128	453	32	95	321	25	90	312	24	60	305	10
August	156	523	53	142	454	37	83	338	20	130	352	30	114	273	24	69	324	13
September	168	442	29	153	440	23	90	257	17	134	386	56	123	351	32	73	210	38
October	191	467	68	158	341	43	97	(163)	36	159	365	63	128	336	51	93	(172)	52
November	247	452	113	175	471	75	136	231	79	209	361	90	170	338	71	149	308	71
December	260	727	103	189	434	68	182	361	89	—	—	—	—	—	—	—	—	—
Mean	224			198			131			150			129			95		

Table LXII.—Ratio (Absolute Range)/(Inequality Range).

Month.	1911.				1912.				Mean of Means.
	E′	S′	V	Mean.	E′	S′	V	Mean.	
January... ...	—	—	—	—	2·15	1·96	2·01	2·04	2·04
February ...	2·13	2·06	2·38	2·19	2·33	1·84	1·82	2·00	2·10
March	2·35	2·21	2·82	2·46	2·08	2·08	2·16	2·11	2·28
April	2·45	2·07	2·53	2·35	2·24	2·63	2·41	2·43	2·39
May	2·85	2·11	3·03	2·66	2·73	2·35	2·55	2·54	2·60
June	2·45	2·48	2·41	2·45	2·93	3·00	2·47	2·80	2·63
July	3·06	2·58	2·73	2·79	2·57	2·59	2·94	2·70	2·74
August	2·27	2·38	2·33	2·33	2·45	2·49	2·71	2·55	2·44
September ...	2·12	2·24	2·04	2·13	1·99	2·18	2·24	2·14	2·14
October	2·07	2·10	2·05	2·07	2·10	2·19	2·09	2·13	2·10
November ...	1·98	1·86	2·08	1·97	2·16	2·17	2·16	2·16	2·07
December ...	2·78	1·91	2·21	2·30	—	—	—	—	2·30
Mean	2·41	2·19	2·42	2·34	2·34	2·32	2·32	2·33	—

TABLE LXIII.—E′ Ranges. Number of Days when Range between Limits stated.

Month or Season.	0 to 50γ.			50γ to 100γ.			100γ to 150γ.			150γ to 200γ.			200γ to 250γ.			250γ to 500γ.			Above 500γ.		
	1911.	1912.	2 Years.	1911.	1912.	2 Years.	1911.	1912.	2 Years.	1911.	1912.	2 Years.	1911.	1912.	2 Years.	1911.	1912.	2 Years.	1911.	1912.	2 Years.
January (30)	—	0	0	—	0	0	—	6	6	—	8	8	—	5	5	—	10	10	—	1	1
February (44)	0	0	0	0	1	1	0	8	8	1	5	6	2	5	7	15	4	19	3	0	3
March (59)	0	0	0	2	9	11	3	7	10	1	10	11	6	1	7	18	1	19	1	0	1
April (56)	0	2	2	2	12	14	1	6	7	6	4	10	7	3	10	8	3	11	2	0	2
May (61)	0	8	8	4	10	14	9	5	14	3	3	6	6	1	7	8	3	11	1	0	1
June (55)	5	5	10	4	11	15	6	2	8	7	3	10	2	4	6	3	3	6	0	0	0
July (60)	1	9	10	7	8	15	7	9	16	3	1	4	6	1	7	6	1	7	1	0	1
August (60)	0	4	4	12	10	22	6	9	15	5	0	5	4	2	6	3	4	7	1	0	1
September (55)	1	0	1	4	11	15	10	9	19	5	6	11	0	2	2	5	2	7	0	0	0
October (55)	0	0	0	2	5	7	9	9	18	8	4	12	6	3	9	6	3	9	0	0	0
November (40)	0	0	0	0	1	1	4	1	5	7	2	9	7	4	11	12	2	14	0	0	0
December (31)	0	—	0	0	—	0	4	—	4	7	—	7	7	—	7	12	—	12	1	—	1
Year (606)	7	28	35	37	78	115	59	71	130	53	46	99	53	31	84	96	36	132	10	1	11
Winter (236)	6	26	32	27	39	66	28	25	53	18	7	25	18	8	26	20	11	31	3	0	3
Equinox (225)	1	2	3	10	37	47	23	31	54	20	24	44	19	9	28	37	9	46	3	0	3
Summer (145)	0	0	0	0	2	2	8	15	23	15	15	30	16	14	30	39	16	55	4	1	5

TABLE LXIV.—S′ Ranges. Number of Days when Range between Limits stated.

Month or Season.	0 to 50γ.			50γ to 100γ.			100γ to 150γ.			150γ to 200γ.			200γ to 250γ.			250γ to 500γ.			Above 500γ.		
	1911.	1912.	2 Years.	1911.	1912.	2 Years.	1911.	1912.	2 Years.	1911.	1912.	2 Years.	1911.	1912.	2 Years.	1911.	1912.	2 Years.	1911.	1912.	2 Years.
January (30)	—	0	0	—	3	3	—	12	12	—	8	8	—	4	4	—	3	3	—	0	0
February (44)	0	0	0	0	4	4	0	8	8	2	6	8	4	5	9	12	0	12	3	0	3
March (58)	0	1	1	4	10	14	2	10	12	4	3	7	5	1	6	14	2	16	2	0	2
April (56)	1	1	2	1	15	16	3	5	8	4	1	5	4	3	7	12	5	17	1	0	1
May (61)	0	6	6	10	13	23	4	5	9	7	3	10	5	0	5	5	3	8	0	0	0
June (52)	4	5	9	4	9	13	6	7	13	5	3	8	3	1	4	4	1	5	0	0	0
July (60)	3	8	11	5	10	15	5	8	13	9	2	11	4	0	4	5	1	6	0	0	0
August (60)	4	4	8	7	11	18	8	9	17	8	1	9	1	2	3	3	2	5	0	0	0
September (55)	1	2	3	7	11	18	6	9	15	6	4	10	2	1	3	3	3	6	0	0	0
October (54)	1	0	1	7	8	15	7	10	17	10	3	13	3	1	4	3	1	4	0	0	0
November (40)	0	0	0	6	2	8	9	2	11	7	2	9	3	3	6	5	1	6	0	0	0
December (31)	0	—	0	4	—	4	9	—	9	9	—	9	3	—	3	6	—	6	0	—	0
Year (601)	14	27	41	55	96	151	59	85	144	71	36	107	37	21	58	72	22	94	6	0	6
Winter (233)	11	23	34	26	43	69	23	29	52	29	9	38	13	3	16	17	7	24	0	0	0
Equinox (223)	3	4	7	19	44	63	18	34	52	24	11	35	14	6	20	32	11	43	3	0	3
Summer (145)	0	0	0	10	9	19	18	22	40	18	16	34	10	12	22	23	4	27	3	0	3

TABLE LXV.—V Ranges. Number of Days when Range between Limits stated.

Month or Season.	0 to 50γ.			50γ to 100γ.			100γ to 150γ.			150γ to 200γ.			200γ to 250γ.			250γ to 500γ.			Above 500γ.		
	1911.	1912.	2 years.	1911.	1912.	2 years.	1911.	1912.	2 years.	1911.	1912.	2 years.	1911.	1912.	2 years.	1911.	1912.	2 years.	1911	1912.	2 years.
January (30)	—	0	0	—	5	5	—	13	13	—	8	8	—	4	4	—	0	0	—	0	0
February (45)	0	0	0	0	5	5	5	11	16	10	6	16	3	1	4	4	0	4	0	0	0
March (59)	3	4	7	4	17	21	8	4	12	7	3	10	3	0	3	6	0	6	0	0	0
April (56)	1	6	7	8	16	24	7	4	11	5	3	8	0	0	0	5	1	6	0	0	0
May (61)	9	17	26	6	6	12	10	3	13	1	1	2	3	0	3	2	3	5	0	0	0
June (55)	7	14	21	10	7	17	4	4	8	4	3	7	1	0	1	1	0	1	0	0	0
July (59)	7	15	22	8	9	17	7	4	11	3	0	3	0	0	0	5	1	6	0	0	0
August (60)	9	13	22	16	13	29	4	2	6	1	0	1	0	0	0	1	1	2	0	0	0
September (54)	6	7	13	11	19	30	3	3	6	1	0	1	2	1	3	1	0	1	0	0	0
October (52)	2	0	2	14	17	31	12	6	18	0	1	1	0	0	0	0	0	0	0	0	0
November (39)	0	0	0	4	3	7	17	4	21	4	1	5	4	0	4	0	2	2	0	0	0
December (31)	0	—	0	4	—	4	6	—	6	12	—	12	4	—	4	5	—	5	0	—	0
Year (601)	44	76	120	85	117	202	83	58	141	48	26	74	20	6	26	30	8	38	0	0	0
Winter (235)	32	59	91	40	35	75	25	13	38	9	4	13	4	0	4	9	5	14	0	0	0
Equinox (221)	12	17	29	37	69	106	30	17	47	13	7	20	5	1	6	12	1	13	0	0	0
Summer (145)	0	0	0	8	13	21	28	28	56	26	15	41	11	5	16	9	2	11	0	0	0

TABLE LXVI.—Incidence of Daily Maxima in E′ (Time of 180° E).

Hour.	0–1	1–2	2–3	3–4	4–5	5–6	6–7	7–8	8–9	9–10	10–11	11–12	12–13	13–14	14–15	15–16	16–17	17–18	18–19	19–20	20–21	21–22	22–23	23–24	Days used.
1911.																									
February	2	1	0	0	0	0	0	0	0	1	0	0	0	0	1	0	2	3	1	2	3	2	2	1	21
March	2	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2	5	4	2	8	2	2	3	0	31
April	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2	5	2	3	2	4	3	0	3	26
May	0	2	0	1	0	0	0	0	1	0	0	0	0	0	0	1	2	3	9	2	7	2	0	1	31
June	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	3	4	3	8	4	3	0	1	27
July	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	4	5	8	5	4	2	0	31
August	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1	3	8	7	5	3	1	0	31
September	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	5	8	4	5	1	0	0	0	25
October	0	0	0	0	0	2	0	0	0	0	0	0	1	0	2	1	3	5	6	4	5	1	1	0	31
November	1	0	0	1	1	1	0	0	0	0	0	0	0	0	0	2	6	3	4	5	1	2	2	1	30
December	2	0	1	1	0	0	3	1	0	1	0	0	1	0	1	0	1	3	2	2	3	5	2	2	31
1912.																									
January	1	2	1	0	2	0	0	2	5	1	0	0	0	0	1	0	2	3	4	3	0	0	0	3	30
February	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	4	3	2	6	2	3	0	0	23
March	0	0	0	0	0	0	0	0	0	0	0	1	0	0	3	1	3	3	5	4	3	2	3	0	28
April	0	0	1	0	0	0	0	0	0	0	0	1	1	0	1	3	1	2	3	5	5	5	1	1	30
May	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	3	3	3	5	2	6	3	0	2	30
June	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2	5	6	5	6	0	1	1	28
July	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1	2	3	4	7	5	3	1	0	29
August	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	6	3	6	3	2	3	0	1	29
September	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	7	5	5	3	2	2	1	30
October	1	0	0	0	0	1	0	0	1	0	0	0	0	1	0	2	4	5	1	5	3	0	0	0	24
November	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	2	2	0	2	1	0	1	0	10
Months.																									
All	15	9	6	4	3	5	3	4	8	3	1	2	4	2	11	26	67	81	88	100	76	48	22	18	606
Winter	4	4	3	2	0	0	0	0	1	0	0	0	0	1	2	10	21	28	46	42	40	21	5	6	236
Equinoctial	5	2	1	0	0	3	0	0	1	0	0	2	3	1	6	13	29	36	29	38	26	15	10	5	225
Summer	6	3	2	2	3	2	3	4	6	3	1	0	1	0	3	3	17	17	13	20	10	12	7	7	145

Table LXVII.—Incidence of Daily Minima in E′ (Time of 180° E).

Hour.	0–1	1–2	2–3	3–4	4–5	5–6	6–7	7–8	8–9	9–10	10–11	11–12	12–13	13–14	14–15	15–16	16–17	17–18	18–19	19–20	20–21	21–22	22–23	23–24	Days used.
1911.																									
February	0	0	0	0	0	0	2	3	4	5	3	0	1	2	1	0	0	0	0	0	0	0	0	0	21
March	0	0	1	1	1	0	2	3	7	10	2	2	1	1	0	0	0	0	0	0	0	0	0	0	31
April	0	0	0	0	0	1	1	3	5	4	3	7	1	0	1	0	0	0	0	0	0	0	0	0	26
May	0	1	0	3	0	2	0	5	3	4	1	6	0	2	1	1	0	1	0	0	0	0	1	0	31
June	1	1	1	0	0	3	4	2	5	1	3	5	0	0	0	1	0	0	0	0	0	0	0	0	27
July	0	0	1	1	1	4	1	4	7	3	2	2	3	0	0	0	0	0	0	0	1	0	0	1	31
August	0	0	1	2	1	4	4	2	3	5	3	3	0	3	0	0	0	0	0	0	0	0	0	0	31
September	0	0	0	0	1	0	0	3	4	9	4	3	0	1	0	0	0	0	0	0	0	0	0	0	25
October	0	0	0	2	0	0	5	3	3	3	6	4	3	2	0	0	0	0	0	0	0	0	0	0	31
November	0	0	0	0	0	0	3	5	7	6	7	1	1	0	0	0	0	0	0	0	0	0	0	0	30
December	0	0	0	0	0	1	4	3	5	10	2	1	0	2	2	1	0	0	0	0	0	0	0	0	31
1912.																									
January	0	0	0	0	2	0	1	2	1	9	8	3	3	1	0	0	0	0	0	0	0	0	0	0	30
February	0	0	0	1	0	1	2	3	3	7	3	2	1	0	0	0	0	0	0	0	0	0	0	0	23
March	0	0	0	0	1	2	1	3	5	3	5	6	1	1	0	0	0	0	0	0	0	0	0	0	28
April	0	1	0	0	2	2	3	3	4	4	4	1	4	1	0	0	0	0	0	0	0	0	0	1	30
May	1	0	0	1	1	2	6	5	2	8	0	1	1	0	0	0	0	0	0	0	0	0	0	2	30
June	1	1	1	2	0	1	3	0	5	5	4	2	1	1	0	1	0	0	0	0	0	0	0	0	28
July	0	1	0	1	2	0	2	1	6	7	4	2	1	2	0	0	0	0	0	0	0	0	0	0	29
August	0	0	1	0	0	2	1	2	7	5	5	3	2	0	0	0	0	0	0	0	0	0	0	0	29
September	0	0	1	0	0	3	1	4	7	4	3	3	1	2	1	0	0	0	0	0	0	0	0	0	30
October	0	0	0	1	0	3	1	3	3	5	3	3	2	0	0	0	0	0	0	0	0	0	0	0	24
November	0	0	0	0	0	1	0	4	4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10
Months.																									
All	3	5	7	16	12	32	47	66	100	118	75	60	27	21	6	4	0	1	0	0	1	0	1	4	606
Winter	3	4	5	11	5	18	21	21	38	38	22	24	8	8	1	3	0	1	0	0	1	0	1	3	236
Equinoctial	0	1	2	4	5	11	14	25	38	42	30	29	13	8	2	0	0	0	0	0	0	0	0	1	225
Summer	0	0	0	1	2	3	12	20	24	38	23	7	6	5	3	1	0	0	0	0	0	0	0	0	145

TABLE LXVIII.—Incidence of Daily Maxima in S′ (Time of 180° E).

Hour.	0–1	1–2	2–3	3–4	4–5	5–6	6–7	7–8	8–9	9–10	10–11	11–12	12–13	13–14	14–15	15–16	16–17	17–18	18–19	19–20	20–21	21–22	22–23	23–24	Days used.
1911.																									
February	0	0	0	0	0	0	0	1	0	0	0	0	2	2	6	6	2	2	0	0	0	0	0	0	21
March	0	0	0	0	0	0	0	0	0	0	0	2	2	3	9	5	6	4	0	0	0	0	0	0	31
April	0	0	0	0	0	0	0	0	0	0	1	3	4	6	2	8	0	1	1	0	0	0	0	0	26
May	0	0	0	0	0	0	0	0	1	1	1	5	0	6	4	5	4	2	1	1	0	0	0	0	31
June	0	0	0	0	0	0	0	0	1	0	0	2	2	4	3	4	6	4	0	0	0	0	0	0	26
July	0	0	0	0	0	0	0	0	1	1	1	1	6	5	3	5	1	5	0	0	1	1	0	0	31
August	0	0	0	0	0	0	0	0	0	0	3	2	4	5	6	5	3	3	0	0	0	0	0	0	31
September	0	0	0	0	0	0	0	0	0	0	1	4	4	3	4	3	2	4	0	0	0	0	0	0	25
October	0	0	0	0	0	0	0	0	0	2	1	2	3	9	5	4	3	2	0	0	0	0	0	0	31
November	0	0	0	0	0	0	0	0	0	1	0	2	5	3	4	11	3	1	0	0	0	0	0	0	30
December	0	0	0	0	0	0	0	0	1	1	1	2	2	4	6	7	2	3	2	0	0	0	0	0	31
1912.																									
January	0	0	0	0	0	0	0	2	1	0	1	2	3	2	11	2	4	0	1	1	0	0	0	0	30
February	0	0	0	0	0	0	0	1	0	0	0	0	0	3	4	8	4	2	1	0	0	0	0	0	23
March	0	0	0	0	0	0	2	0	0	0	3	3	4	2	6	1	5	0	1	0	0	0	0	0	27
April	0	0	0	0	0	0	1	0	0	0	0	4	9	2	6	3	3	2	0	0	0	0	0	0	30
May	1	0	0	0	0	0	0	0	0	0	1	2	4	5	4	6	5	1	1	0	0	0	0	0	30
June	0	0	0	1	0	0	0	1	0	0	0	1	1	5	3	3	5	2	3	0	0	1	0	0	26
July	0	0	0	0	0	0	0	0	0	1	3	0	4	6	4	2	1	5	1	1	1	0	0	0	29
August	0	0	0	0	0	0	0	0	0	1	0	3	5	2	3	7	4	4	0	0	0	0	0	0	29
September	0	0	0	0	0	0	0	0	1	0	2	3	3	4	8	7	2	0	0	0	0	0	0	0	30
October	0	0	0	0	0	0	0	0	0	0	0	2	5	4	8	3	1	0	0	0	0	0	0	0	23
November	0	0	0	0	0	0	0	0	0	0	0	0	3	0	4	1	2	0	0	0	0	0	0	0	10
Months.																									
All	1	0	0	1	0	0	3	5	6	8	19	45	75	85	113	106	68	47	12	3	2	2	0	0	601
Winter	1	0	0	1	0	0	0	1	3	4	9	16	26	38	30	37	29	26	6	2	2	2	0	0	233
Equinoctial	0	0	0	0	0	0	3	0	1	2	8	23	34	33	48	34	22	13	2	0	0	0	0	0	223
Summer	0	0	0	0	0	0	0	4	2	2	2	6	15	14	35	35	17	8	4	1	0	0	0	0	145

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Table LXIX.—Incidence of Daily Minima in S′ (Time of 180° E).

Hour.	0–1	1–2	2–3	3–4	4–5	5–6	6–7	7–8	8–9	9–10	10–11	11–12	12–13	13–14	14–15	15–16	16–17	17–18	18–19	19–20	20–21	21–22	22–23	23–24	Days used.
1911.																									
February	0	2	5	2	0	3	3	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	21
March	5	4	3	4	0	1	4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	6	31
April	4	3	1	1	4	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	7	26
May	1	2	4	5	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	5	3	2	31
June	2	2	1	3	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	4	4	3	26
July	4	3	3	2	7	3	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2	0	4	31
August	3	2	4	2	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	4	6	4	3	31
September	4	1	3	4	1	3	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	4	3	1	25
October	2	4	2	3	2	3	3	2	0	0	0	1	0	0	0	0	0	0	0	0	0	3	2	4	31
November	1	2	5	3	3	3	2	3	0	0	0	0	0	0	0	0	0	0	0	0	0	4	2	2	30
December	1	0	3	2	4	3	7	4	3	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2	31
1912.																									
January	0	4	3	2	4	1	4	5	2	2	0	0	0	0	0	0	0	0	0	0	0	0	1	2	30
February	1	1	2	1	3	2	3	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	23
March	1	2	8	1	1	3	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	2	4	2	27
April	3	3	5	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	4	7	30
May	6	1	1	2	2	3	2	0	0	0	0	0	0	0	0	0	0	0	0	2	4	1	1	5	30
June	8	2	1	5	0	0	1	0	0	1	0	0	0	0	0	0	1	0	0	0	1	2	2	2	26
July	2	2	6	1	3	3	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	5	3	3	29
August	4	2	4	4	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	4	4	29
September	5	0	1	4	0	3	1	1	0	0	0	0	0	0	0	0	0	0	0	1	2	4	1	7	30
October	3	2	2	3	2	3	2	1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	2	1	23
November	2	1	0	0	0	1	3	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	10
Months.																									
All	62	45	67	54	48	44	42	24	11	4	0	1	0	0	0	0	1	0	0	6	19	56	45	72	601
Winter	30	16	24	24	22	14	6	0	1	1	0	0	0	0	0	0	1	0	0	5	15	27	21	26	233
Equinoctial	27	19	25	20	12	17	14	7	1	1	0	1	0	0	0	0	0	0	0	1	4	21	18	35	223
Summer	5	10	18	10	14	13	22	17	9	2	0	0	0	0	0	0	0	0	0	0	0	8	6	11	145

Table LXX.—Incidence of Daily Maxima in V (Time of 180° E).

Hour.	0–1	1–2	2–3	3–4	4–5	5–6	6–7	7–8	8–9	9–10	10–11	11–12	12–13	13–14	14–15	15–16	16–17	17–18	18–19	19–20	20–21	21–22	22–23	23–24	Days used.
1911.																									
February	4	2	2	1	1	2	1	0	1	1	1	0	0	0	1	0	1	1	0	0	0	0	0	3	22
March	7	1	1	0	1	2	0	0	0	5	1	0	0	0	1	0	2	1	0	2	2	1	3	1	31
April	4	2	3	0	1	1	0	2	0	0	0	0	0	0	0	0	0	0	0	1	5	1	1	5	26
May	4	2	2	4	0	0	0	0	0	1	0	0	0	0	0	1	1	1	4	1	4	0	1	5	31
June	6	2	0	1	2	0	0	0	1	0	0	0	0	0	0	0	1	4	1	3	1	0	1	4	27
July	6	1	0	3	1	1	0	0	1	0	0	0	0	0	0	0	0	2	1	4	2	3	4	1	30
August	5	3	2	1	0	0	0	0	0	1	0	0	0	0	0	1	0	0	1	2	4	4	4	3	31
September	7	2	0	0	0	0	0	0	0	2	1	1	0	0	0	0	0	0	1	0	0	1	4	5	24
October	3	2	2	3	2	0	1	2	0	4	1	0	0	0	0	0	0	0	0	0	2	0	1	5	28
November	5	3	3	1	1	3	1	1	5	1	0	0	0	0	0	0	0	0	0	0	0	0	2	3	29
December	4	3	3	2	3	2	1	1	1	1	2	1	0	0	0	0	0	0	0	0	0	1	0	6	31
1912.																									
January	2	2	4	4	4	2	1	0	1	5	0	1	0	0	0	0	0	0	0	1	0	0	1	2	30
February	2	2	0	4	4	2	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0	1	0	4	23
March	6	1	1	3	2	0	2	0	3	1	2	0	0	0	0	0	0	0	0	0	0	1	2	4	28
April	8	2	5	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	4	6	30
May	6	0	3	3	1	0	0	0	0	0	1	0	0	0	0	0	1	2	1	2	2	4	1	3	30
June	1	4	2	2	0	0	0	0	0	0	0	0	0	0	0	1	1	0	4	3	2	4	2	2	28
July	2	3	2	2	3	0	0	0	0	0	0	0	0	0	1	0	0	3	0	3	4	2	1	3	29
August	6	2	1	1	2	0	0	0	1	1	0	0	0	0	0	0	2	0	1	2	2	2	1	5	29
September	10	0	3	1	0	0	0	0	4	1	0	1	0	0	0	0	0	0	1	0	2	2	1	4	30
October ...	2	4	1	1	3	0	0	2	2	2	0	1	0	0	0	0	0	0	0	1	1	0	1	3	24
November	3	3	0	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	10
Months.																									
All	103	46	40	39	31	15	8	8	21	29	11	5	0	0	3	3	9	14	15	26	35	27	35	78	601
Winter	36	17	12	17	9	1	0	0	3	3	1	0	0	0	1	3	6	12	13	20	21	19	15	26	235
Equinoctial	47	14	16	9	9	3	4	6	9	15	5	3	0	0	1	0	2	1	2	5	14	6	17	33	221
Summer	20	15	12	13	13	11	4	2	9	11	5	2	0	0	1	0	1	1	0	1	0	2	3	19	145

TABLE LXXI.—Incidence of Daily Minima in V (Time of 180° E).

Hour.	0–1	1–2	2–3	3–4	4–5	5–6	6–7	7–8	8–9	9–10	10–11	11–12	12–13	13–14	14–15	15–16	16–17	17–18	18–19	19–20	20–21	21–22	22–23	23–24	Days used.
1911.																									
February	0	0	0	0	0	0	0	0	4	2	3	8	3	0	1	1	0	0	0	0	0	0	0	0	22
March	0	0	0	0	0	0	2	4	0	1	7	5	5	4	1	1	1	0	0	0	0	0	0	0	31
April	0	0	0	0	0	0	0	1	1	5	6	4	3	3	1	1	0	0	0	0	0	0	0	1	26
May	0	0	0	0	0	1	0	2	4	3	7	5	5	3	0	1	0	0	0	0	0	0	0	0	31
June	0	0	0	0	0	0	0	6	3	5	4	3	3	2	0	0	1	0	0	0	0	0	0	0	27
July	0	0	0	0	0	0	0	2	6	7	9	2	0	3	0	0	0	0	0	0	1	0	0	0	30
August	0	0	0	0	0	1	2	0	3	1	6	9	4	2	2	0	0	0	1	0	0	0	0	0	31
September	0	0	0	0	0	0	0	2	2	2	3	3	4	2	4	1	1	0	0	0	0	0	0	0	24
October	0	0	0	0	0	0	0	1	1	8	1	5	5	3	2	1	1	0	0	0	0	0	0	0	28
November	0	0	0	0	0	1	2	2	1	2	5	6	3	5	1	1	0	0	0	0	0	0	0	0	29
December	1	0	0	1	0	0	0	3	1	3	4	5	5	1	5	2	0	0	0	0	0	0	0	0	31
1912.																									
January	0	0	0	0	0	0	1	1	1	3	8	5	2	4	3	2	0	0	0	0	0	0	0	0	30
February	0	0	0	0	0	0	1	0	0	4	6	4	4	2	1	1	0	0	0	0	0	0	0	0	23
March	0	0	0	0	0	1	0	0	0	4	3	8	4	4	3	1	0	0	0	0	0	0	0	0	28
April	0	0	0	0	0	0	0	0	0	2	6	7	10	2	1	2	0	0	0	0	0	0	0	0	30
May	0	0	0	0	0	1	0	2	2	10	2	6	5	1	0	1	0	0	0	0	0	0	0	0	30
June	0	0	0	1	1	0	0	3	2	5	2	6	4	4	0	0	0	0	0	0	0	0	0	0	28
July	0	0	0	1	0	0	1	1	3	7	8	1	2	3	1	1	0	0	0	0	0	0	0	0	29
August	0	0	0	0	0	1	1	0	1	3	6	0	10	2	4	1	0	0	0	0	0	0	0	0	29
September	0	0	0	0	0	0	0	0	1	2	8	10	6	1	1	1	0	0	0	0	0	0	0	0	30
October	0	0	0	0	0	0	0	1	0	1	5	1	9	1	4	1	0	1	0	0	0	0	0	0	24
November	0	0	0	0	0	0	0	1	0	1	4	2	0	0	1	1	0	0	0	0	0	0	0	0	10
Months.																									
All	1	0	0	3	1	6	10	32	36	81	113	105	96	52	36	21	4	1	1	0	1	0	0	1	601
Winter	0	0	0	2	1	4	4	16	24	41	44	32	33	20	7	4	1	0	1	0	1	0	0	0	235
Equinoctial	0	0	0	0	0	1	2	9	5	25	39	43	46	20	17	9	3	1	0	0	0	0	0	1	221
Summer	1	0	0	1	0	1	4	7	7	15	30	30	17	12	12	8	0	0	0	0	0	0	0	0	145

Table LXXII.—Frequency of Max.—Min. and Inequality Data as Percentages.

Hour (Time of 180° E).	E′		S′		V	
	Max.—Min.	Inequality.	Max.—Min.	Inequality.	Max.—Min.	Inequality.
1	+18	+14	−110	−131	+178	+147
2	+4	−11	−118	**−138**	+105	+147
3	−14	−34	−126	−132	+92	+121
4	−24	−55	−106	−125	+80	+86
5	−40	−83	−98	−110	+48	+45
6	−80	−106	−88	−89	+9	+2
7	−119	−120	−61	−57	−31	−27
8	−172	−131	−25	−23	−47	−47
9	**−232**	−145	−1	+10	−81	−53
10	−212	**−152**	+24	+41	−187	−87
11	−148	−142	+66	+86	**−246**	−142
12	−90	−113	+125	+115	−238	−170
13	−47	−80	+168	+150	−180	**−181**
14	−16	−28	+207	+177	−103	−173
15	+30	+36	**+230**	**+182**	−62	−147
16	+100	+97	+182	+171	−16	−108
17	+165	+143	+120	+137	+22	−54
18	+188	+163	+62	+93	+33	−12
19	**+210**	**+181**	+10	+34	+49	+29
20	+196	+173	−21	−11	+73	+67
21	+137	+150	−75	−55	+74	+109
22	+77	+121	−104	−97	+76	+135
23	+39	+77	−123	−111	+136	+153
24	+29	+44	**−138**	−123	**+215**	**+158**

CHAPTER VII.

MAGNETIC "CHARACTER." ITS ANNUAL AND DIURNAL VARIATION. THE "27-DAY PERIOD."

Section 36.—Reference has already been made to the magnetic "character" of days and to the international scheme which supplies an annual table of "character" figures for individual days. In this international scheme "day" means a 24-hour period commencing at Greenwich midnight. It is of course equally easy to attach "character" figures at a station whatever hour one chooses to commence the day with, and as the day of 180° E had been used in the original curve measurements, "character" figures 0, 1, 2 were in the first instance assigned to the Antarctic curves for these days. The results appear in Table LXXIII, p. 145. The letter *i* indicates that the record for the day was sensibly defective and the "character" figure in consequence somewhat uncertain. A few hours' trace may suffice to put beyond a doubt the fact that the day must be given a 2. Generally it is only on comparatively quiet days that loss of trace introduces sensible doubt. It is not unlikely that several of the days marked 1 *i* would have got 2's if the record had been complete. In some days of course the deficiency of trace was such that no "character" figure could satisfactorily be assigned. The provisional figures assigned to incomplete days were accepted equally with those assigned to complete days when calculating the monthly mean "character" figures in the last line of Table LXXIII. These monthly means are greatest for the midsummer and least for the midwinter months. The difference between these two seasons is certainly not exaggerated in the table. One of the principal objects in assigning "character" figures is to discriminate between the days of the same month. The disturbance which leads to 1 being given to a day in a highly disturbed month like February, 1911, might very likely lead to the award of a 2 in a quiet month like July, 1912.

The tendency for days of like "character" to occur in groups is a common phenomenon everywhere. The times of most continuous large disturbance in the Antarctic during 1911 were the beginning of February, March 20–29, April 17–22, August 24–28, September 16–23, October 17–21, November 13–17 and December 17–21. On the whole, 1912 was a much quieter year; but there was a marked recrudescence of disturbance in October and November, the full extent of which it was somewhat difficult to judge owing to interruptions of trace.

The longest sequences of days of "character" 0 occurred in 1912, and included March 17-20, April 23–26, May 21–25, June 18–22, and July 10–15.

For the reason already indicated, days which in a more highly disturbed year like 1911 get a 0 or a 1 are not unlikely in a less disturbed year like 1912 to get a 1 or a 2. Thus the tendency in "character" figures is to make the differences between years appear less than they actually are.

Section 37.—The "character" figures in Table LXXIII were assigned during an early stage of the work. Later the idea suggested itself, partly in connection with the diurnal inequalities, of also assigning "character" figures to days starting at Greenwich midnight. The two sets of "character" figures were assigned quite independently, a considerable interval of time intervening. Table LXXIV, p. 146, contains the later set of figures, and includes within parentheses, for comparison, the corresponding international figures given in the De Bilt lists. As in Table LXXIII, *i* indicates that the records for the day were sufficiently incomplete to render the result a little doubtful.

It is hardly necessary to explain that the international lists were not consulted until all the Antarctic figures had been assigned. The international figures represent the arithmetic means of the figures assigned at the numerous observatories which support the international scheme. A point to be duly remembered is that the majority of these stations lie to the north of the tropics, and that only two or three are situated south of the equator. Thus we should not expect much parallelism between the two sets of figures unless a somewhat close connection exists between disturbance in Northern and in extreme Southern latitudes. A general inspection suffices to show that the parallelism is in reality pretty close, but there are a few days of considerable Antarctic disturbance when the international figure is low. A few hours of large disturbance suffice for the award of a 2, and as will be seen later, when dealing with individual disturbances, some short period disturbances appeared in the Antarctic of which there was little or no trace elsewhere. There is, however, hardly an instance of considerable disturbance occurring elsewhere on what was a quiet day in the Antarctic. August 6, 1912, appears an exception to this rule, because the "character" figure assigned to the Antarctic curves is only 1, while the international figure 1·7 represents a very disturbed day indeed. As a matter of fact, a large number of hours' trace was lacking in the Antarctic, and any award was perhaps hardly warranted.

It will be observed that the periods in March, April, August, September, October and November, 1911, which were selected for mention as particularly disturbed on the strength of the Antarctic "character" figures in Table LXXIII, are periods which show in Table LXXIV a sequence of high international "character" figures. The international figures for the beginning of February, 1911, are less prominent while still substantial, but those for December 17–22, 1911—the last mentioned disturbed period in the Antarctic—are rather below than above the mean for that month. There is, as we shall see presently, less parallelism between the disturbance in the Antarctic and in Europe during the Antarctic midsummer—*i.e.*, the European midwinter—than at other seasons. This is not very surprising when we remember that midwinter is magnetically the quietest season in both hemispheres.

The sequence of days of character 0 in 1912 mentioned when discussing Table LXXIII are, it will be seen, all times of low international "character" figures.

The award of international "character" figures to the 114 Greenwich days to which, as Table LXXIV shows, "character" 0 was assigned in the Antarctic had been as follows:—0·0, 28 times; 0·1, 50 times; 0·2, 17 times; 0·3, 14 times; 0·5 once and 0·6, 4 times. Thus on 83 per cent. of the days, when the Antarctic curves were adjudged " character " 0, the international figure did not exceed 0·1, and in 96 per cent. of the days it did not exceed 0·3 ; and 0·3, it will be remembered, is equivalent to 0 being the figure assigned at fully two-thirds of the stations which co-operate with De Bilt.

Section 38.—Table LXXV, p. 147, contains further evidence on this point. It gives the dates of the five days of largest international " character " figure and of the five international quiet days of each month, with the corresponding Antarctic " character " figures. A " — " indicates that owing to deficiency of trace no Antarctic figure was assigned ; this happened on three of the highly disturbed and four of the quiet days. Of the 107 international disturbed days to which Antarctic " character " figures were allotted, no single one got a 0 and only 22 got a 1. In eight of the eleven months of 1911 included every one of the international disturbed days got a 2, and 17 of the 22 international disturbed days which got a 1 came from the quieter year 1912. On 12 of these 17 days the international figure fell short of 1. Of the remaining days one had a 1·0 and three 1·1. One had 1·7, but this was a day on which several hours' Antarctic trace was missing, which may have prejudiced the award of the Antarctic figure.

Of the 106 international quiet days to which Antarctic " character " figures were assigned, 57, or fully the half, got a 0, and only four got a 2. In all four cases the Antarctic curve was near the border line between characters 1 and 2, and three of them occurred in December, 1911, a month in which " character " 0 was assigned only once and " character " 2, 16 times.

Section 39.—Table LXXVI, p. 148, compares the mean of the " character " figures assigned to the Antarctic curves with the corresponding mean international figures for the five disturbed and five quiet days of each month, and for all days of the month. The standard, it should be remembered, is very different at different observatories, and at none probably was it as high as for the Antarctic figures, otherwise the excess of these figures would have been greater than it actually is. As it so happens, in both years, the Antarctic mean figures for all and for quiet days are respectively pretty close to the international mean figures for disturbed and for all days.

The reduction of disturbance in 1912 as compared with 1911 experienced in the Antarctic is also shown clearly in all three sets of international figures.

One rather curious phenomenon in the international data is the close approach to constancy in the mean monthly figures from November, 1911, to November, 1912, inclusive ; they show no trace of a regular seasonal variation. The Antarctic mean monthly figures on the other hand, in 1912 as in 1911, show clearly the marked rise in disturbance which undoubtedly presented itself there in the midsummer months.

It is rather interesting to compare the Antarctic mean monthly figures in Table LXXVI with the corresponding figures obtained independently from days of the time of 180° E. in Table LXXIII. There is absolute agreement in only one month, April, 1912, but the average numerical difference between the character figures for the same month in the two tables is only 0·06, and the mean from the whole 22 months is 1·126 from Table LXXVI and 1·129 from Table LXXIII. This is certainly a closer agreement than the indefiniteness of the criteria applied would have led us to expect.

Section 40.—International "character" figures and the "character" figures assigned at Kew Observatory alone have alike proved excellent material for the elucidation of the "27-day period" in magnetic disturbance. It thus seemed desirable to ascertain whether the Antarctic "character" figures would serve the same purpose. The results of this investigation appear in Tables LXXVII, LXXVIII and LXXIX, pp. 148 and 149. By n is meant a representative day, whether one of the five monthly days representing the presence of disturbance, or one of the five international quiet days representing the absence of disturbance. For the investigation embodied in Table LXXVII, 1911 supplied 55 days of either type, and 1912 supplied 49. Of these 104 days, 40 belonged to the winter, 39 to the equinoctial and 25 to the summer months.

Taking for illustration the 55 representative disturbed days of 1911, the sum of the "character" figures allotted to the Antarctic curves on these days amounted to 106. The sum for the 55 days which immediately preceded them, amounting to 76, appears in the column headed $n - 1$; while the sum for the 55 days which immediately followed the selected days, viz., 98, appears in the column headed $n + 1$. The 55 days which followed the 55 selected days after an interval of 28 days had 90 for the sum of their "character" figures, and this appears in the column headed $n + 28$. Columns $n - 2$ to $n + 2$ suffice to give a good idea of the "primary pulse" of disturbance, and columns $n + 25$ to $n + 30$ give a correspondingly good idea of the "secondary pulse."

Disturbed days often occur in groups. If this were not the case, there would be no reason to expect specially high values in the columns $n - 2$, $n - 1$, $n + 1$ and $n + 2$. If the position in the group of the more highly disturbed of the days composing it were wholly accidental, we should expect closely similar entries in the columns $n - 1$ and $n + 1$, and again in the columns $n - 2$ and $n + 2$. Unless the groups of disturbed days are very long, we may expect the entries in columns $n - 2$ and $n + 2$ to show a marked decline as compared with those in columns $n - 1$ and $n + 1$. To get very smooth results we require the combination of a good many years' data, and it is possible that the unusually asymmetrical character of the primary disturbance pulse in Table LXXVII may be wholly accidental. However that may be, the entries in the column $n + 1$ are exceptionally high as compared with those in column $n - 1$. This may perhaps be the reason why the secondary disturbance pulse in its turn is a little asymmetrical. In the results for the two years combined the maximum values fall in columns $n + 27$ and $n + 28$, but the entry in column $n + 29$ is very little behind. The secondary pulse is undoubtedly very clearly shown.

The primary pulse given by the quiet day data is more symmetrical, and the same is true of the corresponding secondary pulse. The last six lines of Table LXXVII refer to the difference pulses obtained by subtracting quiet day data from corresponding disturbed day data. For instance, the sums of the "character" figures in the 55 selected disturbed days of 1911 and in the 55 selected quiet days of that year were respectively 106 and 35. The difference of these figures, 71, is accordingly the entry under day n

for the difference pulse. These difference pulses are given for the three seasons as well as for the year. The secondary pulse is clearly shown for the separate seasons, though the number of days available especially for summer was undesirably small.

The existence of a secondary pulse with its maximum in the column $n + 27$ means that the 27th day after a highly disturbed or a specially quiet day has a tendency to be of the same type. This peculiarity is shared, but to a minor extent, by days which are adjacent to the 27th and 28th days. The phenomenon is what we should get if magnetic storms and specially quiet times both tended to return after an interval of about 27 days. The more often the return came off the more prominent would be the secondary pulse.

If storms and quiet times tend to recur, a certain proportion of the selected days whether disturbed or quiet would naturally represent the second or third appearance of the phenomenon, and we may thus expect the 27-day period to manifest itself when we consider days before instead of days after the selected disturbed and quiet days. Table LXXVIII shows the realization of this anticipation.

Selected days from February, 1911, could obviously not be used for Table LXXVIII because January data would have been required for the previous pulse, and equally selected days from November and part of October, 1912, could not be used in Table LXXVII because the data for columns $n + 27$, &c., would not have been available. Still the primary pulses in the two cases were sufficiently alike to make it unnecessary to include a primary pulse in Table LXXVIII. The secondary pulse appears as clearly in Table LXXVIII as it did in Table LXXVII. Its crest appears on day $n - 26$.

To enable comparison to be readily made between the results for the 27-day period derived from the Antarctic " character " figures and those obtained for 1911 and 1912 from the international " character " figures, the entries in all the columns were expressed as percentages of the corresponding entry in column n. The results appear in Table LXXIX.

The quantity dealt with is the excess of the sum of the " character " figures for the disturbed and associated days over the corresponding sum for the quiet and associated days. For instance, in the case of the two years combined, the excesses of the disturbed day results in columns $n - 1$, n and $n + 1$ of Table LXXVII over the corresponding quiet day results are respectively 45, 136 and 93. Now $(45/136) \times 100$ is 33, while $(93/136) \times 100$ is 68. Thus 33, 100 and 68 are the entries in columns $n - 1$, n and $n + 1$ in Table LXXIX.

The international " character " figures are on the average so much smaller than the Antarctic figures that it is only by expressing the results as percentages in the above way that we can readily recognise whether the development of the 27-day period in the Antarctic is similar to its development elsewhere. So far as two years can justify a conclusion, we should infer from Table LXXIX that the development in the Antarctic is normal.

Section 41.—The extension of the " character " figure scheme to individual hours is a useful idea due to the late Prof. Bidlingmaier, who applied it to one or two years curves at Wilhelmshaven. It is naturally very laborious and this must stand in the way of its frequent adoption. It seemed, however, a very appropriate method for dealing with the question whether the incidence of disturbance throughout the day presented any outstanding features in the Antarctic. For this purpose it was desirable to apply a corresponding treatment to the contemporaneous records of some European observatory. Use might have been made of Prof. Bidlingmaier's own results for Wilhelmshaven, but it might then have been open to doubt whether personal equation had not contributed to any differences that might have presented themselves. It thus appeared the best course to assign hourly " character " figures myself to the Antarctic curves and the corresponding Eskdalemuir curves. Kew curves would more naturally have appealed to me, but owing to local artificial disturbances they were unsuitable for the purpose.

Hourly " characters " suffer from the same sources of uncertainty as daily " characters." They give no exact numerical measure of disturbance, and as a principal object is to discriminate between the different hours in the same day or month, the standard is almost certain to be different in seasons when disturbances are large and numerous and in seasons when they are few and small. But hourly " character " figures are exposed to an additional source of uncertainty, viz., the influence exerted on one's choice by the ordinary diurnal variation. At certain hours of the day the diurnal changes are normally rapid, and the curves show considerable movements. At other hours the diurnal variation is almost imperceptible, the curves normally being nearly straight lines parallel to the base line. It is much easier in the latter case to appreciate the full extent of disturbance.

In assigning the " character " figure I was guided mainly by the presence or absence of irregular oscillations. Changes of a regular character reasonably assignable to the regular diurnal variation were disregarded. The Antarctic sheets show the simultaneous variation of the three elements, and one's judgment is determined by the joint impression produced at one and the same time by the three traces. The time lines extending right across the sheet, which Dr. Simpson introduced, facilitated the concentration of one's attention on the individual hour under consideration. The Eskdalemuir curves were not so easily dealt with. There, as at the ordinary European station, V is much less disturbed than the components in the horizontal plane. At times, it is true, V at Eskdalemuir shows very large disturbance, but when this happens the other elements are also highly disturbed—though the converse is not equally true. Thus for our present purpose the V traces need hardly be considered. The plan adopted was to go through the Eskdalemuir N and W sheets quite independently, allotting " character " figures 0, 1, 2 to each. If the figures allotted to N and W for any particular hour were the same, that figure was at once accepted. If the figures differed, the N and W traces —and occasionally in case of doubt the V trace also—were juxtaposed, and a decision was come to. Of course large disturbance in a single element was accepted as decisive for a 2, but there was a large number of cases in which the choice was very doubtful, as between a 2 and a 1, or as between a 1 and a 0. The curves of 22 months at two observatories supply records for over 30,000 hours, and it was obvious that if the work were to be done at all within a reasonable time, judicial niceties must be foresworn and decisions taken promptly. No doubt a certain number of the decisions reached would have been upset on careful re-consideration, but the only hour likely to be sensibly prejudiced was that in which the photographic sheets were changed. If part of a particular hour's trace is on one sheet, and part on another—a few minutes' trace being necessarily absent—the impression produced by disturbance may differ from what it would have been if the trace had existed as an uninterrupted whole. The time of changing sheets was much more variable in the Antarctic than at Eskdalemuir, thus this special source of uncertainty would be most likely to be felt at the latter station.

Table LXXX, p. 150, shows for each of the 22 months from February, 1911, to November, 1912, the mean of the hourly " character " figures awarded to the Antarctic curves. The entry under 1 h., for instance, is the mean " character " figure allotted in each day of the month to the sixty minutes ending 1 h. 0 m., the time being that of 180° E. Long. It seemed desirable to employ the same time as for the tabulated hourly values. The mean hourly values from the 11 months of 1911 and the 11 months of 1912 are given separately. In the last column we have for each month the mean of the 24-hourly mean values. There is no *a priori* reason to expect any very close similarity between these monthly mean character figures and those given in Tables LXXIII and LXXVI which are based on whole day " character " figures. One or two highly disturbed hours secure a 2 for the day in which they appear, and no higher figure can be awarded though the whole 24 hours are equally highly disturbed. Thus two months having the same number of days of " character " 2 might differ widely as to the number of hours of " character " 2. Still there is considerable parallelism between the monthly means in Tables LXXIII and LXXX. In both the largest character figures appear in the summer, and the smallest in the winter months. Also February, 1911, supplies the largest, and July, 1912, the smallest figure.

Each of the two 11-month means in Table LXXX shows a well-marked diurnal variation in the " character " figure. Both give a maximum in the forenoon at 9 h. or 10 h., and a minimum near 24 h. There is no very marked variation in the " character " from 6 p.m. to 3 a.m., and it would require a longer period of years to show clearly the exact hour of the minimum. But the rise to the forenoon maximum and the decline after it are pretty rapid. There are very sensible irregularities in the data for individual months, but in most a diurnal variation of the same general character as that shown by the 11-month data is clearly recognisable.

Table LXXXI, p. 151, gives the corresponding data for Eskdalemuir. The standard of disturbance applied to the Eskdalemuir curves was not nearly so high as that applied to the Antarctic curves, yet the monthly mean values for Eskdalemuir average only about 60 per cent. of those for the Antarctic. The lowest monthly means in the last column of Table LXXXI appear at midwinter, 1911–12. The relatively large value in February, 1911, arises from the fact that February preceded the rapid decline in disturbance which set in during 1911. The 11-month means in Table LXXXI show also a decided diurnal variation, but in this case it is the minimum which appears in the morning, while the maximum occurs in the afternoon. To fix the exact hours of maximum and minimum with high precision would require data from a considerable number of years. The existence of a marked diurnal variation in disturbance is of practical importance in connection with the hours of the absolute observations, because when the curves are highly disturbed at the time absolute observations are somewhat uncertain guides to the base line values.

Section 42.—A high mean " character " figure may result from a prevalence of 2's or a scarcity of 0's, or from a combination of both causes. It thus appeared desirable to consider separately the incidence of 2's and 0's. Tables LXXXII and LXXXIII, pp. 152 and 153, give for each month the number of occasions when 2's were awarded at each of the 24 hours in the Antarctic and at Eskdalemuir. Consider, for instance, the results for February, 1911, in Table LXXXII. The number of days' trace available was 26, so the largest possible number of 2's in any single hour of the day was 26. The number actually assigned varied from 25 for the hour ending at 10 h. to 5 for the hour ending at 20 h. The average number was 17·0, or fully 65 per cent. of the possible. Due regard must be held to the number of days available. The comparatively small number of 2's for November, 1912, in Table LXXXII arises from the fact that only nine days' traces were complete. If there had been 30, the mean number of 2's would have been greater than for any month except February, 1911. The frequency of 2's is obviously greatest in summer and least in winter, just as with the mean " character " figures. Taking the year as a whole, 20 per cent. of the hours got a 2, but the percentage varied from 65 in February, 1911, to 7 in July, 1912. The 11-month sums in Table LXXXII show a diurnal variation of the same general type as the " character " figures in Table LXXX, but considerably intensified. In both years the maximum frequency of 2's appears in the hour ending 10 h., and the minimum in the hour ending 20 h., but it would require a large number of years to determine the exact position of the minimum with certainty. The figures from 16 h. to 5 h. are too irregular for the drawing of conclusions. It is obvious that the forenoon hours from 8 a.m. to noon in the Antarctic, especially at midsummer, are much more unfavourable for the taking of absolute observations than the afternoon hours. The Antarctic observers had thus excellent reasons for preferring the latter.

Table LXXXIII, p. 153, shows in like manner the frequency distribution of 2's at Eskdalemuir. The number of 2's awarded in the 22 months was 1,302, or 8·2 per cent. of the possible, a much smaller percentage than in the Antarctic. In January and February, 1912, little over 2 per cent. of the hours got 2's. In spite of the comparatively small number of 2's in Table LXXXIII a diurnal variation in their distribution is clearly shown in both 11-month sums. As in the case of the Antarctic, it is generally similar to the diurnal variation shown by the mean " character " figures. It is, however, more intensified, and the maximum seems somewhat later in the day. The frequency of 2's during any afternoon hour subsequent to 15 h. is large compared with that of any forenoon hour after 5 h. The risk of encountering a highly-disturbed hour during the absolute observations is obviously small if the observations are confined to the forenoon. The forenoon, however, has certain compensating disadvantages, viz., the rapidity of the regular magnetic changes encountered between 8 h. and 12 h., and in the case of H observations the rise of temperature.

Table LXXXIV, p. 154, shows the incidence of " character " 0 throughout the day in the Antarctic. The total number of hours awarded a " 0 " during the 22 months was 3,644, or 25 per cent. of the possible. There were more 0's than 2's in both years, the excess being considerable in 1912. As we should naturally expect, the 0's show opposite phenomena to the 2's. They are most numerous in the midwinter months, and least numerous at midsummer. In the 11-month means they show a well-marked maximum of frequency towards midnight, and a well-marked minimum about 9 h. or 10 h.

Table LXXXV, p. 155, gives the incidence of 0's at Eskdalemuir. The number awarded was 7,859, or fully 49 per cent. of the total number of hours. This is fully six times the number of 2's awarded, the preponderance being greater in 1912 than in 1911. In January, 1912, 67 per cent. and in December, 1911, fully 73 per cent. of the hours got 0's. The two 11-month sums show a well-marked diurnal variation. It is not, however, the exact opposite of that shown by the 2's, the minimum frequency in the 0's presenting itself earlier in the afternoon than the maximum in the 2's. The maximum frequency in 0's appears in the forenoon, but the variation shown, especially by the figures for 1912, is not very regular. On the mean of the 22 months the maximum falls in the hour ending 10 h., but the number in the hour ending at 5 h. is but little inferior, and the true nature of the incidence of 0's between 4 h. and 10 h. would require a longer series of years for its elucidation.

Section 43.—A general consideration of Tables LXXX to LXXXV led to the conclusion that while the diurnal variations in the " character " figures for the Antarctic and Eskdalemuir are absolutely dissimilar when regarded as functions of the local time, they present a pretty close parallelism when regarded as synchronous phenomena determined by G.M.T. To bring out this fact, corresponding data referred to G.M.T. are juxtaposed in Table LXXXVI, p. 156. For this purpose the local time of the Antarctic station has been treated as exactly that of 165° E., while it really differs $5\frac{1}{2}$ minutes from this time. The table contains three different sets of data. 1° mean " character " figures ; 2° the number of 2's as percentages of their mean, *i.e.*, expressed in terms of a unit such that the sum of the 24-hourly values amounts to 2,400 ; 3° the number of 0's, similarly expressed as percentages of their mean. Taking first the mean " character " figures we have data for three groups of months and for the year as a whole. Considering the data for the whole year, we observe in the Antarctic a prominent maximum in the hours ending 21 h. and 22 h., and a not very well marked minimum from 8 h. to 12 h. At Eskdalemuir neither maximum nor minimum is sharply defined, there being a high plateau of values from 15 h. to 1 h., and a valley of low values from 4 h. to 10 h. But in both cases we have the division between high and low values showing the same general relation to G.M.T. Taking a mean between the Antarctic and Eskdalemuir figures we obtain a remarkably regular diurnal variation with the maximum in the hours ending at 21 h. and 22 h., and the minimum in the hours ending at 9 h. and 10 h. The remarkable smoothness of this mean variation must owe something to accident, but it is so suggestive of a general law that the possibility seems worth considering.

Of the three groups of months the first represents midsummer in the Antarctic and midwinter at Eskdalemuir, the last midwinter in the Antarctic and midsummer at Eskdalemuir, while the intermediate group includes the equinoctial months at both stations. We should naturally expect most similarity in the equinoctial data. They do show, as a matter of fact, a close parallelism, being in each case pretty similar to the data obtained from the year as a whole. In the four months November to February we have also a prominent diurnal variation at both places, but the maximum seems to occur some two hours later and the minimum some two hours earlier at Eskdalemuir than in the Antarctic. Still the variations are so small in the Eskdalemuir figures near the hours of maximum and minimum that the difference may be accidental. The mean diurnal variation derived from the two stations is again remarkably smooth, with a maximum in the hour ending 21 h., and a minimum in the hour ending 9 h. The final group of months, May to August, show a much less pronounced and regular diurnal variation, especially in the Antarctic. There is at least a suggestion of a double period at both stations. The principal maximum is obviously in the Greenwich afternoon, but it occurs apparently some hours earlier at Eskdalemuir than in the Antarctic. Whether the secondary maximum between 6 h. and 8 h. is a true one is open to doubt, but the fact that it appears at both stations carried some weight. In the Antarctic the principal minimum would seem to occur at this season between 10 h. and 13 h. At Eskdalemuir it is not clear whether it occurs near 10 h. or near 5 h.

In the second set of figures in Table LXXXVI, showing the incidence of the 2's, the diurnal variation in the data for the whole year is somewhat more conspicuous at Eskdalemuir than in the Antarctic. The remarkable depression in the Eskdalemuir figures at 10 h., there is some reason to suspect, may partly arise from the interruption of trace already referred to. On the whole, the parallelism between the two sets of figures is close, and the arithmetic means derived from the two exhibit a very smooth diurnal variation, which is more pronounced than that already described in the "character" figures but of the same general character. Diurnal variations of a closely similar kind, but not so regular, are exhibited by the figures at the two stations for the season November to February and the equinoctial months. In the months May to August the Antarctic figures exhibit a double period, the principal maximum being near midnight as at the other seasons, but a secondary maximum appearing near the time of the usual minimum. The phenomenon seems due to short disturbances of a certain type described in Chapter XI, which show a marked preference for the hours 6 h.–11 h. G.M.T.

The last set of figures in Table LXXXVI show the incidence of 0's. The data for the whole year from the two stations exhibit diurnal variations which, though somewhat irregular, are obviously of the same general character, with a maximum in the (Greenwich) forenoon, and a minimum in the afternoon. In this case the diurnal variation is most prominent in the Antarctic figures. The diurnal variation shown by the arithmetic means of the two sets of figures is only a little less regular than that obtained for the 2's, and is nearly its converse. In the months November to February the Antarctic figures show a diurnal variation similar in its general character to that exhibited by the data for the whole year, but quite extraordinarily pronounced. At that season in the Antarctic a really quiet hour between 17 h. and 23 h. G.M.T. is an extremely rare event. The curves show an almost unbroken succession of irregular short-period oscillations. Even in the Antarctic midwinter there is a decided though much reduced tendency to short-period oscillations at this time of day, and in the equinoctial months it is quite a prominent feature. Thus in the Antarctic 0's are least frequent in the late (Greenwich) evening at all seasons. At Eskdalemuir in May to August 0's are least frequent at an earlier hour in the afternoon.

On the whole, there seems a remarkable similarity between the diurnal variations of disturbance in the Antarctic and at Eskdalemuir when referred to Greenwich mean time, especially in the months which constitute midsummer in the Antarctic. At first sight it may seem absurd to suppose that the diurnal variation of disturbance at a particular station can depend on anything but the local time. It must, however, be remembered that the magnetic poles do not coincide with the earth's axis of rotation, and that disturbance on the earth might be largely dependent on the position of the magnetic poles relative to the sun, especially on the position of that pole which at the time has the sun above its horizon. The solar hour at a magnetic pole might be a determining factor of high importance in regard to disturbance, and thus the maximum of disturbance might be the same, or approximately the same, at remote stations. There is here obviously a field for further enquiry when hourly "character" data become available from a considerable number of stations.

Table LXXIII.—Magnetic "Character" Figures (Days of 180° E).

Date.	1911.											1912.											
	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	—	2	1	1	1	2	1	1	0	2	1	2	1	1	0	1	2	1	2	1	2	1
2	—	1	1	1	1	2	1	1 i	1	1	2	2	1	1	0	1	2	1 i	0	0	1 i	2
3	—	1	1	0	1	2	1	0	1	2	2	1	1	0	1	1	2	0 i	1	0	1	1
4	—	1	1	0	0	1	1	0	1	2	2	1	1	1	1	—	0	2	0	1	1 i	1
5	2	2	1	1	2	1	2	1	1	2	1	1	1	0	1	2	0	2	0	1	1 i	1
6	2	2	0	1	1	0	2	1	1	1	1	2	1	1	2	2	1	1	1 i	1	0	2
7	2	1	0	2	1	2	1	1	1	1	2	0	0	1	1	1	0	1	1 i	1	1	1 i
8	2	1	1	2	1	2	0	0	1	1	1	1	1	2	1	1	2	1	0	1	2	1
9	2	2	2	1	0	2	0	1	2	2	1	1	1	2	0	1	2	1	0	1	2	—
10	1	1	2	1	2	1	1	1	1	2	0	1	1	1	2	1	2	0	1	1	1 i	2
11	1	0	2	2	1 i	2	0	1	2	1	2	1	2	1	1	0	2	0	1	1	1 i	2
12	1	0	1	2	2	2	0	1	2	1	2	1	1	0	1	2	1	0	0	2	2	2
13	1	0	1 i	0	2	1	1	2	1	2	1	2	2	1	0	2	1	0	0	1	1	1
14	2	2	—	1	1	1	1	1	1	2	1	2	1	0	0	2	1	0	1	1	2	—
15	1 i	1	0	2	1	0	1	1	2	2	2	2	1	1	2	1	1	0	1	1	2	—
16	1 i	1	1	2	1	0	2	2	1	2	1	1	1	1	1	0	—	1	0	1	2	2
17	1	1	2	2	1	1	1	2	2	2	2	1	2	0	2	1	—	0	2	0	2	2
18	1	1	2	1	0	2	1	—	2	1	2	2	2	0	1	0	0	1	1	2	1	2
19	1	0	2	2	0	2	0	—	2	1	2	1	1	0	1	0	0	0	2	1	0	2
20	1	2	2	2	1	2	2	2	2	2	2	1	0	0	2	1	0	1	1	1	0	—
21	1	2	2	2	1	1	0	2	2	2	2	1	1	1	0	0	0	1	1	1	1	—
22	2	2	2	2	2	1	0	2	1	1	1	1	0	2	1	0	0	0	2	1	1	—
23	2	2	1	1	2	1	1	2	1	1	2	2	1	1 i	0	0	1	1	2	1	1	—
24	2	2	1	1	2	0	2	1	1	1	1	1	1	1 i	0	0	1	0	1	2	1	—
25	1	2	1	0	0	1	2	1	2	1	1	1	1	0	0	0	1	0	1	2	1	—
26	2	2	1	1	0	0	2	0	2	1	2	0	—	0	0	1	1	1	1	1	1	—
27	2	2	0	2	0	0	2	1	1	1	2	1	—	1	1	0	2	1	1	1	1 i	—
28	2	2	1 i	1	1	2	2	1	1	1	2	1	—	0	0	1	1	1	1	0	2	—
29	—	2	1 i	1	1	2	1	1	1	1	1	2	1 i	1	0	0	1	0	1	1	1	—
30	—	1	2	0	0	1	1	0 i	1	1	1	1	—	1	0	1	1	0	1	1	1	—
31	—	1	—	2	—	2	2	—	1	—	2	1	—	0	—	1	—	1	1	—	1	—
Mean	1·57	1·35	1·21	1·26	0·97	1·26	1·10	1·07	1·33	1·43	1·52	1·23	1·04	0·71	0·73	0·80	1·00	0·61	0·90	1·00	1·19	1·56

TABLE LXXIV.—Magnetic "Character" Figures (Greenwich Days).

Date.	1911.											1912.										
	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	2 (1·0)	2 (1·0)	1 (0·6)	0 (0·1)	1 (0·9)	2 (1·3)	1 (0·2)	1 (0·2)	0 (0·1)	1 (0·0)	2 (0·7)	2 (0·7)	1 (0·1)	1 (0·4)	0 (0·1)	1 (0·1)	2 (1·0)	1 (0·3)	2 (0·9)	1 (0·3)	2 (1·0)	1 (0·4)
2	2 (1·2)	1 (0·4)	1 (0·5)	1 (0·4)	1 (0·1)	2 (0·9)	1 (0·1)	1 (0·1)	1 (0·8)	1 (0·1)	2 (0·1)	1 (0·0)	1 (0·7)	1 (0·1)	0 (0·3)	1 (0·5)	2 (0·8)	– (0·2)	1 (0·3)	0 (0·1)	1 (0·0)	2 (0·5)
3	2 (0·5)	1 (0·8)	1 (0·8)	0 (0·3)	1 (0·1)	2 (0·8)	1 (0·8)	0 (0·0)	0 (0·5)	2 (1·0)	2 (0·2)	1 (0·1)	1 (0·6)	1 (0·6)	1 (0·4)	1 (0·6)	2 (0·8)	1 (0·9)	1 (0·2)	0 (0·6)	1 (0·6)	1 (0·0)
4	2 (0·5)	1 (0·9)	1 (0·8)	0 (0·0)	1 (1·2)	1 (0·7)	1 (0·9)	0 (0·1)	1 (0·3)	2 (0·7)	1 (0·1)	1 (0·3)	1 (0·3)	0 (0·0)	0 (0·3)	1 (0·5)	0 (0·2)	2 (1·3)	0 (0·0)	1 (0·7)	1*i*(0·3)	1 (0·1)
5	2 (0·9)	2 (1·2)	0 (0·1)	1 (0·6)	2 (1·0)	1 (0·4)	2 (0·8)	1 (0·5)	0 (0·0)	2 (0·7)	1 (0·1)	2 (0·7)	0 (0·1)	1 (0·8)	2 (1·3)	2 (1·3)	0 (0·0)	2 (1·2)	1*i*(0·9)	1 (0·5)	1 (0·0)	2 (0·7)
6	2 (0·9)	1 (0·8)	0 (0·2)	1 (0·8)	1 (0·7)	1 (0·6)	1 (0·6)	0 (0·2)	1 (0·2)	1 (0·3)	2 (1·5)	1 (0·3)	1 (0·1)	1 (0·9)	2 (1·0)	1 (0·9)	1 (0·1)	1 (0·7)	1*i*(1·7)	1 (0·4)	1 (0·1)	– (0·6)
7	1 (0·9)	1 (0·6)	1 (0·5)	2 (1·4)	1 (0·3)	2 (1·0)	1 (0·1)	1 (0·3)	1 (0·5)	1 (0·1)	1 (0·5)	1 (0·3)	1 (0·2)	1 (0·9)	1 (0·8)	1 (0·8)	0 (0·6)	1 (0·6)	1 (0·5)	1 (0·1)	2 (0·4)	1 (0·1)
8	2 (0·9)	2 (0·8)	2 (1·5)	2 (0·8)	1 (0·1)	2 (1·0)	0 (0·1)	1 (0·1)	1 (0·8)	2 (0·8)	1 (0·2)	1 (0·3)	1 (0·4)	2 (1·5)	0 (0·1)	1 (0·7)	2 (1·2)	1 (0·5)	0 (0·0)	1 (0·6)	2 (0·3)	1*i*(0·4)
9	1 (0·5)	1 (0·2)	2 (1·7)	1 (0·5)	1 (1·1)	1 (0·2)	0 (0·2)	0 (0·1)	2 (0·9)	2 (1·1)	0 (0·1)	1 (0·4)	1 (0·2)	1 (1·0)	0 (0·1)	0 (0·1)	2 (0·9)	1 (0·1)	1 (0·0)	1 (0·7)	1*i*(0·2)	– (0·8)
10	1 (0·8)	0 (0·1)	2 (1·2)	1 (0·6)	2 (1·2)	1 (0·6)	1 (0·1)	1 (0·6)	2 (1·6)	2 (0·7)	2 (0·6)	1 (0·5)	2 (0·9)	1 (0·9)	2 (1·0)	1 (0·2)	2 (0·9)	0 (0·1	1 (0·3)	1 (0·2)	1*i*(0·4)	2 (1·2)
11	1 (0·4)	0 (0·1)	2 (0·6)	2 (1·0)	1*i*(1·1)	2 (0·7)	0 (0·1)	1 (0·9)	2 (1·5)	1 (0·3)	2 (1·9)	1 (0·8)	1 (0·7)	1 (0·2)	0 (0·1)	0 (0·6)	1 (0·6)	0 (0·0)	0 (0·2)	1 (0·4)	2 (1·2)	2 (1·0)
12	1 (0·3)	0 (0·1)	1 (0·7)	1 (0·3)	2 (0·8)	2 (0·4)	0 (0·1)	1 (0·8)	1 (0·5)	2 (0·8)	1 (0·5)	2 (1·1)	2 (1·0)	1 (0·4)	1 (0·2)	2 (1·3)	1 (0·3)	0 (0·0)	0 (0·0)	2 (0·6)	1 (0·8)	1 (0·0)
13	2 (1·2)	1 (0·5)	– (0·2)	0 (0·1)	2 (0·9)	1 (0·2)	1 (0·8)	2 (0·5)	1 (0·6)	2 (1·7)	1 (0·1)	2 (1·2)	1 (1·1)	1 (0·1)	0 (0·2)	2 (1·4)	0 (0·1)	0 (0·1)	0 (0·0)	1 (0·3)	1 (0·9)	1*i*(0·2)
14	2 (1·1)	2 (0·9)	0 (0·0)	2 (1·2)	1 (0·9)	1 (0·1)	1 (0·1)	1 (0·1)	1 (0·6)	2 (1·4)	2 (0·6)	2 (0·6)	1 (0·3)	1 (0·6)	1 (0·8)	2 (1·0)	1 (0·2)	0 (0·6)	1 (0·5)	1 (0·3)	2 (1·6)	– (1·4)
15	1 (0·3)	1 (0·8)	1 (0·2)	2 (1·6)	1 (0·6)	0 (0·1)	0 (0·2)	1 (0·8)	2 (0·1)	2 (0·9)	1 (0·1)	1 (0·0)	1 (0·2)	1 (0·7)	2 (1·3)	1 (0·3)	0 (0·1)	0 (0·0)	1 (0·4)	0 (0·0)	2 (1·3)	2 (0·8)
16	1 (0·9)	1 (0·6)	2 (1·7)	2 (1·1)	1 (0·4)	1 (0·1)	2 (0·5)	2 (1·1)	1 (0·7)	2 (0·5)	1 (0·1)	1 (0·0)	1 (0·9)	1 (0·2)	2 (1·0)	0 (0·1)	– (0·1)	1 (0·5)	1 (0·4)	1 (0·0)	2 (0·9)	2 (0·9)
17	1 (0·9)	1 (0·1)	2 (1·3)	2 (0·9)	0 (0·1)	1 (1·1)	1 (0·5)	1*i*(0·7)	2 (1·1)	1 (0·7)	2 (1·0)	2 (0·8)	2 (1·0)	0 (0·0)	2 (1·0)	1 (0·2)	0 (0·3)	1 (0·5)	2 (0·9)	2 (1·8)	1 (0·7)	2 (0·6)
18	1 (0·8)	0 (0·0)	2 (1·1)	1 (0·7)	0 (0·0)	2 (1·0)	0 (0·2)	– (0·3)	2 (1·4)	1 (0·1)	2 (0·6)	2 (0·7)	1 (0·6)	0 (0·1)	1 (0·6)	0 (0·2)	0 (0·2)	1 (0·2)	2 (1·0)	2 (1·1)	1 (0·0)	2 (0·4)
19	1 (0·5)	0 (0·2)	2 (0·9)	2 (0·9)	0 (0·0)	2 (1·2)	2 (1·1)	1 (1·0)	2 (0·9)	2 (0·6)	2 (0·1)	1 (0·4)	1 (0·3)	0 (0·0)	1 (0·6)	1 (0·4)	0 (0·1)	0 (0·1)	2 (0·9)	1 (0·4)	0 (0·0)	—
20	0 (0·3)	2 (1·9)	2 (1·0)	2 (0·8)	1 (0·6)	2 (0·5)	1 (0·8)	2 (1·7)	2 (0·7)	2 (0·5)	1 (0·0)	1 (0·5)	1 (0·1)	0 (0·1)	2 (0·5)	0 (0·3)	0 (0·1)	1 (0·7)	1 (0·2)	1 (0·5)	1 (0·7)	—
21	2 (1·8)	2 (1·7)	2 (1·2)	2 (1·0)	2 (1·0)	1 (0·3)	0 (0·3)	2 (1·6)	1 (0·7)	2 (0·2)	2 (0·1)	1 (0·2)	0 (0·1)	1 (0·9)	0 (0·0)	0 (0·2)	0 (0·2)	1 (0·4)	1 (0·6)	1 (0·1)	1 (0·3)	—
22	2 (1·8)	2 (1·2)	1 (1·1)	1 (0·3)	2 (0·8)	1 (0·3)	0 (0·1)	2 (1·1)	1 (0·6)	1 (0·0)	1 (0·0)	2 (1·0)	1 (0·3)	2 (0·8)	1 (0·1)	0 (0·1)	1 (0·6)	0 (0·1)	2 (1·1)	1 (0·7)	1 (0·4)	—
23	2 (1·3)	2 (1·4)	1 (0·8)	1 (0·6)	2 (0·9)	1 (0·1)	2 (1·8)	2 (0·9)	1 (0·1)	1 (0·0)	2 (0·1)	1 (0·3)	1 (0·8)	– (0·1)	0 (0·3)	0 (0·1)	1 (0·9)	1 (0·1)	2 (0·9)	1 (0·9)	1 (0·3)	—
24	2 (1·1)	1 (1·1)	2 (0·7)	0 (0·3)	1 (0·2)	1 (0·8)	2 (1 4)	1 (0·2)	2 (0·7)	1 (0·1)	1 (0·1)	1 (0·5)	1 (0·9)	1 (0·0)	0 (0·2)	0 (0·3)	1 (0·6)	0 (0·0)	1 (0·4)	2 (1·6)	1 (0·2)	—
25	1 (1·0)	2 (1·2)	1 (0·3)	1 (1·0)	0 (0·0)	0 (0·1)	2 (1·1)	0 (0·0)	2 (0·7)	1 (0·5)	2 (0·8)	1 (0·1)	1 (0·7)	0 (0·1)	0 (0·3)	0 (0·1)	0 (0·2)	1 (0·3)	1 (0·3)	1 (0·3)	1 (0 3)	—
26	2 (0·9)	2 (1·2)	1 (0·2)	1 (0·8)	0 (0·0)	0 (0·1)	2 (1·1)	1 (0·1)	1 (0·3)	1 (0·3)	2 (1·2)	1 (0·0)	– (1·1)	1 (0·6)	0 (0·1)	1 (0·1)	1 (0·2)	1 (0·7)	1 (0·1)	1 (0·6)	1 (0·0)	—
27	2 (1·1)	2 (1·2)	0 (0·3)	2 (0·5)	0 (0·1)	1 (0·4)	2 (0·9)	1 (0·5)	1 (0·4)	1 (0·1)	2 (0·8)	0 (0·1)	– (0·1)	1 (0·0)	1 (0·2)	0 (0·2)	2 (0·8)	1 (0·8)	1 (0·8)	0 (0·0)	1 (0·3)	—
28	2 (1·2)	2 (1·1)	1 (0·8)	1 (0·6)	1 (0·7)	2 (1·6)	2 (0·8)	1 (0·2)	1 (0·0)	1 (0·1)	1 (0·5)	2 (0·5)	– (0·3)	1 (0·7)	0 (0·1)	1 (0·0)	1 (0·9)	0 (0·1)	1 (0·7)	0 (0·0)	2 (0·7)	—
29	—	2 (1·0)	1 (0·5)	1 (0·4)	1 (0·2)	2 (1·1)	1 (0·1)	0 (0·1)	1 (0·6)	1 (0·2)	1 (0·1)	1 (0·1)	0 (0·2)	1 (1·1)	0 (0·1)	1 (0·8)	1 (0·8)	0 (0·0)	1 (0·4)	1 (0·2)	1 (0·1)	—
30	—	1 (0·5)	2 (1·2)	1 (1·0)	0 (0·3)	1 (1·0)	1 (0·2)	0 (0·1)	1 (0·1)	1 (0·2)	1 (0·3)	1 (0·3)	—	1 (0·1)	0 (0·3)	1 (0·6)	1 (0·3)	1 (0·3)	1 (0·3)	1 (0·3)	1 (0·2)	—
31	—	1 (0·7)	—	2 (1·1)	—	2 (0·4)	2 (0·9)	—	2 (0·1)	—	2 (0·9)	1 (0·1)	—	0 (0·1)	—	1 (0·8)	—	1 (1·1)	1 (0·3)	—	1 (0·1)	—

Table LXXV.—Antarctic "Character" Figures on International Disturbed and Quiet Days.

Month.	Dates of the 5 Disturbed Days.					Dates of the 5 Quiet Days.					Antarctic "Character" Figures. On the 5 Disturbed Days.					Antarctic "Character" Figures. On the 5 Quiet Days.				
1911.																				
February ...	2	13	21	22	23	11	12	15	19	20	2	2	2	2	2	1	1	1	1	0
March ...	20	21	23	25	26	10	11	12	17	18	2	2	2	2	2	0	0	0	1	0
April ...	8	9	16	17	30	5	13	14	15	26	2	2	2	2	2	0	—	0	1	1
May... ...	7	14	15	16	31	1	4	13	22	24	2	2	2	2	2	0	0	0	1	0
June ...	4	5	9	10	11	3	17	18	19	25	1	2	1	2	1	1	0	0	0	0
July... ...	1	17	19	28	29	13	14	15	16	26	2	1	2	2	2	1	1	0	1	0
August ...	19	23	24	25	26	7	8	10	11	29	2	2	2	2	2	1	0	1	0	1
September ...	16	19	20	21	22	2	3	14	25	26	2	1	2	2	2	1	0	1	0	1
October ...	9	10	11	17	18	1	5	15	23	28	2	2	2	2	2	0	0	2	1	1
November ...	3	9	13	14	15	1	7	22	23	24	2	2	2	2	2	1	1	1	1	1
December ...	6	11	17	26	31	2	9	21	22	23	2	2	2	2	2	2	0	2	1	2
1912.																				
January ...	11	12	13	17	22	2	15	16	26	27	1	2	2	2	2	1	1	1	1	0
February ...	12	13	16	17	26	5	6	15	20	21	2	1	1	2	—	0	1	1	1	0
March ...	7	8	9	21	29	4	17	18	19	24	1	2	1	1	1	0	0	0	0	1
April ...	5	6	10	15	16	1	8	11	21	28	2	2	2	2	2	0	0	0	0	0
May... ...	5	6	12	13	14	1	16	22	23	26	2	1	2	2	2	1	0	0	0	1
June ...	1	8	9	10	28	5	6	15	19	20	2	2	2	2	1	0	1	0	0	0
July... ...	3	4	5	27	31	10	11	12	15	24	1	2	2	1	1	0	0	0	0	0
August ...	5	6	18	19	22	4	8	12	13	26	1	1	2	2	2	0	0	0	0	1
September ...	4	17	18	23	24	2	15	16	27	28	1	2	2	1	2	0	0	1	0	0
October ...	1	11	13	14	15	2	5	18	19	31	2	2	1	2	2	1	1	1	0	1
November ...	10	11	14	16	22	3	12	21	29	30	2	2	—	2	—	1	1	—	—	—

TABLE LXXVI.—International and Antarctic "Character" Figures. Mean Monthly Values.

Month.	1911.						1912.					
	International "Character" Figures.			Antarctic "Character" Figures.			International "Character" Figures.			Antarctic "Character" Figures.		
	Dist. Days.	All Days.	Quiet Days.	Dist. Days.	All Days.	Quiet Days.	Dist. Days.	All Days.	Quiet Days.	Dist. Days.	All Days.	Quiet Days.
January ...	—	—	—	—	—	—	0·98	0·42	0·02	1·8	1·26	0·8
February ...	1·46	0·89	0·36	2·0	1·54	0·8	1·02	0·49	0·12	1·5	1·00	0·6
March	1·48	0·78	0·08	2·0	1·26	0·2	1·08	0·45	0·02	1·2	0·83	0·2
April	1·48	0·76	0·14	2·0	1·28	0·5	1·12	0·45	0·08	2·0	0·73	0·0
May	1·28	0·70	0·16	2·0	1·23	0·2	1·18	0·47	0·10	1·8	0·77	0·4
June	1·12	0·53	0·04	1·4	1·00	0·2	0·98	0·47	0·08	1·8	0·86	0·2
July	1·26	0·61	0·12	1·8	1·32	0·6	1·06	0·41	0·02	1·4	0·70	0·0
August ...	1·30	0·53	0·10	2·0	1·06	0·6	1·12	0·49	0·02	1·6	1·03	0·2
September ...	1·30	0·50	0·06	1·8	0·97	0·6	1·22	0·47	0·02	1·6	0·97	0·2
October ...	1·30	0·59	0·06	2·0	1·26	0·8	1·20	0·46	0·02	1·8	1·23	0·8
November ...	1·42	0·49	0·04	2·0	1·47	1·0	1·06	0·45	0·00	2·0	1·53	1·0
December ...	1·30	0·45	0·08	2·0	1·48	1·4	—	—	—	—	—	—
Means	1·34	0·62	0·11	1·91	1·26	0·63	1·09	0·46	0·04	1·68	0·99	0·40

TABLE LXXVII.—Antarctic "Character" Figures. Sums on Selected and Associated Days.

Day.	$n-2$	$n-1$	n	$n+1$	$n+2$	$n+25$	$n+26$	$n+27$	$n+28$	$n+29$	$n+30$
Disturbed and associated days—											
1911 (55 days) ...	55	76	106	98	88	63	72	83	90	85	76
1912 (49 „) ...	44	58	81	72	53	48	55	64	57	56	45
Total (104 days) ...	99	134	187	170	141	111	127	147	147	141	121
Quiet and associated days—											
1911 (55 days) ...	67	54	35	46	66	65	50	47	54	67	74
1912 (49 „) ...	42	35	16	31	44	37	41	41	44	49	50
Total (104 days) ...	109	89	51	77	110	102	91	88	98	116	124
Disturbed and associated, less quiet and associated—											
1911 (55 days) ...	−12	+22	+71	+52	+22	− 2	+22	+36	+36	+18	+2
1912 (49 „) ...	+ 2	+23	+65	+41	+ 9	+11	+14	+23	+13	+ 7	−5
Total (104 days) ...	−10	+45	+136	+93	+31	+ 9	+36	+59	+49	+25	−3
Winter (40 days) ...	+ 3	+25	+57	+41	+20	+ 6	+23	+32	+23	+14	+2
Equinox (39 days) ...	− 6	+16	+55	+39	+15	+ 5	+ 9	+20	+17	+10	0
Summer (25 days) ...	− 7	+ 4	+24	+13	− 4	− 2	+ 4	+ 7	+ 9	+ 1	−5

TABLE LXXVIII.—Antarctic "Character" Figures. Sums on Associated Days.

Day.	n − 30	n − 29	n − 28	n − 27	n − 26	n − 25	n − 24
Days associated with disturbed days—							
1911 (50 days)	49	51	67	79	84	80	69
1912 (55 „)	61	56	55	67	70	67	55
Total (105 days)	110	107	122	146	154	147	124
Days associated with quiet days—							
1911 (50 days)	64	60	54	48	47	51	61
1912 (55 „)	57	51	47	49	49	47	52
Total (105 days)	121	111	101	97	96	98	113
Days associated with disturbed, less days associated with quiet days— Total (105 days)	−11	−4	+21	+49	+58	+49	+11

TABLE LXXIX.—"Character" Figures. Differences between Sums on Disturbed and Associated Days on the one hand and Sums on Quiet and Associated Days on the other, expressed as Percentages of Difference on day n.

—	Day.	$n-2$	$n-1$	n	$n+1$	$n+2$	$n+25$	$n+26$	$n+27$	$n+28$	$n+29$	$n+30$
Antarctic Figures	1911	−17	+31	+100	+73	+31	− 3	+31	+51	+51	+25	+3
	1912	+ 3	+35	+100	+63	+14	+17	+21	+35	+20	+11	−8
	Mean	− 7	+33	+100	+68	+22	+ 7	+26	+43	+35	+18	−3
International Figures	1911	+ 5	+46	+100	+49	+ 9	+14	+35	+47	+36	+11	+1
	1912	0	+42	+100	+47	− 8	+ 7	+21	+30	+ 8	− 6	−7
	Mean	+ 3	+44	+100	+48	+ 1	+11	+28	+39	+22	+ 3	−3

TABLE LXXX.—Antarctic Hourly "Character" Figures (Day of 180° E).

Hour ending at	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	12 h.	13 h.	14 h.	15 h.	16 h.	17 h.	18 h.	19 h.	20 h.	21 h.	22 h.	23 h.	24 h.	Mean.
1911.																									
February	1·50	1·62	1·58	1·65	1·69	1·77	1·73	1·92	1·92	1·96	1·92	1·81	1·81	1·65	1·65	1·65	1·46	1·38	1·23	1·15	1·50	1·58	1·38	1·50	1·62
March	1·00	0·90	0·71	0·90	0·77	0·84	1·00	1·26	1·55	1·55	1·29	1·35	1·10	1·06	1·06	0·94	1·03	1·03	0·84	0·94	0·90	0·97	0·84	0·97	1·03
April	1·12	0·85	0·81	0·81	1·04	0·96	0·96	1·08	1·19	1·31	1·35	1·35	1·15	1·31	1·15	1·19	1·12	1·00	0·81	1·08	1·00	0·92	0·85	0·92	1·05
May	0·71	0·97	0·94	1·03	0·84	0·77	0·81	1·13	1·10	1·06	0·97	1·03	0·77	0·77	0·97	0·81	0·77	0·97	1·16	0·71	0·84	0·71	0·77	0·87	0·90
June	0·81	0·70	0·59	0·41	0·44	0·52	0·81	0·81	1·00	0·67	0·85	0·78	0·81	0·70	0·70	0·74	0·96	0·89	0·81	0·93	0·70	0·70	0·89	0·70	0·75
July	0·73	0·90	0·83	0·97	0·97	1·00	0·90	0·80	1·03	1·03	0·80	0·87	0·83	0·77	0·80	0·87	0·80	0·83	1·03	1·07	1·10	0·97	1·00	0·87	0·91
August	0·63	0·73	0·83	0·73	0·80	0·90	0·73	0·83	0·87	0·87	0·87	0·80	0·83	0·83	0·77	0·87	0·73	0·73	0·80	0·80	0·90	0·80	0·83	0·73	0·80
September	0·80	0·84	0·76	0·80	0·80	0·76	0·96	0·88	0·96	1·04	1·00	1·04	1·00	0·88	0·80	0·80	0·92	0·92	0·92	0·80	0·72	0·88	0·76	0·68	0·86
October	0·65	0·81	0·61	0·94	1·03	1·10	1·29	1·19	1·26	1·35	1·32	1·13	1·03	0·94	0·94	0·71	0·84	0·84	0·90	0·90	0·68	0·87	0·81	0·84	0·96
November....	0·97	1·03	1·13	1·17	1·20	1·47	1·43	1·50	1·53	1·57	1·33	1·47	1·17	1·23	0·97	1·07	0·97	0·97	0·73	0·67	0·73	0·70	0·80	0·80	1·11
December	0·77	1·16	1·10	1·29	1·29	1·42	1·61	1·55	1·55	1·55	1·48	1·23	1·13	1·13	1·00	0·77	0·71	0·74	0·81	0·81	0·68	0·71	0·71	0·77	1·08
Mean 11 months	0·88	0·96	0·90	0·97	0·99	1·05	1·11	1·18	1·27	1·27	1·20	1·17	1·06	1·02	0·98	0·95	0·94	0·94	0·91	0·90	0·89	0·89	0·88	0·88	1·01
1912.																									
January	0·90	1·03	1·23	1·19	1·32	1·48	1·61	1·48	1·71	1·68	1·65	1·35	1·29	1·26	1·06	0·94	1·00	0·90	0·97	0·74	0·65	0·74	0·81	1·00	1·17
February	0·80	0·76	0·88	1·08	1·08	1·32	1·44	1·56	1·64	1·68	1·56	1·32	1·28	1·16	1·16	1·24	1·00	0·96	0·76	0·84	0·64	0·76	0·60	0·64	1·09
March	0·68	0·57	0·68	0·75	0·75	0·79	0·89	1·11	1·11	1·21	1·11	1·14	1·04	1·00	0·93	0·79	0·71	0·43	0·64	0·54	0·61	0·71	0·64	0·57	0·81
April	0·75	0·75	0·61	0·71	0·61	0·75	0·96	0·96	0·82	1·00	1·00	1·00	1·04	0·89	0·93	0·82	0·61	0·61	0·68	0·54	0·68	0·89	0·71	0·82	0·80
May	0·77	0·63	0·73	0·77	0·77	0·77	0·77	0·83	0·83	0·83	0·67	0·73	0·77	0·83	0·77	0·60	0·67	0·70	0·67	0·70	0·73	0·70	0·50	0·67	0·73
June	0·64	0·75	0·75	0·71	0·54	0·61	0·64	0·79	1·00	0·89	0·82	0·75	0·64	0·71	0·68	0·71	0·61	0·86	0·79	0·86	0·75	0·75	0·75	0·71	0·74
July	0·56	0·68	0·76	0·72	0·68	0·60	0·80	0·64	0·68	0·68	0·48	0·56	0·56	0·76	0·60	0·56	0·64	0·64	0·64	0·68	0·56	0·40	0·48	0·48	0·62
August	0·64	0·61	0·68	0·79	0·75	0·75	0·86	0·89	0·96	1·11	1·00	0·93	0·96	0·89	0·93	0·89	0·89	0·82	0·68	0·68	0·64	0·54	0·61	0·54	0·79
September	0·70	0·74	0·85	0·74	0·67	0·81	0·96	1·30	1·26	1·30	1·37	1·41	0·93	1·00	0·89	0·89	0·89	0·78	0·78	0·78	0·78	0·67	0·70	0·78	0·92
October	0·91	1·00	0·91	1·00	1·00	1·14	1·36	1·45	1·36	1·50	1·41	1·27	1·41	1·05	1·14	0·95	1·00	0·95	0·64	0·77	0·64	0·68	0·64	0·73	1·04
November....	1·22	1·11	1·00	1·00	1·33	1·44	1·89	1·78	1·89	1·56	1·67	1·56	1·22	1·22	1·22	1·11	1·33	1·22	1·00	0·89	1·00	1·11	1·00	0·89	1·28
Mean 11 months	0·78	0·78	0·83	0·86	0·86	0·95	1·11	1·16	1·21	1·22	1·16	1·09	1·01	0·98	0·94	0·86	0·85	0·81	0·75	0·73	0·70	0·72	0·68	0·71	0·91

TABLE LXXXI.—Eskdalemuir Hourly "Character" Figures (Time G.M.T.).

Hour ending at	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	12 h.	13 h.	14 h.	15 h.	16 h.	17 h.	18 h.	19 h.	20 h.	21 h.	22 h.	23 h.	24 h.	Mean.
1911.																									
February	1·14	0·79	0·75	0·71	0·54	0·57	0·61	0·71	0·82	0·82	0·89	0·82	0·89	0·93	0·96	0·86	1·04	1·07	1·07	1·07	1·25	1·18	1·14	1·04	0·90
March	0·87	0·74	0·65	0·65	0·61	0·65	0·58	0·55	0·58	0·55	0·58	0·81	0·74	0·77	0·81	0·81	0·87	0·87	0·77	0·90	0·84	0·87	0·77	0·94	0·74
April	0·90	0·77	0·67	0·73	0·57	0·50	0·53	0·50	0·57	0·47	0·57	0·67	0·80	0·67	0·73	0·80	0·83	0·87	0·83	0·90	0·90	0·83	0·83	0·87	0·72
May	0·65	0·65	0·74	0·65	0·39	0·52	0·68	0·52	0·48	0·52	0·74	0·71	0·52	0·84	1·10	1·10	0·90	0·97	0·90	0·84	0·84	0·68	0·90	0·77	0·73
June	0·60	0·67	0·53	0·50	0·47	0·43	0·50	0·57	0·40	0·40	0·47	0·57	0·63	0·71	0·77	0·57	0·73	0·73	0·80	0·73	0·70	0·60	0·77	0·73	0·61
July	0·68	0·65	0·58	0·58	0·48	0·71	0·55	0·55	0·55	0·48	0·61	0·65	0·74	1·10	1·00	1·26	1·13	1·16	1·03	0·81	0·84	0·68	0·71	0·77	0·76
August	0·58	0·65	0·55	0·35	0·42	0·48	0·45	0·52	0·48	0·35	0·42	0·52	0·55	0·61	0·87	0·97	0·90	0·94	0·65	0·68	0·52	0·61	0·58	0·55	0·59
September	0·50	0·53	0·40	0·33	0·43	0·40	0·23	0·53	0·40	0·33	0·57	0·67	0·80	0·70	0·60	0·73	0·77	0·77	0·57	0·57	0·60	0·50	0·57	0·53	0·54
October	0·48	0·45	0·34	0·21	0·28	0·38	0·28	0·38	0·45	0·34	0·62	0·62	0·69	0·59	0·62	0·66	0·52	0·66	0·72	0·41	0·72	0·97	0·69	0·62	0·53
November....	0·73	0·57	0·40	0·40	0·37	0·33	0·20	0·23	0·37	0·33	0·33	0·43	0·47	0·60	0·53	0·50	0·43	0·47	0·60	0·43	0·50	0·57	0·63	0·67	0·46
December	0·71	0·42	0·32	0·23	0·23	0·19	0·16	0·16	0·16	0·23	0·29	0·19	0·29	0·32	0·35	0·45	0·42	0·39	0·42	0·42	0·42	0·39	0·35	0·61	0·34
Mean 11 months	0·71	0·63	0·54	0·49	0·44	0·47	0·43	0·47	0·48	0·44	0·55	0·61	0·65	0·71	0·76	0·79	0·78	0·81	0·76	0·71	0·74	0·72	0·72	0·74	0·63
1912.																									
January	0·58	0·55	0·42	0·29	0·35	0·26	0·16	0·23	0·16	0·13	0·32	0·29	0·29	0·32	0·29	0·32	0·35	0·29	0·23	0·32	0·48	0·58	0·61	0·61	0·35
February	0·55	0·52	0·38	0·38	0·24	0·21	0·34	0·21	0·24	0·21	0·24	0·28	0·38	0·41	0·34	0·45	0·34	0·48	0·48	0·62	0·62	0·66	0·66	0·52	0·41
March	0·68	0·48	0·39	0·26	0·19	0·26	0·29	0·23	0·39	0·19	0·35	0·48	0·42	0·61	0·48	0·52	0·58	0·61	0·48	0·58	0·55	0·68	0·58	0·48	0·45
April	0·47	0·53	0·43	0·50	0·40	0·33	0·40	0·33	0·37	0·40	0·57	0·60	0·67	0·70	0·73	0·83	0·80	0·80	0·73	0·80	0·73	0·63	0·70	0·63	0·59
May	0·58	0·55	0·45	0·29	0·29	0·45	0·39	0·52	0·35	0·26	0·45	0·68	0·84	0·77	0·84	0·90	0·77	0·90	0·97	0·84	0·90	0·71	0·55	0·65	0·62
June	0·53	0·53	0·50	0·47	0·40	0·43	0·53	0·63	0·43	0·33	0·43	0·53	0·67	0·83	0·97	0·97	0·87	0·80	0·93	0·70	0·87	0·60	0·60	0·80	0·64
July	0·58	0·55	0·55	0·35	0·16	0·39	0·35	0·55	0·35	0·35	0·42	0·48	0·74	0·71	0·90	0·94	0·87	0·77	0·81	0·68	0·65	0·68	0·55	0·61	0·58
August	0·81	0·81	0·48	0·71	0·58	0·52	0·65	0·61	0·48	0·32	0·48	0·55	0·52	0·71	0·74	0·97	0·90	0·97	1·06	0·87	0·68	0·87	0·87	0·74	0·70
September	0·87	0·63	0·60	0·43	0·53	0·40	0·60	0·50	0·50	0·33	0·53	0·70	0·57	0·73	0·63	0·83	0·70	0·60	0·57	0·67	0·63	0·80	0·70	0·87	0·62
October	0·72	0·76	0·48	0·48	0·41	0·45	0·31	0·59	0·45	0·24	0·48	0·62	0·59	0·66	0·48	0·59	0·66	0·66	0·59	0·52	0·66	0·66	0·48	0·45	0·54
November....	0·60	0·47	0·50	0·50	0·50	0·33	0·47	0·53	0·33	0·37	0·50	0·57	0·63	0·50	0·60	0·47	0·53	0·50	0·40	0·67	0·87	0·70	0·67	0·67	0·54
Mean 11 months	0·63	0·58	0·47	0·42	0·37	0·37	0·41	0·45	0·37	0·28	0·43	0·53	0·57	0·63	0·64	0·71	0·67	0·67	0·66	0·66	0·69	0·69	0·63	0·64	0·55

Table LXXXII.—Number of Occurrences of "Character" 2 in Antarctic (Time of 180° E).

Hour ending at	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	12 h.	13 h.	14 h.	15 h.	16 h.	17 h.	18 h.	19 h.	20 h.	21 h.	22 h.	23 h.	24 h.	Mean.	Days used.
1911.																										
February	15	19	17	17	18	20	19	24	24	25	24	21	21	17	17	17	13	11	9	5	15	16	11	13	17·0	26
March	11	6	2	4	1	2	5	9	19	18	11	12	6	9	9	6	9	8	3	6	3	7	5	9	7·5	31
April	8	5	3	1	4	2	3	7	7	10	11	11	7	11	6	7	6	4	4	9	4	5	6	6	6·1	26
May	2	6	4	6	4	3	4	9	6	9	7	10	1	3	6	4	3	6	11	1	8	4	3	3	5·1	31
June	5	3	2	0	0	1	5	5	5	2	5	6	6	4	3	5	6	5	4	6	2	2	6	5	3·9	27
July	3	6	4	4	5	4	2	1	6	6	4	4	4	3	3	5	3	4	6	8	9	7	8	5	4·7	30
August	1	4	5	2	3	5	3	4	3	3	6	3	2	5	5	3	3	2	3	2	3	8	5	4	3·6	30
September	3	5	3	2	1	1	4	2	3	5	5	3	3	4	2	3	4	5	4	3	3	4	4	3	3·3	25
October	4	5	1	6	7	6	12	11	11	12	12	6	6	2	1	1	3	3	4	5	2	6	5	5	5·7	31
November	5	5	7	7	8	14	14	15	16	19	13	15	9	10	8	9	4	6	3	2	2	5	5	5	8·6	30
December	6	10	9	10	11	13	19	17	17	17	15	10	7	10	6	3	3	2	1	1	2	3	3	4	8·3	31
Total— 11 months....	63	74	57	59	62	71	90	104	117	126	113	101	72	78	66	63	57	56	52	48	53	67	61	62	—	—
1912.																										
January	2	4	9	8	11	15	19	15	22	21	20	13	11	9	5	5	4	4	4	1	2	2	2	5	8·9	31
February	2	0	2	5	5	10	11	14	17	17	14	9	9	6	4	7	2	4	2	1	1	3	1	0	6·1	25
March	2	1	4	3	2	2	2	4	5	8	6	7	4	6	3	1	1	0	2	1	3	3	3	1	3·1	28
April	4	3	1	2	1	3	5	2	4	6	4	4	5	5	6	6	5	4	3	1	3	7	6	4	3·9	28
May	5	3	3	3	1	2	2	5	1	4	4	4	4	6	5	2	1	4	4	5	5	4	3	3	3·5	30
June	4	3	3	3	1	1	0	2	4	4	4	4	4	2	3	5	3	7	2	4	2	5	3	4	3·2	28
July	3	4	4	1	1	0	3	0	1	1	3	2	2	3	1	1	2	3	2	2	2	1	1	1	1·8	25
August	1	1	2	5	3	1	2	2	3	5	4	4	3	4	4	3	2	2	1	3	2	2	3	2	2·7	28
September	2	3	3	2	1	3	3	10	9	10	11	11	2	5	4	3	3	2	3	3	2	4	4	5	4·5	27
October	3	6	3	3	2	5	8	11	8	11	10	7	9	4	4	2	3	2	0	0	1	3	2	2	4·5	22
November	3	3	1	1	3	4	8	7	8	5	6	5	2	3	2	2	3	2	2	2	3	2	2	1	3·3	9
Total— 11 months....	31	31	35	36	31	46	63	72	82	92	86	70	55	53	41	37	29	34	25	23	26	36	30	28	—	—

TABLE LXXXIII.—Number of Occurrences of "Character" 2 at Eskdalemuir (Time G.M.T.).

Hour ending at	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	12 h.	13 h.	14 h.	15 h.	16 h.	17 h.	18 h.	19 h.	20 h.	21 h.	22 h.	23 h.	24 h.	Mean.	Days used.
1911.																										
February	6	3	2	1	1	0	0	1	1	1	2	0	1	3	4	4	11	10	9	10	12	11	9	6	4·5	28
March	6	6	4	4	4	4	1	0	1	0	1	3	2	2	4	3	7	7	6	9	9	9	5	8	4·4	31
April	6	4	4	4	2	1	1	1	1	1	0	2	2	2	2	3	2	6	6	6	8	8	6	5	3·5	30
May	2	5	6	3	2	2	2	1	0	1	2	0	1	4	7	7	7	7	5	4	4	2	8	6	3·7	31
June	4	5	1	3	2	1	0	2	1	1	0	2	2	3	4	2	2	4	3	4	7	4	4	6	2·8	30
July	4	4	5	3	1	2	2	1	2	0	1	2	4	10	9	10	10	8	6	3	3	3	4	5	4·2	31
August	1	3	3	0	0	1	0	0	1	0	1	1	2	1	5	4	5	5	1	4	2	3	5	4	2·2	31
September	1	2	1	1	3	1	0	1	1	0	1	2	3	2	2	3	5	3	2	3	5	3	3	3	2·1	30
October	3	2	2	1	1	2	1	1	0	0	1	2	0	0	3	3	0	3	2	2	8	7	2	2	2 0	29
November	5	3	1	1	1	0	0	0	0	0	0	2	2	2	3	3	2	1	5	3	2	3	2	6	2·0	30
December	7	3	2	1	2	2	1	1	1	2	3	1	2	1	1	3	3	3	4	4	2	2	2	3	2·3	31
Total— 11 months....	45	40	31	22	19	16	8	9	9	6	12	17	21	30	44	45	54	57	49	52	62	55	50	54	—	—
1912.																										
January	2	2	1	0	0	0	1	1	0	0	0	0	0	0	0	0	1	0	0	0	1	3	3	2	0·7	31
February	1	2	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	3	2	2	2	1	0·7	29
March	4	2	1	1	1	0	0	0	0	0	0	0	0	0	1	1	2	3	1	3	2	3	4	3	1·3	31
April	2	2	2	2	2	3	2	1	2	1	0	0	1	1	2	2	4	2	1	3	2	2	2	2	1·8	30
May	2	2	2	1	1	3	1	2	3	0	0	4	3	2	1	3	1	2	3	6	6	5	2	2	2·4	31
June	3	3	3	2	1	0	2	3	3	1	1	3	2	4	5	4	3	2	3	2	5	2	2	5	2·7	30
July	3	1	2	2	0	0	0	1	2	0	1	2	2	3	5	4	2	4	4	1	4	2	3	4	2·2	31
August	6	6	2	5	2	2	1	1	0	0	0	0	0	1	3	3	5	5	5	5	2	5	4	5	2·8	31
September	5	3	3	2	1	1	2	0	1	1	1	1	1	2	3	4	3	3	2	5	4	4	3	4	2·5	30
October	5	5	1	1	1	0	1	1	1	0	0	0	1	1	1	3	4	4	3	2	3	2	1	1	1·7	29
November	2	0	1	1	1	0	1	3	1	0	0	1	2	0	2	1	3	3	2	3	7	4	2	4	1·8	30
Total— 11 months....	35	28	19	18	10	9	11	13	14	3	3	11	12	14	23	25	28	29	24	33	38	34	28	33	—	—

Table LXXXIV.—Number of Occurrences of "Character" 0 in the Antarctic (Time of 180° E).

Hour ending at	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	12 h.	13 h.	14 h.	15 h.	16 h.	17 h.	18 h.	19 h.	20 h.	21 h.	22 h.	23 h.	24 h.	Mean.	Days used
1911.																										
February	2	3	2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	3	1	2	1	1	0	0·7	26
March	11	9	11	7	8	7	5	1	2	1	2	1	3	7	7	8	8	7	8	8	6	8	10	10	6·5	31
April	5	9	8	6	3	3	4	5	2	2	2	2	3	3	2	2	3	4	9	7	4	7	10	8	4·7	26
May	11	7	6	5	9	10	10	5	3	7	8	9	8	10	7	10	10	7	6	10	13	13	10	7	8·4	31
June	10	11	13	16	15	14	10	10	5	11	9	12	11	12	11	12	7	8	9	8	10	10	9	13	10·7	27
July	11	9	9	5	6	4	5	7	5	5	10	8	9	10	9	9	9	9	5	6	6	8	8	9	7·5	30
August	12	12	10	10	9	8	11	9	7	7	10	9	7	10	12	7	11	10	9	8	6	14	10	12	9·6	30
September	8	9	9	7	6	7	5	5	4	4	5	2	3	7	7	8	6	7	6	8	10	7	10	11	6·7	25
October	15	11	13	8	6	3	3	5	3	1	2	2	5	4	3	10	8	8	7	8	12	10	11	10	7·0	31
November	6	4	3	2	2	0	1	0	0	2	3	1	4	3	9	7	5	7	11	12	10	14	11	11	5·3	30
December	13	5	6	1	2	0	0	0	0	0	0	3	3	6	6	10	12	10	7	7	12	12	12	11	5·7	31
Total— 11 months....	104	89	90	67	66	56	54	47	31	40	51	49	56	72	73	83	80	78	80	83	91	104	102	102	—	—
1912.																										
January	5	3	2	2	1	0	0	0	0	0	0	2	2	1	3	7	4	7	5	9	13	10	8	5	3·7	31
February	7	6	5	3	3	2	0	0	1	0	0	1	2	2	0	1	2	5	8	5	10	9	11	9	3·8	25
March	11	13	13	10	9	8	5	1	2	2	3	3	3	6	5	7	9	16	12	14	14	11	13	13	8·5	28
April	11	10	12	10	12	10	6	3	9	6	4	4	4	8	8	11	16	15	12	14	12	10	14	9	9·6	28
May	12	14	11	10	8	9	9	10	6	9	14	12	11	11	12	14	11	13	14	14	13	13	18	13	11·7	30
June	14	10	10	11	14	12	10	8	4	7	9	11	14	10	12	13	14	11	8	8	9	12	10	12	10·5	28
July	14	12	10	8	9	10	8	9	9	9	16	13	13	9	11	12	11	12	11	10	13	16	14	14	11·4	25
August	11	12	11	11	10	8	6	5	4	2	4	6	4	7	6	6	5	7	10	12	12	15	14	15	8·5	28
September	10	10	7	9	10	8	4	2	2	2	1	0	4	5	7	6	6	8	9	9	8	13	12	11	6·8	27
October	5	6	5	3	2	2	0	1	0	0	1	1	0	3	1	3	3	3	8	5	9	10	10	8	3·7	22
November	1	2	1	1	0	0	0	0	0	0	0	0	0	1	0	1	0	0	2	3	3	1	2	2	0·8	9
Total— 11 months....	101	98	87	78	78	69	48	39	37	37	52	53	57	63	65	81	81	97	99	103	116	120	126	111	—	—

TABLE LXXXV.—Number of Occurrences of "Character" 0 at Eskdalemuir (Time G.M.T.).

Hour ending at	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	12 h.	13 h.	14 h.	15 h.	16 h.	17 h.	18 h.	19 h.	20 h.	21 h.	22 h.	23 h.	24 h.	Mean.	Days used.
1911.																										
February	2	9	9	9	14	12	11	9	6	6	5	5	4	5	5	8	10	8	7	8	5	6	5	5	7·2	28
March	10	14	15	15	16	15	14	14	14	14	14	9	10	9	10	9	11	11	13	12	14	13	12	10	12·4	31
April	9	11	14	12	15	16	15	16	14	17	13	12	8	12	10	9	7	10	11	9	11	13	11	9	11·8	30
May	13	16	14	14	21	17	12	16	16	16	10	9	16	9	4	4	10	8	8	9	9	12	11	13	12·0	31
June	16	15	15	18	18	18	15	15	19	19	16	15	13	12	11	15	10	12	9	12	16	16	11	14	14·6	30
July	14	15	18	16	17	11	16	15	16	16	13	13	12	7	9	2	6	3	5	9	8	13	13	12	11·6	31
August	14	14	17	20	18	17	17	15	17	20	19	16	16	13	9	5	8	7	12	14	17	15	18	18	14·8	31
September	16	16	19	21	20	19	23	15	19	20	14	12	9	11	14	11	12	10	15	16	17	18	16	17	15·8	30
October	18	18	21	24	22	20	22	19	16	19	12	13	9	12	14	13	14	13	10	19	16	8	11	13	15·7	29
November	13	16	19	19	20	20	24	23	19	20	20	19	18	14	17	18	19	17	17	20	17	16	13	16	18·1	30
December	16	21	23	25	26	27	27	27	27	26	25	26	24	22	21	20	21	22	22	22	20	21	22	15	22·8	31
Total— 11 months....	141	165	184	193	207	192	196	184	183	193	161	149	139	126	124	114	128	121	129	150	150	151	143	142	—	—
1912.																										
January	15	16	19	22	20	23	27	25	26	27	21	22	22	21	22	21	21	22	24	21	17	16	15	14	20·8	31
February	14	16	19	19	22	23	19	23	23	23	22	21	18	17	19	16	19	16	15	14	13	12	12	15	17·9	29
March	14	18	20	24	26	23	22	24	19	25	20	16	18	12	17	16	15	15	17	16	16	13	17	19	18·4	31
April	18	16	19	17	20	23	20	21	21	19	13	12	11	10	10	7	10	8	9	9	10	13	11	13	14·2	30
May	15	16	19	23	23	20	20	17	23	23	17	14	8	9	6	6	8	5	4	11	9	14	16	13	14·1	31
June	17	17	18	18	19	17	16	14	20	21	18	17	12	9	6	5	7	8	5	11	9	14	14	11	13·5	30
July	16	15	16	22	26	19	20	15	22	20	19	18	10	12	8	6	6	11	10	11	15	12	17	16	15·1	31
August	12	12	18	14	15	17	12	13	16	21	16	14	15	10	11	4	8	6	3	9	12	9	8	13	12·0	31
September	9	14	15	19	15	19	14	15	16	21	15	10	14	10	14	9	12	15	15	15	15	10	12	8	13·8	30
October	13	12	16	16	18	16	21	13	17	22	15	11	13	11	16	15	14	14	15	16	13	12	16	17	15·1	29
November	14	16	16	16	16	20	17	17	21	19	15	14	13	15	14	17	17	18	20	13	11	13	12	14	15·8	30
Total— 11 months....	157	168	195	210	220	220	208	197	224	241	191	169	154	136	143	122	137	138	137	146	140	138	150	153	—	—

TABLE LXXXVI.—Hourly "Character" Figures, Antarctic and Eskdalemuir. Variation in Greenwich Day.

Hour ending at		1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	12 h.	13 h.	14 h.	15 h.	16 h.	17 h.	18 h.	19 h.	20 h.	21 h.	22 h.	23 h.	24 h.
Mean "character" figure— November, December, January, February	Antarctic	1·29	1·25	1·14	1·06	1·02	0·98	0·91	0·83	0·82	0·88	0·85	0·92	0·98	1·11	1·16	1·23	1·32	1·47	1·62	1·60	1·70	1·66	1·59	1·41
	Eskdalemuir	0·70	0·54	0·44	0·38	0·35	0·29	0·28	0·31	0·30	0·31	0·40	0·38	0·44	0·46	0·46	0·48	0·49	0·49	0·48	0·54	0·63	0·63	0·63	0·67
	Mean	1·00	0·90	0·79	0·72	0·68	0·64	0·60	0·57	0·56	0·59	0·62	0·65	0·71	0·78	0·81	0·86	0·90	0·98	1·05	1·07	1·17	1·14	1·11	1·04
Equinoctial months	Antarctic	1·09	1·02	0·98	0·89	0·89	0·82	0·78	0·79	0·75	0·82	0·74	0·79	0·83	0·81	0·74	0·83	0·83	0·89	1·05	1·15	1·19	1·28	1·23	1·21
	Eskdalemuir	0·69	0·61	0·50	0·45	0·43	0·42	0·40	0·45	0·46	0·36	0·53	0·65	0·66	0·68	0·64	0·72	0·72	0·73	0·66	0·67	0·70	0·74	0·67	0·67
	Mean	0·89	0·81	0·74	0·67	0·66	0·62	0·59	0·62	0·61	0·59	0·64	0·72	0·74	0·74	0·69	0·78	0·78	0·81	0·86	0·91	0·95	1·01	0·95	0·94
May, June, July, August	Antarctic	0·77	0·78	0·78	0·76	0·76	0·80	0·82	0·80	0·78	0·70	0·73	0·70	0·69	0·75	0·76	0·77	0·72	0·74	0·79	0·84	0·93	0·89	0·81	0·81
	Eskdalemuir	0·63	0·63	0·55	0·49	0·40	0·49	0·51	0·56	0·44	0·38	0·50	0·59	0·65	0·78	0·90	0·96	0·88	0·90	0·89	0·77	0·75	0·68	0·69	0·70
	Mean	0·70	0·70	0·67	0·62	0·58	0·64	0·67	0·68	0·61	0·54	0·61	0·65	0·67	0·76	0·83	0·86	0·80	0·82	0·84	0·81	0·84	0·79	0·75	0·75
Year	Antarctic	1·05	1·02	0·97	0·90	0·89	0·87	0·84	0·81	0·78	0·80	0·77	0·80	0·83	0·89	0·89	0·94	0·96	1·03	1·15	1·20	1·27	1·28	1·21	1·14
	Eskdalemuir	0·67	0·59	0·50	0·44	0·39	0·40	0·40	0·44	0·40	0·35	0·48	0·54	0·58	0·64	0·67	0·72	0·70	0·71	0·68	0·66	0·69	0·68	0·66	0·68
	Mean	0·86	0·81	0·73	0·67	0·64	0·63	0·62	0·62	0·59	0·58	0·62	0·67	0·71	0·76	0·78	0·83	0·83	0·87	0·91	0·93	0·98	0·98	0·94	0·91
Number of 2's as percentage of mean— November, December, January, February	Antarctic	111	107	76	74	52	50	37	20	42	52	42	53	59	79	91	95	113	150	185	179	206	205	183	139
	Eskdalemuir	212	119	73	40	46	26	33	53	33	33	53	33	60	46	73	93	159	139	159	179	192	199	166	179
Equinoctial months	Antarctic	109	119	91	75	88	73	60	73	54	101	91	91	96	88	52	60	49	62	109	145	171	207	181	158
	Eskdalemuir	166	135	93	83	78	62	41	26	36	16	21	52	52	52	93	114	140	161	119	171	212	197	135	145
May, June, July, August	Antarctic	91	105	105	98	81	116	116	109	116	116	112	95	84	105	95	84	63	60	74	98	102	119	130	130
	Eskdalemuir	109	127	105	83	39	48	35	48	52	13	26	61	70	122	170	162	153	162	131	127	144	114	140	162
Year	Antarctic	104	111	91	82	74	80	71	67	71	90	82	80	80	91	79	80	75	91	123	141	160	177	165	142
	Eskdalemuir	162	127	90	69	54	45	36	42	40	21	33	49	61	73	112	123	151	154	136	159	183	170	147	162
	Mean	133	119	91	75	64	62	54	54	56	56	58	64	71	82	95	102	113	122	130	150	171	174	156	152
Number of 0's as percentage of mean— November, December, January, February	Antarctic	54	68	91	145	135	159	161	178	253	232	219	181	175	105	91	41	37	7	3	0	3	7	10	41
	Eskdalemuir	72	90	101	107	112	120	122	120	120	119	105	106	99	94	96	96	102	100	103	96	82	83	79	74
Equinoctial months	Antarctic	47	81	75	103	111	127	133	137	141	142	169	150	142	144	146	112	105	90	60	43	45	34	37	28
	Eskdalemuir	91	101	119	126	130	129	129	117	116	134	99	81	78	74	90	76	81	82	90	96	96	85	90	90
May, June, July, August	Antarctic	98	101	102	106	100	98	92	97	105	129	119	121	121	111	102	97	102	96	88	81	55	73	102	102
	Eskdalemuir	109	111	126	135	146	126	119	111	138	145	119	108	95	75	59	44	59	56	52	80	88	98	100	102
Year	Antarctic	66	83	89	118	115	128	129	137	166	168	169	151	146	120	113	83	81	64	50	41	34	38	50	57
	Eskdalemuir	91	101	115	123	129	125	123	116	125	133	108	98	91	81	82	72	81	79	82	91	89	89	90	89
	Mean	79	92	102	120	122	126	126	127	145	150	138	125	118	101	97	78	81	72	66	66	62	64	70	73

CHAPTER VIII.

TERM HOURS. MAGNETIC "ACTIVITY."

Section 44.—Before the expedition set sail a series of term hours had been arranged, and an appeal issued to observatories at home and abroad to take quick runs of the magnetographs during these hours, and supply copies of the traces obtained for comparison with the corresponding traces to be obtained in the Antarctic. In response to this appeal, copies—in one or two cases apparently originals—of the records obtained during some at least of the selected hours were received from the following observatories :—

In Europe : De Bilt, Eskdalemuir, Greenwich, Kew, San Fernando, Seddin, Stonyhurst, Uccle and Val Joyeux ; in Asia : Alibag and Lukiapang ; in Africa and the Indian Ocean : Helwan and Mauritius ; in North America : Agincourt (Toronto), Cheltenham (Maryland), Sitka, Tucson and Vieques (Porto Rico) ; and in South America : Pilar. Barrackpore, Dehra Dun, Kodaikanal and Toungoo—observatories of the Survey of India—sent instead of curves eye readings, taken at 1-minute intervals, representing the expenditure of a large amount of time and effort.

The pre-arranged term hours, all specified in Greenwich time, were :—8 h. to 10 h. on May 29, June 2, 26, 30 and July 24, 28, 1911 ; 17 h. to 19 h. on May 22, 26, June 19, 23 and July 17, 21, 1911 ; 18 h. to 20 h. on November 20, 24 and December 18, 22, 1911, as well as January 22, 26, 1912.

The primary object in view was the study of simultaneous magnetic disturbances at different parts of the earth. It was anticipated that the great majority of the term hours would prove blanks so far as disturbance was concerned, the chance of any considerable disturbance happening at ordinary stations at a pre-arranged hour being small. Thus a considerable number of term hours was required to give a reasonable chance of success. If the sole object had been to secure a disturbance of any kind, the chance of success at the stations in ordinary latitudes would have been greater if equinoctial months had been selected. But the Expedition of 1902–04 had shown that in May, June and July there is a tendency for disturbances to occur in the Antarctic having a comparatively short duration and an unusual definiteness of character. In 1902–03 these were especially numerous between 8 h. and 10 h. G.M.T., and the special aim of the first set of 12 term hours was to secure a quick run record of one of these. Again the 1902–03 records had shown that in the Antarctic morning between 17 h. and 19 h. G.M.T. there is more than the usual tendency to rapid oscillatory movements, and the second set of 12 term hours had these principally in view. It was also hoped that the taking of morning and evening records from the same season of the year would afford a basis for the comparison of disturbance at different hours of the day. It was known that the Antarctic midwinter was much the quietest season in that region, but the experience of 1902–03 had shown that disturbance in the Antarctic might reasonably be expected at any season, the real difficulty being to hit on it elsewhere. The original list included only these 24 term hours, but Dr. Simpson having expressed a desire for some near the Antarctic midsummer, the final 12 in November, December and January were added.

The selection of term hours for international magnetic co-operation is not a new departure. The practice goes back to the time of Gauss. It was then a necessary preliminary to co-operative effort, since eye-readings only were possible. In its present shape of quick runs, or photographic records taken with the drum rotating more rapidly than usual—generally at 12 times the normal rate—it originated, I think, with Prof. Eschenhagen at Potsdam. He arranged for two or three quick runs in 1896, in which a good many observatories participated, and on one of these occasions a sensible disturbance occurred. It was this probably which induced those responsible for the German Antarctic Expedition of 1902–03 to suggest a number of term hours in which the British Expedition of that date agreed to participate. Owing to a misunderstanding as to the hours, and a remarkable absence of disturbance, the result in 1902–03 was rather a fiasco so far, at least, as the British Expedition was concerned. Though the experiment was hardly a success, it constituted a precedent which those responsible for the programme of the Expedition of 1911–12 thought it well to follow. Considering the general quietness of 1911 and 1912—a quietness natural in years so near sun-spot minimum—there was more success in securing disturbances than might have been expected, and it is to be hoped that those who undertook the somewhat onerous labour which co-operation entailed will feel that their time was not wasted. But before any elaborate system of term hours is again selected for international co-operation, the whole question should be considered somewhat carefully. Two aspects of the case appeal to any one who has discussed term hour data. The first is that in quick-run magnetograms with a time scale 12 times as open as usual, but with only normal sensitiveness, the gradient shown by the trace during any small disturbance is too slight to catch the eye. Movements that would at once arrest attention in the ordinary trace are hardly recognisable on mere general inspection in a quick-run trace.

It is thus difficult to gauge rapidly the general nature of the disturbance. This would be feasible only if the opening out of the time scale were accompanied by an increase of sensitiveness. Changes of sensitiveness, however, are troublesome. Moreover, if a really large disturbance happened to intervene, any large increase of sensitiveness would probably lead to loss of trace. The ideal thing would be to have at each station records from two magnetographs, one having the normal sensitiveness and time scale, the other increased sensitiveness and a more open time scale. The one trace would serve for macroscopic, the other for microscopic investigation.

As matters stand, to base a comparison of disturbance on quick run curves implies numerous accurate measurements answering to short intervals of time. If there are a number of term hours, and many stations co-operate, the measurement of the curves entails an immense amount of labour, and the resulting mass of detail may well prove overwhelming. In many cases there seems to be a mixture of what is comparatively local and of what is of more general incidence in disturbance, and the former part may eclipse the latter. Also at some hours of the day—hours depending on local time, and so varying with the station—the normal diurnal changes are comparable in rapidity with minor disturbances. Thus the interpretation of the measurements, however carefully made, presents difficulties. Again full advantage cannot be taken of the open time scale unless there is very accurate information as to the time marks on the trace. It is only at some stations that the true time answering to the time marks is known, to within a few seconds, and there is reason to fear that in some magnetographs when quick run the uniformity in the angular velocity of the drum leaves something to be desired. Taking everything into account, I am inclined to doubt whether an extensive programme of term hours can be recommended unless the participating stations are specially selected, and a very large amount of time can be devoted to the intercomparison of the records.

In the present case it was very difficult to decide what to do with the records. The only practical way of rendering them serviceable to all for minute investigations would have been to reproduce the curves photographically. This would, however, have entailed a great amount of space and a large expenditure. In many cases, moreover, the object would have been very imperfectly accomplished, owing to uncertainties about the time marks. Again, several of the co-operating stations were known to suffer sensibly from artificial disturbances, and the appearance of the curves at some of the other stations was at least suspicious. It was thus clear that even with a lavish expenditure of time, the complete separation of the chaff from the wheat would be very problematical.

The material it was finally decided to publish consists mainly of (i) readings of the curves at 5-minute intervals; (ii) the application of these readings to a study of "magnetic activity"; (iii) a comparison of the curves for a few occasions when the disturbance was especially large.

It was decided after minute inspection that some of the curves were so affected by artificial disturbances that effort had better be concentrated on the others. This applied mainly to vertical force curves, but in a few cases to curves of all the elements. As the mention of names in this connection might give offence, I shall only say that Kew was one of the observatories concerned. The absence of vertical force data, it should be added, was due in some cases not to artificial disturbance, but to the fact that no V curves were received.

Some stations sent full details as to both base line values and scale values, so that absolute values might have been given for them. Other stations, however, sent little if any information as to base line values. As a common mode of presenting the results was desirable, and the advantage of absolute over relative values was open to some doubt, it was decided to give the results as differences. To avoid the use of algebraic signs, the lowest value of the element during the two hours was taken as zero. D was regarded as increasing when the north end of the magnet moved to the east, and V as increasing when the pull on the north pole towards the earth's centre was increased. Thus, at western European stations the higher the value under D the smaller was the (westerly) declination. For greater parallelism with the other stations E (not W) was taken at one of the elements at Eskdalemuir and Potsdam. In their case, the higher the value in the table the lower was the numerical value of the component perpendicular to the astronomical meridian.

The entry in every case under D is not the angular measure but its force equivalent, thus enabling all the data to be expressed in terms of a single unit, 1γ. All the data for a single station are collected together, as the arrangement most economical of space. The data appear in pp. 516 to 548, the stations being arranged according to latitude, the most northerly coming first.

The geographical co-ordinates of the stations are given in Table LXXXVII, along with the difference between the local time and that of Greenwich. In this table the stations are arranged according to longitude so as to juxtapose those the local time at which differs least.

TABLE LXXXVII.—Stations Co-operating in Term Hour Observations.

Stations with Westerly Longitude.							Stations with Easterly Longitude.						
Station.	Longitude.		Time, late.		Latitude.		Station.	Longitude.		Time, early.		Latitude.	
	°	′	h.	m.	°	′		°	′	h.	m.	°	′
Greenwich	0	0	0	0	51	28 N.	Lukiapang ...	121	2	8	4	31	19 N.
Kew	0	19	0	1	51	28 N.	Toungoo	96	27	6	26	18	56 N.
Stonyhurst... ...	2	28	0	10	53	51 N.	Barrackpore ...	88	22	5	53	22	46 N.
Eskdalemuir ...	3	12	0	13	55	19 N.	Dehra Dun ...	78	3	5	12	30	19 N.
San Fernando ...	6	12	0	25	36	28 N.	Kodaikanal ...	77	28	5	10	10	14 N.
Pilar	63	53	4	16	31	40 S.	Alibag	72	52	4	51	18	39 N.
Vieques	65	26	4	22	18	9 N.	Mauritius	57	33	3	50	20	6 S.
Cheltenham ...	76	50	5	7	38	44 N.	Helwan	31	21	2	5	29	52 N.
Agincourt	79	16	5	17	43	47 N.	Seddin	13	1	0	52	52	17 N.
Tucson	110	50	7	23	32	15 N.	De Bilt	5	11	0	21	52	5 N.
Sitka	135	20	9	1	57	3 N.	Uccle	4	21	0	17	50	48 N.
Honolulu	158	4	10	32	21	19 N.	Val Joyeux ...	2	1	0	8	48	49 N.

Section 45.—The application of the results to a study of magnetic "activity" was not in contemplation when the programme of term hours was arranged. It came about in the following way: The international scheme of "character" figures for individual days, of which De Bilt is the headquarters, has been in operation with marked success since 1906. But it has been recognised in various circles, including De Bilt itself, that there is a somewhat large accidental element in the choice, and that considerable fluctuations arise in the standard applied at most stations. It has been felt that a scheme having less arbitrariness in its execution might have advantages. A scheme of this kind was proposed some years ago by the late Professor Bidlingmaier, based on what he called

" magnetic activity," and the International Magnetic Bureau issued an invitation to several stations, including Kew Observatory, to give the scheme a short preliminary trial. The existence of simultaneous records, mostly quick-run, from so large a number of stations provided ideal material for putting to the test a method suggested by Bidlingmaier for arriving in a comparatively simple way at a measure of one element of the " activity," the evaluation of which according to the exact formula is a very laborious process. When deciding to apply the material to this object, I realised that a considerable amount of labour was entailed, but the reality exceeded my anticipations. To render the results intelligible, a short explanation is necessary of what Bidlingmaier meant by " magnetic activity."

Suppose α, β, γ to be the rectangular components of magnetic force at any point x, y, z, then

$$(1/8\pi)\int\int\int(\alpha^2+\beta^2+\gamma^2)\,dx\,dy\,dz$$

is the usual expression for the magnetic energy of the field. If we suppose α, β, γ to represent not absolute values of the force components but their departures from some standard value, the above integral is one of which Professor Bidlingmaier desired to get the mean value throughout the 24 hours. This value he described as the " magnetic activity " for the day. What to take as standard value is a very difficult point, which we need not consider at the moment. Let us suppose for simplicity it is the mean value for the day. Also let us suppose at any instant between hours $n-1$ and n the departure of any magnetic element from its mean value for the day to be

$$y = y_n + \eta,$$

where y_n is the mean value of the departure for the whole hour. Then using τ to represent one hour, we have

$$\int_{(n-1)\tau}^{n\tau}(y_n+\eta)^2\,dt = \tau\,y_n^2 + \mathrm{I}_n,$$

$$\text{where } \mathrm{I}_n = \int_{(n-1)\tau}^{n\tau}\eta^2\,dt.$$

The mean value of the integral for the whole day is

$$(1/8\pi)\,(1/24\tau)\int_0^{24\tau} y^2\,dt = \mathrm{A}_1 + \mathrm{A}_2\,;$$

where

$$\mathrm{A}_1 = (1/8\pi)\,(y_1^2 + \,.\,.\, + y_{24}^2)/24,$$
$$\mathrm{A}_2 = (1/8\pi)\,(\mathrm{I}_1 + \,.\,.\, \mathrm{I}_{24})/24.$$

The contribution of the individual hour to this expression thus consists of two parts. One of these $(1/8\pi)\,y_n^2/24$ depends not so much on changes occurring during the particular hour as on what takes place during adjacent hours. For instance, on a day ordinarily regarded as perfectly quiet, during the hour containing the daily maximum or minimum we have a large departure from the mean value of the day, and so a large value y_n^2. In such a case A_1 represents " activity " associated with the force system to which the regular diurnal inequality is due. The second term is by no means independent of the regular diurnal variation, receiving contributions from it as well as from the irregular oscillatory movements usually regarded as disturbance. The contribution from the regular diurnal inequality is largest for those hours of the day at which the diurnal inequality changes are most rapid, and during these hours it may be by no means negligible compared with the contribution from irregular movements unless the hour is one of very decided disturbance. Again, it must be remembered that the amplitude of the regular diurnal inequality is affected, especially in the Antarctic, by the presence of disturbance. The value of A_1 in short may be very largely influenced by the presence of disturbance. Thus it would not be correct to regard the value of I_n for a particular hour as an exact measure of the disturbance existing during that hour. At the same time it is a quantity which increases very largely with disturbance, and in the absence of any exact definition of disturbance it is probably as good a measure as we can get, especially when we are comparing the same hour of different days at the same station.

If a suitable mechanical integrator existed by which I_n could be rapidly measured, the time required might not be prohibitive ; but failing this Bidlingmaier attempted to see whether a sufficiently satisfactory approximation could not be derived from a consideration of the hourly range, *i.e.*, the difference between the largest and least values of the hour. He measured the Wilhelmshaven D and H curves at 6-minute intervals, and plotted the results against the corresponding hourly ranges. From a large number of curve measurements he obtained data for the " activities " (of the type A_2) in a number of hours having the same range, and he concluded that it would be accurate enough to simply measure the hourly range and assume for the corresponding " activity " the mean of the values he had found. It was suggested to several observatories, including Kew, that a preliminary trial should be made of Bidlingmaier's scheme, accepting his relations between the " activity " of type A_2 and the hourly range. As, however, Bidlingmaier's numerical relationships between hourly " activities " and ranges had been based on the results of only one station, it seemed to me that a desirable preliminary was to test them by applying them to the term hour curves. It was only after the necessary measurements had been made that I noticed that if the relationships found by Bidlingmaier were correct, " activity " must vary with the sensitiveness of the magnetograph. The true " activity," if a natural physical quantity, must be independent of the sensitiveness of the instrument, and if the results of measurement really accorded with Bidlingmaier's relationships, it would mean that an undesirable instrumental element was not eliminated.

The only relation between the " activity " and the range which leaves the " activity " independent of the sensitiveness is the parabolic, the " activity " being proportional to the square of the range.

The term-hour curves, as already stated, were measured at 5-minute intervals. This gives for the hour thirteen ordinates $\eta_0, \eta_1 \ldots \eta_{12}$. The quantity

$$\{\tfrac{1}{2}(\eta_0^2 + \eta_{12}^2) + \eta_1^2 + \ldots + \eta_{11}^2\}/12, \text{ written for brevity } (1/12)\ \Sigma\eta^2,$$

was taken as the equivalent of $(1/\tau)\int_0^\tau \eta^2 dt$, where τ represents one hour. The relation suggested above by theoretical considerations

$$(1/12)\Sigma\eta^2 = CR^2 \quad . \quad . \quad . \quad . \quad . \quad (17),$$

where R is the hourly range and C a constant, was on the whole in good accordance with the observational results at stations outside the Antarctic, when a mean was taken from a large number of "activities." The values obtained for the constant C were practically the same for declination, horizontal force and vertical force, the mean obtained in the several investigations varying from 0·092 to 0·098. Thus if we had accepted $R^2/100$ as the equivalent of $(1/12)\Sigma\eta^2$ we should have obtained, when a large number of hours were included, nearly the same result as if we had actually measured the curves and done the arithmetical operations indicated by the summation. Supposing only two measurements necessary for the determination of R, the economy of effort would be enormous.

When, however, we look closely into the matter the results are less satisfactory. The values assigned to R were really derived from the 5-minute measurements, but the range thus found will only sometimes accord with the true range for the hour, and in the case of some disturbed curves it may be a good deal less. If the element is rising or falling continuously throughout the hour, η_0 and η_{12} must be the extreme ordinates, and $\eta_0 \backsim \eta_{12}$ the exact range. But even in quiet days, there are at least two turning points, and more often four in the course of the 24 hours, and the coincidence of a turning point with one of the points of measurement would be pure accident. During disturbed times the exact coincidence of the extreme ordinates with any of the 5-minute ordinates must be rare in any hour. It is true that as a rule the inferiority of what we may call the 5-minute range to the true hourly range will be small, but occasionally it will be very considerable. As the true "activity" is calculated from the 5-minute measurements, it is obvious *a priori* that a uniform relation is much more probable between the "activity" and the 5-minute range, than between the "activity" and the absolute hourly range. Why, it may be asked, was the latter range not measured, as it must have been it which Bidlingmaier contemplated using, otherwise there would have been no real economy in the use of his "activity" range relationships. If we had to take 5 or 6-minute measurements to obtain R, the use of his relationships would be no economy at all, so far as measurements are concerned.

The answer to the query is that as a matter of fact the ranges which Bidlingmaier used in establishing his relationships were derived from 6-minute measurements, and the only way to put his conclusions to a fair test was to employ ranges similarly obtained. Very probably he may have believed that in the great majority of cases the difference between the 6-minute range (and still more the 5-minute range) and the absolute hourly range would be so small that any relationship established for the former could be applied with sufficient accuracy to the latter. When I commenced the investigation I did not realise the extent to which the 5-minute range and the absolute range were likely to differ during really disturbed hours. It was only after comparing the two sets of ranges for the Antarctic curves that the importance of the difference came home to me. On the other hand, it was immediately patent that during really quiet times at some stations it was practically impossible to recognise in the quick run curves exactly where the maxima and minima ordinates fell. In such cases the repeated trials necessary to an assurance that we had got the true absolute range took more time than the 5-minute measurements. To have obtained hourly ranges in both ways would thus have added immensely to the labour.

A more important objection to the use of the relation (17) is that while at the ordinary station it applies with very considerable accuracy to the mean of a large number of hours having the same R, the values actually found for $(1/12)\Sigma\eta^2$ in individual cases differed enormously. For the same value of R, in the same element, at the same station, one got in a good many cases measured values of $(1/12)\Sigma\eta^2$ standing to one another in the ratio of 2 : 1 ; and ratios of 3 : 1, or even 4 : 1, were occasionally met with. The scheme, it is true, contemplated dealing with the 24 hours of the day together, and if the "activity" calculated from the range was too high for some of these, it would naturally be too low for other hours. But different hours contribute very differently, and on disturbed days the contributions from three or four hours may easily exceed all the rest. Thus it would inevitably happen that the mean value of the "activity" of the type we are considering, if calculated from the hourly ranges, would be largely in error in a considerable number of days. The full discussion of this question would, however, take us too far afield. Further information will be found by those who desire it in *Terrestrial Magnetism*, June, 1917, p. 57, and in *Roy. Soc. Proc.* A, vol. 94, 1918, pp. 536–547.

Section 46.—What it is proposed to do here is to give particulars of the hourly ranges—as given solely by measurements at the 5-minute intervals, except in the case of the Antarctic—and of the corresponding values of $(1/12)\Sigma\eta^2$ as derived from the 5-minute measurements. The hourly ranges at the co-operating stations appear in Tables LXXXVIII to XCIII, pp. 175 to 180, and the values of $(1/12)\Sigma\eta^2$ in Tables XCIV to XCIX, pp. 181 to 186.

The original curve measurements were all made in millimetres. The values of η and of the hourly ranges were first expressed in mm., and the values of $(1/12)\Sigma\eta^2$ in mm^2. Conversion to 1γ in the case of the ranges and to $(1\gamma)^2$ in case of $(1/12)\Sigma\eta^2$ was then made by means of the scale values of the curves. The scale values supplied for D gave the angular equivalent of 1 mm., but the force equivalent is immediately derivable from the fact that an angular change ΔD is equivalent to a change HΔD in value of the horizontal force. When only 2 or 3-figure accuracy is wanted in HΔD, 3-figure accuracy in H suffices.

The stations, with the exception of the three last in Tables LXXXVIII to XCIII, are arranged in order of longitude, proceeding from East to West. This was done with a view to juxtaposing stations whose local time differed least, it being the local time which determines the phase of the regular diurnal variation.

The blanks in individual hours in the range and " activity " tables mean in general that no curve was received for the date in question ; in other cases the record was incomplete. The reason for putting Greenwich, Kew and San Fernando at the foot of Tables LXXXVIII to XCIII, and omitting them from Tables XCIV to XCIX, was that while the ranges of the components in the horizontal plane seemed in general ascertainable with fair accuracy in spite of artificial disturbance, the same could not be said of the " Activities." Greenwich suffered decidedly the least of the three.

In the absence of special disturbance, the range will naturally be largest for those hours of the day when the changes shown by the diurnal inequality are most rapid. Ranges for the day hours, *i.e.*, between 6 h. and 18 h. L.M.T. will naturally exceed those for night hours, unless the day maximum or minimum falls within the selected hour. Bearing this in mind, a general idea of the relation to be expected between the ranges at different stations during quiet times may be derived from Table LXXXVII.

When the term hours were 8 to 10 G.M.T. they fell in the early morning or late evening at stations intermediate in longitude to Pilar and Honolulu. Thus small ranges would be anticipated at these stations, especially Pilar where June represents midwinter. Also the D ranges at the European stations, where the time fell in the forenoon, might be expected to exceed those at the Indian stations where the time fell in the afternoon, for the rise to the westerly maximum is a good deal more rapid than the subsequent swing to the east. These anticipations are only partly fulfilled. Pilar, Vieques, Tucson and Honolulu, it is true, especially the first and last mentioned, give usually decidedly smaller ranges than the European stations ; but on several days Agincourt and still more Sitka come well to the front, and the Indian stations do not on the whole fall short of the European. Some stations usually stand out from their neighbours, Sitka, Kodaikanal and Stonyhurst in particular. This is not surprising in the case of Sitka, for, as we shall see when dealing with magnetic storms, it is a very highly disturbed station, immensely more so than Honolulu its next neighbour in the tables. On a really quiet day like June 30, ranges at Sitka are as small as elsewhere, but on a disturbed day like July 28 it is otherwise. Why Kodaikanal ranges should tend to exceed those at Dehra Dun and Alibag is not obvious ; it can hardly arise from difference in local time. Stonyhurst is another puzzling case. The H ranges are generally similar to those at Greenwich and Kew and other European stations, but the D ranges are very outstanding. There are unfortunately no Eskdalemuir D ranges for comparison, but the Eskdalemuir W ranges are very similar to the D ranges at Kew, and from its geographical position one would have expected Stonyhurst D ranges to be intermediate between those at Kew and Eskdalemuir.

It must be remembered that while the curves were read to 0·1 mm., accuracy to 0·1 mm. is hard to secure, even when the traces are sharply defined, and in some cases the definition was anything but sharp. Also the sensitiveness varied much at different stations. Thus at Seddin the sensitiveness for each of the three elements lay between $2\cdot0\gamma$ and $2\cdot4\gamma$ per 1 mm., whereas at Alibag 1 mm. in the D trace was equivalent to 11γ. If we take $0\cdot1$ mm. as a limit to the error of measurement in an ordinate—an optimistic view for the best of curves—the range being the difference of two ordinates must be allowed a limit of error of $0\cdot2$ mm. Even at Seddin this would represent $0\cdot4\gamma$ or $0\cdot5\gamma$, and in D at Alibag it would be equivalent to $2\cdot2\gamma$. Thus much importance should not be attached to apparent small differences between the ranges at neighbouring stations.

Kew and Greenwich are so near together that we should naturally expect corresponding hourly ranges to be identical to the nearest 1γ. If there had been no artificial disturbance, a comparison of the ranges at the two places would have given an excellent idea of the accuracy reasonably attainable. But, under the existing conditions, the larger apparent differences may reasonably be ascribed to artificial disturbance. Some allowance also should be made for the fact that the instruments in use at the two places differed in type and in sensitiveness.

But for the fact that while D and H are recorded at De Bilt, N and W are recorded at Seddin, we should have expected very similar ranges from the two stations. A close agreement would also be expected between Uccle and Val Joyeux.

In the case of the term hours 17 h.–19 h. we should expect on quiet days the American stations to have the largest ranges and the Asiatic the least. This, generally speaking, was true of both hours on May 22, June 19 and July 21, and of the second hour on May 26. The first hour on May 26, and both hours on July 17 were a good deal disturbed, and during these hours there were large ranges at the European as well as the American stations.

We should also expect 18 h.–20 h. G.M.T. to show the largest ranges at American stations, and as the season was from November to January, *i.e.*, midsummer in the southern hemisphere—we should expect Pilar to be pre-eminent. The Pilar ranges are in fact sometimes the largest, and they are decidedly more prominent relatively than during the term hours of May, June and July. At the same time, absolutely considered, they are never very large, and sometimes they are quite small. The Stonyhurst D ranges for hours from 17 h. to 20 h. are less outstanding than those for hours 8 h. to 10 h. Still the majority of them seem unduly large compared with the corresponding ranges at other European stations.

Section 47.—Tables XCIV to XCIX give the values of $(1/12)\Sigma\eta^2$ during all the term hours at the co-operating stations. As already explained, the experimental relationship obtained between the activity of type A_2 and the range was approximately

$$(1/12)\Sigma\eta^2 = R^2/10. \quad . \quad . \quad . \quad . \quad . \quad (17').$$

On comparing corresponding data in Tables XCIV to XCIX, and Tables LXXXVIII to XCIII, it will be found that in a considerable proportion of cases the above numerical relation is not far from true, but in other cases it is far otherwise. As $(1/12)\Sigma\eta^2$ is at best only an approximation to the value of the theoretical integral, it may appear illogical to go to decimals of $(1\gamma)^2$ in the tables. A principal reason for doing so was to show how very small A_2 often is, especially in V.

The entries under " D or W " for Stonyhurst look even more remarkable than those in the range tables. There is no single instance in which the Stonyhurst-D entry under hours 8–9 and 9–10 is not in excess of that at every other European station, and the excess is very large except for the unusually disturbed time 8 h.–9 h. on July 28. Sitka alone shown a larger value than Stonyhurst, and that on only two hours out of the twelve.

In the second group of term hours 17 h.–19 h. this great pre-eminence of Stonyhurst D values is only sometimes apparent, and usually only in the second hour 18 h.–19 h. In the third group of term hours the Stonyhurst-D value for 18 h.–19 h. is usually but little outstanding, whereas it is always outstanding for 19 h.–20 h. There is certainly no obvious reason why disturbance at Stonyhurst should be so outstanding as compared with that from other European stations, or why the contribution from D to the " activity " should bear to the contribution from H a ratio altogether different from what obtains elsewhere. At the same time, if there were any error in the scale value it should show itself invariably and in all hours alike, and it should lead to diurnal inequalities differing conspicuously from those at other British stations.

Superficial inspection of the tables discloses that the contribution from V to the " activity " is usually the least, but it does not show whether D or H usually contributes most.

Tables C to CII, pp. 187 to 189, give the combined activities $\overline{H}$ from the two horizontal components and the total activity T (of the type A_2) obtained by adding to this the contribution from V.

It will be seen that the " activity " at Kodaikanal for 8 h.–9 h. and 9 h.–10 h. is in general decidedly larger than that at the other Indian stations. But this superiority of Kodaikanal does not extend to the hours 17–18, 18–19 or 19–20.

Section 48.—Tables CIII, CIV and CV, pp. 190 to 192, give mean values of the " activities " for the several term hours from all the available stations combined. The means M_1 and M_1' are confined to the " activities " from the horizontal components. M_1 includes every station which had both horizontal components complete, M_1' differs only in omitting Stonyhurst. M_2 includes only stations which had vertical force as well as horizontal force data, and M_2' again differs only in omitting Stonyhurst. Even if we were certain of the absolute correctness of the Stonyhurst D data, their character was so exceptional that a mean from which Stonyhurst data were excluded appeared desirable. The number of stations from which the mean is derived is stated in all cases.

Much the largest " activities " in Table CIII come from July 28. The contribution from the vertical component is in every case the least. It forms as much as 26 per cent. of the total activity for M_2' on July 24, 8 h.–9 h., but only 7 per cent. for 9 h.–10 h. of the same day.

In Table CIV, 18 h.–19 h. of July 17 supplies the largest value, a value considerably in excess of the largest in Table CIII. Taking M_2' we see that the contribution from V to the total varied from 19 per cent. for 17 h.–18 h. of June 19 to less than $4\frac{1}{2}$ per cent. for 18 h.–19 h. on July 17. On June 23 there was no Stonyhurst record, so M_1 is the same as M_1' and M_2 as M_2'.

In Table CV there is comparatively little difference between the different hours. The largest activities appear in 18 h.–19 h. of December 18 and January 22. On January 26 there was no Stonyhurst record for 18 h.–19 h. The "activities" in Table CV are generally less than those in Tables CIII and CIV. This was to be expected because, if we except Pilar and Mauritius, Table CV deals with midwinter, the other two tables with midsummer.

Section 49.—Table CVI, p. 193, gives the term hour ranges in the Antarctic for E′, S′ and V. Two values are given, the first being derived from the 5-minute measurements as in the case of the co-operating stations, the second being the absolute hourly range.

The 5-minute range equals the absolute range 13 times in V, 7 times in S′, but only 3 times in E′. The difference between the two ranges is not always small. Thus on January 22, hour 19–20, in E′ the 5-minute range is only 66 per cent. of the absolute range, while on November 24, hour 19–20, and on June 19, hour 18–19, the 5-minute range in V is only from 58 to 59 per cent. of the absolute range. On January 22, hour 19–20, the true minimum in E′ occurred two minutes after the previous 5-minute reading. During these two minutes the element fell 59γ, rising 68γ in the course of the next three minutes. The fall when quickest was at the exceptional rate of 43γ per minute.

Under such circumstances it would obviously require measurements at intervals much shorter than 5 minutes to satisfactorily represent the time integral A_2.

Whether we take 5-minute ranges or absolute ranges, the V ranges in Table CVI are relatively much more important than those in Tables LXXXVIII to XCIII. Taking absolute ranges in Table CVI, there is one hour, 18 h.–19 h., on January 26 when the V range is the largest of the three, and eight hours in which it comes second in size, being equal to the E′ range on one of these occasions. The E′ range is the largest in 22 hours, and the S′ range the largest in 9 hours, the two being equal in one hour on May 22. The S′ range is absolutely the smallest of the three in seven hours, and the E′ range in one hour. The E′ and V ranges for 8 h.–9 h., June 2, share the lowest place. On December 18 the E′ ranges in both hours and the S′ range in the first hour attain a size rarely reached by the *daily* range in tropical latitudes. At Kew a daily range of 200γ in H or D occurs on the average only about four times a year, and is very rarely encountered in years with as little sunspot development as 1911 and 1912.

Section 50.—Table CVII, p. 193, gives the values of $(1/12)\Sigma\eta^2$ in the Antarctic for the several term hours. The contributions from E′, S′ and V are given separately. The entry under "$\overline{\mathrm{H}}$" represents the sum of the contributions from the horizontal components E′ and S′, and the entry under "T" adds to this the contribution from V.

The "activities" for the first group of term hours, occurring in the Antarctic midwinter, are similar in size to the corresponding "activities" elsewhere. In fact the " activity " in the Antarctic for 8 h.–9 h. on June 30 is considerably below the average. The time 8 h.–10 h. G.M.T. is usually quiet in the Antarctic unless a disturbance of the special type discussed in Chapter XI comes along. July 28th was an occasion of more than usual disturbance, but unfortunately the Antarctic record for 8 h.–9 h. was incomplete. The " activity " for 9 h.–10 h. on July 28 was much in excess of that at any of the co-operating stations except Sitka, but the Sitka " activity " was the larger of the two, especially in V. As we shall see later, large V disturbances are rather characteristic of Sitka. The Antarctic " activity " was also much above the average found for the co-operating stations on both hours of June 2, but the value for 8 h.–9 h. was exceeded by that at Sitka.

The second set of term hours 17 h.–19 h. G.M.T. fell at a more disturbed part of the Antarctic day. July 17 was the day of greatest " activity " elsewhere, but unfortunately there was no Antarctic record on that occasion. On June 19, 17 h.–18 h., the Antarctic " activity " was only a little above the average for other stations, but in all the other nine hours for which records were obtained its excess was conspicuous.

Taking in chronological order the 10 hours for which data exist, the ratio borne by the total magnetic " activity " in the " Antarctic " to the mean " activity " for the co-operating stations including Stonyhurst had the following values 4·9, 5·3, 2·8, 15·6, 1·2, 3·6, 19·2, 14·9, 35·6 and 13·7. The least value of the ratio was that for 17 h.–18 h. on June 19. During this hour conditions were generally very quiet, but the " activity " in the Antarctic was exceeded by that at Cheltenham, Agincourt, Tucson and Honolulu. The largest value, 35·6, of the ratio occurred on 17 h.–18 h., July 21. Outside the Antarctic that hour was on the whole quiet; though considerably less so than 17 h.–18 h. June 19; but the two hours agreed in showing the greatest " activity " at Tucson, and on both occasions the " activity " was particularly low between the longitudes of Barrackpore and Mauritius. In the Antarctic an unusual feature of the hour 17–18, July 21, was that the contribution from V largely exceeded that from E′. Elsewhere, including Sitka, the contribution from V was generally very small. Except on June 19 the total " activity " in the Antarctic was exceeded only once and at one place, viz. on May 26, hour 17–18, at Eskdalemuir.

The third group of term hours represented midsummer in the Antarctic, but midwinter elsewhere except at Mauritius and Pilar. Thus, during these hours we should naturally expect large values for the ratio (Antarctic total " activity ") / (mean total " activity " elsewhere, including Stonyhurst). The values obtained for the ratio are, however, simply enormous, being in chronological order 108, 99, 74, 154, 1998, 477, 188, 216, 178, 252, 110 and 37. The largest value of the ratio, answering to 18 h.–19 h. December 18, no doubt represents a distinctly exceptional state of matters; but the choice of the twelve term hours was fortuitous, except that times were chosen near new moon with a view to facilitating auroral observations. It is true that in the Antarctic disturbance is more prevalent between 17 h. and 19 h. than in most hours of the day; but the same is true of Eskdalemuir, and so presumably of at least the European stations. It is thus a natural inference that any estimate of the " activity " of changes in the earth's magnetic field which leaves the polar regions out of account is likely to be hopelessly incomplete.

Section 51.—Table CVIII, p. 194, aims at comparing the values of the "activity" for the same hour on different days at different parts of the globe. Only the contributions from the components in the horizontal plane are considered, except in the case of the Antarctic, where the contributions from all three components are given as well. Take for illustration 9 h.–10 h. G.M.T. Returns for the six days were complete for four European stations (Stonyhurst, De Bilt, Uccle and Val Joyeux), five North American stations (Sitka, Agincourt, Cheltenham, Tucson and Vieques), five Indian stations (Dehra Dun, Alibag, Barrackpore, Toungoo and Kodaikanal). The mean values of $(1/12)\Sigma\eta^2$ from the six hours were $32\cdot5\gamma^2$ for the four European, $19\cdot3\gamma^2$ for the five American, $25\cdot3\gamma^2$ for the five Indian, and $21\cdot9\gamma^2$ for the whole 14 stations. On May 29 the mean values of $(1/12)\Sigma\eta^2$ were $29\cdot7\gamma^2$ for the European, $4\cdot7_3\gamma^2$ for the American, $12\cdot7\gamma^2$ for the Indian and $15\cdot6\gamma^2$ for all the stations combined. And we have

$$(29\cdot7/32\cdot5)100 = 91, \ (4\cdot7_3/19\cdot3)\ 100 = 25, \text{ and so on.}$$

In the case of 8 h.–9h. and 9 h.–10 h. the large size of the European mean value is due to the inclusion of Stonyhurst. It was unfortunate that owing to failure of trace on one day neither Seddin nor Eskdalemuir data could be utilised. In the case of hour 8–9, July 28 was much the most disturbed day at the European and Indian stations, but in the American group it was slightly exceeded by June 2. Even in the American group the disturbance on June 2 was practically confined to Sitka, while that on July 28 visibly affected the great majority of stations. The parallelism between the European and Indian stations is fairly close, but June 26 was quieter and July 24 less quiet in Europe than in India. As there was unfortunately no Antarctic record during 8 h.–9 h. on July 28, the Antarctic results are based on only five term hours; so corresponding results restricted to the same five hours were also obtained for the other stations. The parallelism between the Antarctic results and those from the other stations is fairly close. In each case June 2 figures as the most disturbed day and June 30 as the least disturbed.

In the case of hour 9–10, July 28 is everywhere the most disturbed day; but while its pre-eminence in the American stations is considerably greater than in the case of 8 h.–9 h., the reverse is true elsewhere. It is the exceptionally large size of the "activity" on July 28 at the American stations—especially Sitka—which makes the American percentage figures for the other days appear so low compared with those elsewhere. In the Antarctic, as elsewhere, July 28 was easily first; the chief peculiarity was that June 2 was much more disturbed than June 26.

In the case of hour 17–18 Europe is represented by only two stations (Seddin and De Bilt), but they show a very good general agreement. There were four North American and five Indian stations, as well as three miscellaneous (Honolulu, Mauritius and Pilar). The Antarctic record for July 17 was lacking, so only five hours were available for it. A second set of values for the same five hours was thus calculated for the several groups of co-operating stations. The hour fell in the early morning at the Indian stations, and conditions there were generally very quiet. Except in the Antarctic, May 26 was the most disturbed day, July 17 coming next; while May 22 and June 19 were conspicuously quiet. These last two days were also very quiet in the Antarctic; but there June 23 and July 21, especially the latter, were much more disturbed than May 26. If we consult Table CI we find that, with the solitary exception of Lukiapang, the "activity" whether horizontal or total was invariably greater on May 26 than on July 21. The difference between the Antarctic and other regions on this occasion is thus unusually conspicuous. It is somewhat suggestive that the difference between the Antarctic "activities" on the two days is most marked in the vertical component. There are various reasons for regarding great "activity" in the vertical component as an indication that the primary source of disturbance is not far from overhead.

The same stations were available for hour 18–19 as for hour 17–18 in the second group of term days. Records being again lacking for July 17 in the Antarctic, two sets of data had to be prepared for the other stations. The European and American figures for the several days are remarkably similar. July 17 is out of all comparison the most disturbed day, being followed after a long interval by May 26. Omitting July 17, the figures from the Antarctic and the mean of the other stations agree in the order in which the days come.

In the case of hour 18–19, in the third group of term hours, Europe is represented by four stations (Eskdalemuir, Seddin, De Bilt and Uccle), America by only two (Cheltenham and Vieques), India by five (Dehra Dun, Barrackpore, Toungoo, Alibag and Kodaikanal), and there is one additional station Pilar, making 12 in all. The time being midwinter at all the stations except Pilar, "activities" naturally rule low. The order in which the days come is rather markedly different. The European and Indian groups make December 18 the day of largest "activity," and it is slightly above the mean in the American group; but the European and Indian groups make November 20 a day of low "activity," while the American group makes it high. In the case of January 26 the Indian and American groups agree in making the "activity" low, while the European group makes it high. In the Antarctic the "activity" on December 18 was enormously greater than on any other day. Taking the horizontal components, the "activity" in the Antarctic was 60 times as great on December 18 as on January 26, whereas in Europe the "activities" on the two occasions were practically equal.

For hour 19–20 Stonyhurst was available, bringing the number of European stations up to five. The contribution from Stonyhurst unfortunately rather dwarfed those from the other four stations. There were still only two American stations, this time Sitka and Cheltenham. There were the same five Indian stations, and in addition Honolulu and Pilar, making 14 stations in all. The European, Indian and American data make January 22 much the most disturbed day, and even in the Antarctic it shows conspicuously more "activity" than any day except December 18. The comparatively high position taken by December 18 in the case of the mean from the 14 co-operating stations is mainly due to the large contribution from Pilar. The disturbance on December 18, though largely local to the Antarctic, would naturally be felt more throughout the southern than the northern hemisphere.

Section 52.—Table CIX, p. 195, compares the " activities " from the declination and horizontal force (West and North components in two cases) derived from all the co-operating stations. July 17 was so outstanding that it seemed best to form two sets of results, one including the other excluding it. Similarly, the exceptionally large D contributions from Stonyhurst made it desirable to give alternative results, one excluding Stonyhurst. If we omit the highly-disturbed day July 17, the D contribution is the larger if we include Stonyhurst; otherwise the H contribution is larger by a small margin. In either case the D and H contributions are of like importance. Neither can be omitted without a very serious underestimate of the " activity." Also on comparing the previous tables—where data for individual hours are given—it is obvious that even when we take the same hour of the day the ratio of the D to the H contribution at the same station varies too much to admit of any safe inference being drawn from the magnitude of the one as to the magnitude of the other.

Table CX, p. 195, is similar to Table CIX, but includes the vertical as well as the horizontal components. It is restricted to stations which supplied all three components, which accounts for some apparent inconsistencies with the previous table. The lowest of the four estimates makes the contribution from the vertical force one-ninth of that from the two horizontal components. Thus the vertical force contribution for the average hour at the average station is by no means negligible, and there are individual occasions, *e.g.*, both hours of July 28 at Sitka, when the contribution from V is both relatively and absolutely considerable. Still it would appear that the omission of the vertical component would be unlikely to seriously prejudice the conclusion that would be reached as to the " character " of the hour or day, if data from a large number of stations were considered.

Section 53.—Table CXI, p. 195, contrasts the results obtained for the Antarctic " activities " from the three groups of term hours. In the first group July 28 contributed only to the second hour, 9 h.–10 h. In the third group December 18 was omitted because on that occasion the disturbance was so outstanding it would have swamped the other days. Thus a better idea of the average relative importance of V was obtained by omitting it. Two sets of general means are given, the first based on all the 33 term hours for which records were complete, including the two on December 18, the second omitting December 18. In the first group of term hours the contribution from E′ is the largest, being on the mean of the two hours about 47 per cent. of the total, as compared with 38 per cent. from S′ and 15 per cent. from V. In the second group there is a marked difference between the two hours, the S′ contribution being the larger in the one, the E′ contribution in the other. The contribution from V averages about 18½ per cent. In the third group the contribution from E′ is much the largest in both hours, and the contribution from V is about 17 per cent. of the total. The " activity " was so much larger during the third group of term hours than during the first two that the third group is largely dominant in the two final means. If we omit December 18 we find the contribution from E′ nearly $2\frac{1}{2}$ times that from S′, and the contribution from V about 17 per cent. of the total. If we retain December 18 the relative importance of the contribution from E′ rises and that from V sinks.

It must be remembered that in Tables XCIII to CXI we are dealing with only a few hours of the day, and that if we had "activity" data from all hours of the day, and from all days of the year, our conclusions might be considerably different.

There are reasons, however, for believing that the results in Table CXI are more representative than might be thought. I have pointed out elsewhere that there is reason to expect the square of the daily range to give at least a rough idea of the total "activity," including the part derivable from the diurnal inequality as well as the part we have just been considering. If we take the values to the nearest 1γ of the absolute ranges and inequality ranges from all days, we have for the three midwinter months of 1911 and the three midsummer months of 1911–12 the results appearing in Table CXII, p. 196. Squaring the ranges we get the results in Table CXIII, p. 196.

Thus at midwinter—the season including the two first groups of term hours—the contributions from E′ and S′ are not far from equal; while at midsummer—the season of the third group of term hours—the contribution from E′ is markedly the larger. Also the preponderance of the E′ contribution in midsummer is larger when we consider the absolute than when we consider the inequality ranges. This is at least suggestive of a tendency for the E′ contribution to be relatively increased by disturbance, and so is in harmony with the fact that the percentage contribution from E′ in Table CXI is larger when we include than when we exclude December 18.

Taking the mean square of the ranges from the three elements we get, for the relative values of "activity" at midsummer and midwinter:

from absolute ranges, 1·6; from inequality ranges, 2·4.

In the case of the term hours 18 h.–19 h. is the only hour common to the two seasons. If we omit December 18 as outstanding we have five hours in each case. From these we find

(midsummer "activity")/(midwinter "activity") = 4·6.

Comparing this with the corresponding results from the two sets of daily ranges we should, I think, infer that even when we exclude December 18, either the midsummer term hours encountered more disturbance, or the midwinter term hours encountered less disturbance, than was quite characteristic of the season of the year.

At the same time, the day lacking in the Antarctic at midwinter was July 17 and, as Table CVIII shows, the "activity" on this occasion at stations outside the Antarctic was much above the average. Also, while no Antarctic record was got between 17 h. and 19 h. on July 17, there was record up to about 16 h. 55 m., and again subsequent to 19 h. 10 m. During the interval there was a fall of 70γ in E′, so that element must have possessed considerable "activity" during one at least of the term hours. Thus it is highly probable that but for the loss of trace on July 17 the result obtained for the Antarctic "activity" at midwinter would have been considerably larger.

If we combine the Antarctic results for the two hours 18 h.–20 h. of December 18, we find that the contribution of the horizontal components to $(1/12)\Sigma\eta^2$ amounted to $14593\gamma^2$. If, on the other hand, we combine the results from the horizontal components at all the co-operating stations on all the 36 term hours—representing in all an aggregate of 700 hours—we obtain $12871\gamma^2$. "Activity" such as that exhibited in the Antarctic during the term hours of December 18 is very rare in temperate latitudes; but it does present itself during disturbances of the largest size, such as occur once or twice in ten years. In such cases the disturbance is world wide, and the time of greatest "activity" may extend over several hours, minor though still large movements existing for a day or more. This will give some idea of how enormously the magnetic "activity" encountered during a storm of the first class exceeds that encountered on the average day. Another conclusion suggested by the Antarctic figures is that any calculation of the annual "activity" over the globe which is based on records confined to low and mean latitudes must inevitably lead to a very inadequate estimate.

Section 54.—The traces received from Agincourt were not quick runs, but copies of the ordinary slow run curves, in which the times shown were those of 75° W. By an oversight, in the original measurements the times shown were treated as if times G.M.T. The first set of values of $(1/12)\Sigma\eta^2$ obtained thus referred to times 5 hours in advance of the true term hours. On the mistake being discovered, the curves were remeasured at the proper times, and the data employed in Tables XCIII to CII refer to the same hours as the data for the other stations.

Having "activity" data for the two sets of hours at Agincourt, it is well to utilise them. The term hours of any one group of days are, of course, too few for the results to be accepted as wholly representative of the hours of the day at the particular season, still they should suffice to give a general idea.

Table CXIV, p. 196, gives the mean results obtained, employing only those days when there were data for all four hours. The quantity tabulated is $(1/12)\ \Sigma\eta^2$, the unit being $(1\gamma)^2$, and the time is L.M.T.

There was no day in which the value of $(1/12)\Sigma\eta^2$ was nearly so large for hour 3–4 as it was for either hour 8–9 or hour 9–10; and the same was true for hour 4–5, except on one occasion when the value for hour 8–9 was exceeded. Thus the lesser "activity" of the early morning hours 3 h.–5 h. as compared with 8 h.–10 h. may be accepted as a general feature, at least near midsummer.

The prominent position of hour 17–18 in the second group of term days is due to the exceptionally large contribution from July 17. If we omitted that day, the hour 12–13 would take the first place. The second and third groups of days agree in making the "activity" for hour 18–19 less than that for hour 13–14. The differences between the results for the second group (midsummer) and the third group (midwinter) for the common hours 13–14 and 18–19 are very striking.

TABLE LXXXVIII.—Ranges during Term Hours (Unit 1γ).

Station.	May 29, 1911.						June 2, 1911.						June 26, 1911.					
	8 h.–9 h.			9 h.–10 h			8 h.–9 h.			9 h.–10 h.			8 h.–9 h.			9 h.–10 h.		
	D or W.	H or N.	V.	D or W.	H or N.	V.	D or W.	H or N.	V.	D or W.	H or N.	V.	D or W.	H or N.	V.	D or W.	H or N.	V.
Stonyhurst ...	20·5	6·4	5·2	27·4	3·2	6·2	14·8	3·2	2·1	25·1	5·3	3·1	22·8	6·4	10·4	30·2	1·6	4·2
Eskdalemuir ...	4·3	13·8	5·6	9·5	6·0	8·4	—	—	—	—	—	—	4·3	5·2	8·7	7·8	6·1	5·8
Pilar	2·2	2·4	2·2	1·5	2·6	1·4	3·0	2·4	0·8	3·0	2·8	1·2	1·5	2·1	0·8	2·2	3·3	2·0
Vieques ...	6·0	1·1	2·3	6·0	2·0	1·7	4·3	2·5	2·3	5·1	2·3	1·1	1·7	2·0	1·7	13·7	4·8	2·9
Cheltenham ...	5·9	2·0	1·7	8·8	5·4	1·1	8·2	5·6	3·9	5·3	2·5	3·9	2·9	2·8	2·1	10·0	7·1	4·3
Agincourt ...	5·4	0·9	—	6·6	2·7	—	9·7	8·0	—	9·1	1·8	—	2·4	4·0	—	13·9	5·8	—
Tucson... ...	0·8	2·6	1·8	0·8	2·6	0·7	12·7	3·5	1·5	7·2	4·6	0·0	1·6	1·3	0·8	1·6	6·0	0·4
Sitka	5·5	6·0	1·4	3·7	5·2	2·8	22·5	37·2	12·8	13·8	11·2	9·0	4·1	2·2	0·9	5·5	3·0	1·4
Honolulu ...	3·4	2·1	2·0	1·7	2·8	0·0	2·5	6·7	1·8	1·7	3·9	0·8	3·4	2·1	1·8	3·4	2·8	1·0
Lukiapang ...	3·7	9·6	1·0	—	—	0·5	3·2	9·6	2·8	4·2	17·3	1·1	2·3	2·9	1·9	2·3	—	—
Toungoo ...	9·8	10·7	1·8	0·0	3·8	3·2	0·6	11·3	4·4	10·4	9·9	4·0	8·7	15·0	5·3	3·5	12·9	1·3
Barrackpore ...	5·5	12·0	3·2	9·9	9·6	2·7	7·7	10·0	1·8	8·8	5·3	5·4	12·1	11·0	4·5	7·7	15·3	1·8
Dehra Dun ...	9·7	5·7	5·3	7·8	3·2	2·9	2·0	2·0	—	9·7	4·1	6·7	8·8	4·5	6·3	6·8	7·3	3·6
Kodaikanal ...	13·2	24·2	14·6	6·6	13·3	6·8	7·7	6·6	1·1	12·1	11·5	5·1	11·0	25·4	5·1	9·9	19·9	6·8
Alibag	15·4	4·6	8·4	8·8	9·2	3·7	1·1	6·0	5·6	9·9	1·4	7·4	11·0	9·2	14·0	9·9	16·1	6·5
Mauritius ...	—	—	—	2·3	8·5	4·3	0·8	12·7	1·5	8·3	5·8	0·0	9·1	11·1	8·9	12·1	2·7	1·5
Helwan ...	18·5	13·5	5·6	5·3	12·1	4·4	15·0	8·2	10·0	5·3	12·3	1·9	21·2	15·0	5·6	8·8	12·3	8·8
Seddin	11·8	9·9	4·6	18·6	1·2	6·0	6·1	5·8	2·4	6·5	4·4	2·0	14·7	3·9	7·0	9·8	12·6	17·0
De Bilt... ...	12·6	10·2	—	17·2	2·6	—	9·7	5·6	—	6·3	5·6	—	2·9	4·3	—	18·9	12·5	—
Uccle	10·0	8·8	—	13·3	1·2	—	6·1	2·9	—	3·3	2·9	—	2·8	1·2	—	12·7	10·5	—
Val Joyeux ...	6·6	12·5	—	12·8	2·0	—	7·1	8·2	—	5·7	2·3	—	—	—	—	13·3	7·4	—
Greenwich ...	6·8	13·0	5·8	10·8	1·4	8·7	4·1	4·3	2·9	5·4	5·8	4·4	2·7	4·3	4·4	12·2	5·8	13·1
Kew	9·4	8·0	—	9·4	5·4	—	7·0	5·4	—	4·7	5·4	—	2·3	2·7	—	9·4	8·0	—
San Fernando	4·1	4·3	—	20·7	8·6	—	8·3	8·6	—	8·3	8·6	—	4·1	—	—	16·6	—	—

Table LXXXIX.—Ranges during Term Hours (Unit 1γ).

Station.	June 30.						July 24.						July 28.					
	8 h.–9 h.			9 h.–10 h.			8 h.–9 h.			9 h.–10 h.			8 h.–9 h.			9 h.–10 h.		
	D or W.	H or N.	V.	D or W.	H or N.	V.	D or W.	H or N.	V.	D or W.	H or N.	V.	D or W.	H or N.	V.	D or W.	H or N.	V.
Stonyhurst ...	17·1	3·7	5·2	21·1	4·8	5·7	20·5	6·9	4·7	25·1	6·4	4·2	30·2	14·8	10·4	41·1	20·1	3·1
Eskdalemuir ...	4·3	6·1	4·8	2·6	5·2	7·8	8·6	6·1	3·0	9·5	8·7	5·0	20·7	21·8	9·9	15·6	28·8	6·9
Pilar	2·2	2·9	3·0	1·5	2·4	2·6	1·5	5·7	0·2	5·2	4·8	0·4	3·7	4·1	1·4	1·5	4·1	0·8
Vieques ...	1·7	0·8	1·1	5·1	0·8	1·7	7·7	6·1	4·6	2·6	4·1	3·5	5·1	7·7	8·0	7·7	4·4	4·6
Cheltenham ...	1·8	3·0	2·1	5·9	5·2	3·2	9·4	5·5	2·1	2·9	5·8	1·0	8·8	17·4	4·2	19·3	9·2	1·0
Agincourt ...	2·4	1·8	—	7·2	1·3	—	11·5	5·3	—	6·0	5·8	—	16·3	18·2	—	26·6	13·3	—
Tucson... ...	0·8	1·3	0·4	1·6	1·6	0·4	6·4	5·7	0·4	3·2	7·4	1·5	8·0	11·2	1·1	13·5	8·7	0·8
Sitka	3·2	3·0	0·9	4·1	3·7	1·4	4·1	6·2	1·4	7·8	4·5	1·4	20·2	25·9	14·2	46·8	36·6	31·8
Honolulu ...	0·0	1·3	5·0	0·8	1·8	1·3	2·5	3·6	2·0	2·5	4·3	2·0	2·5	4·8	—	6·8	8·2	—
Lukiapang ...	9·3	4·8	1·9	—	—	—	0·9	6·4	6·6	—	—	—	—	23·5	5·5	—	—	—
Toungoo ...	3·5	9·9	5·3	11·0	7·0	7·9	3·5	5·4	4·9	9·2	10·7	4·9	11·5	17·2	0·2	5·8	23·0	0·5
Barrackpore ...	7·7	4·8	2·7	4·4	9·6	6·8	4·4	4·8	1·4	8·8	12·0	4·5	24·2	17·2	6·3	5·5	21·0	4·1
Dehra Dun ...	3·9	7·3	2·7	9·7	5·3	6·8	6·8	8·1	6·5	8·8	11·4	1·4	17·5	16·2	8·8	14·6	15·4	6·5
Kodaikanal ...	6·6	9·1	3·4	0·0	17·5	2·3	3·3	10·9	11·3	1·1	16·9	6·2	17·6	30·2	5·1	14·3	29·0	9·0
Alibag	7·7	2·3	6·5	4·4	14·8	3·7	7·7	5·5	2·8	5·5	18·0	3·7	12·1	21·7	19·5	11·0	21·2	6·5
Mauritius ...	10·6	6·9	14·6	12·1	11·1	3·7	15·9	12·2	9·5	9·9	13·3	4·4	15·9	4·2	3·7	7·6	7·4	2·2
Helwan ...	12·4	10·2	3·1	10·6	8·2	5·6	—	—	—	—	—	—	—	—	—	—	—	—
Seddin	10·6	5·6	3·2	7·1	6·5	8·0	9·0	6·5	7·2	9·0	7·7	1·8	24·9	—	—	18·4	—	—
De Bilt... ...	3·4	2·0	—	5·7	5·6	—	8·6	6·9	—	9·7	7·3	—	33·2	21·1	—	17·2	19·8	—
Uccle	5·0	2·9	—	3·9	2·9	—	7·2	5·9	—	6·6	1·8	—	19·3	12·3	—	18·2	12·9	—
Val Joyeux ...	8·5	2·0	—	4·3	2·0	—	9·0	5·1	—	9·5	5·1	—	20·9	13·7	—	21·8	14·0	—
Greenwich ...	5·4	2·9	8·7	2·7	4·3	8·7	8·1	5·8	4·4	9·5	5·8	4·4	21·7	14·5	11·6	14·9	18·8	8·7
Kew	4·7	5·4	—	7·0	5·4	—	9·4	5·4	—	11·7	5·4	—	21·1	13·4	—	23·4	18·7	—
San Fernando...	4·1	4·3	—	8·3	12·9	—	12·4	4·3	—	12·4	12·9	—	8·3	17·2	—	29·0	12·9	—

TABLE XC.—Ranges during Term Hours (Unit 1γ).

Station.	May 22.						May 26.						June 19					
	17 h.–18 h.			18 h.–19 h.			17 h.–18 h.			18 h.–19 h.			17 h.–18 h.			18 h.–19 h.		
	D or W.	H or N.	V.	D or W.	H or N.	V.	D or W.	H or N.	V.	D or W.	H or N.	V.	D or W.	H or N.	V.	D or W.	H or N.	V.
Stonyhurst ...	9·1	10·1	1·0	21·7	9·5	3·1	20·6	25·4	5·2	28·0	13·8	4·2	8·6	4·2	3·6	22·8	6·9	1·6
Eskdalemuir ...	6·0	11·2	4·7	3·5	6·0	2·8	18·1	26·8	4·7	7·8	13·8	4·7	—	—	—	—	—	—
Pilar	4·5	2·6	6·6	7·5	4·8	5·4	5·2	8·8	4·2	4·5	6·0	4·2	3·7	3·3	1·6	6·7	3·3	5·4
Vieques ...	4·3	1·7	2·3	1·7	2·0	1·7	1·7	7·1	8·6	1·7	4·0	7·5	8·5	1·7	2·9	8·5	2·3	3·5
Cheltenham ...	5·9	7·8	6·2	2·9	4·8	6·2	4·7	29·5	6·1	2·3	13·9	3·9	11·7	6·2	3·2	5·3	7·7	6·0
Agincourt ...	6·0	5·3	—	1·8	13·3	—	12·7	34·2	—	6·6	13·3	—	13·9	8·0	—	9·7	12·4	—
Tucson... ...	8·8	8·5	2·1	12·7	3·7	3·2	25·5	16·2	2·1	17·5	12·0	3·9	20·7	2·0	12·1	15·1	13·6	0·8
Sitka	8·7	7·5	5·7	7·8	4·5	5·7	15·6	11·9	4·7	10·6	16·4	3·3	2·8	7·5	2·4	4·6	4·5	2·4
Honolulu ...	10·2	2·8	1·8	4·2	2·6	2·0	14·4	4·4	2·5	3·4	1·5	7·6	10·2	2·6	2·5	2·5	7·7	5·0
Lukiapang ...	—	4·8	1·6	—	—	0·8	6·0	4·8	1·8	5·1	9·6	1·4	1·4	3·8	1·9	2·8	2·9	0·6
Toungoo ...	2·3	3·8	1·8	1·2	5·1	3·7	10·4	5·6	0·9	1·7	1·3	2·3	4·0	0·8	0·4	5·8	4·6	1·3
Barrackpore ...	3·3	3·8	3·6	3·3	6·2	2·3	6·6	8·1	2·3	3·3	4·8	1·8	2·2	2·4	1·8	2·2	3·3	0·9
Dehra Dun ...	2·0	4·5	—	1·0	6·9	1·6	4·9	4·9	2·4	2·9	5·7	2·4	1·0	2·8	—	2·0	2·8	—
Kodaikanal ...	3·3	4·2	1·7	3·3	6·0	2·3	1·1	9·1	1·7	4·4	2·4	1·7	0·0	0·6	0·0	0·0	4·8	1·7
Alibag	2·2	2·8	0·9	0·0	5·5	0·9	5·5	8·3	4·7	2·2	3·7	1·9	4·4	3·2	3·7	3·3	1·4	2·8
Mauritius ...	1·5	3·7	—	2·3	4·2	—	9·9	9·5	4·3	3·0	5·3	1·2	3·0	4·2	2·2	1·5	5·3	3·7
Helwan ...	3·5	1·3	1·2	5·3	3·4	1·9	—	—	—	1·8	—	3·1	1·8	2·7	1·9	1·8	3·4	1·3
Seddin	2·2	5·1	3·0	2·7	6·8	2·0	18·4	23·7	5·6	9·2	9·9	4·8	1·8	6·1	3·4	3·5	7·5	3·2
De Bilt... ...	2·3	5·6	—	4·0	4·9	—	26·3	17·5	—	6·9	11·9	—	3·4	4·0	—	2·3	6·6	—
Uccle	4·4	7·6	—	1·1	5·9	—	12·2	17·6	—	4·4	10·5	—	2·2	1·8	—	2·8	5·3	—
Val Joyeux ...	4·7	3·1	—	—	—	—	9·5	—	—	—	—	—	—	—	—	1·9	6·6	—
Greenwich ...	4·1	4·3	—	2·7	5·8	—	13·6	21·7	7·3	5·4	11·6	4·4	4·1	2·9	5·8	2·7	7·2	1·5
Kew	4·7	8·0	—	4·7	8·0	—	14·0	21·4	—	4·7	13·4	—	4·7	2·7	—	4·7	8·0	—
San Fernando...	4·1	8·6	—	8·3	12·9	—	8·3	8·6	—	4·1	12·9	—	4·1	4·3	—	4·1	4·3	—

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TABLE XCI.—Ranges during Term Hours (Unit 1γ).

Station.	June 23, 1911.						July 17, 1911.						July 21, 1911.					
	17 h.–18 h.			18 h.–19 h.			17 h.–18 h.			18 h.–19 h.			17 h.–18 h.			18 h.–19 h.		
	D or W.	H or N.	V.	D or W.	H or N.	V.	D or W.	H or N.	V.	D or W.	H or N.	V.	D or W.	H or N.	V.	D or W.	H or N.	V.
Stonyhurst ...	—	—	—	—	—	—	13·7	38·2	2·1	11·4	44·0	3·6	11·4	12·7	3·6	14·3	11·1	2·1
Eskdalemuir ...	5·2	16·6	1·9	11·2	17·5	1·9	20·7	41·9	4·0	34·6	45·4	8·9	8·6	13·1	1·0	6·9	15·7	2·0
Pilar	3·7	3·6	2·4	9·0	4·5	1·6	3·7	13·6	9·4	6·0	6·4	4·0	3·7	5·5	1·2	3·0	2·2	2·6
Vieques ...	1·7	5·1	4·0	6·8	5·6	4·0	15·4	5·5	6·9	3·4	16·8	12·6	—	—	—	—	—	—
Cheltenham ...	8·8	10·3	8·1	1·2	9·5	2·7	10·5	18·8	5·8	24·6	39·7	5·3	8·8	10·4	2·6	4·7	7·7	7·9
Agincourt ...	10·3	12·4	—	7·9	8·9	—	18·7	24·4	—	36·8	42·6	—	10·9	12·4	—	7·2	10·7	—
Tucson... ...	14·3	7·1	8·7	9·6	4·7	2·6	13·5	13·5	3·4	16·7	7·2	3·0	16·7	3·2	2·6	5·6	5·8	0·0
Sitka	16·5	14·2	2·4	16·1	8·2	4·7	19·7	25·4	5·7	69·8	57·5	16·6	15·1	11·2	4·3	23·0	16·5	6·6
Honolulu ...	5·9	1·3	7·8	5·9	2·1	7·3	7·6	4·6	2·5	19·5	5·4	10·1	6·8	2·3	7·6	11·9	4·6	9·6
Lukiapang ...	2·3	7·7	1·3	6·0	3·4	2·6	6·5	9·3	2·8	11·1	6·9	2·8	8·4	2·5	2·8	4·6	3·4	2·8
Toungoo ...	2·9	5·9	1·3	8·7	0·5	2·2	0·6	5·6	0·2	1·7	9·6	0·7	9·8	0·5	0·5	0·6	0·8	0·2
Barrackpore ...	3·3	5·7	2·7	7·7	3·8	1·8	3·3	8·6	2·7	9·9	10·5	2·3	5·5	4·3	1·8	6·6	1·9	2·3
Dehra Dun ...	1·0	7·3	—	7·8	3·7	1·4	2·9	7·3	—	8·8	14·6	3·2	2·9	3·2	0·9	5·8	4·1	0·9
Kodaikanal ...	5·5	3·6	2·8	1·1	1·2	1·1	2·2	6·0	2·8	5·5	6·6	4·5	5·5	1·8	2·8	4·4	1·2	3·9
Alibag	3·3	4·1	3·7	4·4	6·5	4·7	2·2	6·5	3·7	7·7	12·0	4·7	3·3	3·7	7·4	6·6	1·8	4·7
Mauritius ...	4·6	3·7	0·7	9·1	6·9	0·0	2·3	8·0	1·5	0·8	10·6	2·9	3·0	3·2	1·5	3·0	6·4	1·5
Helwan ...	6·2	4·8	3·1	1·8	3·4	3·8	—	—	—	—	—	—	—	—	—	—	—	—
Seddin	4·7	10·4	3·2	4·3	12·1	3·6	6·5	30·2	6·6	7·4	43·6	10·0	8·6	10·2	3·8	2·5	9·2	2·8
De Bilt... ...	4·0	12·2	—	5·7	15·5	—	6·9	34·6	—	17·2	46·9	—	12·0	8·2	—	4·6	8·6	—
Uccle	5·5	9·4	—	2·8	13·5	—	—	25·8	—	—	31·1	—	6·6	7·0	—	1·7	5·3	—
Val Joyeux ...	4·3	9·8	—	2·8	11·7	—	3·8	23·4	—	—	—	—	4·7	9·0	—	3·8	8·2	—
Greenwich ...	5·4	11·6	2·9	5·4	15·9	2·9	4·1	30·3	4·4	14·9	36·1	5·8	6·8	10·1	2·9	4·1	8·7	7·3
Kew	2·3	8·0	—	4·7	13·4	—	4·7	29·4	—	16·4	34·8	—	7·0	8·0	—	4·7	8·0	—
San Fernando...	12·4	8·6	—	8·3	12·9	—	8·3	8·6	—	4·1	30·0	—	4·1	8·6	—	8·3	4·3	—

Table XCII.—Ranges during Term Hours (Unit 1γ).

Station.	November 20.						November 24.						December 18.					
	18 h.–19 h.			19 h.–20 h.			18 h.–19 h.			19 h.–20 h.			18 h.–19 h.			19 h.–20 h.		
	D or W.	H or N.	V.	D or W.	H or N.	V.	D or W.	H or N.	V.	D or W.	H or N.	V.	D or W.	H or N.	V.	D or W.	H or N.	V.
Stonyhurst ...	6·9	2·1	1·6	16·6	1·0	2·1	6·3	2·6	3·1	18·8	3·1	1·0	9·1	5·2	4·7	17·1	1·6	8·3
Eskdalemuir ...	3·5	3·5	3·5	2·6	3·5	2·6	0·9	2·6	2·6	1·7	2·6	0·9	6·9	6·1	0·9	0·0	4·4	0·0
Pilar	10·5	4·0	3·2	9·7	3·8	3·4	7·5	4·1	4·2	6·0	2·1	1·4	5·2	3·6	3·8	23·2	3·6	2·0
Vieques ...	8·5	2·0	1·7	6·0	1·7	2·4	2·6	5·2	0·7	3·4	2·9	0·7	3·4	7·3	1·9	—	—	—
Cheltenham ...	7·0	8·6	3·8	7·0	6·7	3·3	4·7	7·5	2·3	6·4	3·5	1·4	8·2	5·0	4·4	4·7	4·5	2·9
Agincourt ...	2·4	9·3	—	9·1	5·3	—	5·4	9·3	—	6·0	8·4	—	—	—	—	—	—	—
Tucson... ...	9·6	4·4	1·8	5·6	5·9	4·2	—	—	—	—	—	—	—	—	—	1·6	1·7	8·3
Sitka	8·3	7·6	2·8	4·6	3·6	3·8	7·8	3·6	2·4	4·1	4·9	1·4	—	—	—	5·5	3·1	1·0
Honolulu ...	2·5	4·5	0·6	7·6	6·6	7·2	1·7	3·7	2·4	3·4	2·6	3·0	3·4	1·1	1·3	0·0	3·2	2·9
Lukiapang ...	1·9	1·4	1·6	1·4	1·8	1·2	0·5	5·5	1·2	0·9	3·7	2·9	4·6	—	—	3·7	—	—
Toungoo ...	2·3	5·9	2·1	3·5	3·8	5·2	2·3	5·4	2·1	1·2	3·2	2·1	2·3	4·8	0·5	0·0	4·3	4·2
Barrackpore ...	1·1	1·4	0·9	1·1	1·0	1·4	0·0	4·8	1·8	0·6	3·8	1·8	4·4	4·8	2·3	1·1	0·5	1·8
Dehra Dun ...	1·0	4·1	0·8	1·0	1·6	0·8	1·0	7·7	1·6	2·0	2·8	1·6	3·9	4·5	1·7	1·0	2·4	1·3
Kodaikanal ...	3·3	2·4	2·6	3·3	1·8	1·1	2·2	3·0	3·4	2·2	3·9	2·6	4·4	4·8	3·2	3·3	3·6	0·0
Alibag	3·3	2·3	2·8	2·2	2·3	2·8	3·3	4·6	1·9	3·3	1·8	2·8	3·3	4·6	4·6	3·3	1·8	1·9
Mauritius ...	2·3	3·7	—	3·0	3·7	—	—	8·0	—	2·3	4·8	—	1·5	5·3	1·4	0·0	3·2	0·7
Helwan ...	—	—	—	—	—	—	0·9	5·5	—	3·5	4·0	0·6	5·3	2·7	1·2	1·8	2·7	1·8
Seddin	4·3	2·0	1·3	2·2	1·5	1·1	2·2	4·4	1·5	1·7	2·4	1·3	7·3	5·1	1·7	3·9	2·0	1·5
De Bilt... ...	4·0	3·3	—	4·0	2·6	—	1·7	3·0	—	3·4	3·3	—	7·4	4·0	—	4·6	2·3	—
Uccle	2·8	1·8	—	1·1	1·2	—	2·2	2·9	—	1·1	2·3	—	4·4	1·8	—	3·3	1·2	—
Val Joyeux ...	3·8	5·2	—	—	—	—	2·8	5·6	—	4·7	3·6	—	5·2	4·8	—	3·8	1·6	—
Greenwich ...	4·1	4·3	2·9	2·7	1·4	1·5	2·7	4·3	2·9	1·4	2·9	1·5	5·4	4·3	4·4	1·4	2·9	2·9
Kew	1·9	2·7	—	3·3	2·7	—	2·3	5·4	—	2·3	8·0	—	7·0	5·4	—	4·7	2·7	—
San Fernando...	8·3	8·6	—	4·1	4·3	—	4·1	4·3	—	4·1	4·3	—	4·1	8·6	—	4·1	4·3	—

Table XCIII.—Ranges during Term Hours (Unit 1γ).

Station.	December 22, 1911.						January 22, 1912.						January 26, 1912					
	18 h.–19 h.			19 h.–20 h.			18 h.–19 h			19 h.–20 h.			18 h.–19 h.			19 h.–20 h.		
	D or W.	H or N.	V.	D or W.	H or N.	V.	D or W.	H or N.	V.	D or W.	H or N.	V.	D or W.	H or N.	V.	D or W.	H or N.	V.
Stonyhurst ...	7·4	5·2	5·2	19·4	6·2	3·6	5·7	6·2	8·8	17·7	7·3	5·2	—	—	—	22·8	1·0	6·8
Eskdalemuir ...	2·6	3·5	2·7	3·5	7·9	0·0	3·5	8·7	1·8	4·3	10·5	3·6	5·2	6·1	2·7	4·3	3·5	0·0
Pilar	12·7	6·2	4·0	1·5	3·1	3·4	6·0	3·3	6·0	6·0	6·4	1·4	3·0	3·6	4·0	15·0	8·4	6·4
Vieques ...	5·1	3·5	0·4	8·5	6·4	7·3	6·0	8·1	3·2	4·3	5·8	2·1	5·1	1·7	0·7	3·4	1·7	1·1
Cheltenham ...	7·6	6·4	1·5	5·9	2·2	2·2	4·1	3·0	4·5	3·5	7·0	3·5	4·7	5·0	3·5	4·7	2·0	1·0
Agincourt ...	4·8	11·1	—	6·6	5·3	—	6·6	3·1	—	4·8	6·2	—	3·6	4·0	—	5·4	1·8	—
Tucson... ...	—	—	—	5·6	3·0	4·0	3·2	3·2	1·1	4·8	5·7	2·2	1·6	1·9	2·2	2·4	0·9	3·6
Sitka	4·6	2·7	2·9	4·1	2·7	1·0	12·9	8·5	5·8	11·5	8·5	3·9	2·8	—	1·4	4·1	3·1	1·0
Honolulu ...	—	—	—	5·1	4·2	4·5	2·5	3·5	3·5	0·0	3·5	1·0	2·5	1·9	1·0	2·5	2·4	0·0
Lukiapang ...	0·9	6·1	1·0	1·4	4·7	1·6	2·3	4·1	1·0	2·3	5·4	0·5	2·3	4·1	1·9	2·3	2·3	1·0
Toungoo ...	1·2	7·5	1·1	0·0	2·7	4·2	1·2	6·7	1·2	1·2	3·8	1·2	1·2	2·4	0·5	1·7	5·6	0·9
Barrackpore ...	1·1	6·2	1·8	1·1	3·3	0·9	2·2	4·8	1·4	3·3	6·2	1·8	3·3	1·9	0·9	1·1	1·4	1·4
Dehra Dun ...	2·0	3·7	0·9	2·9	4·1	0·9	2·9	4·5	0·4	2·9	6·5	0·9	2·9	2·0	1·3	2·0	1·2	0·9
Kodaikanal ...	1·1	4·8	3·7	1·1	6·0	2·6	0·0	5·4	0·5	0·0	4·2	5·3	3·3	1·2	2·1	2·2	1·2	2·6
Alibag	2·2	4·6	2·8	2·2	4·6	4·6	3·3	4·6	3·7	2·2	5·5	2·8	2·2	1·8	1·9	2·2	1·8	2·8
Mauritius ...	0·8	4·2	2·1	1·5	2·1	1·4	—	—	—	—	—	—	—	—	—	—	—	—
Helwan ...	1·8	3·4	2·5	4·4	6·7	2·5	1·8	4·7	1·8	0·0	10·1	3·1	3·5	2·0	1·2	2·7	3·4	0·0
Seddin	2·2	4·4	0·6	3·5	8·1	0·9	2·8	8·1	1·7	3·9	11·5	2·2	6·5	2·7	1·3	3·7	3·7	2·4
De Bilt... ...	2·9	4·0	—	2·9	9·9	—	2·3	6·9	—	2·9	12·2	—	6·9	2·6	—	4·6	2·6	—
Uccle	1·7	3·5	—	2·8	5·9	—	3·3	4·1	—	2·8	7·6	—	3·3	5·3	—	1·7	2·3	—
Val Joyeux ...	3·3	3·6	—	3·8	8·0	—	6·6	4·4	—	4·3	10·8	—	5·2	3·2	—	3·3	1·6	—
Greenwich ...	2·7	4·3	4·4	1·4	5·8	2·9	4·1	5·9	2·9	2·7	10·3	1·4	4·1	5·9	2·9	4·1	3·0	1·4
Kew	4·7	5·4	—	4·7	8·0	—	4·7	8·0	—	4·7	13·4	—	4·7	5·4	—	7·0	8·0	—
San Fernando...	4·1	4·3	—	8·3	8·6	—	8·3	8·6	—	4·1	12·9	—	4·1	4·3	—	4·1	4·3	—

TABLE XCIV.—" Magnetic Activity " during Term Hours. Value of $(1/12)\Sigma\eta^2$ in terms of $(1\gamma)^2$.

Station.	May 29, 1911.						June 2, 1911.						June 26, 1911.					
	8 h.–9 h.			9 h.–10 h.			8 h.–9 h.			9 h.–10 h.			8 h.–9 h.			9 h.–10 h.		
	D or W.	H or N.	V.	D or W.	H or N.	V.	D or W.	H or N.	V.	D or W.	H or N.	V.	D or W.	H or N.	V.	D or W.	H or N.	V.
Stonyhurst ...	39·9	3·8	2·4	67·2	0·8	3·3	22·6	0·9	0·6	53·0	2·0	0·5	44·3	5·0	12·3	92·0	0·3	1·8
Eskdalemuir ...	1·3	16·3	3·1	9·3	4·2	9·2	—	—	—	—	—	—	1·6	1·5	11·8	5·1	2·6	5·2
Pilar	1·0	0·6	0·4	0·4	0·9	0·2	0·7	0·6	0·1	0·6	0·6	0·1	0·5	0·4	0·1	0·8	0·7	0·6
Vieques ...	3·4	0·1	0·2	2·8	0·4	0·4	2·1	0·8	0·6	2·5	0·4	0·2	0·6	0·4	0·3	17·1	1·9	0·4
Cheltenham ...	2·3	0·3	0·2	5·7	3·1	0·1	6·3	3·4	2·1	2·8	0·6	1·3	1·1	0·8	0·2	9·3	4·8	1·7
Agincourt ...	3·8	0·1	—	5·0	0·5	—	8·5	5·7	—	7·6	0·6	—	0·6	1·4	—	16·5	4·8	—
Tucson ...	0·1	0·8	0·1	0·2	0·7	0·1	22·5	0·5	0·1	5·4	1·5	0·0	0·2	0·1	0·0	0·3	3·3	0·0
Sitka	4·7	5·9	0·2	1·8	3·4	0·5	45·2	79·9	16·0	9·2	9·9	7·8	1·5	0·8	0·1	2·8	0·5	0·2
Honolulu ...	0·6	0·5	0·7	0·7	0·9	0·0	1·1	6·5	0·4	0·4	1·4	0·1	1·3	0·6	0·2	1·3	0·9	0·1
Lukiapang ...	0·7	7·9	0·2	—	—	2·2	0·3	12·2	0·9	1·3	34·3	0·3	0·7	0·7	0·5	0·6	—	—
Toungoo ...	10·3	9·0	0·4	0·0	0·6	1·2	0·0	16·3	1·9	5·7	6·6	1·2	9·8	19·8	4·7	0·9	15·5	0·2
Barrackpore ...	2·7	12·7	0·7	10·6	8·2	0·6	7·0	11·8	0·3	4·4	3·7	2·4	18·9	10·2	1·9	9·2	22·0	0·2
Dehra Dun ...	11·1	2·8	3·4	5·0	1·1	0·5	0·4	0·4	—	9·4	1·2	3·3	6·7	2·8	4·4	2·9	6·6	0·7
Kodaikanal ...	20·8	42·0	18·2	5·9	17·6	2·2	7·3	5·8	0·3	17·0	9·9	3·6	5·5	51·5	1·8	4·4	46·7	6·4
Alibag	14·8	2·9	5·6	7·0	7·5	2·0	0·3	3·5	1·7	6·7	0·2	5·6	16·0	8·7	17·7	8·5	23·6	4·9
Mauritius ...	—	—	—	0·6	9·1	1·8	0·1	14·6	0·2	7·6	3·1	0·0	6·9	13·4	8·3	15·1	0·4	0·4
Helwan ...	41·4	23·6	3·1	3·5	14·3	1·2	18·7	4·2	8·8	2·8	14·5	0·3	36·5	20·8	2·5	4·4	12·3	6·5
Seddin	15·1	7·4	2·6	32·5	0·1	2·5	3·7	2·9	0·6	4·6	0·8	0·3	24·6	1·4	3·8	6·0	13·5	26·0
De Bilt... ...	16·4	10·5	—	23·8	0·3	—	11·4	2·0	—	2·0	3·6	—	0·6	1·8	—	35·9	15·1	—
Uccle	10·0	9·3	—	12·5	0·1	—	3·0	0·7	—	1·0	0·9	—	0·8	0·3	—	16·4	10·0	—
Val Joyeux ...	3·1	13·4	—	13·6	0·3	—	5·6	3·8	—	1·7	0·2	—	—	—	—	16·3	5·4	—

TABLE XCV.—" Magnetic Activity " during Term Hours. Value of $(1/12)\Sigma\eta^2$ in terms of $(1\gamma)^2$.

Station.	June 30, 1911.						July 24, 1911.						July 28, 1911.					
	8 h.–9 h.			9 h.–10 h.			8 h.–9 h.			9 h.–10 h.			8 h.–9 h.			9 h.–10 h.		
	D or W.	H or N.	V.	D or W.	H or N.	V.	D or W.	H or N.	V.	D or W.	H or N.	V.	D or W.	H or N.	V.	D or W.	H or N.	V.
Stoneyhurst ...	19·0	0·7	2·2	44·0	2·3	2·4	38·8	3·2	2·2	66·0	3·9	1·8	101·2	20·1	8·1	112·7	18·1	0·6
Eskdalemuir ...	1·1	3·5	1·3	0·8	3·8	6·9	5·8	3·7	1·2	7·2	6·3	1·4	46·6	47·1	7·7	17·1	56·5	3·8
Pilar	0·5	0·6	0·9	0·2	0·6	0·9	0·4	1·9	0·0	3·1	2·2	0·0	1·4	1·5	0·2	0·2	1·7	0·0
Vieques ...	0·3	0·0	0·2	1·9	0·0	0·3	8·6	2·6	2·2	0·4	2·2	1·0	2·1	2·6	5·2	4·0	1·5	2·1
Cheltenham ...	0·4	0·9	0·5	3·2	2·1	1·2	9·0	3·0	0·6	0·6	4·3	0·1	7·5	15·6	1·5	21·0	5·3	0·1
Agincourt ...	0·3	0·3	—	4·3	0·1	—	16·3	3·2	—	3·4	3·2	—	17·1	21·5	—	37·7	9·1	—
Tucson ...	0·1	0·1	0·0	0·3	0·2	0·0	2·6	2·2	0·0	0·9	6·0	0·1	4·0	5·6	0·1	13·8	4·6	0·1
Sitka	0·8	0·6	0·2	2·4	0·8	0·2	1·8	4·8	0·1	5·3	2·4	0·2	47·4	47·9	22·1	193·6	117·8	136·1
Honolulu ...	0·0	0·1	1·7	0·1	0·3	0·2	0·6	1·1	0·4	0·4	2·2	0·2	1·3	2·1	—	5·0	6·7	—
Lukiapang ...	7·5	3·0	0·5	—	—	—	0·1	4·4	3·8	—	—	—	—	42·2	3·7	—	—	—
Toungoo ...	0·7	8·8	3·5	15·0	6·3	3·6	0·7	2·4	4·4	7·3	15·4	3·6	19·7	46·5	0·0	2·9	45·3	0·0
Barrackpore ...	6·3	2·2	0·5	1·5	10·6	3·5	1·1	3·1	0·1	9·2	15·7	1·4	71·4	41·5	4·0	2·4	40·4	1·2
Dehra Dun ...	0·9	4·7	0·5	10·3	3·1	3·2	4·3	6·7	3·2	7·3	15·0	0·3	37·7	28·1	3·8	21·7	14·9	4·3
Kodaikanal ...	4·2	8·4	1·5	0·0	32·3	0·3	0·8	14·2	18·0	0·3	32·7	5·7	23·0	113·9	2·2	21·8	33·1	5·8
Alibag	6·5	0·3	4·6	1·7	20·1	1·3	2·8	2·6	1·0	4·3	36·6	1·3	21·2	54·8	34·2	14·9	47·3	3·3
Mauritius ...	14·1	4·5	16·4	11·2	5·6	0·5	17·0	12·1	8·5	7·1	12·1	0·8	21·0	1·8	1·3	7·1	3·0	0·5
Helwan ...	13·6	8·4	1·1	7·3	6·1	2·8	—	—	—	—	—	—	—	—	—	—	—	—
Seddin	8·8	2·6	1·2	2·8	4·3	4·1	9·2	4·5	4·6	5·3	4·8	0·2	53·6	—	—	27·0	—	—
De Bilt... ...	1·2	0·3	—	2·3	2·7	—	8·0	4·1	—	6·8	4·0	—	100·1	37·0	—	13·6	27·8	—
Uccle	2·8	1·3	—	1·5	1·4	—	3·1	3·1	—	3·1	0·4	—	31·9	14·4	—	26·8	13·0	—
Val Joyeux ...	7·6	0·2	—	1·3	0·4	—	8·4	2·5	—	7·4	3·3	—	48·2	16·9	—	31·4	12·9	—

TABLE XCVI.—" Magnetic Activity " during Term Hours. Value of $(1/12)\Sigma\eta^2$ in terms of $(1\gamma)^2$.

Station.	May 22, 1911.						May 26, 1911.						June 19, 1911.					
	17 h.–18 h.			18 h.–19 h.			17 h.–18 h.			18 h.–19 h.			17 h.–18 h.			18 h.–19 h.		
	D or W.	H or N.	V.	D or W.	H or N.	V.	D or W.	H or N.	V.	D or W.	H or N.	V.	D or W.	H or N.	V.	D or W.	H or N.	V.
Stonyhurst	4·3	10·7	0·1	37·8	7·2	0·4	38·2	87·6	2·5	74·1	16·9	1·5	7·5	1·4	1·5	40·0	6·9	0·3
Eskdalemuir ...	2·6	12·2	1·2	1·3	3·5	0·7	41·8	92·5	1·7	6·9	16·8	2·5	—	—	—	—	—	—
Pilar	1·2	0·6	4·0	8·7	2·3	2·4	2·7	7·0	1·6	2·3	3·1	1·4	1·1	0·6	0·2	3·7	0·8	3·2
Vieques ...	2·0	0·5	0·6	0·4	0·5	0·5	0·2	6·8	8·9	0·3	1·7	5·2	6·9	0·2	1·0	8·4	0·5	1·3
Cheltenham ...	2·1	4·5	4·8	0·6	1·8	1·7	2·1	102·4	2·5	0·3	18·4	1·0	10·7	5·9	0·8	3·1	6·7	3·5
Agincourt ...	2·3	2·4	—	0·5	12·5	—	11·8	145·5	—	5·2	13·1	—	15·8	6·5	—	4·6	13·8	—
Tucson... ...	7·9	7·5	0·4	8·9	1·3	1·4	62·1	28·8	0·3	18·7	10·0	1·8	38·4	0·2	15·0	23·6	20·0	0·1
Sitka	7·1	5·6	2·5	7·1	1·5	3·6	25·9	18·6	2·8	9·4	23·9	0·9	1·0	4·5	0·4	1·7	1·5	0·4
Honolulu ...	11·8	1·1	0·4	2·1	0·5	0·4	17·8	1·9	0·5	1·3	0·2	4·6	13·1	1·0	1·2	0·8	5·6	3·1
Lukiapang ...	—	2·8	0·4	—	—	0·1	4·7	1·6	0·3	1·6	5·3	0·2	0·2	1·7	0·3	0·7	0·7	0·0
Toungoo ...	0·5	1·1	0·4	0·1	1·9	1·1	15·1	3·8	0·1	0·4	0·1	0·6	0·6	0·1	0·0	4·9	3·1	0·3
Barrackpore ...	1·5	1·9	1·0	0·9	3·7	0·4	5·3	4·1	0·3	1·0	3·3	0·3	0·6	0·5	0·3	0·7	1·0	0·1
Dehra Dun ...	0·5	2·3	—	0·2	3·9	0·5	3·3	2·7	1·0	0·6	3·4	0·6	0·2	0·6	—	0·7	1·1	—
Kodaikanal ...	0·8	1·5	0·3	0·9	4·3	0·5	0·2	3·9	0·4	2·2	0·5	0·3	0·0	0·0	0·0	0·0	2·7	0·3
Alibag	0·5	0·9	0·2	0·0	2·3	0·2	3·5	4·4	3·0	0·6	1·5	0·4	1·7	1·1	1·2	0·8	0·2	0·9
Mauritius ...	0·4	1·1	—	0·4	1·9	—	11·4	7·7	2·4	0·9	3·7	0·2	1·0	1·7	0·4	0·4	2·6	0·8
Helwan ...	1·0	0·3	0·1	1·9	1·5	0·6	—	—	—	0·3	—	0·9	0·4	0·9	0·3	0·5	0·8	0·2
Seddin	0·4	2·6	0·5	0·8	5·1	0·4	42·6	54·1	2·6	7·8	10·1	4·0	0·3	2·6	0·8	0·7	4·5	1·1
De Bilt... ...	0·3	3·3	—	1·6	4·3	—	90·6	46·3	—	5·2	19·0	—	1·3	1·3	—	0·5	3·8	—
Uccle	1·2	5·5	—	0·2	4·1	—	16·9	36·7	—	0·9	12·4	—	0·7	0·4	—	0·6	2·2	—
Val Joyeux ...	2·8	0·9	—	—	—	—	8·7	—	—	—	—	—	—	—	—	0·3	4·8	—

TABLE XCVII.—" Magnetic Activity " during Term Hours. Value of $(1/12)\Sigma\eta^2$ in terms of $(1\gamma)^2$.

Station.	June 23, 1911.						July 17, 1911.						July 21, 1911.					
	17 h.–18 h.			18 h.–19 h.			17 h.–18 h.			18 h.–19 h.			17 h.–18 h.			18 h.–19 h.		
	D or W.	H or N.	V.	D or W.	H or N.	V.	D or W.	H or N.	V.	D or W.	H or N.	V.	D or W.	H or N.	V.	D or W.	H or N.	V.
Stonyhurst ...	—	—	—	—	—	—	22·3	116·2	0·7	10·7	243·4	2·3	8·3	13·5	2·0	20·7	8·5	0·4
Eskdalemuir ...	3·8	16·1	0·5	5·9	28·1	0·3	33·4	173·3	0·7	130·0	242·8	11·7	5·9	14·1	0·2	3·4	16·5	0·7
Pilar	0·7	1·4	0·6	6·8	1·2	0·3	1·1	9·4	7·6	3·3	4·7	0·8	2·1	3·4	0·1	0·5	0·6	0·8
Vieques ...	0·3	3·5	1·5	5·5	2·1	1·8	23·8	2·8	8·1	1·4	25·2	18·6	—	—	—	—	—	—
Cheltenham ...	9·5	10·4	9·0	2·3	8·4	0·9	6·6	35·0	3·5	93·1	157·8	2·3	10·0	8·7	0·4	2·1	5·5	6·3
Agincourt ...	7·9	14·4	—	5·9	8·0	—	25·5	64·6	—	218·5	157·9	—	11·3	13·2	—	2·8	6·8	—
Tucson... ...	14·3	6·3	4·9	8·8	2·3	0·7	7·0	14·5	1·1	43·3	4·4	0·9	28·3	0·8	0·5	3·1	3·0	0·0
Sitka	23·6	14·5	0·4	14·6	4·2	1·6	32·5	58·7	3·2	539·7	397·0	32·3	12·9	10·9	1·0	36·4	20·0	3·2
Honolulu ...	2·4	0·1	8·2	4·4	0·4	5·2	5·4	1·5	0·6	48·6	4·7	14·3	3·0	0·5	5·2	17·7	2·3	8·9
Lukiapang ...	0·5	5·6	0·4	6·5	0·8	0·8	3·3	4·2	0·9	11·2	4·2	0·7	7·8	0·5	0·7	1·9	0·9	0·4
Toungoo ...	0·9	5·5	0·2	10·5	0·0	0·3	0·1	4·1	0·0	0·3	10·3	0·1	16·9	0·0	0·0	0·1	0·0	0·0
Barrackpore ...	1·7	3·2	0·4	6·8	1·1	0·4	2·0	4·2	0·7	14·5	12·3	0·6	2·5	2·4	0·2	4·0	0·5	0·7
Dehra Dun ...	0·2	7·0	—	5·1	1·2	0·2	0·9	4·6	—	10·8	30·0	0·9	0·9	1·2	0·2	3·2	1·2	0·1
Kodaikanal ...	1·8	1·3	1·8	0·3	0·2	0·2	0·2	5·2	1·5	5·1	7·9	3·0	2·1	0·4	1·0	3·1	0·2	2·3
Alibag	0·7	1·9	1·3	1·6	2·6	1·3	0·4	2·3	0·8	4·9	14·9	1·4	1·0	1·6	4·8	3·3	0·3	1·2
Mauritius ...	1·8	0·9	0·1	5·3	4·4	0·0	0·5	2·9	0·3	0·1	14·4	0·4	0·9	1·1	0·1	0·8	4·2	0·3
Helwan ...	2·3	2·8	1·5	0·3	0·6	1·1	—	—	—	—	—	—	—	—	—	—	—	—
Seddin	3·0	10·4	0·6	1·5	8·3	0·8	3·7	88·8	5·1	4·5	238·7	14·2	5·9	5·5	1·3	0·6	7·2	0·8
De Bilt... ...	2·2	12·3	—	2·6	14·4	—	7·6	106·4	—	29·8	277·1	—	9·7	5·2	—	1·8	6·6	—
Uccle	1·9	5·2	—	0·4	11·2	—	—	73·4	—	—	134·3	—	3·5	3·0	—	0·3	2·1	—
Val Joyeux ...	1·4	6·0	—	0·6	8·2	—	1·1	50·1	—	—	—	—	2·0	7·5	—	1·2	4·7	—

TABLE XCVIII.—" Magnetic Activity " during Term Hours. Values of $(1/12)\Sigma\eta^2$ in terms of $(1\gamma)^2$.

Station.	November 20, 1911.						November 24, 1911.						December 18, 1911.					
	18 h.–19 h.			19 h.–20 h.			18 h.–19 h.			19 h.–20 h.			18 h.–19 h.			19 h.–20 h.		
	D or W.	H or N.	V.	D or W.	H or N.	V.	D or W.	H or N.	V.	D or W.	H or N.	V.	D or W.	H or N.	V.	D or W.	H or N.	V.
Stonyhurst ...	2·4	0·4	0·2	26·4	0·1	0·6	3·6	0·7	0·6	24·1	1·1	0·1	5·5	0·9	2·2	30·9	0·3	4·6
Eskdalemuir ...	1·0	1·3	0·5	0·4	0·7	0·3	0·1	0·9	0·6	0·6	1·1	0·1	5·8	1·6	0·1	0·0	1·8	0·0
Pilar	10·4	1·9	1·0	7·9	1·8	1·0	5·2	1·8	1·9	3·5	0·4	0·1	2·5	0·6	1·3	59·1	1·4	0·2
Vieques ...	9·6	0·5	0·3	3·5	0·6	0·3	0·8	2·4	0·1	1·2	0·8	0·1	1·8	2·8	0·3	—	—	—
Cheltenham ...	2·5	3·5	0·8	4·1	3·8	1·2	2·9	7·1	0·7	4·6	1·6	0·2	5·2	2·7	1·9	2·3	2·0	0·6
Agincourt ...	0·3	4·0	—	5·3	2·0	—	2·1	8·3	—	4·8	6·3	—	—	—	—	—	—	—
Tucson ...	8·2	1·8	0·4	3·3	2·9	1·6	—	—	—	—	—	—	—	—	—	0·5	0·3	7·5
Sitka	6·8	5·0	0·7	2·4	0·5	1·7	3·4	0·9	0·4	1·2	2·7	0·3	—	—	—	3·6	1·3	0·1
Honolulu ...	0·5	1·1	0·1	3·2	3·6	4·1	0·2	1·6	0·7	1·7	1·0	0·6	1·6	0·1	0·2	0·0	1·1	1·3
Lukiapang ...	0·4	0·1	0·3	0·2	0·1	0·1	0·0	2·8	0·2	0·1	1·3	0·6	2·8	—	—	1·5	—	—
Toungoo ...	0·4	2·7	0·2	1·2	1·7	3·5	0·6	3·8	0·3	0·2	0·6	0·4	1·1	3·2	0·0	0·0	2·6	1·9
Barrackpore ...	0·3	0·2	0·1	0·2	0·1	0·2	0·0	2·5	0·4	0·0	1·2	0·3	1·1	3·2	0·6	0·2	0·1	0·4
Dehra Dun ...	0·2	1·4	0·1	0·2	0·1	0·1	0·1	6·5	0·3	0·5	0·9	0·2	2·2	2·7	0·3	0·2	0·8	0·2
Kodaikanal ...	1·3	0·6	0·4	0·9	0·2	0·2	0·5	1·2	1·1	0·4	1·5	1·3	3·4	1·7	1·1	1·2	1·2	0·0
Alibag	0·8	0·2	0·9	0·7	0·4	0·4	1·0	2·6	0·8	0·9	0·4	1·0	1·6	1·2	2·3	1·3	0·2	0·2
Mauritius ...	0·3	1·4	—	0·6	1·5	—	—	3·9	—	0·7	2·0	—	0·2	1·3	0·1	0·0	1·0	0·1
Helwan ...	—	—	—	—	—	—	0·1	2·5	—	0·4	1·5	0·1	2·6	0·5	0·1	0·5	0·6	0·2
Seddin	2·0	0·4	0·2	0·5	0·1	0·1	0·2	1·9	0·2	0·5	0·4	0·2	4·3	1·3	0·4	1·4	0·4	0·2
De Bilt... ...	1·7	0·8	—	0·7	0·6	—	0·3	1·4	—	1·2	1·1	—	7·3	1·4	—	2·3	0·6	—
Uccle	0·4	0·3	—	0·1	0·1	—	0·4	0·6	—	0·1	0·5	—	3·4	0·2	—	1·6	0·2	—
Val Joyeux ...	1·9	2·0	—	—	—	—	0·8	2·8	—	1·2	1·6	—	1·9	1·6	—	1·3	0·3	—

TABLE XCIX.—"Magnetic Activity" during Term Hours. Value of $(1/12)\Sigma\eta^2$ in terms of $(1\gamma)^2$.

Station.	December 22, 1911.						January 22, 1912.						January 26, 1912.					
	18 h.–19 h.			19 h.–20 h.			18 h.–19 h.			19 h.–20 h.			18 h.–19 h.			19 h.–20 h.		
	D or W.	H or N.	V.	D or W.	H or N.	V.	D or W.	H or N.	V.	D or W.	H or N.	V.	D or W.	H or N.	V.	D or W.	H or N.	V.
Stonyhurst ...	4·6	1·7	2·4	30·1	2·5	1·1	2·1	2·8	4·8	34·5	5·7	2·1	—	—	—	43·7	0·1	1·9
Eskdalemuir ...	0·5	1·1	0·7	1·7	4·6	0·0	1·5	6·3	0·5	1·2	11·1	0·7	3·6	4·1	0·8	2·3	0·7	0·0
Pilar	14·4	2·8	1·4	0·2	0·3	1·6	4·8	1·0	3·6	5·0	3·4	0·3	0·7	0·6	1·0	19·1	5·9	4·3
Vieques ...	2·4	0·9	0·0	8·1	2·8	4·1	4·3	5·6	0·9	1·9	2·6	0·4	1·7	0·2	0·1	0·6	0·2	0·1
Cheltenham ...	5·4	4·2	0·3	2·7	0·3	0·5	1·7	0·8	1·8	0·7	3·8	1·3	1·8	2·5	0·6	2·6	0·3	0·1
Agincourt ...	1·2	9·6	—	4·4	2·4	—	2·7	0·6	—	1·9	3·6	—	2·1	1·3	—	2·7	0·2	—
Tucson... ...	—	—	—	3·8	1·3	1·4	0·8	0·9	0·1	1·5	2·0	0·5	0·3	0·2	0·3	0·7	0·1	1·4
Sitka	2·6	0·5	0·9	1·4	0·9	0·1	10·1	5·0	1·4	10·1	4·9	1·2	0·6	—	0·1	1·2	0·7	0·1
Honolulu ...	—	—	—	2·4	1·5	1·6	0·9	1·0	1·0	0·0	1·2	0·1	1·2	0·3	0·1	0·7	0·7	0·0
Lukiapang ...	0·2	1·9	0·1	0·1	1·9	0·3	0·5	1·6	0·1	0·5	3·0	0·0	0·7	0·6	0·3	0·5	0·4	0·1
Toungoo ...	0·3	7·0	0·1	0·0	0·7	1·8	0·2	5·3	0·1	0·2	1·3	0·1	0·2	0·3	0·0	0·3	2·9	0·1
Barrackpore ...	0·1	3·3	0·3	0·3	1·1	0·1	0·4	1·1	0·2	1·1	3·6	0·3	1·0	0·5	0·1	0·2	0·2	0·2
Dehra Dun ...	0·4	1·6	0·1	0·5	0·5	0·1	1·0	1·8	0·0	0·6	4·3	0·1	0·8	0·4	0·2	0·3	0·2	0·1
Kodaikanal ...	0·2	2·5	0·5	0·1	1·3	0·7	0·0	2·7	0·0	0·0	1·9	3·4	1·3	0·2	0·4	0·6	0·1	0·8
Alibag	0·8	1·6	1·4	0·5	0·9	2·3	0·8	2·3	0·8	0·5	2·4	0·7	0·6	0·2	0·8	0·4	0·3	0·8
Mauritius ...	0·1	1·7	0·4	0·3	0·3	0·2	—	—	—	—	—	—	—	—	—	—	—	—
Helwan ...	0·6	1·4	0·3	2·1	1·9	0·3	0·5	1·4	0·4	0·0	9·8	1·0	2·4	0·4	0·2	0·4	0·6	0·0
Seddin	0·5	1·6	0·0	1·5	3·8	0·1	0·3	5·1	0·2	1·9	11·2	0·3	5·5	0·8	0·1	1·6	1·2	0·5
De Bilt... ...	1·2	1·7	—	1·3	6·2	—	0·4	3·0	—	0·4	13·7	—	4·6	1·3	—	1·7	0·5	—
Uccle	0·5	1·0	—	0·9	3·8	—	0·4	1·4	—	0·6	5·0	—	1·2	4·0	—	0·5	0·5	—
Val Joyeux ...	1·0	0·7	—	1·1	3·9	—	2·6	2·4	—	1·2	11·0	—	2·4	1·2	—	1·2	0·3	—

Table C.—" Magnetic Activity " during Term Hours. Values of $(1/12)\Sigma\eta^2$ in terms of $(1\gamma)^2$.

Station.	8 h.–9 h.												9 h.–10 h.											
	May 29.		June 2.		June 26.		June 30.		July 24.		July 28.		May 29.		June 2.		June 26.		June 30.		July 24.		July 28.	
	$\bar{H}$.	T.	$\bar{H}$.	T.	$\bar{H}$.	T.	$\bar{H}$.	T.	$\bar{H}$.	T.	$\bar{H}$.	T.	$\bar{H}$.	T.	$\bar{H}$.	T.	$\bar{H}$.	T.	$\bar{H}$.	T.	$\bar{H}$.	T.	$\bar{H}$.	T.
Stonyhurst	43·7	46·1	23·5	24·1	49·3	61·6	19·7	21·9	42·0	44·2	121·3	129·4	68·1	71·4	55·0	55·5	92·3	94·1	46·3	48·6	70·0	71·8	130·8	131·4
Eskdalemuir....	17·6	20·7	—	—	3·1	14·9	4·6	5·9	9·5	10·7	93·7	101·4	13·5	22·8	—	—	7·7	12·8	4·6	11·4	13·5	14·9	73·6	77·5
Pilar	1·7	2·1	1·3	1·4	0·9	0·9	1·1	2·0	2·3	2·3	2·9	3·1	1·3	1·5	1·2	1·3	1·4	2·0	0·8	1·7	5·3	5·3	1·9	1·9
Vieques	3·5	3·8	2·8	3·5	1·0	1·3	0·4	0·5	11·2	13·4	4·7	9·9	3·2	3·6	2·9	3·2	19·0	19·4	2·0	2·3	2·6	3·6	5·6	7·6
Cheltenham	2·5	2·7	9·7	11·8	1·9	2·2	1·3	1·8	12·1	12·6	23·1	24·6	8·8	8·9	3·4	4·7	14·0	15·7	5·3	6·5	5·0	5·1	26·3	26·4
Agincourt	3·9	—	14·2	—	2·0	—	0·7	—	19·5	—	39·5	—	5·5	—	8·2	—	21·3	—	4·4	—	6·6	—	46·8	—
Tuscon	0·9	1·0	23·1	23·2	0·3	0·3	0·3	0·3	4·8	4·8	9·6	9·6	0·9	1·0	6·8	6·8	3·6	3·6	0·5	0·6	6·9	7·0	18·5	18·5
Sitka	10·6	10·8	125·1	141·1	2·3	2·4	1·5	1·7	6·6	6·7	95·3	117·4	5·3	5·8	19·1	26·9	3·3	3·5	3·2	3·3	7·7	7·9	311·4	447·5
Honolulu	1·1	1·8	7·6	7·9	1·9	2·1	0·1	1·8	1·7	2·1	3·4	—	1·6	1·6	1·8	1·9	2·2	2·3	0·4	0·6	2·6	2·9	11·7	—
Lukiapang	8·6	8·8	12·5	13·5	1·4	1·9	10·6	11·1	4·5	8·3	—	—	—	—	35·6	35·9	—	—	—	—	—	—	—	—
Toungoo	19·3	19·7	16·3	18·2	19·6	34·3	9·5	13·1	3·1	7·5	66·2	66·2	0·6	1·8	12·3	13·5	16·4	16·5	21·2	24·8	22·7	26·2	48·2	48·2
Barrackpore	15·4	16·1	18·8	19·1	29·1	31·0	8·5	9·0	4·2	4·3	112·9	116·9	18·8	19·4	8·1	10·5	31·0	31·2	12·1	15·6	25·0	26·3	42·8	44·0
Dehra Dun	13·9	17·3	0·7	—	9·5	14·0	5·6	6·1	11·0	14·2	65·8	69·6	6·1	6·7	10·6	13·9	9·5	10·2	13·4	16·6	22·4	22·6	36·6	40·9
Kodaikanal	62·8	81·0	13·1	13·4	57·0	58·8	12·6	14·1	14·9	32·9	136·9	139·1	23·5	25·7	26·9	30·5	51·1	57·5	32·3	32·5	33·0	38·7	54·9	60·7
Alibag	17·7	23·3	3·8	5·5	24·7	42·4	6·8	11·4	5·4	6·4	76·0	110·2	14·5	16·5	6·9	12·5	32·1	37·0	21·8	23·1	40·9	42·2	62·2	65·5
Mauritius	—	—	14·7	14·9	20·3	28·6	18·6	35·0	29·1	37·6	22·9	24·1	9·7	11·5	10·7	10·7	15·4	15·9	16·9	17·4	19·2	20·0	10·1	10·6
Helwan	65·0	68·1	22·9	31·7	57·3	59·8	22·1	23·2	—	—	—	—	17·8	19·0	17·3	17·6	16·7	23·3	13·4	16·2	—	—	—	—
Seddin	22·5	25·1	6·6	7·1	26·0	29·8	11·4	12·6	13·7	18·3	—	—	32·6	35·1	5·4	5·7	19·6	45·5	7·0	11·1	10·2	10·4	—	—
De Bilt	26·9	—	13·4	—	2·4	—	1·5	—	12·2	—	137·0	—	24·1	—	5·6	—	51·0	—	5·0	—	10·8	—	41·4	—
Uccle	19·3	—	3·7	—	1·2	—	4·1	—	6·1	—	46·3	—	12·7	—	1·9	—	26·4	—	2·9	—	3·5	—	39·8	—
Val Joyeux	16·5	—	9·4	—	—	—	7·9	—	10·9	—	65·1	—	13·9	—	2·0	—	21·7	—	1·7	—	10·6	—	44·3	—

TABLE CI.—" Magnetic Activity " during Term Hours. Value of $(1/12)\Sigma\eta^2$ in terms of $(1\gamma)^2$.

Station.	17 h.–18 h.												18 h.–19 h.											
	May 22.		May 26.		June 19.		June 23.		July 17.		July 21.		May 22.		May 26.		June 19.		June 23.		July 17.		July 21.	
	$\overline{H}$.	T.	$\overline{H}$.	T.	$\overline{H}$.	T.	$\overline{H}$.	T.	$\overline{H}$.	T.	$\overline{H}$.	T.	$\overline{H}$.	T.	$\overline{H}$.	T.	$\overline{H}$.	T.	$\overline{H}$.	T.	$\overline{H}$.	T.	$\overline{H}$.	T.
Stonyhurst	15·1	15·1	125·8	128·4	8·9	10·4	—	—	138·5	139·2	21·8	23·8	45·0	45·4	91·0	92·5	46·9	47·2	—	—	254·1	256·4	29·2	29·5
Eskdalemuir....	14·8	16·0	134·3	136·0	—	—	19·9	20·4	206·7	207·4	20·0	20·2	4·8	5·5	23·7	26·2	—	—	34·0	34·3	372·8	384·5	19·9	20·6
Pilar	1·8	5·7	9·7	11·3	1·7	1·9	2·1	2·7	10·5	18·1	5·5	5·6	11·0	13·4	5·4	6·8	4·4	7·6	8·0	8·3	8·0	8·8	1·1	1·9
Vieques	2·5	3·1	7·0	15·9	7·1	8·1	3·8	5·3	26·5	34·7	—	—	0·9	1·4	2·0	7·3	8·9	10·2	7·6	9·4	26·6	45·2	—	—
Cheltenham	6·6	11·4	104·5	107·0	16·6	17·4	19·9	29·0	41·6	45·1	18·7	19·1	2·5	4·1	18·7	19·7	9·9	13·4	8·6	9·5	250·9	253·2	7·6	13·9
Agincourt	4·7	—	157·3	—	22·3	—	22·3	—	90·1	—	24·5	—	13·0	—	18·3	—	18·4	—	13·9	—	376·4	—	9·6	—
Tucson	15·4	15·9	90·9	91·2	38·6	53·6	20·6	25·5	21·4	22·6	29·1	29·6	10·2	11·6	28·7	30·5	43·5	43·6	11·1	11·9	47·7	48·5	6·0	6·0
Sitka	12·7	15·2	44·5	47·3	5·4	5·9	38·1	38·5	91·2	94·3	23·8	24·7	8·6	12·2	33·3	34·2	3·2	3·6	18·8	20·3	936·7	969·0	56·4	59·6
Honolulu	12·9	13·3	19·7	20·2	14·1	15·3	2·5	10·7	6·9	7·5	3·5	8·7	2·6	3·0	1·5	6·1	6·4	9·5	4·8	10·0	53·3	67·6	20·0	28·9
Lukiapang	—	—	6·4	6·7	2·0	2·3	6·1	6·5	7·5	8·4	8·3	9·1	—	—	6·9	7·1	1·4	1·4	7·3	8·1	15·5	16·1	2·8	3·2
Toungoo	1·6	2·0	18·9	18·9	0·7	0·7	6·3	6·5	4·2	4·2	16·9	17·0	2·0	3·1	0·5	1·1	8·0	8·2	10·6	10·9	10·6	10·6	0·1	0·1
Barrackpore....	3·5	4·5	9·4	9·8	1·1	1·4	4·9	5·3	6·2	6·8	4·9	5·1	4·6	5·0	4·3	4·6	1·7	1·8	7·9	8·4	26·8	27·4	4·5	5·2
Dehra Dun	2·8	—	6·0	7·1	0·8	—	7·2	—	5·5	—	2·2	2·4	4·1	4·6	4·0	4·6	1·8	—	6·3	6·5	40·8	41·7	4·4	4·5
Kodaikanal	2·3	2·6	4·1	4·4	0·0	0·1	3·1	4·9	5·4	6·9	2·5	3·5	5·3	5·7	2·6	3·0	2·7	3·0	0·5	0·7	13·0	16·0	3·3	5·7
Alibag	1·5	1·7	7·9	10·9	2·8	4·0	2·6	3·9	2·7	3·5	2·6	7·4	2·3	2·5	2·2	2·6	1·0	2·0	4·2	5·5	19·8	21·2	3·6	4·8
Mauritius	1·5	—	19·1	21·5	2·7	3·1	2·7	2·8	3·4	3·7	2·0	2·1	2·2	—	4·6	4·8	3·0	3·8	9·7	9·7	14·5	14·9	5·1	5·3
Helwan	1·3	1·4	—	—	1·3	1·6	5·1	6·6	—	—	—	—	3·4	4·0	—	—	1·3	1·5	1·0	2·1	—	—	—	—
Seddin	3·1	3·6	96·7	99·3	2·9	3·8	13·4	13·9	92·5	97·6	11·5	12·8	5·9	6·4	17·9	21·9	5·2	6·3	9·7	10·5	243·2	257·3	7·8	8·6
De Bilt	3·6	—	136·9	—	2·6	—	14·5	—	113·9	—	14·9	—	5·9	—	24·2	—	4·3	—	17·0	—	306·9	—	8·4	—
Uccle	6·7	—	53·6	—	1·1	—	7·1	—	—	—	6·5	—	4·3	—	13·3	—	2·9	—	11·6	—	—	—	2·3	—
Val Joyeux	3·6	—	—	—	—	—	7·4	—	1·2	—	9·5	—	—	—	—	—	5·1	—	8·8	—	—	—	5·9	—

TABLE CII.—" Magnetic Activity " during Term Hours. Value of $(1/12)\Sigma\eta^2$ in terms of $(1\gamma)^2$.

Station.	18 h.–19 h.												19 h.–20 h.											
	Nov. 20.		Nov. 24.		Dec. 18.		Dec. 22.		Jan. 22.		Jan. 26.		Nov. 20.		Nov. 24.		Dec. 18.		Dec. 22.		Jan. 22.		Jan. 26.	
	$\bar{H}$.	T.	$\bar{H}$.	T.	$\bar{H}$.	T.	$\bar{H}$.	T.	$\bar{H}$.	T.	$\bar{H}$.	T.	$\bar{H}$.	T.	$\bar{H}$.	T.	$\bar{H}$.	T.	$\bar{H}$.	T.	$\bar{H}$.	T.	$\bar{H}$.	T.
Stonyhurst	2·8	3·0	4·3	4·9	6·4	8·6	6·2	8·6	4·9	9·7	—	—	26·5	27·1	25·2	25·3	31·2	35·8	32·6	33·7	40·2	42·3	43·8	45·6
Eskdalemuir....	2·3	2·8	0·9	1·5	7·4	7·5	1·7	2·3	7·8	8·3	7·7	8·5	1·1	1·4	1·7	1·9	1·8	1·8	6·3	6·3	12·3	13·0	3·0	3·0
Pilar	12·3	13·3	7·0	8·9	3·1	4·4	17·2	18·6	5·8	9·5	1·3	2·3	9·7	10·6	4·0	4·1	60·5	60·7	0·5	2·1	8·4	8·6	25·0	29·3
Vieques	10·1	10·4	3·2	3·3	4·6	4·8	3·3	3·3	9·9	10·9	1·9	1·9	4·1	4·4	2·0	2·1	—	—	10·9	15·0	4·6	4·9	0·8	0·9
Cheltenham	6·0	6·8	10·0	10·7	7·9	9·8	9·6	9·9	2·5	4·3	4·3	4·9	7·9	9·1	6·3	6·4	4·3	4·9	3·0	3·5	4·5	5·8	2·9	2·9
Agincourt	4·3	—	10·5	—	—	—	10·8	—	3·3	—	3·4	—	7·3	—	11·2	—	—	—	6·8	—	5·6	—	2·9	—
Tucson	10·0	10·3	—	—	—	—	—	—	1·7	1·8	0·5	0·8	6·2	7·8	—	—	0·8	8·3	5·1	6·5	3·5	4·0	0·8	2·3
Sitka	11·8	12·5	4·3	4·7	—	—	3·1	4·1	15·0	16·5	—	—	2·9	4·6	3·9	4·1	4·9	4·9	2·3	2·4	15·0	16·2	1·9	2·0
Honolulu	1·6	1·6	1·8	2·5	1·7	1·9	—	—	1·9	2·9	1·5	1·6	6·8	10·9	2·7	3·3	1·1	2·4	3·9	5·5	1·2	1·3	1·4	1·4
Lukiapang	0·5	0·8	2·8	3·0	—	—	2·2	2·3	2·0	2·1	1·3	1·6	0·3	0·4	1·4	1·9	—	—	2·0	2·4	3·5	3·5	0·9	1·0
Toungoo	3·2	3·4	4·3	4·6	4·3	4·3	7·4	7·4	5·5	5·6	0·5	0·5	2·9	6·3	0·8	1·2	2·6	4·5	0·7	2·5	1·4	1·5	3·2	3·3
Barrackpore	0·5	0·6	2·5	2·9	4·3	4·9	3·4	3·7	1·5	1·7	1·5	1·6	0·3	0·5	1·3	1·6	0·3	0·7	1·4	1·5	4·7	5·0	0·4	0·7
Dehra Dun	1·6	1·7	6·6	6·9	5·0	5·3	2·0	2·1	2·8	2·8	1·2	1·4	0·4	0·5	1·3	1·5	1·0	1·2	1·0	1·1	4·9	5·0	0·5	0·6
Kodaikanal	1·9	2·2	1·7	2·8	5·0	6·2	2·7	3·2	2·7	2·7	1·5	1·9	1·1	1·3	1·9	3·2	2·4	2·4	1·4	2·1	1·9	5·3	0·7	1·5
Alibag	1·0	1·9	3·6	4·3	2·8	5·1	2·4	3·8	3·1	3·9	0·8	1·6	1·1	1·5	1·3	2·3	1·6	1·8	1·4	3·7	2·9	3·6	0·7	1·5
Mauritius	1·7	—	—	—	1·5	1·6	1·8	2·1	—	—	—	—	2·1	—	2·7	—	1·0	1·1	0·5	0·7	—	—	—	—
Helwan	—	—	2·6	—	3·1	3·2	2·0	2·3	1·9	2·3	2·8	3·0	—	—	1·9	2·0	1·1	1·3	4·0	4·3	9·8	10·8	1·0	1·0
Seddin	2·4	2·7	2·1	2·4	5·6	6·0	2·1	2·1	5·4	5·6	6·3	6·4	0·6	0·8	0·9	1·1	1·8	2·0	5·3	5·3	13·0	13·3	2·9	3·4
De Bilt	2·5	—	1·8	—	8·7	—	2·9	—	3·4	—	5·9	—	1·3	—	2·3	—	2·9	—	7·6	—	14·1	—	2·2	—
Uccle	0·7	—	1·0	—	3·6	—	1·5	—	1·7	—	5·2	—	0·2	—	0·6	—	1·8	—	4·7	—	5·6	—	1·0	—
Val Joyeux	3·9	—	3·6	—	3·5	—	1·7	—	5·0	—	3·6	—	—	—	2·8	—	1·5	—	5·1	—	12·2	—	1·5	—

TABLE CIII.—" Magnetic Activity " during Term Hours.
Mean Value of $(1/12)\Sigma\eta^2$ in terms of $(1\gamma)^2$.

Date.	Nature of Mean.	8 h.–9 h.						9 h.–10 h.					
		Number of Stations.	D or W.	H or N.	$\overline{H}$.	V.	T.	Number of Stations.	D or W.	H or N.	$\overline{H}$.	V.	T.
May 29	M_1	20	10·2	8·5	18·7	—	—	20	10·4	3·7	14·1	—	—
	M_1'	19	8·6	8·7	17·3	—	—	19	7·4	3·9	11·3	—	—
	M_2	16	10·6	8·5	19·2	2·6	21·8	16	9·6	4·6	14·2	1·6	15·8
	M_2'	15	8·7	8·9	17·5	2·6	20·2	15	5·7	4·8	10·5	1·5	12·1
June 2	M_1	20	8·3	8·8	17·2	—	—	20	7·3	4·8	12·1	—	—
	M_1'	19	7·9	9·7	17·6	—	—	19	4·9	5·0	9·8	—	—
	M_2	15	9·2	10·9	20·1	2·3	22·4	16	8·3	5·7	14·0	1·7	15·7
	M_2'	14	8·2	11·6	19·9	2·4	22·3	15	5·4	5·9	11·3	1·8	13·0
June 26	M_1	20	8·9	7·1	16·1	—	—	20	13·2	9·5	22·8	—	—
	M_1'	19	7·1	7·2	14·3	—	—	19	9·1	10·0	19·1	—	—
	M_2	17	10·4	8·2	18·6	4·2	22·7	16	11·2	9·7	21·0	3·5	24·4
	M_2'	16	8·3	8·4	16·6	3·7	20·3	15	5·9	10·3	16·2	3·6	19·8
June 30	M_1	21	4·6	2·5	7·1	—	—	20	5·6	5·2	10·8	—	—
	M_1'	20	3·9	2·6	6·5	—	—	19	3·6	5·3	8·9	—	—
	M_2	17	5·0	2·9	7·9	2·2	10·1	16	6·4	6·2	12·6	2·0	14·5
	M_2'	16	4·1	3·1	7·2	2·2	9·3	15	3·9	6·4	10·3	1·9	12·3
July 24	M_1	20	7·0	4·3	11·2	—	—	19	7·7	9·1	16·7	—	—
	M_1'	19	5·3	4·3	9·6	—	—	18	4·4	9·4	13·8	—	—
	M_2	16	6·5	4·5	11·0	3·2	14·2	15	8·3	10·8	19·1	1·2	20·3
	M_2'	15	4·3	4·6	8·9	3·2	12·1	14	4·2	11·3	15·5	1·2	16·7
July 28	M_1	18	33·5	28·8	62·3	—	—	18	30·4	25·5	55·9	—	—
	M_1'	17	29·5	29·3	58·8	—	—	17	25·6	25·9	51·5	—	—
	M_2	13	31·1	32·9	64·0	6·9	70·9	13	33·3	30·0	63·3	12·1	75·4
	M_2'	12	25·3	33·9	59·2	6·9	66·0	12	26·7	31·0	57·7	13·1	70·8

Table CIV.—" Magnetic Activity " during Term Hours. Mean Value of $(1/12)\Sigma\eta^2$ in terms of $(1\gamma)^2$.

Date.	Nature of Mean.	17 h.–18 h. Number of Stations.	D or W.	H or N.	$\overline{\overline{H}}$.	V.	T.	18 h.–19 h. Number of Stations.	D or W.	H or N.	$\overline{\overline{H}}$.	V.	T.
May 22	M_1	20	2·6	3·3	5·9	—	—	19	3·9	3·4	7·3	—	—
	M_1'	19	2·5	2·9	5·4	—	—	18	2·0	3·2	5·2	—	—
	M_2	14	3·1	3·6	6·8	1·2	7·9	15	4·8	2·7	7·5	1·0	8·5
	M_2'	13	3·0	3·1	6·1	1·3	7·4	14	2·4	2·4	4·9	1·0	5·9
May 26	M_1	19	20·8	34·6	55·4	—	—	19	7·4	8·6	16·0	—	—
	M_1'	18	19·9	31·6	51·5	—	—	18	3·6	8·2	11·8	—	—
	M_2	16	17·3	26·7	44·0	1·9	46·0	16	8·0	7·4	15·5	1·6	17·1
	M_2'	15	15·9	22·7	38·6	1·9	40·5	15	3·6	6·8	10·4	1·6	12·0
June 19	M_1	19	5·3	1·6	7·0	—	—	20	4·8	4·2	9·0	—	—
	M_1'	18	5·2	1·7	6·9	—	—	19	3·0	4·0	7·0	—	—
	M_2	15	5·6	1·5	7·1	1·6	8·6	15	6·0	3·8	9·8	1·0	10·9
	M_2'	14	5·4	1·5	6·9	1·6	8·5	14	3·6	3·6	7·2	1·1	8·3
June 23	M_1'	20	4·0	6·4	10·5	—	—	20	4·7	5·4	10·1	—	—
	M_2'	15	4·5	5·6	10·1	2·1	12·2	16	5·3	4·1	9·4	1·0	10·4
July 17	M_1	19	9·3	39·4	48·8	—	—	18	65·0	102·7	167·6	—	—
	M_1'	18	8·6	35·1	43·8	—	—	17	68·2	94·4	162·6	—	—
	M_2	15	9·5	34·9	44·4	2·3	46·7	16	57·6	88·3	145·9	6·5	152·4
	M_2'	14	8·6	29·1	37·6	2·4	40·1	15	60·7	78·0	138·7	6·8	145·5
July 21	M_1	19	7·1	4·9	12·0	—	—	19	5·6	4·8	10·4	—	—
	M_1'	18	7·0	4·4	11·5	—	—	18	4·8	4·6	9·4	—	—
	M_2	15	7·2	4·3	11·5	1·2	12·7	15	6·7	4·7	11·5	1·7	13·2
	M_2'	14	7·2	3·6	10·8	1·1	11·9	14	5·7	4·5	10·2	1·9	12·0

TABLE CV.—"Magnetic Activity" during Term Hours.
Mean Value of $(1/12)\Sigma\eta^2$ in terms of $(1\gamma)^2$.

Date.	Nature of Mean.	18 h.–19 h.						19 h.–20 h.					
		Number of Stations.	D or W.	H or N	$\overline{H}$.	V.	T.	Number of Stations.	D or W.	H or N.	$\overline{H}$.	V.	T.
November 20	M_1	20	2·6	1·5	4·0	—	—	19	3·2	1·1	4·4	—	—
	M_1'	19	2·6	1·5	4·1	—	—	18	2·0	1·2	3·1	—	—
	M_2	15	3·1	1·4	4·5	0·4	4·9	15	3·7	1·1	4·8	1·0	5·8
	M_2'	14	3·2	1·5	4·6	0·4	5·1	14	2·0	1·2	3·2	1·1	4·3
November 24	M_1	19	1·2	2·8	3·9	—	—	20	2·4	1·4	3·8	—	—
	M_1'	18	1·0	2·9	3·9	—	—	19	1·3	1·4	2·7	—	—
	M_2	14	1·3	2·6	3·9	0·6	4·5	15	2·7	1·1	3·8	0·4	4·1
	M_2'	13	1·1	2·8	3·9	0·6	4·5	14	1·1	1·1	2·2	0·4	2·6
December 18	M_1	17	3·0	1·6	4·6	—	—	18	5·9	0·9	6·8	—	—
	M_1'	16	2·9	1·6	4·5	—	—	17	4·4	0·9	5·4	—	—
	M_2	14	2·8	1·7	4·5	0·8	5·3	15	6·7	1·0	7·8	1·2	8·9
	M_2'	13	2·6	1·7	4·3	0·7	5·0	14	5·0	1·1	6·1	0·9	7·0
December 22	M_1	19	2·0	2·5	4·4	—	—	21	3·0	2·0	5·1	—	—
	M_1'	18	1·8	2·5	4·3	—	—	20	1·7	2·0	3·7	—	—
	M_2	15	2·2	2·3	4·5	0·6	5·1	17	3·3	1·5	4·8	1·0	5·8
	M_2'	14	2·0	2·3	4·3	0·5	4·8	16	1·6	1·5	3·1	0·9	4·1
January 22	M_1	20	1·8	2·6	4·4	—	—	20	3·2	5·3	8·5	—	—
	M_1'	19	1·8	2·6	4·4	—	—	19	1·5	5·2	6·8	—	—
	M_2	16	1·9	2·8	4·7	1·0	5·7	16	3·7	4·5	8·2	0·8	9·0
	M_2'	15	1·9	2·8	4·6	0·8	5·4	15	1·7	4·4	6·1	0·7	6·8
January 26	M_1	—	—	—	—	—	—	20	4·1	0·8	4·9	—	—
	M_1'	18	1·8	1·1	2·8	—	—	19	2·0	0·9	2·8	—	—
	M_2	—	—	—	—	—	—	16	4·7	0·9	5·6	0·7	6·3
	M_2'	14	1·5	0·8	2·4	0·4	2·8	15	2·1	1·0	3·1	0·6	3·7

Table CVI.—Antarctic Ranges during Term Hours (Unit 1γ).

Date.	Hour G.M.T.	E′.		S′.		V.		Hour G.M.T.	E′.		S′.		V.	
May 29	8–9	12·3	16·2	12·3	13·2	5·3	5·3	9–10	11·0	11·6	6·2	6·2	7·6	7·6
June 2	8–9	10·3	12·9	15·6	15·6	12·9	12·9	9–10	17·4	20·0	14·8	18·0	6·8	8·4
„ 26	8–9	11·0	11·6	18·0	18·0	7·6	7·6	9–10	9·0	11·6	8·2	9·8	3·0	3·0
„ 30	8–9	4·5	4·7	4·1	4·1	3·8	3·8	9–10	9·0	11·0	7·4	9·0	5·3	5·3
July 24	8–9	15·5	15·5	6·5	7·4	7·6	7·6	9–10	12·9	12·9	10·5	10·5	3·0	3·0
„ 28								9–10	45·2	53·0	59·1	63·2	10·7	18·3
May 22	17–18	14·2	18·7	11·4	12·3	13·7	13·7	18–19	18·7	19·4	15·0	19·4	14·5	14·5
„ 26	17–18	36·2	36·2	13·2	14·1	7·6	9·1	18–19	53·6	64·6	25·5	28·2	16·7	26·6
June 19	17–18	7·8	8·4	9·8	13·9	3·0	4·6	18–19	18·7	24·5	17·2	17·2	7·6	12·9
„ 23	17–18	29·7	42·0	52·5	63·3	13·7	15·2	18–19	14·2	18·1	34·4	35·3	21·3	21·3
July 21	17–18	26·5	31·7	53·5	53·5	29·7	29·7	18–19	30·4	38·1	31·6	39·7	13·7	16·7
Nov. 20	18–19	42·0	47·8	48·4	53·9	26·6	32·0	19–20	65·9	75·6	27·3	30·0	43·4	47·9
„ 24	18–19	52·3	69·8	27·3	34·1	19·8	25·9	19–20	68·5	83·3	42·3	47·1	12·9	22·1
Dec. 18	18–19	262·9	269·4	163·0	163·7	32·7	37·3	19–20	202·2	210·6	60·0	68·2	50·2	60·9
„ 22	18–19	82·7	95·0	56·6	63·4	40·3	41·9	19–20	94·3	102·7	29·3	38·9	72·3	73·1
Jan. 22	18–19	81·4	97·5	35·5	44·3	45·7	51·0	19–20	126·0	190·6	83·2	86·6	67·7	78·4
„ 26	18–19	36·2	41·3	27·3	29·3	47·2	51·7	19–20	43·3	43·9	38·2	43·6	18·3	22·8

Table CVII.—Antarctic "Magnetic Activity" during Term Hours. Value of $(1/12)\Sigma\eta^2$ in terms of $(1\gamma)^2$.

Date.	Hour G.M.T.	E′.	S′.	V.	$\overline{H}$.	T.	Hour G.M.T.	E′.	S′.	V.	$\overline{H}$.	T.
May 29	8–9	11·6	7·4	2·4	19·0	21·4	9–10	9·5	3·0	4·8	12·5	17·3
June 2	8–9	11·1	21·5	14·6	32·6	47·2	9–10	25·9	24·1	2·7	50·0	52·7
„ 26	8–9	10·8	12·1	2·0	22·9	24·9	9–10	8·2	7·1	0·6	15·3	15·9
„ 30	8–9	1·5	1·0	0·9	2·5	3·4	9–10	7·6	3·2	4·0	10·9	14·9
July 24	8–9	16·4	3·9	4·4	20·3	24·7	9–10	10·1	6·8	0·8	16·9	17·7
„ 28	8–9						9–10	36·5	127·9	7·1	164·4	171·5
May 22	17–18	14·0	9·6	15·1	23·6	38·7	18–19	15·4	18·5	11·3	33·9	45·2
„ 26	17–18	115·9	8·8	5·3	124·7	130·0	18–19	178·7	46·8	42·1	225·5	267·6
June 19	17–18	3·9	6·1	0·5	10·0	10·5	18–19	23·3	10·7	5·2	34·1	39·3
„ 23	17–18	36·9	171·6	25·6	208·5	234·2	18–19	20·7	100·5	33·9	121·1	155·0
July 21	17–18	49·6	268·8	133·5	318·3	451·8	18–19	73·0	87·9	20·2	160·9	181·2
Nov. 20	18–19	188·0	302·2	40·3	490·2	530·4	19–20	327·4	61·3	184·9	388·7	573·6
„ 24	18–19	229·1	73·3	30·8	302·4	333·2	19–20	455·5	155·6	20·5	611·1	631·6
Dec. 18	18–19	7946·4	2537·6	105·2	10484·0	10589·2	19–20	3886·8	221·9	134·3	4108·7	4243·0
„ 22	18–19	589·2	266·3	102·8	855·5	958·3	19–20	791·0	50·5	413·3	841·5	1254·8
Jan. 22	18–19	745·4	107·0	161·1	852·4	1013·5	19–20	1625·5	368·9	276·4	1994·4	2270·8
„ 26	18–19	112·6	52·1	143·9	164·7	308·6	19–20	125·2	75·7	32·7	200·9	233·7

TABLE CVIII.—Absolute and Relative Values of $(1/12)\Sigma\eta^2$ ("Magnetic Activity") during Term Hours.

—	Hour G.M.T.	Mean (γ^2)	May 29	June 2	June 26	June 30	July 24	July 28	Hour G.M.T.	Mean (γ^2)	May 29	June 2	June 26	June 30	July 24	July 28
Europe, horizontal ...	8–9	31·9	94	42	55	26	64	319	9–10	32·5	91	50	146	43	73	197
N. America, horizontal	8–9	14·4	30	242	10	6	75	237	9–10	19·3	25	42	63	16	30	424
India, horizontal ...	8–9	29·0	89	36	103	30	27	315	9–10	25·3	50	51	111	80	114	194
All stations, horizontal	8–9	21·1	77	87	67	23	50	296	9–10	21·9	59	49	111	51	79	251
,, ,,	8–9	12·9	126	144	111	38	81	—	—	—	—	—	—	—	—	—
Antarctic, horizontal ...	8–9	19·5	98	167	118	13	104	—	9–10	45·0	28	111	34	24	38	365
Antarctic, total ...	8–9	24·3	88	194	102	14	102	—	9–10	48·3	36	109	33	31	36	355
	Hour G.M.T.	Mean (γ^2)	May 22	May 26	June 19	June 23	July 17	July 21	Hour G.M.T.	Mean (γ^2)	May 22	May 26	June 19	June 23	July 17	July 21
Europe, horizontal ...	17–18	42·2	8	276	7	33	245	31	18–19	54·7	11	38	9	24	503	15
N. America, horizontal	17–18	40·0	25	248	52	63	152	60	18–19	81·3	11	30	23	16	495	25
India, horizontal ...	17–18	4·7	50	198	23	103	102	124	18–19	6·8	54	40	45	87	327	47
All stations, horizontal	17–18	20·6	26	252	39	55	172	56	18–19	35·4	16	33	23	27	473	28
,, ,,	17–18	17·6	30	293	46	65	—	66	18–19	9·0	64	132	90	104	—	110
Antarctic, horizontal ...	17–18	137·1	17	91	7	152	—	233	18–19	115·1	29	196	30	105	—	140
Antarctic, total ...	17–18	173·0	23	75	6	135	—	261	18–19	137·7	33	194	29	113	—	131
	Hour G.M.T.	Mean (γ^2)	Nov. 20	Nov. 24	Dec. 18	Dec. 22	Jan. 22	Jan. 26	Hour G.M.T.	Mean (γ^2)	Nov. 20	Nov. 24	Dec. 18	Dec. 22	Jan. 22	Jan. 26
Europe, horizontal ...	18–19	3·8	52	39	167	54	122	166	19–20	9·8	60	63	80	115	174	108
N. America, horizontal	18–19	6·1	132	109	102	105	102	50	19–20	5·0	109	102	92	53	196	48
India, horizontal ...	18–19	2·9	56	128	148	123	107	38	19–20	1·6	73	84	99	74	200	70
All stations, horizontal	18–19	4·1	89	90	126	113	105	77	19–20	6·3	72	62	134	82	148	102
Antarctic, horizontal ...	18–19	2191·5	22	14	478	39	39	8	19–20	1357·6	29	45	302	62	147	15
Antarctic, total ...	18–19	2288·9	23	15	463	42	44	13	19–20	1534·6	37	41	277	82	148	15

TABLE CIX.—Mean Term Hour "Magnetic Activities." Comparison of Components.

—	All Days.					Omitting July 17.				
	(1/12) $\Sigma\eta^2$ in $(1\gamma)^2$.			Percentages.		(1/12) $\Sigma\eta^2$ in $(1\gamma)^2$.			Percentages.	
	D or W.	H or N.	$\overline{\overline{H}}$.	D or W.	H or N.	D or W.	H or N.	$\overline{\overline{H}}$.	D or W.	H or N.
All Co-operating Stations ...	8·7	9·7	18·4	47·3	52·7	7·2	6·3	13·5	53·1	46·9
Omitting Stonyhurst	7·4	9·3	16·7	44·3	55·7	5·7	6·3	12·0	47·7	52·3

TABLE CX.—Mean Term Hour "Magnetic Activities." Comparison of Components.

Co-operating Stations.	Days.	(1/12) $\Sigma\eta^2$ in $(1\gamma)^2$.					Percentages.			
		D or W.	H or N.	$\overline{\overline{H}}$.	V.	Total.	D or W.	H or N.	$\overline{\overline{H}}$.	V.
All	All	8·9	9·5	18·4	2·1	20·4	43·5	46·5	90·0	10·0
,, ...	Omitting July 17	7·4	6·3	13·7	1·9	15·6	47·2	40·6	87·8	12·2
Omitting Stonyhurst.	All	7·2	9·0	16·2	2·0	18·2	39·5	49·2	88·7	11·3
,, ,,	Omitting July 17	5·5	6·3	11·8	1·9	13·7	40·3	45·9	86·2	13·8

TABLE CXI.—Antarctic "Magnetic Activities" at Different Hours and Seasons.

—	Hour G.M.T.	(1/12) $\Sigma\eta^2$ in $(1\gamma)^2$.					Percentages.			
		E′.	S′.	$\overline{\overline{H}}$.	V.	Total.	E′.	S′.	$\overline{\overline{H}}$.	V.
May 29; June 2, 26, 30; July 24, 28.	8–9 9–10	10·3 12·3	9·2 8·8	19·5 21·1	4·9 2·6	24·3 23·7	42·2 51·8	37·8 37·3	80·0 89·1	20·0 10·9
May 22, 26; June 19, 23; July 21.	17–18 18–19	44·0 62·2	93·0 52·9	137·0 115·1	36·0 22·6	173·0 137·7	25·5 45·2	53·7 38·4	79·2 83·6	20·8 16·4
Nov. 20, 24; Dec. 22; Jan. 22, 26.	18–19 19–20	372·9 664·9	160·2 142·4	533·0 807·3	95·8 185·6	628·8 992·9	59·3 67·0	25·5 14·3	84·8 81·3	15·2 18·7
All (33) hours (including Dec. 18).		536·5	158·2	694·6	60·1	754·7	71·1	20·9	92·0	8·0
31 hours (omitting Dec. 18) ...		189·3	79·4	268·7	56·3	325·0	58·3	24·4	82·7	17·3

TABLE CXII.—Mean Absolute Ranges and Inequality Ranges in Antarctic.

Range in	May.		June.		July.		November.		December.		January.	
	Abs.	Iny.	Abs.	Iny.	Abs.	Iny.	Abs.	Iny.	Abs.	Iny.	Abs.	Iny.
	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
E′	205	72	146	60	188	62	247	125	260	93	231	108
S′	163	78	149	60	175	68	175	94	189	99	164	84
V	119	39	92	38	128	47	136	65	182	82	145	72

TABLE CXIII.—Mean Squares of Antarctic Ranges.

——	Midwinter.						Midsummer.					
	Absolute Ranges.			Inequality Ranges.			Absolute Ranges.			Inequality Ranges.		
	E′	S′	V	E′	S′	V	E′	S′	V	E′	S′	V
Mean R^2/γ^2 ...	32895	26465	13003	4209	4769	1725	60657	31081	24215	11979	8564	5378
Percentages of Total	45·4	36·6	18·0	39·3	44·6	16·1	52·3	26·8	20·9	46·2	33·0	20·8

TABLE CXIV.—Agincourt "Magnetic Activities." Mean Values of $(1/12)\Sigma\eta^2$ in terms of $(1\gamma)^2$.

First Group (4 days).				Second Group (6 days).				Third Group (5 days).			
L.M.T.	D.	H.	$\overline{\overline{H}}$.	L.M.T.	D.	H.	$\overline{\overline{H}}$.	L.M.T.	D.	H.	$\overline{\overline{H}}$.
3 h.–4 h. ...	9·4	6·6	16·0	12 h.–13 h.	12·4	41·1	53·5	13 h.–14 h.	1·7	4·8	6·5
4 h.–5 h. ...	15·7	4·4	20·1	13 h.–14 h.	39·6	35·3	74·9	14 h.–15 h.	3·8	2·9	6·8
8 h.–9 h. ...	60·2	34·0	94·2	17 h.–18 h.	6·1	108·2	114·3	18 h.–19 h.	2·5	3·0	5·5
9 h.–10 h. ...	60·7	29·1	89·8	18 h.–19 h.	6·0	34·3	40·3	19 h.–20 h.	0·7	1·8	2·5

CHAPTER IX.

Discussion of Selected Disturbed Term Hours.

May 26, 1911, 17 *h.*–19 *h.* *G.M.T.*

Section 55.—On this term day very sensible movements occurred at most of the stations. Except in the Antarctic there was more disturbance between 17 h. and 18 h. than between 18 h. and 19 h.; but the movements during the latter hour near 18 h. 30 m. seem the most interesting, and are specially considered. The following curves were selected for reproduction in Plate XV: the three components in the Antarctic, H at Tucson, H and D at Cheltenham, N at Seddin, and H and D at Sitka.

The movements between 18 h. 20 m. and 18 h. 35 m. in N at Eskdalemuir and in H at De Bilt and Val Joyeux are very similar to the movements in N at Seddin. At all these places between about 18 h. 27·5 m. and 18 h. 31 m., there is rather a smart rise in H or N, interrupted for about half a minute by a smart but smaller movement in the opposite direction. The other magnetic elements during this time showed little trace of disturbance. The movement in H or N just referred to may be regarded as consisting of:—

—	Val Joyeux.	De Bilt.	Seddin.	Stonyhurst.	Eskdalemuir.
Resultant change	$+7\gamma$	$+10\gamma$	$+11\gamma$	$+12\gamma$	$+15\gamma$
Including reverse change ...	-1γ	-2γ	-3γ	-3γ	-3γ

There are apparent small differences in the times at which these movements are shown on the different curves, but the general resemblance of the movements is so close there can be but little doubt that they were really synchronous at all the stations. The D or E trace showed very little movement at this time.

During the time occupied by the above movements there were also decided movements in the Antarctic and at Tucson, Cheltenham and Sitka, but the features characteristic of the European stations are not recognisable. In the Antarctic there was a considerable rise and fall of E′, with but very little change in N′. Also the movement lasted about 10 minutes, from about 18 h. 27 m. to 18 h. 37 m., consisting of a rise of 37γ in E′ and fall of 35γ. At Tucson between 18 h. 26 m. and 18 h. 31·5 m. there were *two* oscillations in H, the successive movements being $+2\gamma$, -3γ, $+2\gamma$, -2γ. At Cheltenham between 18 h. 20 m. and 18 h. 31·5 m. the H trace shows a succession of pulsations, with an average period of about 45 seconds. The following changes in H appeared between 18 h. 29 m. and 18 h. 31·5 m., $+7\gamma$, -5γ, $+4\gamma$, -3γ and $+4\gamma$. A tendency to pulsations was visible throughout the greater part of the two hours 17 h.–19 h., but the movements were generally considerably smaller than the above. The D trace was much quieter, but small pulsations can be recognised in it.

At Sitka between 18 h. 28 m. and 18 h. 32 m., H fell about 18γ. Between 18 h. 28 m. and 18 h. 34 m. D moved $2'$ ($= 9\gamma$) to the West, and $4'$ ($= 19\gamma$) to the East, the turning point coming at about 18 h. 29·5 m. Thus while at most stations near 18 h. 30 m. the movements in D or E were much smaller than those in H or N, this was not the case at the geographically extreme stations, the Antarctic and Sitka.

The remarkable feature on May 26, 1911, is that while most of the stations showed special magnetic disturbance near 18 h. 30 m., it took a very varied form at different places. Over considerable areas, *e.g.*, throughout Western Europe, there was similarity of type, but areas remote from one another showed different characteristics.

July 17, 1911.

Section 56.—Whilst the disturbance between 17 h. and 19 h. on July 17, 1911, was not what would usually be called a magnetic storm, it was of considerable intensity, at least at the European and American stations. At the former it was unquestionably the most disturbed time experienced in any of the term hours. The Antarctic trace was unfortunately lost, but not improbably the disturbance there may have been trivial as compared with the disturbance of December 18, for conditions were comparatively quiet at the more southerly of the co-operating stations.

A variety of interesting details appeared in the records from the co-operating stations. The following were selected for reproduction in Plate XVI: Pilar H, Porto Rico H, Alibag H, Cheltenham H, De Bilt H, Seddin N, E and V, Eskdalemuir N and E, Sitka H, D and V.

In general, Sitka being the chief exception, the disturbance in H or N was larger than that in D or E. The disturbance in the latter element was in general by no means negligible, but besides being smaller than the disturbance in H it presented fewer noteworthy features. In the H or N curves three features appeal in general to the eye. The first of these is a series of comparatively slow oscillations of no very regular character, but with the maxima and minima more or less synchronous at the several stations. The times of the turning points as shown by the curves are given in the following table.

TABLE CXV.—Times of Turning Points during Term Hours 17 h.–19 h., July 17, 1911.

Station.	Maxima in H or N.				Minima in H or N.				
	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.
Pilar	—	17 33	17 46	18 15	17 18	—	17 40	18 0	18 48
Porto Rico ...	—	17 34	17 49	18 15	—	—	17 40	18 0	—
Alibag ...	—	17 33	17 49	18 13	—	—	17 40	18 0	18 48
Honolulu ...	17 22	17 32	—	—	—	—	17 39	17 59	—
Tucson ...	17 20	—	—	18 15	—	—	—	—	—
Cheltenham ...	—	17 34	17 51	18 15	17 15	—	17 40	18 0	18 49
Agincourt ...	—	17 32	17 50	18 15	17 18	—	17 40	18 0	18 50
Val Joyeux ...	17 24	17 34	17 49	—	17 20	17 27·5	—	18 0	18 48
De Bilt ...	17 25	17 34	17 49	18 15	17 20	17 27·5	17 40	17 58	18 49
Seddin ...	17 25	17 34	17 49	18 15	17 19	17 28	17 39	17 59	18 52
Stonyhurst ...	17 26	17 36	17 50	18 17	17 21	17 29	17 40	17 59	18 52
Eskdalemuir ...	17 25	17 35	17 49	18 16	17 20	17 28	17 40	17 59	18 48

At Val Joyeux trace was missing near 18 h. 15 m., and near 17 h. 40 m. it was so nearly level that no exact time could be assigned for the maximum which then occurred. The times shown on the Stonyhurst trace were fully 1 minute slow, if we may judge by some prominent oscillations which were presumably synchronous at all the European stations. Some of the oscillations included in Table CXV were small, especially at the more Southern stations, and the curvature near the turning points on the traces was so small that the precise times of their occurrence were difficult to fix. We should infer that the general character of the slower changes in H was the same at all the stations in the table, H rising at all or falling at all. Sitka, however, differed from the other stations, the H trace showing maxima at about 17 h. 20 m., 17 h. 37 m. and 18 h. 47 m., and minima at about 17 h. 23 m., 17 h. 34 m., 18 h. 14 m. and 18 h. 25 m. Thus on the whole the changes in H at Sitka were opposite in direction to those occurring elsewhere.

Of the slower changes in H (or N), the rise to a maximum about 17 h. 34 m., and the fall to a minimum about 17 h. 40 m. were generally the most conspicuous. The amplitudes measured for these two movements were as follows :—

Pilar.	Porto Rico.	Alibag.	Honolulu.	Tucson.	Cheltenham.	Agincourt.	Val Joyeux.	De Bilt.	Seddin.	Stonyhurst.	Eskdalemuir.
$+2\gamma$	$+4\gamma$	$+1\gamma$	$+1\gamma$	$+1\gamma$	$+12\gamma$	$+8\gamma$	$+12\gamma$	$+18\gamma$	$+15\gamma$	$+19\gamma$	$+21\gamma$
-5γ	-3γ	-5γ	-2γ	-3γ	-8γ	-5γ	-7γ	-12γ	-12γ	-13γ	-14γ

It will be noticed that the first movement was in general the smaller at the Southern stations, but the larger at the Northern. The difference between Tucson and Cheltenham is remarkable. In Western Europe both movements showed a tendency to increase with the latitude.

The second of the principal features alluded to above was a series of shorter period oscillations commencing about 17 h. 40 m. These were particularly clearly shown at Seddin, thanks to the high sensitiveness of the Seddin magnetographs. The oscillations are superposed on a gradual rise in the element, so that the steps down are less than the steps up. The change between 17 h. 45 m. and 17 h. 47·5 m. may be regarded either as one oscillation, with the first movement arrested for a short time, or as two oscillations. On the former view five oscillations are shown, on the latter six. At most of the stations only the earlier of these oscillations are clearly recognisable. The results of the measurements possible appear in the earlier columns of Table CXVI, p. 200. For the three oscillations included the average period was about $1\frac{2}{3}$ minute.

The third feature mentioned above was a second series of oscillations commencing about 18 h. 19 m. These are again particularly well shown at Seddin, where five or six oscillations are recognisable. At most of the stations not more than three oscillations were clearly shown, and the measurements appearing in the later columns of Table CXVI are confined to them.

TABLE CXVI.—Amplitudes of Oscillations in H (or N) during Term Hours, July 17, 1911.

Station.	Oscillations commencing about 17 h. 40 m.						Oscillations commencing about 18 h. 19 m.					
	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
Pilar ...	+0·7	−0·5	—	—	—	—	−0·3	+ 0·1	− 1·5	+0·3	−0·3	+0·9
Porto Rico ...	+1·4	−0·8	—	—	—	—	−1·1	+ 0·8	− 1·1	+0·3	−1·4	+1·4
Alibag ...	+2	−1·5	+ 2	−0·5	+1	−0·5	−1	+ 4	− 4	+2	−1·5	+1
Honolulu ...	+1	−1	—	—	—	—	−0·5	+ 0·3	− 0·8	+1·3	−1·0	+0·8
Tucson ...	+1	−1	—	—	—	—	−3·3	+ 0·3	− 2·1	+1·2	−0·3	+1·2
Cheltenham	+2	−1	—	—	—	—	−6	+ 0·7	− 3	+0·5	−0·8	+2
Val Joyeux ...	+4	−2	+ 5	−1	—	—	—	—	—	—	—	—
De Bilt ...	+5	−4	+ 7	−1	+5	−1	−7	+12	− 8	+4	−6	+5
Seddin ...	+7	−6	+ 8	−3	+6	−1	−5	+15	−12	+5	−6	+5
Stonyhurst ...	+6	−4	+ 8	−1	+5	−1	−7	+12	− 7	+5	−6	+6
Eskdalemuir	+7	−4	+10	−2	+7	−1	−9	+14	− 9	+4	−5	+8

At the more Southern stations the movements were so small that results had to be given to $0 \cdot 1\gamma$ or $0 \cdot 5\gamma$ to show the order of magnitude. No high accuracy is claimed for these figures. The trace from Val Joyeux was incomplete, and that from Agincourt being slow run was unsuitable for the measurement of rapid changes. There were movements in H, and still more in D, at Sitka during the time, but they could not be satisfactorily identified with the movements elsewhere. The first three oscillations after 18 h. 19 m. were on the whole larger than those after 17 h. 40 m., but they showed the same tendency to be largest at the more Northern European stations. The periods, however, of the two series of oscillations were decidedly different. The mean period for the first three in each case was for the first series $1\frac{2}{3}$ minute, as already stated, as compared with $1\frac{1}{4}$ minute for the second series. The periods were thus in the ratio of 4 : 3.

Small short-period oscillations or pulsations were recognisable throughout most of the Cheltenham and Stonyhurst H traces, but their appearance was rather suggestive of an instrumental origin. The general correspondence of the phenomena at all the stations except Sitka suggests a source of disturbance either very deep seated, or remarkably similar in widely different latitudes. Under such circumstances the difference between Sitka and the other stations is certainly strange. The parallelism of the Sitka H and D traces is unusually marked. This suggests little variation in the azimuth of the horizontal disturbing force at that station for two hours.

July 28, 1911, 8 *h*.–10 *h*.

Section 57.—The disturbance of July 28, 1911, showed a less variable distribution of intensity than that of July 17, being very sensible in all continents. On the whole, moreover, the disturbance in D (or E) was as large as that in H (or N), though the individual D movements made less appeal to the eye. The following curves were selected for reproduction in Plate XVII: Antarctic N′, E′ and V, Pilar H, Honolulu H, Tucson H, Cheltenham H, Eskdalemuir N, Sitka H, D and V.

A series of comparatively slow oscillations was visible at all the stations between 8 h. 30 m. and 9 h. The approximate times of the turning points are given in Table CXVII.

TABLE CXVII.—Times of Turning Points during Term Hour 8 h.–9 h., July 28, 1911.

Station.	Element.	Maxima.			Minima.		
		h. m.	h. m.	h. m.	h. m.	h. m.	h. m.
Antarctic ...	N′	8 32	8 39	8 53	8 36	8 45	—
,, ...	E′	8 32	8 42·5	—	8 36	—	8 55
Pilar ...	H	8 30	8 36	8 47	8 33	8 42	—
Porto Rico ...	H	8 30	8 39	8 46	8 33	8 42	8 51
Honolulu ...	H	—	8 37	—	8 32·5	8 42·5	—
Alibag ...	H	—	8 36	—	8 32	8 42	—
Tucson ...	H	—	8 37–39	8 48	8 33	8 42·5	—
Cheltenham	H	8 31	8 37–39	8 47	8 34	8 43	8 50–52
Agincourt ...	H	—	8 39	8 46	8 34	8 43	—
Val Joyeux...	H	8 31	8 37–39	8 45	8 32–34	8 42·5	8 51–52
,, ...	D (West)	8 31	8 37	8 45	8 34	—	8 47·5
De Bilt ...	H	8 33	8 42·5	—	8 31·5	8 37–39	8 46
Seddin ...	W	8 31	8 42·5	—	8 35	—	8 47
Eskdalemuir	N	8 34	8 42·5	8 52·5	8 31·5	8 37–39	8 46
,,	W	8 31	8 37	—	8 33–35	8 38	8 47
Sitka ...	H	—	8 40	8 48	8 34	8 43	8 52·5

The oscillations were nowhere very prominent, and the curves near the turning points were in general rounded and sometimes flat, so that in many cases it was difficult to assign very definite times. It appeared clear, however, that we had to do with a closely parallel set of movements at the different stations, having presumably a common origin.

A small but unusually distinct oscillation with a period of about 45 seconds was visible at about 9 h. 7 m. as follows :—

At Honolulu, with amplitude of 2γ in H,
At Tucson, with amplitudes of 2γ in H and 2γ in D,
At Cheltenham, with amplitudes of 1γ in H and 2γ in D,
At Sitka, with amplitudes of 2γ in H and 5γ in D.

The quick run was started too late in the Antarctic, so that the commencement of the first hour is unrepresented in Plate XVII. A prominent feature there in the traces of all three elements, especially E′, is a series of oscillations during a few minutes immediately before and after 10 h. These were accompanied by a marked rise in both N′ and E′. Oscillations very similar to these occurred apparently simultaneously at the following stations :—

Honolulu in H (accompanied by a rise of force) ;
Tucson in H (accompanied by a rise), and also less prominently in D (accompanied by westerly movement) ;
Cheltenham in H (accompanied by a fall), and also to a minor extent in D (accompanied by westerly movement) ;
Sitka in H (accompanied by a rise), and also very prominently in D (accompanied by slight easterly movement), and even visibly in V (accompanied by a rise).

These oscillations are not distinctly recognisable at Pilar or Alibag, or at any of the European stations.

During the greater part of the two hours, especially the later part, pulsations with a period of about 15 seconds are clearly visible in the N and E traces at Eskdalemuir, and in the H traces at Cheltenham and Stonyhurst. They are not visible in the Antarctic or Pilar traces, and whilst small irregular oscillations occur at intervals in the Sitka H and D traces, they seem to be of a different type.

December 18, 1911, 18 *h.*-20 *h.*

Section 58.—The Antarctic curves are reproduced in Plate XVIII. They show a very deep and symmetrical bay in N′ and E′, the changes in the two elements being nearly in phase throughout. The movements in the Antarctic were of quite a different order from those recorded elsewhere, even at Pilar, where D had a range equivalent to 23γ.

The curves other than those for the Antarctic make little appeal to the eye, and so have not been reproduced. They would add little to the information given by the numerical data derived from the measurements at 5-minute intervals. In this case presumably the disturbance was of a comparatively local character. There were, however, between 19 h. 35 m. and 20 h. small pulsations with a period of from 30 to 60 seconds in the D and H curves at Sitka, which are doubtfully represented in the H trace at Pilar and possibly even in the E′ Antarctic trace.

CHAPTER X.

DISTURBANCES IN GENERAL. "SUDDEN COMMENCEMENTS."

Section 59.—Let us suppose that an electric current in a fixed circuit gradually starts from zero, increases to a maximum and then gradually falls to zero, and that within its range of sensible magnetic action no part of space contains matter of sensible electrical conductivity or magnetic quality, then the magnetic field at any given point will gradually rise from zero, attain a maximum and again fall to zero. The magnetic force vector would have a fixed direction and vary only in intensity, in other words the components of the magnetic field due to the current at the point would throughout the whole time stand to one another in a constant ratio.

The earth, at least near the surface, is a poor conductor of electricity, but not an absolute non-conductor, and its material is not wholly devoid of magnetic quality. Thus even if an external electric current pursued a fixed path, complications in the magnetic phenomena might arise from induced electric currents.

The larger magnetic storms in this country are usually accompanied by visible aurora, and presumably the electrical discharges of which aurora is supposed to consist are associated with if not identical with the currents to which the magnetic storms are due. Uniformity in brightness or fixity of position are at least unusual in auroras, thus *a priori* we should hardly expect fixity of direction to be a general characteristic of the magnetic vector during disturbance at any place.

At times, however, oscillations present themselves in one or both of the horizontal components of force, occasionally even in the vertical component, which show at least an approach to the ideal state of things first mentioned, *i.e.*, they answer at least approximately to a vector fixed in position. A few instances of this kind were described in my discussion of the Antarctic Expedition of 1902–04. Mr. L. F. Richardson has described a considerable number of oscillatory movements of this kind at Eskdalemuir to which he has given the name of K movements. In general, in my experience, if one examines the curves minutely, one finds that the two traces relating to forces in the horizontal plane—at most stations declination and horizontal force traces—do not remain strictly in phase for any length of time. Investigation of this point is difficult, owing to the fact that ordinarily one minute of time is represented by only from 0·25 to 0·3 mm. of abscissa, while the traces from the two horizontal components usually differ somewhat in definition or in width. Also the amplitudes of what appear to be corresponding movements in the two horizontal components are often so different that the eye does not readily notice small differences in phase. When one deals with corresponding records from a number of stations, the question of identity in phase is even more difficult. At a single station the D and H curves usually have their time marks dependent on the same clock, so that clock error affects the two alike ; also the abscissæ corresponding to one hour of time are usually nearly if not quite identical. But the D traces, for example, from two different stations are affected by different clock errors, and there may well be an uncertainty of the order of 1 minute in any identification of times. Then the equivalents of one hour of time are seldom identical. There is a big difference between the ordinary Kew pattern magnetograph, with about 15 mm. to the hour, and the ordinary Eschenhagen pattern with about 20 mm. to the hour, and there are usually small differences between instruments of the same pattern. Thus superposing one curve—or a tracing of it made on transparent paper—on a second curve is not so helpful as it would be if time scales were everywhere identical. In many cases—I believe in most cases—where the D and H traces at a station seem to remain in phase throughout the whole of an oscillation, there is only an approach to identity in phase, and the direction of the vector really varies somewhat.

By treating the vectorial direction as constant during an oscillation, one may of course only be leaving out of account some small secondary disturbance, a non-essential and merely disturbing factor. It may be a case, so to speak, of sifting the chaff from the wheat. I have preferred, however, to follow the same course as I adopted with the Antarctic curves of 1902–03, treating to and fro movements separately. In the great majority of cases the to and fro movements in the Antarctic oscillations were conspicuously different in amplitude and in duration.

After examining the Antarctic curves I selected a number of representative disturbances, and sent a list of them to various observatories, asking for copies of some or all of the corresponding traces. In reply most generous contributions of curves were received from the following observatories : Agincourt (Toronto), Alibag (Bombay), Buitenzorg (Java), Helwan, Honolulu, Mauritius and Sitka. Particulars were also supplied in all cases as to the scale values of the curves. The original Eskdalemuir curves were put at my disposal by the Director of the Meteorological Office. Eight stations, of course, cannot well represent the whole world, but the material received required a great deal of time for adequate consideration.

Section 60.—The first disturbances which I propose to consider are of the type known as " sudden commencements," or s.c's as I shall call them for brevity. They derive their name from the circumstance of their occurrence on those occasions when they appeal most to the eye. On the occasions referred to the curves have been quiet for some hours, nothing in their appearance suggesting a termination of quiet conditions. Then suddenly a sharp movement begins, which in low and middle latitudes is normally much largest in H. In the course of five minutes H may have risen 50γ or more. A considerable proportion of the very largest magnetic storms are preceded by these movements, and they are not unnaturally regarded as precursors or commencements of the storm.

When one looks closely into the subject a number of points present themselves.

In some cases the s.c. is immediately followed by highly-disturbed conditions. In other cases some hours elapse before any further large movement occurs. The conditions for some time after an s.c. are practically always less quiet than before, but in a third class of cases nothing follows during the next 24 hours even distantly approaching a magnetic storm. In this third class of cases the s.c. may be itself the largest movement that occurs, and it is sometimes almost an isolated movement in the middle of a decidedly quiet piece of curve. In all three cases alike the s.c. is essentially a universal phenomenon, appearing at all stations it would seem simultaneously—so far at least as ordinary magnetographs permit us to judge—and large enough to be recognisable in ordinary magnetograms. If, however, we examine carefully all the magnetograms at a single station we find in an average year a considerable number of movements so similar in appearance to s.c's that without recourse to the curves of other stations we could not distinguish them with certainty from ordinary s.c's. They are excluded from that category simply because they are not represented at distant stations. For instance, a careful search through the Eskdalemuir curves from March 13, 1911, to November 25, 1912, disclosed 102 movements which seemed possible s.c's; but only about one-fifth proved undoubted s.c's. One or two of the Eskdalemuir movements that proved to be universally represented were less like the typical s.c. than others which were not represented at a distance. 1911 and 1912 were quiet years, few disturbances occurring at Eskdalemuir worthy to be called magnetic storms, and the s.c's preceding one or two of the largest Eskdalemuir disturbances presented features that were abnormal, or at least which would have been deemed abnormal in Kew curves in past years. Unfortunately artificial disturbances are now so large at Kew that the smaller features of natural movements cannot be made out satisfactorily.

In temperate and still more in tropical latitudes the outstanding feature in an s.c. is the rise in H. At Bombay, for instance, this is the one thing that appeals to the eye, and the movement seems generally if not always unidirectional. At Kew the rise in H is still in general the principal feature, but a smaller previous movement of shorter duration in the opposite direction is sometimes clearly seen, and is frequently suggested. The tendency to oscillation seems decidedly greater at Eskdalemuir than at Kew. In the Antarctic curves of 1902–03 I found only 4 or 5 s.c's, mostly incomplete through loss of trace, but in all the oscillatory character was pronounced. The oscillatory nature of the movement in the Antarctic is abundantly confirmed by the curves of 1911–12, every s.c. observed being oscillatory. There were 13 in all for which two at least of the co-operating stations sent copies of traces. These 13 s.c's as shown by the Antarctic curves are reproduced in the upper part of Plate XIX. Only a short portion of curve is given in each case. The first movement, though usually considerably the smaller, is by no means negligible, either in amplitude or duration, compared with the second.

The curves are tracings of the originals and are shown natural size. The time scale was very approximately 20 mm. to the hour throughout. If we suppose our base line at the bottom of the sheet, the top curve represents what we have called

E′, the element increasing up the sheet. If we suppose the other two elements also to increase up the sheet, the middle curve represents what we may call N′ (N′ = − S′ of our previous notation), and the lowest curve is the vertical force acting on the north pole of a magnet in the direction towards the earth's centre. The scale value for E′ was 1 mm. = $6 \cdot 46\gamma$ throughout. In N′ the equivalent of 1 mm. was $8 \cdot 8\gamma$ on April 8, April 9 and May 29, 1911 ; $8 \cdot 1\gamma$ on June 9 and June 30, 1911 ; and $6 \cdot 82\gamma$ in all the later curves. In V the equivalent of 1 mm. was $7 \cdot 61\gamma$ in the first 10 cases, and $7 \cdot 92\gamma$ on January 17, September 30 and October 20, 1912. In every case except October 2, 1911, the turning point between the first and second movements of the s.c. was as near as could be judged simultaneous for the three elements, but in the most favourable case differences in phase less than 0·5 minute could not have been detected with certainty.

As already remarked, if we take a tropical station like Bombay the principal movement in H is always in one direction, but amongst the Antarctic s.c's recorded in 1902–03 there were two in which the fall in H preceded the rise, and two in which the rise preceded the fall. This variability of direction is also in evidence in 1911–12. The two types are best represented by the two earliest s.c's in Plate XIX, occurring respectively on April 8 and April 9, 1911. On April 8 the second and larger movement is up the sheet, but on April 9 it is down the sheet. The type exhibited on April 9 is the less usual. The s.c. of September 30, 1912, is a second clear example of this type. It is also clearly represented by the s.c. of June 30 so far as E′ and V are concerned, but short-period oscillations were in progress in N′ at the time, and the identification of the movements representing the s.c. might be questioned. The other movements were unmistakably of the same type as the s.c. of April 8, with two partial exceptions, the s.c's of October 2, 1911, and January 17, 1912. On October 2 the E′ movement was clearly of the dominant type. The V movement seems also of that type, though again, in presence of other short-period movements, identification may be a little doubtful, but the N′ movement was peculiar. The first movement was undoubtedly up the sheet (as on April 9), but it continued after the E′ and V movements had reversed, and the return movement down the sheet was synchronous with part of the rise and all of the subsequent short fall seen in the E′ and V traces. On January 17, 1912, the turning points in the three elements apparently synchronised, but the N′ movements were directly opposed to the others.

The order in which the traces come in Plate XIX with E′ at the top and V at the foot is that usual in the original curves. It has the subsidiary advantage of putting at the top the element in which the s.c. movement is usually largest.

Section 61.—Before discussing the Antarctic s.c. movements further, it is desirable to consider the general character of the simultaneous movements recorded elsewhere. The lower part of Plate XIX and Plates XX to XXVII show side by side the Antarctic movements and the corresponding movements, so far as the curves were available, from Buitenzorg (near Batavia, Java), Alibag (near Bombay), Honolulu, Helwan, Eskdalemuir and Sitka. The curves are all tracings of the originals or of photographic copies of these. The stations are arranged in order of latitude from South to North. Copies were also received of many of the s.c's from Agincourt (near Toronto) and Mauritius. But at Agincourt vertical force was not represented, and rapid movements in the D and H traces were usually faint and difficult to copy. The Mauritius curves were not received until after the work for the other stations had been completed, and they are of an unusual type and so do not readily lend themselves to optical comparisons with other stations.

The curves are all shown natural size, and up the sheet represents in each case the same direction as in the original curve. The scale values are indicated by lines whose length represents 50γ. At Buitenzorg and Eskdalemuir the top curve represents N and the middle curve E. At the other co-operating stations they represent respectively H and D. At Buitenzorg declination was less than 1° East, so the difference between H and N or between D and E was microscopic. The lowest curve in all cases represents V.

The direction of the arrow shows the direction of increase of N (or H), of E (or easterly declination), and in V of downward directed force on a north pole. At all the stations movement up the sheet represents increasing horizontal force or increasing north component. Movement up the sheet represents diminishing easterly declination at Honolulu and Sitka, and increasing westerly force at Eskdalemuir. At the other stations it represents increase of easterly force or easterly declination. At Buitenzorg the south pole dips, but movement up the sheet represents a numerically diminishing vertical force, *i.e.*, a force tending to reduce the southerly dip, and so attracting the north pole downwards. At Honolulu and Sitka the north pole dips, but movement up the sheet represents numerically diminishing vertical force.

It is important to notice the difference in scale values between corresponding curves at the different stations, and between the different curves at the same station. The scale value of a declination magnetograph is usually given in angular measure. If, however, ΔD denotes the angular change in declination corresponding to 1 mm. of ordinate at a station where H is the horizontal force, the corresponding scale value in terms of force is 1 mm. $= H\Delta D$. For instance, at Agincourt, 1 mm. $= 1'\cdot281$, and, taking $H = \cdot1597$ as a sufficiently approximate value during 1911, we get in terms of force 1 mm. $= 1\cdot281 \times \cdot000291 \times \cdot1597 = 5\cdot95\gamma$. The angular scale value being determined by the distance between the magnet mirror and the drum on which the photographic paper is wound, is practically constant. Thus the D scale value in terms of force varies as H changes, and so is slightly affected by ordinary secular change. For ordinary purposes D scale values may be regarded as constant for several consecutive years, and they are as a rule much less variable than those of H or V. With the exception, however, of Sitka, the scale values of the H and N magnetographs varied but little.

The relatively large size of the H or N s.c. movement appeals to the eye in most of the plates, especially at Buitenzorg, Alibag, Honolulu and Helwan. But at the last three of these stations the comparative insignificance of the D movement is partly due to the contracted nature of the D scale. Magnetographs were originally designed with an eye to European conditions. A D magnetograph having 1 mm. $= 1'$ of arc—a very common sensitiveness in Eschenhagen instruments—would have at Kew a force sensitiveness of 1 mm. $= 5 \cdot 3\gamma$, a fairly convenient value for ordinary purposes. But if removed to Bombay it would give 1 mm. $= 10 \cdot 6\gamma$ approximately, which is far from sensitive enough considering tropical conditions.

S.c's seem to have been regarded by Prof. Kr. Birkeland as a form of what he called "equatorial perturbations," a species which he believed to be specially developed near the equator. At first sight this supposed pre-eminence at the equator may seem to be confirmed by the plates, but this is not really the case. The prominence at the stations nearest the equator, especially Buitenzorg and Honolulu, is due to the very open scale possessed by the N and H curves at these stations. When we allow for the scale value, the amplitude, as we shall see presently, is much larger in the Antarctic than elsewhere.

Section 62.—There is another feature of s.c's—most in evidence in low latitudes—which is well illustrated in some of the plates. On April 8, 1911, for instance, it is very clearly seen at Buitenzorg. After the sharp initial rise, N very shortly begins to fall, but it remains conspicuously above its original value for nearly an hour, and then falls almost as suddenly as it originally rose. This gives the curve a sort of crested appearance. While details of the smaller movements on April 8 differ at the different stations, a crest in the H curve generally similar to that in N at Buitenzorg is prominent at Alibag, Honolulu and Helwan, and there is at least a suggestion of a crest in the Antarctic in E′, at Eskdalemuir in N, and at Sitka in H. The occasions when the crested appearance is most in evidence are June 9 (at Buitenzorg, Alibag, Honolulu, Helwan and Eskdalemuir), August 19 (at Buitenzorg, Alibag, Helwan, Sitka, and less clearly Eskdalemuir); December 10, 1911 (Buitenzorg, Alibag, Honolulu, Helwan and Eskdalemuir), and especially September 30, 1912 (Buitenzorg, Alibag, Honolulu, Helwan and Agincourt). In other cases there are indications of a crest, but it is obscured by other movements. Thus on January 17, 1912, it is recognisable in the N and H curves, but is partly masked by a progressive movement down the sheet at Buitenzorg and up the sheet at Alibag, Honolulu, Helwan and Eskdalemuir. The crest will seldom be recognised in the plates, except in the H and N curves, but it can usually be detected on minute inspection of the Alibag D and V curves. The definition of the copies of these curves was exceptionally good, and they stood microscopic examination.

The end of the crest, though fairly definite, is not as clearly marked as the commencing movement. Thus perhaps all we can say with certainty is that the duration of the crest is at least very approximately the same at all the stations. In the plates it looks shorter at Alibag and Helwan than at Buitenzorg and Honolulu, but that arises simply from the difference in the time scales.

So far as I am aware, Dr. Moos, Director of the Government Observatory, Bombay, was the first to notice the phenomenon of the crest, and he dealt with it at considerable length in his most elaborate work, 'Bombay Magnetic Observations, 1846–1905,' the most complete discussion with which I am acquainted of the results from any one magnetic observatory. The phenomenon seems especially clearly shown at Bombay, and Dr. Moos reproduces a good many examples of it, some distinctly more striking than those occurring in 1911 or 1912. Dr. Moos apparently divides s.c's into two classes, according as they are or are not followed by large disturbances. In the former case, at Bombay as elsewhere, the normal course is for H to become considerably depressed towards the end of the storm. In the latter case at Bombay there is little if any depression, and practically the sole evidence of disturbance may be a crest such as that of September 20, 1912, the curve becoming normal again or nearly so after the crest disappears. Dr. Moos seems disposed, for reasons I cannot altogether follow, to associate the crests and their preceding s.c's with special seismic conditions in the earth's interior. While the crested condition is undoubtedly most easily recognised in cases where the s.c. is not followed by a large storm, it seems fairly conspicuous in other cases. On April 8, 1911, for instance, a crest, though comparatively short lived, is clearly apparent, and though the largest movements of the ensuing magnetic storm did not occur for several hours afterwards, there was very considerable intervening disturbance even at Buitenzorg and Alibag. The Antarctic curves show that during the existence of crests magnetic disturbance is specially active in those regions where it is usually most prominent.

The circumstances of the crest do undoubtedly recall the suggestion that has been made by Profs. Birkeland and Störmer that a gigantic ring of electrons at a great height in equatorial regions might come more or less suddenly into operation. Its supposed presence has been invoked by Prof. Störmer to account for some of the phenomena of aurora and magnetic storms. If the path of ions emanating from the sun be calculated it is found that none should get to any great distance from the earth's magnetic poles unless either their velocities are higher than those observed in our laboratories, or their approach to equatorial regions is assisted by some extraneous magnetic field. Electrons describing circular orbits at a great height in equatorial regions would supply the sort of extraneous field desired. The field they would produce at the earth's surface would be similar to that caused by a circular current encircling the equator. It would thus, if exactly in the astronomical equator, show itself by a rise or fall in the N component. Near the equator the declination is everywhere small, so that of H and D the former would be the element chiefly concerned. The existence of a crest seems at first sight to fit in admirably with this theory. But it must be remembered that even when the crest is associated with a large magnetic storm, it is as a precursor rather than as a concomitant; also, as Dr. Moos has shown, crests are in many cases not even precursors of large storms.

Section 63.—As I have explained in considerable detail elsewhere, appreciable uncertainty prevails in general as to the exact time of commencement of s.c's, and the exact equivalence of movements in the curves of the different elements. At some stations the time marks appear on the base lines, at others on the curves themselves. In the former case there may be parallax to allow for between the curve and its base line, *i.e.*, the line connecting synchronous points on the curve and base line may not be strictly perpendicular to the latter. When the relative positions of the curve and base line are clearly visible at the beginning and end of the day's trace, parallax can be measured and allowed for. But the copies of the disturbed curves supplied only sometimes included a stopping or starting point, and some of the curves which included such a point were too faint or too poorly defined near their extremities to admit of any exact measure of parallax. When the time break comes in the curve itself the trace is of course lost while the light is interrupted. This is annoying when the break happens to come on, as it did in one or two cases of s.c's, while an interesting movement is in progress. The loss when the interruption extends to 3 or 4 minutes—a customary duration—may be serious. To reduce this source of loss, the interval has been much reduced at some stations, *e.g.*, De Bilt and Eskdalemuir; but this sometimes results in the break not being clearly visible, especially in copies of the original curve. Thus, speaking generally, copies of curves, even photographic copies, are seldom suitable for fixing times of movements with very high precision. Usually s.c. movements, especially those in the H trace, can have their times assigned with at least as high precision as any other type of movement. But in the case of the Mauritius curves they suffered exceptionally from a peculiarity in the method of registration adopted there. In addition to the hour marks, which are broad and go right across the trace, there appear in the photograph a series of lines running parallel to the base line, and representing a scale which may represent millimetres, or minutes of arc, or any other unit of ordinate thought desirable. In every case the face of the steep slope on the H trace representing an s.c. movement was cut by at least one, more usually two, of these lines. Wherever such an intersection took place, the definition suffered. The consequence was that in most cases no very exact time could be assigned to the duration of the movement, and in many cases the same remark applies to the commencement. A further trouble was that the distance between consecutive 2-hour breaks was markedly different for the D and H curves. In some cases, while an s.c. movement was of quite considerable magnitude, no movement whatever could be detected in the Mauritius D trace. In other cases a small movement could be seen, but, according to the time marks—*i.e.*, assuming the rate of rotation of the drum uniform between any two consecutive marks—it followed several minutes after the H movement. Any results as to the azimuth of the force vector in the horizontal plane would have been too uncertain at Mauritius, and no such data appear in the following tables. There were no V traces from Mauritius.

In the Antarctic at the times of the s.c's the curves were generally sensibly on the slope, and more often than not oscillatory as well; still the two movements which there constituted the s.c. were usually so large that the change in the slope of the curve was conspicuous. At other stations it was often hardly possible to say whether the principal movement in H, or N, was or was not preceded by a smaller and much shorter movement in the opposite direction.

Whether the D (or W) and V movements were unidirectional was a still more troublesome question. At some stations, *e.g.*, Alibag, the D and V movements owing to the insensitiveness of the magnetographs were usually microscopic. At Eskdalemuir the usual change in V was a fall, but owing to the low sensitiveness some appreciable time elapsed before it became big enough to catch the eye.

As a preliminary to the plates the photographic curves had to be traced on transparent paper, using for guidance a pencil line perpendicular to the time line and intended to correspond exactly to the commencement of the s.c. Any error in setting the original curve to this line was equivalent of course to shifting the trace of one of the elements bodily relative to the others. For instance, an error of 0·3 mm. of this kind in, say, a Sitka curve would result in associating all incidents in the curve concerned with incidents in the other curves which really happened one minute earlier or later, according to the direction of the misadjustment. Thus while every reasonable care was taken, the plates are intended to give correct general ideas, but not to afford means of measuring times with absolute precision. In arriving at the times of commencement given in the discussion of the individual s.c's, special weight was given to the Eskdalemuir curves, as these were originals.

April 8, 1911, *Plate XIX.*

Section 64.—The time of commencement was about 11 h. 21 m. G.M.T. During the previous twelve hours conditions had been everywhere ordinarily quiet. Sometime previous to the s.c. a gradual but considerable rise commenced in H or N at most of the stations, which is particularly conspicuous in the open scale curves at Buitenzorg and Honolulu. This had, however, slackened a little, and the s.c. represented so much more rapid a change that the commencement is very clearly shown at all the stations where the photographic paper was sensitive enough.

In the Antarctic, where there were two large movements in opposite directions, the commencement and the two subsequent turning points being clearly shown, the three elements seemed to be in phase. After these two movements, which are regarded as constituting the s.c., a less rapid movement tended to restore the elements to their undisturbed values, but oscillations ensued. In E′ the crest seems to be distinctly represented, being terminated by a large movement down the sheet, which seems to be synchronous or very nearly so with movements down the sheet in the N or H curves at the other stations. These terminating movements commenced a little within an hour after the s.c. began.

At Mauritius, as generally elsewhere, H was rising at the time, but the rate suddenly accelerated, just as at Alibag, a rise of about 21γ occurring in 2 or 3 minutes. But instead of attaining a peaked summit immediately as in the Buitenzorg N curve, or a nearly flat plateau as in the Alibag H curve, the Mauritius H trace shows a rise continuing for about 15 minutes. The slope, though much reduced after the first 2 or 3 minutes, was quite considerable, the total rise during the 15 minutes amounting to 32γ. After 15 minutes there was a gradual fall, but a crest remained which terminated in much the same way as at Alibag. During the very rapid part of the initial rise in H the D trace showed a very slight westerly movement, but the slope of the curve seemed the same as for some time before the s.c. movement began. Then after the s.c. movement in H had changed into the much slower rise, the D trace showed a pretty rapid movement to the east equivalent in force to about 6γ. After remaining almost level for 10 minutes, a reverse movement followed to the west, so that the curve showed a small bay.

In the original N curve at Buitenzorg there was in reality no trace visible between the commencement and the attainment of the summit shown in Plate XIX. The restoration of the missing part by a straight line is supported by the phenomena at other stations in low latitudes, but is conjectural. The principal movement must obviously have been a rise, but it may possibly have been preceded by a small movement down the sheet. The movement in E at Buitenzorg is clearly oscillatory, a small almost instantaneous rise of E being followed by a larger fall. Whether the earlier movement preceded or synchronised with the early part of the apparently unidirectional movement in N is uncertain. The V trace at Buitenzorg was going up the sheet at the time. The terminal part of this movement is steeper than the rest, and might be part of the s.c. It is followed by a sharp small movement down the sheet, and this by a much larger, gradually slackening, movement up the sheet. This final V movement certainly answers in part to the recoveries shown by N and E, which have not been regarded as part of the s.c., but it seems natural to regard the s.c. movement in V as oscillatory.

The Alibag, Honolulu and Helwan H curves are clear. No trace of a preliminary inverse movement can be seen in them. The same is true of Agincourt, so far as can be seen. At Alibag the s.c. seems represented in D and V by a small sharp movement down the sheet. The subsequent movements up the sheet represent a recovery which set in almost at once, but did not for a considerable time bring the elements back to their undisturbed position. Nearly an hour after the s.c. there are synchronous movements in the H, D and V curves, which seem to mark as it were the close of the incident. The result is to leave a sort of shallow ravine or valley in the D and V curves corresponding in time with the crest in the H curve.

At Honolulu the D trace shows a very small oscillation first to east then to west; it is the latter which seems to synchronise with the rise in H. The s.c. movement in the V trace was down the sheet, but this represents an inwardly directed force on a north pole, and not an outwardly directed force as at Alibag, and there is a rapid recovery.

The movements at Helwan were very similar to those at Alibag. At Agincourt the principal (westerly) movement in D was preceded by a rapid smaller movement to the east.

At Eskdalemuir the N movement was undoubtedly oscillatory and unusually complex. There was first a very rapid small rise, followed by a still more rapid and larger fall, the two movements being over in about a minute, and only then occurred the main movement, a rise in N. The appearance of the curve suggests a continuous succession of small rapid oscillations, superposed on a principal movement. If the curve stood alone, it would not suggest a crest, but the equivalent of what is a crest at Helwan and Alibag is easily recognised. The E curve shows oscillations like the N curve. A very rapid movement up the sheet preceded a larger but similarly rapid movement down the sheet. This was followed by a larger movement up the sheet which took place jerkily. This movement partly corresponded in time with the principal rise in N, but it continued, though at a slower rate, for some time after the N movement had ceased. The V movement was oscillatory, but the first movement up the sheet was so small it is hardly visible, and during the subsequent movement down the sheet there was at least a suggestion of further minor oscillations.

At Sitka the commencing movement in H was distinctly oscillatory, a small and rapid fall preceding a large rise. At the same time there had been a number of small oscillations during the previous hour, and it is possible that the first movement arose from the same source as these. After the s.c. proper, the H trace exhibited numerous small oscillations, like the N trace at Eskdalemuir. The commencing D movement was also oscillatory, the second and larger movement up the sheet corresponding with the large rise in H. The principal V movement at Sitka was down the sheet, representing as at Honolulu an inwardly directed force on a north pole. But it seemed to be preceded by a very small rapid movement in the opposite direction.

The general description will have made it clear that at most stations it was difficult to say whether the different elements were in phase or not. This rendered it very difficult to draw conclusions. The following table shows the results considered most probable after a careful measurement of the curves. $\overline{\mathrm{H}}$ stands for the horizontal component of the vector to which the movement could be assigned, T for the total force (*i.e.*, the resultant of $\overline{\mathrm{H}}$ and the vertical component).

ψ is the inclination of $\overline{\mathrm{H}}$ to astronomical north, counted from 0° to 360° through East (90°). χ is the inclination of T to the horizontal plane. The letter *a* denotes that the force on the north pole lay above, *b* that it lay below the horizon. The estimated durations depended mainly on measurements of the H and N curves.

TABLE CXVIII.—S.c. Movements on April 8, 1911.

Station.	Movement.	$\overline{\mathrm{H}}$.	T.	ψ.	χ.	Duration.
		γ	γ	°	°	Minutes.
Antarctic	First	111	114	269	12 *a*	2
,, ...	Second	227	237	72	16 *b*	3
Mauritius	Principal	21	—	—	—	2
Buitenzorg	,, ...	52·9	53·1	347	4 *a*	3
Alibag	,, ...	40·5	42·0	342	15 *a*	2
Honolulu	,, ...	31·6	34·2	6	22 *b*	2·5
Helwan	,, ...	42·2	43·9	343	16 *a*	4
Agincourt	,, ...	31·4	—	328	—	6 ?
Eskdalemuir	First	11·0	11·2	315	10 *b*	0·5
,, ...	Second	48·5	48·7	130	5 *a*	1·5
,, ...	Principal	66·2	66·3	319	4 *a*	4
Sitka	First	15·2	15·3	134	6 *a*	0·5
,, ...	Principal	83·3	83·9	357	7 *b*	2·5

The s.c. itself was of considerable magnitude, and disturbed conditions continued after it; but the principal movements, constituting what might fairly be termed a magnetic storm, did not appear until 8 or 10 hours had elapsed. They continued until about 24 hours after the s.c. They were especially large at Agincourt and Sitka, the latter station being even more disturbed than the Antarctic. The storm is discussed later in Section 92 and Table CXLII.

April 9, 1911, *Plate XX.*

Section 65.—The s.c. began about 22 h. 21 m. on April 9, 1911. The magnetic storm of the previous day had fairly subsided about 8 hours before. At some stations, especially Buitenzorg, Honolulu and Helwan, conditions were distinctly quiet when the s.c. occurred.

In the Antarctic there were small oscillations going on at the time, but they were too small to obscure the phenomena. The s.c. movement was clearly oscillatory, the first movement up the sheet being followed by a larger, equally rapid, movement down the sheet. The times of commencement and the end of the first movement seem the same for the three elements. The end of the second movement is more difficult to assign, owing to the minor oscillations. The downward movement in V ceases when a slackening appears in the rate of fall of N′. If we take the lowest point in the V curve as the end of the second movement, it lasted about $3\frac{1}{3}$ minutes; whereas if we take the lowest point in the N′ curve, it lasted about 7 minutes. There are turning points in the E′ curve at both these times, the later giving somewhat the larger range.

At Mauritius the movement showed no sign of oscillation. In addition to the ordinary sharp rise in H of about 16γ, in about 6 minutes, there was in D an easterly movement, equivalent in force to about 6γ, which appeared synchronous with the movement in H. The H trace showed a distinctly crested appearance for about an hour after the s.c.

At Buitenzorg in the original curves there was some interference of the N and V traces, and it is just possible that the large N movement up the sheet was preceded by a small movement in the opposite direction, as the V trace would have hidden any such movement. So far as one can see, there was a unidirectional movement in N up the sheet, lasting about 4 minutes, during which the E trace made a short excursion down the sheet, and a longer and larger excursion up the sheet, reaching its summit simultaneously with the N trace. The V trace is also distinctly oscillatory, but each of the two movements took longer than the apparently corresponding E movements. The summits of the three curves are all a little rounded, especially that of V, so that the values of the different elements answering to the summits may fairly be regarded as corresponding. Comparing these with the values prior to the s.c. we get a measure of the change of field, but it must be recognised that the vector deduced does not represent a disturbing force fixed in azimuth.

The Honolulu curves were exceptionally clear, and they show no sign of oscillation in the s.c. in H and D. The H curve started rising very steeply, the first half of the rise taking much less time than the second. The small rise in the D curve, and the fall in the V curve seemed to be completed during the first half of the H rise, but during the remainder of the time when H was rising, the changes in D and V were so small as to be comparatively unimportant. Still the elements can hardly be said to have been in phase.

At Helwan a decided recovery from the s.c. movement set in almost immediately, but the s.c. itself was apparently unidirectional in all three elements, and they may fairly be said to have been in phase throughout.

At Agincourt the H and D curves were decidedly oscillatory, the second movement being considerably the larger. A peculiarity was that the second movement in the D curve continued for a minute or two after the second movement in H had ceased, and a rapid movement in the opposite direction had set in.

At Eskdalemuir the phenomena were peculiar. The N curve which for some time had been level showed a pretty steep rise, in which some very small oscillations can be seen. This went on for about $2\frac{1}{2}$ minutes during which the E trace went slightly down the sheet, while no movement is recognisable in V. Then suddenly the N movement up the sheet greatly accelerated, the E movement reversed and the V trace went down the sheet. It is presumably the second movements in N and E, and the movement in V that represent the s.c. The fall in V really continued without sensibly slackening for a minute or two after the summits in the N and E curves were reached, and after being level for a short time the curve continued down the sheet for a considerable time before any recovery set in.

At Sitka the s.c. movement was distinctly oscillatory in H and D, and apparently so also in V, but the first movement in V is not very decided and may proceed from some separate source, as the curves were not free from minor oscillations when the s.c. began. The first movements in H and D seem to synchronise, but the second movement in D was reversed before the H curve reached its summit. The end of the second movement in D synchronises with a marked slackening in the rise of H and with the summit of the V curve, and seems on the whole the most natural point to accept as the end of the s.c. The full summit of the H curve synchronises apparently with the end of the rapid part of the third movement (westerly) in D. If it were taken as the end of the s.c. the difference in the estimate of the azimuth of the disturbing force would be considerable.

Table CXIX represents the results derived from the measurements made on the curves, the notation being the same as in Table CXVIII.

TABLE CXIX.—S.c. Movements on April 9, 1911.

Station.	Movement.	H.	T.	ψ.	χ.	Duration.
		γ	γ	°	°	Minutes.
Antarctic	First	60·9	62·6	59	13 *b*	2
,, ...	Second ...	148	150	216	10 *a*	3
		or 181	182	225	7 *a*	7
Mauritius	Principal	17	—	—	—	6
Buitenzorg	,, ...	19·1	19·3	11	9 *b*	4
Honolulu	,, ...	14·7	15·3	359	16 *b*	3
Helwan	,, ...	34·2	35·9	346	18 *a*	4
Agincourt	First	11·4	—	137	—	1·5
,, ...	Principal	67·9	—	344	—	3·5
Eskdalemuir	First	11·0	11·0	19	0	2
,, ...	Principal	76·0	76·6	343	7 *a*	4
Sitka	First	9·2	9·3	248	10 *b*	1
,, ...	Principal	37·7	38·0	73	8 *a*	2

After the s.c. there was considerable disturbance with quieter interludes until 16 h. of April 10. Conditions were then quiet for some 4 hours, when further considerable disturbance commenced and continued until about 3 h. on the 11th. Particulars of these disturbances will be found in Sections 93 and 94, and in Tables CXLIII and CXLIV.

May 29, 1911, *Plate XX.*

Section 66.—The s.c. of May 29, 1911, commenced about 14 h. 34 m. G.M.T. The curves had been extremely quiet for some hours previously.

In the Antarctic a very small bay presented itself in the curves between 11 h. and 12 h. and a larger one earlier, between 6 h. and 7 h. These were, however, short isolated events, and otherwise there had been little disturbance since 0 h. As usual, the Antarctic curves show an oscillatory movement, and the three elements are fairly in phase. The amplitude was considerable, but the movements lasted about 10 minutes, so the slope of the curves is less steep than usual in s.c's.

At Mauritius there was a rise as usual in H, lasting about 5 minutes, followed by a more gradual fall, which did not restore the element to its original value. The phenomena closely resembled those shown by the H curve at Alibag. There was no visible movement in D.

At Buitenzorg the N and E movements were unidirectional, a recovery setting in, however, almost at once. The V movement on the other hand may most fairly be regarded as oscillatory. The first and smaller movement, down the sheet, seemed to commence simultaneously with the N and E movements, but it terminated sooner, and the movement in V up the sheet was well under weigh before the commencing movements in N and E finished. The summit in the V curve occurred several minutes after that in N. At Alibag the movements in all the elements seemed unidirectional.

At Honolulu the N and V movements appear unidirectional, and the elements in step. The D movement, however, was oscillatory, the two movements occupying about the same time as the single movement in the other elements. The second D movement was the larger, but only by about 0′·1.

At Helwan the H and V traces were very faint. Apparently the movements were all unidirectional, as at Alibag. Recovery set in more immediately in D than in the other elements.

At Agincourt the movements were of an unusual type. In H there was a rapid but comparatively small rise, followed immediately by a similarly rapid fall of double the size. Shortly after came a rise bringing the trace nearly back to its original level. The three movements occupied about 10 minutes. Thus while the commencing movement, as is usual in lower latitudes, was a rise in H, it was less prominent than the subsequent fall.

In D apparently there was a movement to the west, too rapid to be clearly shown, followed immediately by a much larger but less rapid movement to the east, which lasted about five minutes. A slower westerly movement immediately followed, bringing the magnet back about 20 minutes after the start to its original position.

At Eskdalemuir the N and E movements were conspicuously oscillatory, the second movements, representing a north-westerly force, being much the larger. The commencing V movement was apparently also oscillatory; but the first movement up the sheet is very small and might represent merely a small flaw in the paper. The principal movements in the three elements ended at approximately the same time, and a recovery immediately set in, the elements resuming very approximately their undisturbed values within about 18 minutes of the start.

At Sitka the H and D traces fouled one another. So far as can be seen, the D movement was oscillatory, the H not. The first movement in D was small and very rapid. The second movement in D was much larger than the movement in H, an unusual feature. The H curve reached its summit first; but both summits being rounded, it is natural to regard the end of the movement as fixed by the D curve, as the D movement was the dominant one. The V trace has a faint suggestion of a very small and rapid preliminary movement up the sheet, which may or may not have been real. The only unmistakable movements are the principal movement down the sheet and the subsequent recovery which immediately set in. The results derived from the curve measurements are given in Table CXX.

TABLE CXX.—S.c. Movements on May 29, 1911.

Station.	Movement.	$\overline{\text{H}}$.	T.	ψ.	χ.	Duration.
		γ	γ	°	°	Minutes.
Antarctic	First	27·1	27·9	216	14 *a*	2
,, ...	Second	62·0	67·2	54	23 *b*	8
Mauritius	Principal	11	—	—	—	5
Buitenzorg	,, ...	19·5	19·7	350	8 *b*	6
Alibag	,, ...	16·2	16·5	353	10 *a*	5½
Honolulu	,, ...	8·1	8·5	3	18 *b*	5½
Helwan	,, ...	12·8	13·3	319	16 *a*	4
Agincourt	First	8·4	—	297	—	2
,, ...	Second	27·9	—	112	—	6
Eskdalemuir	First	15·2	15·2	149	3 *b*	1
,, ...	Second	68·9	69·2	330	5 *a*	5
Sitka	Principal	14·2	15·1	329	20 *b*	4½

After the s.c. the Antarctic curves show some minor oscillations—a normal feature at that hour of the day—and the curves at most of the other stations were a little less quiet than before the s.c. Subsequently, however, conditions were decidedly quiet, and continued so for some 20 hours. The afternoon of May 30 and forenoon of May 31 showed moderate disturbance at Eskdalemuir, but this would not naturally be associated with the s.c. Undoubtedly, the natural conclusion to be drawn is that the s.c. was an isolated incident during a quiet time.

June 9, 1911, *Plate XXI*.

Section 67.—The s.c. began about 16 h. 31 m. G.M.T. on June 9. In the Antarctic, conditions had been exceptionally quiet during the previous eight hours. The movement was oscillatory, an exceptional feature being that the excess of the second movement over the first was small. The second movement did not end sharply. A less steep slope followed a steeper slope in E′ and N′, while the summit of the V curve was rounded. There is a choice between the end of the steep slope and the extreme summit as fixing the end. Other oscillatory movements at once ensued, so the s.c. is unusually inconspicuous.

At Mauritius there was a rise of about 8γ in H in the course of about six minutes, the trace retaining a distinctly crested appearance until about 18 h. 45 m., when a smart fall of about 7γ occurred. No certain movement could be recognised in the D trace.

At Buitenzorg there was no sign of oscillation in the commencing N movement, which was fairly prominent. The element remained decidedly above its undisturbed value for over two hours. The crested appearance is conspicuous, and is almost equally so in the N or H traces at all the other stations, except Sitka and the Antarctic. The duration of the crest seems the same at all the stations, where it was recognisable. The commencing movement in E at Buitenzorg was also unidirectional, and it was in phase with that in N. In V the commencing movement down the sheet ended before the commencing movements in N and E, and a larger movement up the sheet had made considerable progress before the summit of the N curve was attained. The V trace was moving up the sheet when the s.c. began, so the second or recovery movement may partly represent the continued action of the pre-existing forces. The second movement in V continued after the commencing movements in N and E had ended, and considerably exceeded the first movement.

At Alibag the movement seemed unidirectional in all the elements, but the amplitude was very small except in H. The H trace shows a conspicuous crest, and small as the disturbance was in D and V, movements corresponding to the cessation of the crest in H are clearly recognisable in both these elements.

At Honolulu the movement in H was clearly unidirectional. The trace was moving up the sheet at the time, and following on the rapid rise is a crest having about the same slope as the trace prior to the s.c. The existence of this slope renders the ending of the crest less distinct than at Alibag. The D trace at Honolulu was distinctly oscillatory, a very small movement down the sheet either anticipating the H movement altogether or synchronising with a small part of it. The upward movement in D seems to finish before the first movement in H, but the D trace was moving down the sheet when the s.c. began, and this general movement down the sheet continued for nearly two hours, and probably neutralised part of the second s.c. movement. The V trace was also moving down the sheet when the s.c. began. The commencing movement was apparently unidirectional. The tendency to recovery would seem to have been neutralised by the continuance of the pre-existing movement down the sheet.

At Helwan the H trace as usual closely resembled that at Alibag and showed the crest well. The D trace showed very little movement, but a depression persisted for some time. No V trace was received.

At Agincourt the s.c. movement was not recorded, as its time synchronised with that of the change of photographic paper.

At Eskdalemuir the movement appears to be in the main unidirectional in all the elements. It is small and the original curves were rather faint, but the N trace was rather jerky, minute pulsations being evidently in progress during the rise. The rise in the E curve was interrupted, a short practically level portion of curve separating two rises. Thus a vector derived from the commencing and final positions shown by the N and E traces does not in this case imply a disturbing force acting persistently in one direction. The irregularities may represent the intervention of some disturbing force quite distinct from the s.c., but that is a matter of speculation. The V trace showed a fall as usual, but it was very small.

At Sitka all three traces show oscillatory movements. The first movement, which was very small except in D, was down the sheet in H and D, but up in V. The second movement, up the sheet in H and D and down in V, is more clearly shown. This movement was apparently interrupted by another, the consequence being that the H and D curves have each two summits, the former being the higher in H but the lower in D. The first summit has been regarded in the calculations as concluding the movement. The hollow in the V curve is so rounded that it affords no help to fixing the end of the s.c. All the Sitka curves show a recovery within a comparatively short time. Further disturbance followed and was in progress at the time when the crest subsided at the other co-operating stations. Regarded by themselves, the Sitka curves do not suggest a crest.

The results derived from the curve measurements are given in Table CXXI.

TABLE CXXI.—S.c. Movements on June 9, 1911.

Station.	Movement.	$\overline{H}$.	T.	ψ.	χ.	Duration.
		γ	γ	°	°	Minutes.
Antarctic	First	17·8	18·4	234	14 *a*	2
,, ...	Second ... {	23·9	24·8	59	16 *b*	3½
		or 25·4	26·5	57	17 *b*	5½
Mauritius	Principal	8	—	—	—	6
Buitenzorg	,, ...	12·8	13·1	349	13 *b*	9
Alibag	,, ...	11·7	12·0	350	13 *a*	7
Honolulu	,, ...	7·7	8·1	15	17 *b*	5½
Helwan	,, ...	12·4	—	350	—	7
Eskdalemuir	,, ...	20·2	20·4	335	8 *a*	6
Sitka	First	5·3	5·6	137	17 *a*	1½
,, ...	Second	15·7	16·4	300	17 *b*	4½

In the Antarctic, during the $3\frac{1}{2}$ hours immediately following the s.c. the conditions, though much less quiet than before, were unquiet rather than disturbed. But from 4 to 17 hours subsequent to the s.c. there was considerable disturbance in all the elements. The s.c. occurred about $4\frac{1}{2}$ h. on the 10th, in the time of 180° E., and the ranges for that day 258γ in S′, 375γ in E′ and 184γ in V were amongst the largest of the month. During the time when the crest was in evidence, large irregular movements did not present themselves, but subsequently all the stations showed very considerable disturbance. In this case then a decided crest was associated with an unmistakable though only second-rate magnetic storm. Further particulars of this storm will be found in Section 97 and Table CXLVII.

June 30, 1911, *Plate XXI.*

Section 68.—On June 30, 1911, the s.c. began at about 21 h. 50 m. G.M.T. Conditions had been unusually quiet during the previous 24 hours.

In the Antarctic, while the previous conditions were quiet, minute oscillations were in progress at the time, and these tend to obscure the movements in N′, which were unusually small. As usual the movement was oscillatory in all the elements. The second movement was only a little bigger than the first. Thus the appearance is more suggestive of a "tooth" disturbance—*i.e.*, a sharp spur-like isolated movement—than an ordinary s.c. The movement was first noticed in the Antarctic curves, but it was considered a doubtful s.c. until confirmed by the traces from other stations. The oscillations which follow in the Antarctic curves make nearly as much appeal to the eye, but there is practically no trace of them in the curves from the other stations, while the s.c. itself, though not large, is clearly shown.

At Mauritius H rose about 6γ in 5 minutes. A recovery set in almost at once, bringing the trace down approximately to its original level by 22 h. 30 m. The appearance rather suggests a "crest" depressed by some independent cause. No certain movement was visible in D.

At Buitenzorg the movement in N was apparently oscillatory, but the first movement down the sheet is very small. The E trace is not very clear. There seems a very small movement up the sheet synchronising with the downward movement in N. At the time when the summit of the N curve was reached, the E curve was practically at its undisturbed level. A slight fall then ensued, followed by a rise. The V curve shows no visible departure from levelness during the first movement in N. It then moved down the sheet as N went up, but started going up before the summit of the N curve was reached, and continued to rise, though very slowly, for a sensible time after N had begun to fall.

At Alibag the H curve shows only the ordinary rise distinctly, but there is a faint suggestion of a previous downward movement, which may or may not be real. The D trace is also ambiguous. There may be a tiny hump on it prior to the small visible depression. A similar remark applies to the V trace. This is an instance in which considerably higher sensitiveness would probably have been advantageous.

At Honolulu the decisive H movement up the sheet is preceded by a downward movement, but this was so slow we should not naturally regard it as part of an s.c. The D trace, which was moving up the sheet when the sudden movement in N began, shows a small rapid up and down movement, which left the value of the element at the time when the summit of the N curve was reached practically the same as before. The V movement seems unidirectional, the fall synchronising with the rise in N. A recovery, however, set in at once in V, while the N curve if anything still continued to rise.

At Agincourt the s.c. was conspicuously oscillatory. The H trace shows a rapid fall and rise, even the former by no means microscopic. After the summit was reached a second small oscillation ensued, before a decided recovery set in. The D curve showed four rapid movements West, East, West, East, the first pair of movements synchronising with the first two in H. The movements, though small, were by no means microscopic; the first of the two easterly movements being about twice the size of the other three movements.

At Eskdalemuir the N and E movements were distinctly oscillatory. In V only a single movement, down the sheet, is recognisable; it seems to correspond in time with the second movements in N and E.

No copies of this disturbance were received from Helwan or Sitka.

The results derived from the curve measurements are given in Table CXXII.

TABLE CXXII.—S.c. Movements on June 30, 1911.

Station.	Movement.	$\bar{H}$.	T.	ψ.	χ.	Duration.
		γ	γ	°	°	Minutes.
Antarctic	First	25·9	28·3	92	24 *b*	2
"	Second	30·8	34·1	262	25 *a*	2
Mauritius	Principal	6	—	—	—	5
Buitenzorg	"	8·1	8·2	0	10 *b*	6½
Alibag	"	7·7	8·4	344	23 *a*	6
Honolulu	"	6·2	6·7	10	23 *b*	4
Agincourt	First	7·6	—	203	—	1½
"	Second	32·5	—	12	—	2½
Eskdalemuir	First	5·1	5·1	149	0	2½
"	Second	22·2	22·4	335	7 *a*	3

In the Antarctic conditions became and continued distinctly unquiet after the s.c. appeared, but no considerable disturbance ensued until some 7 hours had elapsed. From 7 to 20 hours subsequent to the s.c. conditions though not violently disturbed were considerably more disturbed than usual. The s.c. occurred a little before 10 h. in the time of 180° E. on July 1, and the ranges for the next two days were as follows: July 1, 200γ in S′, 229γ in E′, and 134γ in V; July 2, 314γ in S′, 247γ in E′, and 127γ in V. July 3 was also a highly disturbed day, but this presumably was a distinct phenomenon. At the co-operating stations the s.c. was immediately followed by a moderate disturbance, which was characterised, especially at Agincourt and Eskdalemuir, by the presence of incessant small oscillations. The largest movements, which represented only a minor storm, occurred between 16 and 20 hours after the s.c.

August 19, 1911, *Plate XXII.*

Section 69.—On August 19, 1911, the s.c. began about 12 h. 15 m. G.M.T. For 16 hours previously the curves everywhere had been very quiet; thus the conditions were exceptionally favourable for showing details.

In the Antarctic as usual the movement was oscillatory, the second movement being conspicuously the larger. But while the slope of the second E′ movement was practically uniform until the summit was nearly attained, the rate of change in N′ and V showed a decided slackening after the original undisturbed level was reached. Thus the movement does not really represent a force having a fixed direction.

At Mauritius there was a rise of about 12γ in H in the course of about 6 minutes. The value of H continued to rise very slightly for about 30 minutes after the end of the s.c. A fall then set in, which was pretty rapid for a few minutes. The appearance of the curve was thus crested like that of the H curves at Alibag and Helwan, except that the crest, instead of being level as at these two stations, had a slight slope upwards. At the time of the s.c. the D trace was showing a gradual westerly movement. A small but fairly sharp movement, with a force equivalent of 4γ, took place to the east about the time the rise in H was ending, after which the westerly movement reasserted itself.

At Buitenzorg the N curve shows no sign of oscillation, there being a rise at a practically uniform slope until the summit is almost reached. The E trace, on the other hand, is distinctly oscillatory. There was first a small rapid movement up the sheet, followed immediately by a movement down the sheet which slackened suddenly, a steep slope being followed by a less steep one. The time when the lowest point was reached agrees apparently with the time when the summit was attained in the N curve. In the V trace there was a small rapid fall, then a practically level piece, and then a rise. This had brought the curve to above its undisturbed level before the rise in the N curve had ceased, and it continued for a considerable time after the recovery in N had set in. Thus the three elements were conspicuously out of phase throughout. The N and V curves exhibit a sort of "crest," lasting little over half an hour, and there is a corresponding depression in the E curve.

At Alibag the movement appeared unidirectional in all the elements. The slope, however, of the H curve, which commenced very steeply, fell off, the first third of the rise being accomplished in much less than a third of the time. After the rise the curve remained quite level for some 20 minutes, when a sharp slope down ensued, lasting about 8 minutes. The "crest" thus formed represents about the same interval of time as that described at Buitenzorg, but the two crests differ considerably in appearance. In the case of the D and V curves at Alibag a recovery set in immediately after the end of the commencing movement, but it was not completed until the crest in H began to subside.

At Helwan the phenomena closely resembled those at Alibag. A change of slope in the commencing rise in H is not recognisable, but the trace is rather indistinct. The crest is almost an exact counterpart of that at Alibag, having the same duration and a similarly flat top. The D and V movements—thanks partly to greater sensitiveness in the instruments—are larger than at Alibag, and details of the recovery are thus more easily made out. The depression in the D and V curves terminated synchronously with the crest in the H curve. Their appearance bears a resemblance to the impress of a seal in wax.

At Agincourt the commencing movement was unidirectional in both H and D, and, though small, so rapid as to suggest discontinuity in the trace. The H trace showed a crest, but was not flat-topped, minor oscillations ensuing almost as soon as the sudden rise ended.

At Eskdalemuir the movement was exceedingly complex. Both the N and E traces show a very rapid movement up the sheet—of considerable size in N—followed by a larger and equally rapid fall. The fall is immediately followed by a rise, which was suddenly arrested during a minute or so, a small portion of practically level trace appearing in each curve. The movement up the sheet was then continued, though somewhat less rapidly. The E curve shows a practically uninterrupted rise to a summit, though in approaching it the rate of rise diminished. In the N curve a summit was also reached synchronously with that in E, but the rise to it was not uninterrupted. The time when the summit appeared in the E trace has been accepted as the end of the third movement, but possibly the first peak in the N curve might have been preferable. The V trace shows a movement down the sheet, with one or two small oscillations superposed.

At Sitka the H and D movements were clearly oscillatory. Of the first movements that in D was considerably the larger, and the second movement in D was not much less than the second in H. The V curve was crossed by the D curve during the s.c., and it is difficult to say whether the V movement was oscillatory or not. A movement down alone is clearly seen, but there is rather a suggestion of a previous very small movement up the sheet. The H and D traces at Sitka are not flat-topped, but bear a considerable resemblance to the N trace at Buitenzorg, having like it a somewhat crested appearance.

The results derived from the curve measurements are given in Table CXXIII.

TABLE CXXIII.—S.c. Movements on August 19, 1911.

Station.	Movement.	$\bar{H}$.	T.	ψ.	χ.	Duration.
		γ	γ	°	°	Minutes.
Antarctic	First	26·1	27·4	248	18 *a*	1·5
,, ...	Second	81·4	84·4	71	15 *b*	7
Mauritius	Principal	12	—	—	—	6
Buitenzorg	,, ...	40·9	41·0	355	4 *b*	7·5
Alibag...	,, ...	18·9	19·5	347	14 *a*	5
Helwan	,, ...	16·7	17·8	326	20 *a*	6
Agincourt	,, ...	14·9	—	302	—	2·5
Eskdalemuir	First	20·6	20·6	340	3 *a*	0·5
,, ...	Second	39·2	39·3	154	3 *b*	1
,, ...	Start to summit ...	34·1	34·3	321	7 *a*	9
Sitka	First	5·7	5·8	133	9 *a*	1·5
,, ...	Second	41·4	42·0	352	10 *b*	6

In the Antarctic the s.c. movement itself was large, but after it subsided conditions were rather quiet for 3 hours. Moderate movements then ensued during the next 18 hours. The largest movements occurred from $8\frac{1}{2}$ to 13 hours after the s.c. The s.c. occurred shortly after 0 h. (time of 180° E.) on the 20th, and the ranges for that "day" were 181γ in S′, 236γ in E′ and 86γ in V. The traces of the horizontal components at Eskdalemuir and Sitka exhibited an unquiet oscillatory condition for 15 or 16 hours after the s.c. There was nothing, however, at these or the other co-operating stations that would naturally be called a magnetic storm.

Further particulars of the disturbance on August 19–20 will be found in Section 101 and Table CLI.

October 2, 1911, *Plate XXII.*

Section 70.—The s.c. on October 2, 1911, began about 4 h. 8 m. G.M.T. The curves had been quieter than usual during the two previous days. In the Antarctic the motion was oscillatory in all the elements, but there are exceptional features in the N′ curve. The E′ and V traces seem fairly in step. Each shows two oscillations. The first oscillation in E′ appears a normal s.c., the first movement down the sheet being followed by a larger and similarly rapid movement up the sheet. The synchronous oscillation in V also appears quite normal, except that it is unusually small. The second oscillation in the two elements is less rapid, and in E′ is considerably smaller than the first; it may have arisen from a distinct source. The N′ trace is exceptional in that the first movement is not down the sheet like the first movements in E′ and V, but is up the sheet. Further, it lasts almost as long as the first two movements combined in the other elements. It is followed by a larger movement down the sheet which terminates before the fourth but later than the third movement in E′ and V.

At Mauritius H rose 8γ in about five minutes, the major part of the rise appearing to be nearly instantaneous. The trace had a slight slope up the sheet at the time, and this slope was continued in a crest which followed the s.c. The downward movement ending the crest represented about 4γ and was very rapid. The time from the start of the s.c. until the end of the step down from the crest was only about 20 minutes. D had an oscillation of $1'{\cdot}3$ ($= 8\gamma$) to the west and $0'{\cdot}5$ to the east, all in the course of about 8 minutes, the westerly movement synchronising or nearly so with the rise of 8γ in H. A slow westerly movement was in progress when the s.c. began, and it continued after the oscillation at about the same rate as before.

At Buitenzorg the N movement seems unidirectional; but the E movement is unmistakably oscillatory, the second movement being followed by a gradual recovery. The V trace was moving up the sheet when the s.c. began. It shows a comparatively rapid small movement down the sheet, followed by a gradually slackening upward movement, which brought the trace considerably above its undisturbed level. The N trace after rising at a nearly uniform rate suddenly reduced the rate very much, the rise at this reduced rate being small. It is the point where the rate is reduced that accords in time with the lowest points in the E and V curves, and it has accordingly been regarded as the true end of the s.c.

No curves were received from Alibag.

At Honolulu the H and V traces are unidirectional, while the D trace is oscillatory. While the H trace is unidirectional, the slope is conspicuously fastest at first, and the end of the steeper part of the slope is at least approximately synchronous with the end of the sudden rise in the D curve. The fall, however, in the V curve continued until the end of the further slow rise in H, and this latter point is fairly synchronous with the end of the second movement in D. It thus appeared best to regard the principal movement as ending when the highest point appeared on the H curve, and to calculate the vector by comparison of the curves at this time and immediately before the s.c. began.

At Helwan the H movement though small is distinct, and shows no trace of oscillation. The recovery was very gradual, but set in almost at once. No measurable movement appeared in D. As usual the V curve shows a small fall followed by a recovery. The curve was very faint and the measurements made probably not very accurate.

At Agincourt the commencing H movement was similar to that at Helwan, but within 10 minutes from the start the trace had fallen half-way back to its undisturbed level. The D trace was moving up the sheet at the time and is not very clear. Apparently the s.c. movement was oscillatory, a small movement up the sheet being followed by a larger movement down the sheet. This latter movement and the recovery from it are clearly shown.

At Eskdalemuir the movements are very small, but that in E is distinctly oscillatory. The N movement, as compared with that of the average s.c., is smaller relatively than the E movement. So far as can be made out, the N movement up the sheet and the first E movement down the sheet correspond in time, but the duration of the movements is so short that this is uncertain. The second and larger movement in E up the sheet seems to correspond in time with an inconspicuous fall in N. If this analysis is correct, the first movement was somewhat the larger in N, but the second movement decidedly the larger in E. In the V curve there seems to be a small rapid movement up the sheet, preceding a slightly larger but distinctly visible movement down the sheet.

At Sitka there was a considerable H movement, and the movements in all the elements were conspicuously oscillatory. In this case the second is obviously the principal movement, and represents as usual a rise in H. The second movement was followed by a pretty rapid recovery, especially in D. Small oscillatory movements were in evidence for some time before the s.c., but did not obscure its main features.

The results derived from the curve measurements are given in Table CXXIV.

TABLE CXXIV.—S.c. Movements on October 2, 1911.

Station.	Movement.	H.	T.	ψ.	χ.	Duration.
		γ	γ	°	°	Minutes.
Antarctic	First	15·1	15·8	303	17 *a*	1·25
"	Second	25·3	26·6	75	18 *b*	2
Mauritius	Principal	11	—	—	—	5
Buitenzorg	"	16·9	16·9	350	5 *a*	1·5
Honolulu	"	6·9	7·7	32	26 *b*	4·5
Helwan	"	8·0	9·4	—	32 *a*	5
Agincourt	First	9·5	—	344	—	2
"	Second	7·7	—	124	—	6
Eskdalemuir	First	9·7	9·7	26	3 *b*	0·5
"	Second	13·5	13·6	255	8 *a*	3
Sitka	First	10·9	11·1	197	8 *a*	1·25
"	Second	27·7	27·9	12	6 *b*	1·75

In the Antarctic it was decidedly less quiet after the s.c. than before, and it remained so for some 16 hours, but the disturbance was nothing out of the way. The largest range on the day of occurrence of the s.c. or on the following day was only 152γ in E′. At Eskdalemuir and Sitka the horizontal components were distinctly unquiet for 12 hours after the s.c., numerous small oscillations taking place. At Eskdalemuir the V trace remained very quiet, and there was nothing approaching a magnetic storm. The only considerable disturbance appearing in the traces received from the co-operating stations occurred in the Sitka V trace, between 4 and 12 hours after the s.c. There was a rise of about 180γ in V in the course of $1\frac{1}{2}$ hours; simultaneously there were oscillations in the H and D curves, but only of about half the amplitude.

November 8, 1911, *Plate XXIII.*

Section 71.—The s.c. of November 8, 1911, commenced about 13 h. 43 m. G.M.T. During the previous 24 hours it had been decidedly quiet in the Antarctic and very quiet at Eskdalemuir.

In the Antarctic the movement was of the usual oscillatory type. In N′ and E′ it was large, and was immediately followed by other considerable oscillations. During the second and larger movement of the s.c. the slope of the N′ and E′ curves diminished only slightly before the summit was reached, but in V the rate of rise towards the end was much reduced.

At Mauritius H rose about 11γ in about 5 minutes. There continued to be if anything a slight upward slope in the curve for about 55 minutes after the s.c., followed by a slow fall, but hardly to the original level. No certain movement appeared in D at the time of the s.c.

At Buitenzorg numerous small oscillations preceded the large rise in N, and the last of these may possibly represent a small preliminary movement down the sheet, but if so it was no larger than the similar previous movements. Most probably the

N movement was unidirectional. The E movement on the other hand was undoubtedly oscillatory. We have first a small sudden movement up the sheet, followed at once by a somewhat larger but slower movement down the sheet; this was followed by a short nearly level piece of curve and then a slight further fall. It is the conclusion of this second fall that seems to answer in time to the summit of the N curve. The end of the first fall in the E trace seems to correspond in time to a slight slackening in the rate of rise of N. The V trace shows a moderately gradual fall, followed at once by a recovery, which brought the trace to above its undisturbed position. The recovery had made considerable progress before the summit of the N curve was reached.

At Alibag the movements appeared much simpler than at Buitenzorg. There was the usual rise in H with no indication of a previous fall, while the D and V traces went slightly down the sheet. A recovery set in at once in D and V. H retained an enhanced value for some 8 hours. The fall which then ensued, however, was considerably in excess of the initial sudden rise, so the appearance is hardly that of the ordinary crest.

At Honolulu the s.c. was preceded, as at Buitenzorg, by minute pulsations, visible in both the N and V traces, but the commencing movement in H seems unidirectional. In the rise to the summit three sensibly different slopes are recognisable in the H curve, the first being the steepest. A slight recovery set in at once but did not proceed far; and H remained, as at Alibag, decidedly above its undisturbed value during 8 hours before a decided fall commenced.

The V curve also shows a unidirectional s.c. movement, but a recovery set in shortly, and the original level was practically recovered in about 10 minutes from the commencement. The D movement was apparently oscillatory, a very small short movement down the sheet preceding a slower movement up the sheet. During the upward movement the curve shows two distinct slopes, the first the steeper. The summit was reached somewhat later than that of the H curve.

Phenomena at Helwan closely resembled those at Alibag. The commencing movement appeared unidirectional in the three elements, but the movement in D down the sheet is exceedingly small. After the rise the H trace remained nearly level during 8 hours. During the next $1\frac{1}{2}$ hours there were successive descents, representing altogether a fall about $3\frac{1}{2}$ times as large as the initial rise. The movements in the V curve, a fall followed at once by a partial recovery, are more in evidence than at Alibag. Further, 8 hours after the s.c., there are decided movements in the V trace synchronising with those just described in H.

At Agincourt the movement in H was not of the usual s.c. type. An insignificant rise was immediately followed by a larger fall, which was succeeded by oscillatory movements. The D trace showed three movements in rapid succession, a small fall, a larger rise and a still larger fall; the third movement occupied about twice the time of the first two combined, but its slope was pretty steep. The end of the third movement in D seemed to correspond with that of the second movement in H, and the time marks rather suggest that the first movement in D preceded the first movement in H.

The abnormality in the Eskdalemuir curves can be seen in Plate XXIII. The N and E curves show similar movements. A small movement up the sheet is followed by one in the opposite direction. After a quite perceptible pause this is followed by a considerably larger movement up the sheet, which proceeds in a jerky fashion, especially in N. In V there is a small movement down the sheet, which seems to correspond in time with the third movement in N and E.

At Sitka pulsations preceded the s.c. in both the H and D curves. The D curve also was moving down the sheet at the time ; but apparently the commencing movement was unidirectional in all the elements. The H and D traces fouled one another just after the summit of the H curve was passed. Thus the summit of the D curve is somewhat indistinctly shown in the original, but it clearly occurred somewhat later than the turning points on the H and V curves, which fairly synchronised. It is thus natural to take the summit of the H curve as representing the end of the proper s.c. movement. The V trace was moving slightly up the sheet when the s.c. began, and after the commencing movement ended it continued its upward course and did not stop until the level was considerably higher than that prior to the s.c. movement.

The results derived from the curve measurements are given in Table CXXV.

TABLE CXXV.—S.c. Movements on November 8, 1911.

Station.	Movement.	$\overline{\overline{H}}$.	T.	ψ.	χ.	Duration.
		γ	γ	°	°	Minutes.
Antarctic	First	35·7	37·3	265	17 *a*	1·5
,, ...	Second	89·6	91·6	67	12 *b*	5·5
Mauritius	Principal	11	—	—	—	5
Buitenzorg	,, ...	12·0	12·1	349	8 *a*	3
		or 22·6	22·7	352	4 *b*	7
Alibag	,, ...	15·2	15·4	354	9 *a*	7
Honolulu	,, ...	12·4	12·8	357	14 *b*	6
Helwan	,, ...	13·5	14·9	354	25 *a*	6
Agincourt	First	12·7	—	275	—	2
,, ...	Second	23·4	—	79	—	6
Eskdalemuir	First	8·0	8·0	320	0	0·5
,, ...	Second	11·3	11·3	113	0	1
,, ...	Third	30·1	30·2	303	4 *a*	6·5
Sitka	Principal	22·0	22·6	328	13 *b*	6

In the Antarctic the s.c. was immediately followed by a markedly oscillatory state of matters, the oscillations being numerous and of considerable size. About $6\frac{1}{2}$ hours after the s.c. larger movements appeared, continuing for 9 or 10 hours. The s.c. occurred between 1 h. and 2 h. on November 9 by the time of 180° E, and the ranges on that day were 324γ in S′, 308γ in E′ and 210γ in V. At Eskdalemuir no disturbance worth mentioning followed the s.c. until 7 hours had elapsed. Moderate disturbances, hardly reaching the standard of a magnetic storm, then presented themselves, continuing throughout the whole of next day. There then occurred what might fairly be called a magnetic storm—also represented in the Antarctic—but it would not naturally be associated with the s.c. Further particulars of what occurred on November 8–9 will be found in Section 106 and Table CLVI.

November 12, 1911, *Plate XXIII.*

Section 72.—The s.c. of November 12, 1911, began about 15 h. 5 m. G.M.T. Conditions had been fairly quiet at all the stations including the Antarctic during the previous 12 hours.

In the Antarctic the movement was as usual oscillatory. The second movement was the larger, but its excess was smaller than usual. The three elements were fairly in phase, but the rate of change in V during the second movement showed a slackening towards the end, which is much less apparent in the other elements, especially N′ which exhibited a practically uniform slope.

At Mauritius H rose about 8γ in about 5 minutes. The H trace exhibited a well-marked crest, lasting for about 1¼ hours after the s.c. began. The crest showed a slight slope up, in accordance with the normal direction of change at that hour. The descent from the crest was rapid at first, then slower. During the s.c. no decided movement could be seen in the D trace, which remained nearly level.

At Buitenzorg the N and E s.c. movements are distinctly oscillatory, the first movements—down the sheet in N and up in E—being very small. In each instance, however, the trace suggests that what has been called above the first movement was itself preceded by a still smaller movement in the opposite direction. If this were the case, they were probably associated not with the s.c., but with some small pulsations which shortly preceded it. The V movement, unidirectional and down the sheet, seems to synchronise with the principal movement in N. It was immediately followed by a recovery, which brought the trace decidedly above its undisturbed level. The N curve was distinctly crested. About 1¼ hours after the s.c. there were distinct movements downward. According as we regard these, or some later but larger movements, as terminating the crest, we should estimate its duration as slightly exceeding an hour or as 3½ hours.

At Alibag the hour break occurred after the s.c. had begun, but before it was completed; and as it crosses all the curves there is some slight uncertainty as to the exact amplitude, which may have slightly exceeded that given by the measurements made immediately the hour break ended. The movement was unidirectional in all the elements, and the changes were in the usual directions. The movements in D and V were very small. There is a decided crest on the H curve, with alternatives for its duration exactly as at Buitenzorg. At Alibag the 3½-hour alternative seems the preferable one.

At Honolulu, where the curves were very clear, the commencing movement appeared unmistakably unidirectional in H and V. In D it was insignificant, but seemed to consist of a very small movement down the sheet, followed by a slightly larger movement up the sheet, taking in all 6 or 7 minutes. A recovery set in shortly in V but lasted only for some 10 minutes, a small depression remaining. The H curve shows a distinct crest. The trace was going up the sheet prior to the s.c., and the crest shows a similar slight slope. The more natural estimate of the duration of the crest is $3\frac{1}{2}$ hours, but its level was interrupted, as at Buitenzorg and Alibag, shortly after the end of the first hour.

At Helwan the commencing movement seemed decidedly unidirectional in the three elements, but the D movement was microscopic. The H curve closely resembles that at Alibag, showing a decided crest. After the commencing movement down the sheet, the V trace shows a partial recovery; but the curve remained decidedly depressed for over an hour, when a small but conspicuous and rapid movement brought it up to about the undisturbed level, synchronously with a break in the crest line in H. During the depression the appearance of the V curve is distinctly suggestive of the impress of a seal.

At Agincourt the s.c. began while the traces were interrupted by the hour break. The obscuration lasted four minutes. But unless the movement took the unusual form for Agincourt of a rapid oscillation it must have been unusually small. The D curve shows an easterly movement of $1'\cdot5$ in 8 minutes, between the end of the hour break and the next ensuing turning point.

At Eskdalemuir the movements were exceedingly small, even in N. The V movement is hardly recognisable. The movement in N was seemingly oscillatory, a tiny fall preceding a larger rise. The rise, small as it is, was interrupted, a nearly level short portion of curve intervening between the first and steeper slope and the final approach to the summit. In the E curve there is no recognisable preliminary movement down the sheet; the movement up the sheet has the terraced appearance even more developed than in N.

No Sitka curves were available.

The results derived from the curve measurements are given in Table CXXVI.

TABLE CXXVI.—S.c. Movements on November 12, 1911.

Station.	Movement.	$\overline{\text{H}}$.	T.	ψ.	χ.	Duration.
		γ	γ	°	°	Minutes.
Antarctic	First	42·1	44·3	248	18 *a*	2
,, ...	Second	64·7	69·7	61	22 *b*	5
Mauritius	Principal	8	—	—	—	5
Buitenzorg	First	1·1	1·1	146	0	1·25
,, ...	Principal	13·4	13·4	348	4 *a*	3
Alibag	,, ...	9·3	9·4	354	12 *a*	6
Honolulu	,, ...	5·8	6·1	6	17 *b*	7
Helwan	,, ...	8·1	8·9	355	25 *a*	5·5
Eskdalemuir	First	1·7	1·7	180	0	0·5
,, ...	Principal	10·9	10·9	332	0	5·5

In the Antarctic conditions were highly disturbed from 1 to 9 hours after the s.c. The s.c. occurred just after 3 h. on November 13 for the time of 180° E, and the ranges for that day were 255γ in S′, 452γ in E′ and 207γ in V. The 14th and 15th were similarly disturbed. At Eskdalemuir the conditions during the 8 hours following the s.c., though less quiet than before it, would hardly be termed disturbed. There then appeared a considerable hump on the N curve, and fair movements in the other elements. No really large disturbance, however, ensued until the afternoon of the 13th, when a moderate magnetic storm commenced, which continued until the 14th. Whether the magnetic storm and the s.c. were inter-connected must remain a matter for conjecture.

December 10, 1911, *Plate XXIV*.

Section 73.—The s.c. on December 10, 1911, began about 15 h. 39 m. G.M.T. Considering the season of the year, conditions in the Antarctic during the previous 24 hours might be fairly regarded as decidedly quiet. At Eskdalemuir during the same time conditions had been exceptionally quiet.

In the Antarctic the s.c. movement was oscillatory in all the elements, which seemed in phase throughout. As usual, the second movement was the larger. The first oscillation was immediately followed by a second and much smaller one. This second oscillation may be quite independent, or it may represent an interruption in the second movement of the s.c. If the second view were accepted the estimated amplitudes of the second movement given in Table CXXVII would be considerably increased.

At Mauritius H rose about 10γ in 6 minutes. The trace had then a slight general slope up the sheet—interrupted only by a small oscillation—which lasted until 1 h. 50 m. after the s.c. began. The crest thus formed was ended by a slight but sharp fall. During the s.c. no movement could be detected in the D trace, which was level at the time.

At Buitenzorg the movement appeared to be clearly unidirectional in N and E. There was, however, a point in each trace where the slope diminished. This point seems to correspond to the end of a small downward movement in the V trace. A recovery commenced in V before the turning points in N and E were reached, and it continued until the curve was very appreciably above its undisturbed level. The N trace had a crested appearance, terminated by a sharp downward movement about 1 h. 50 m. after the s.c. The element remained, however, above its undisturbed value for quite 7 hours in all.

At Alibag the s.c. movement in H seemed clearly unidirectional, and, though not very large, was conspicuous, owing to the quietness of the preceding trace. The element remained decidedly above its undisturbed value for 8 hours, but the trace lost its crested appearance simultaneously with the N trace at Buitenzorg. In D and V the s.c. was represented by a small movement down the sheet. The recovery took place shortly. The curves thus show a small dimple or cup-shaped depression.

At Honolulu the movement appeared to be unidirectional in all the elements, but the H trace shows a succession of rises like the steps in a stair. As these go on for a considerable time, and corresponding pulsations are recognisable in the V trace, it is difficult to decide when the s.c. ended. Guided partly by the D curve, it was decided for the calculations embodied in Table CXXVII to assume the s.c. to terminate at the end of the second not the first slope in the H trace.

At Helwan, the H and D curves were very like those at Alibag. The V trace was very faint, but a cup-shaped depression was easily recognised.

At Agincourt the s.c. movement in H was small, and was somewhat interrupted as at Honolulu. The D movement, though also small, was simpler and more clearly shown, the trace exhibiting a cup-shaped depression. The s.c. was represented by a small movement of about 1′ to the East.

At Eskdalemuir the movements, though small, were clearly shown, owing to the previous quiet character of the curves. The movement in N was decidedly oscillatory, a small rapid movement down the sheet preceding the principal movement up the sheet. The summit is very rounded. The E trace showed a small movement up the sheet, immediately followed by a less rapid and somewhat smaller movement down the sheet. The movements are so small it is difficult to decide what exactly corresponds in the N and E traces. The end of the second E movement seems to answer approximately in time to the summit of the N curve, and the results given in Table CXXVII assume the first movements in N and E to synchronise. At the same time, the actual time measurements suggested a slightly longer duration for the first movement in E than for that in N.

At Sitka the s.c. movements were also insignificant. The D movement was the largest and clearest. It was oscillatory, a rapid small movement down the sheet preceding a larger movement up the sheet, the rate of which markedly declined before the summit was reached. The H trace shows a small rise, corresponding apparently to the first movement in D, followed by a practically equal fall. The curve then rose in a series of small steps, representing presumably pulsations. The s.c. in V was probably oscillatory, a small movement up the sheet preceding a larger but slower fall. The latter, however, is alone unmistakably shown. The depression did not take long to disappear.

The results derived from the curve measurements are given in Table CXXVII.

TABLE CXXVII.—S.c. Movements on December 10, 1911.

Station.	Movement.	$\overline{H}$.	T.	ψ.	χ.	Duration.
		γ	γ	°	°	Minutes.
Antarctic	First	46·7	49·1	263	18 *a*	1·25
,, ...	Second	71·1	79·2	79	26 *b*	3
,, ...	Third	4·5	6·4	278	46 *a*	1·5
,, ...	Fourth	22·8	24·0	69	18 *b*	1·75
Mauritius	Principal	10	—	—	—	6
Buitenzorg	,, ...	11·7	11·8	353	6 *a*	3
		or 16·5	16·5	351	4 *b*	6
Alibag	,, ...	10·7	10·9	352	10 *a*	6
Honolulu	,, ...	6·0	6·2	353	13 *b*	5
Helwan	,, ...	9·7	10·4	342	21 *a*	8
Agincourt	,, ...	5·0	—	70	—	—
Eskdalemuir	First	6·3	6·3	236	0	1·5
,, ...	Second	16·1	16·2	13	8 *a*	3·5
Sitka	First	5·3	5·3	62	5 *a*	1·5
,, ...	Second	6·9	7·2	296	17 *b*	4·5

In the Antarctic conditions became conspicuously more disturbed immediately the s.c. occurred. Within an hour conditions were highly disturbed, and very large movements followed. In the time of 180° E the s.c. occurred between 3 h. and 4 h. of December 11, and the ranges for that day were 434γ in N′, 727γ in E′, and 331γ in V. At Eskdalemuir and the other co-operating stations conditions remained fairly quiet for 8 hours after the s.c. A magnetic storm then ensued, especially active at Sitka, which lasted most of the subsequent day. Further particulars will be found in Section 110 and Table CLX.

In this case we have a somewhat insignificant s.c. associated apparently with a very active magnetic storm. Also the s.c. was particularly small at the North American stations, where the subsequent disturbance was particularly large.

January 17, 1912, *Plate XXV.*

Section 74.—The s.c. of January 17, 1912, began about 4 h. 42 m. G.M.T. In the Antarctic conditions had been quiet during the previous 2 hours, but prior to that the customary amount of disturbance had prevailed. At Eskdalemuir, and at least the majority of the co-operating stations, conditions had been very quiet for 5 or 6 hours, and no disturbance of any size had been recorded during the whole of the previous day.

In the Antarctic a somewhat similar movement, which was not, however, represented elsewhere, had occurred about 4 hours earlier. The s.c. movement itself in the Antarctic was less sharply defined than usual, the turning points being rounded, especially in the V trace. Also while the first movement in E′ and V was as usual down the sheet, the first movement in N′ was up the sheet. In the oscillation which occurred 4 hours earlier, the first movement had the direction usual in s.c.'s, being down the sheet in all three elements.

At Mauritius H rose about 11γ in 7 minutes. It is difficult to assign an end to the s.c. because the diminution in the slope of the trace was gradual, and the value of H continued to rise uninterruptedly for fully an hour. The trace had a distinctly crested appearance, but more than one point might be selected for the end of the crest. The choice giving the shortest duration would make the end about 1 h. 50 m. subsequent to the s.c. Corresponding at least approximately with the s.c. movement in H, there was in D a westerly movement with a force equivalent of about 7γ. If anything, the D movement seemed to commence a little after the H movement, but the hour intervals in the two curves differed.

At Buitenzorg the movements were of the usual type and unidirectional in N and E, the N movement being of considerable size. The E and V traces were going up the sheet at the time, and presumably the forces causing these movements continued to act during the s.c., reducing the amplitudes of the small s.c. movements down the sheet. The lowest point in the V curve answers apparently to a point in the N curve where a slight slackening appears in the rate of rise. The recovery in V had proceeded some way before the summit of the N curve was reached, and before it ceased the V trace had been raised considerably above its undisturbed level.

At Alibag the movements were in the main of the usual type. The D and V traces show small cup-like depressions. The H trace, after the usual rapid rise, exhibits a further rise at an equally uniform but much slower rate, and a series of irregular movements carry it still further up the sheet. Only the first movement has been regarded as included in the s.c. On the whole, the H curve has a somewhat crested appearance.

At Honolulu the movements were also unidirectional, but the rise in the H and the fall in the V trace show a sudden reduction in the rate of change when about half the movement had been accomplished. The movement in D is as usual very small, and recovery set in at once, leaving a small cup-like depression.

The Helwan curves resemble those for Alibag, but the depressions in the D and V curves are more conspicuous, and the H curve is fully as crested in appearance.

At Agincourt the movement in H is rounded, and after the summit is reached there is an immediate fall equal to about half the rise. Thus the curve is dissimilar in appearance from the H curves at Alibag, Honolulu and Helwan. The movement in D is small, but appears to be oscillatory, the first movement—an increase of westerly declination—being reversed a very appreciable time before the summit of the H curve is reached.

At Eskdalemuir the commencing movement is small, and apparently unidirectional in all the elements, but the rate of movement diminishes in both the N and E curves before the summit is reached, and a partial recovery sets in at once, as in the Agincourt H curve.

At Sitka there were previous pulsations visible in the H curve, and the movement may not have been unidirectional, though on the whole it seems so. After the first rise the H curve has a short almost level portion, and then a slight further rise. The D curve shows two oscillations. The first movement of the first oscillation seems to end synchronously with the first upward movement in H, and in the calculations embodied in Table CXXVIII the end of these movements has been accepted as the end of the s.c. The V curve shows a succession of small oscillations or pulsations. The movement in progress at the time of the s.c. was down the sheet.

The results derived from the curve measurements are given in Table CXXVIII.

TABLE CXXVIII.—S.c. Movements on January 17, 1912.

Station.	Movement.	$\overline{H}$.	T.	ψ.	χ.	Duration.
		γ	γ	°	°	Minutes.
Antarctic	First	40·3	41·4	313	14 *a*	2·5
,, ...	Second	69·0	70·5	131	12 *b*	8
Mauritius	Principal	13	—	—	—	7
Buitenzorg	,, ...	7·5	7·5	353	2 *a*	3
		or 17·9	18·0	0	6 *b*	7·5
Alibag	,, ...	17·5	17·9	354	12 *a*	8
Honolulu	,, ...	9·3	9·9	20	21 *b*	6
Helwan	,, ...	10·9	11·5	329	19 *a*	6
Agincourt	,, ...	9·2	—	340	—	4
		or 13·3	—	353	—	8
Eskdalemuir	,, ...	14·9	15·0	306	7 *a*	5
Sitka	,, ...	11·9	11·9	10	5 *b*	2·5

In the Antarctic for the first 5 hours after the s.c., while there was a little more disturbance than before the s.c., there was nothing worth mentioning. But between 11 and 21 hours after the s.c. there were considerable movements, representing at least an approach to a magnetic storm. The s.c. occurred between 16 h. and 17 h. of the 17th in the time of 180° E, and the ranges on the 18th were 249γ in N′, 292γ in E′, and 165γ in V. At Eskdalemuir the N curve was unquiet after the s.c., exhibiting numerous small oscillations during the rest of the day, but there was nothing approaching a magnetic storm. There was greater disturbance at Sitka, especially from 5 to 7 hours after the s.c.; during this time a change of about 100γ took place in V in less than an hour, and synchronously there was a change of about 12′ in D at Agincourt.

September 30, 1912, *Plate XXVI.*

Section 75.—The s.c. of September 30, 1912, began about 21 h. 36 m. G.M.T. During the previous 24 hours conditions had been decidedly quiet in the Antarctic, and at least as quiet as usual at Eskdalemuir. The crest phenomenon was particularly prominent on this occasion, and in addition to the usual traces covering from 1 to 2 hours after the s.c., Plate XXVI includes longer portions of curve from the Antarctic, Alibag, Honolulu, Helwan, Agincourt and Eskdalemuir for the whole time during which the crest persisted.

In the Antarctic the commencing movement was oscillatory as usual, the second movement being much the larger; but the movements in all the traces were, as on April 9, 1911, in the opposite direction to that usual in s.c's. The end of the first movement is clear, and the times for the different elements seem to accord, but owing to the movements in progress at the time, it is difficult to say exactly when the first movement commenced. The start seems pretty clear in N′, but in E′ either the commencing movement suddenly accelerated, or the first part of the upward movement comes from a separate source. In V the upward movement was in steps.

The calculation made of the amplitude of the movement assumed that in V the s.c. was represented by the step nearest the summit, and in E′ by the part having the steepest slope, as this seemed to fit in best with the N′ movement. If the E′ trace had alone existed, it would have been doubtful whether to take for the end of the s.c. the end of the swift downward motion, or the lowest point which was reached 4 minutes later. But the former alternative seems clearly the best, as it fits in with the times indicated by the N′ and V traces.

At Mauritius H rose about 11γ in about 8 minutes. There was also apparently a very small easterly movement in D, with a force equivalent of about 2γ.

At Buitenzorg a number of pulsations had appeared previously in the N curve, but so far as can be seen the commencing movement in that element was unidirectional. The slope of the upward movement began shortly to fall off, and the final rise near the summit is conspicuously slower than the rest. The movement in the E trace seems clearly oscillatory. A rapid movement down the sheet came first, then a somewhat larger but slower movement up the sheet, and finally a still larger movement down the sheet. The V trace shows a very small fall, followed by a considerably larger rise. Opinions may well differ as to how to analyse the commencing movements. If we take the extreme summit of the N curve as representing the end of the s.c., its duration would be 10·5 minutes, which is unusually long. The summit of the N curve answers practically to the end of the third movement in E and the second in V. The first movement in E had apparently only about half the duration of the first movement in V, and no special feature appeared on the N curve at the end of either of these movements. But the summit of the E curve, representing the end of the second movement in that element, seems represented by a marked change of slope in the N curve. If we accept this as the end of the s.c., we give it a duration of about 6 minutes.

At Alibag there seems nothing unusual in the commencing movement. It is represented in the D and V curves as usual by a very small temporary depression, and in the H curve by a rise, at a slope which is nearly uniform until close to the summit.

At Honolulu the large movement up the sheet in H seems preceded by a very small downward movement, but pulsations occurred during the two previous hours, and the downward movement may be no part of the s.c. After a short time the slope of the rise in H fell off. Shortly thereafter it became steep again, but at the end of 6 minutes it diminished markedly. The extreme summit was reached about 10 minutes from the start. The D trace was moving up the sheet prior to the s.c., and the commencing movement down the sheet was so small that it practically amounted to merely neutralising the rise. The V trace went perceptibly down the sheet in two steps, and then went up again. The end of the second step in V seems to answer in time to the marked slackening near the summit of the N trace, which suggests 6 minutes for the duration of the s.c.

At Helwan the H trace closely resembles that at Alibag. The D curve shows an almost imperceptible temporary depression. The V curve shows a decided fall, followed by a slower recovery.

At Agincourt the commencing H movement was apparently oscillatory, a small movement down the sheet preceding a moderate movement upwards. The rate of rise was very rapid at first, but fell off considerably, though remaining fairly rapid until the summit was reached. The D movement was insignificant, but apparent oscillatory.

At Eskdalemuir the principal movement in N, up the sheet, seems preceded by a very small fall. This may come from a distinct source, as it seems prior to any visible movement in E or V. The summit in the N curve is rounded, but the change of slope is gradual throughout. The rise in the E curve exhibits two fairly distinct slopes. The summits in the N and E curves are reached simultaneously, and presumably represent the end of the s.c. The fall in the V trace is larger than in some previous cases, and during the fall the slope seems fairly uniform.

No Sitka curves were available.

The crest is very clearly shown in the H or N curves at all the stations except the Antarctic. It lasted for fully 5 hours, the movements terminating it being to all appearance synchronous at the different stations. The time scale is sufficiently alike at Alibag, Helwan and Eskdalemuir to enable the general similarity of the features in the H or N traces at these stations to be taken in at a glance. The phenomenon is almost as clear in the E trace as the N trace at Eskdalemuir, so both are reproduced in Plate XXVI. The time scale at Agincourt is intermediate between that of the ordinary Kew pattern and Eschenhagen magnetographs, so exact correspondence in time between the Agincourt and Eskdalemuir phenomena can hardly be decided by the eye alone, but the close general resemblance of the Agincourt H trace to the Eskdalemuir N trace is easily recognised. The Honolulu H trace is put under the Antarctic traces in Plate XXVI, as the time scale was practically the same. The breaks in the Honolulu curve arose from the fact that scale value determinations were being made. If the Antarctic E′ trace were inverted it would have a somewhat crested aspect, but neither the N′ nor the V trace suggests a crest.

The results as to the commencing movements derived from the curve measurements are given in Table CXXIX.

TABLE CXXIX.—S.c. Movements on September 30, 1912.

Station.	Movement.	$\overline{\text{H}}$.	T.	ψ.	χ.	Duration.
		γ	γ	°	°	Minutes.
Antarctic	First	45·5	46·2	53	10 *b*	2
,, ...	Second	111·2	125·7	248	28 *a*	4·5
Mauritius	Principal	11	—	—	—	8
Buitenzorg	,, ...	11·7	11·7	1	0	6
		or 14·2	14·6	352	12 *b*	10·5
Alibag	,, ...	13·8	13·8	354	4 *a*	7
Honolulu	,, ...	9·6	10·1	15	18 *b*	6
Helwan	,, ...	16·7	17·8	348	20 *a*	8
Agincourt	,, ...	15·5	—	355	—	10
Eskdalemuir	,, ...	24·4	25·0	339	12 *a*	7

In the Antarctic after the s.c., conditions became distinctly less quiet than before. There was some loss of trace from 7 to 8½ hours, and from 11½ to 13½ hours after the s.c. During the first of these intervals there was a considerable change in E′, which may have been oscillatory. With this possible exception the movements, though very much in excess of what was customary on quiet days, were of an unusually regular character. The s.c. occurred between 9 h. and 10 h. of October 1 in the time of 180° E., and the ranges shown by the incomplete traces of that day were 210γ in N′, 288γ in E′, and 172γ in V. They were amongst the largest ranges on October days. The crest persisting after the s.c. at Eskdalemuir represented only a small force. There were larger movements in both N and E, from 6 to 18 hours after the s.c., but nothing approaching a magnetic storm. A more disturbed state of matters was shown from 5 to 15 hours after the s.c. by the Agincourt curves. During this interval there was a range of 84γ in H and 23′ in D. At Alibag and Helwan, after the crest subsided, the curves showed the ordinary features of a quiet day. At Alibag this quiet state of matters lasted more than 24 hours. A minor disturbance which began some 30 hours after the s.c. can hardly be related to it.

Further particulars as to the disturbances on September 30 and October 1, 1912, will be found in Section 133 and Table CLXXXV.

October 20, 1912, *Plate XXVII.*

Section 76.—The s.c. of October 20, 1912, began about 17 h. 20 m. G.M.T. From 10 to 3 hours prior to the s.c., conditions had been unusually quiet in the Antarctic, but during the 3 hours immediately preceding the s.c., decided unquietness prevailed, incessant small oscillations appearing in all the traces. The preceding unquietness was much less conspicuous at the co-operating stations, but pulsations were recognisable at most.

In the Antarctic the s.c. is hardly of the usual type, but rather resembles an enlarged pulsation. The two movements down and up the sheet were nearly equal, the first being slightly the greater, and the duration was unusually short. The beginning and end of the first movement seem identical in the three elements and are very sharply defined. Opinions might differ, however, as to the second movement. The V curve after returning to its original height remains level for two minutes before going further up the sheet in a series of steps. In its case the time when the original level was resumed seems the only natural end one can assign to the s.c. The N′ trace, after reaching its original level synchronously with the V trace, immediately executes a second oscillation. In this oscillation the second movement is much the larger, raising the trace considerably above its original level. If the N′ trace stood alone, the first movement of the second oscillation might be regarded as merely a short interference with the second movement of the s.c. The phenomena in E′ resemble those in N′, except that the second movement of the first oscillation falls short of the original level, and the second oscillation only brings the trace to its original level. If the E′ trace had stood alone, it would have been natural to regard the s.c. as ending with the second oscillation. In view, however, of the V phenomena, the end of the first oscillation has been accepted for the end of the s.c. in calculating the results in Table CXXX.

At Mauritius there was a well marked s.c. movement in H, the element rising 17γ in about 4 minutes. The D trace showed a small easterly movement with a force equivalent of about 2γ. After the summit of the H trace was reached, there was immediately a slight fall, but a well marked crest persisted until about 65 minutes after the commencement of the s.c. The fall from the crest took place in a series of steps.

At Buitenzorg the s.c. presents the usual features, and unlike the Antarctic s.c. is larger than usual. The rise in the N curve and the falls in the E and V curves seem to end approximately at the same time, but the copy of the V trace received was too faint to permit of certainty on this point. Recovery sets in at once, but is only partial in N and E. In V, however, as seems usual at Buitenzorg, the trace is raised considerably above its original level.

At Alibag the movement is unidirectional as usual, and somewhat above the average size in D and V. As at Buitenzorg, H remained well above its undisturbed value for over an hour, but the crested appearance is less pronounced than usual.

At Honolulu the movements in H and D are somewhat above the average size. The D trace shows two small knobs. If it stood alone, we should naturally accept the summit of the first and higher knob as representing the end of the s.c. In support of this view there is the further fact that the first summit in D tallies fairly in time with a point on the H trace where the slope distinctly falls off. On the other hand, the slope in the H trace after this point remains steep, and as the H movement is much the largest its summit seems the natural limit to take. The V trace shows a fairly steep fall, occupying somewhat longer than the rise to the first summit in D, succeeded by a nearly level part. It thus affords little guidance for fixing the end of the s.c.

At Honolulu an exceptional feature is the very considerable movement up the sheet in V, which set in shortly after the s.c. and continued for several hours.

At Helwan the movements are of the type usually encountered there, except that the recovery which set in at once in D brought the trace to somewhat above its original level, and was immediately followed by a movement in the same direction as the commencing movement and fully larger. A considerable resemblance will be noticed between the H traces after the s.c. at Alibag, Honolulu and Helwan, and the N trace at Buitenzorg. The chief difference is that the H trace at Honolulu has a general tendency up the sheet as compared with the others.

At Agincourt the curves, especially the H curve, were not very clear. Apparently the commencing movement in H was oscillatory, a small movement down the sheet preceding a much larger movement up the sheet; but the slope of the upward movement is interrupted by a pulsation, and the first movement down the sheet may represent part of a preceding pulsation. The D movement was clearly oscillatory, a sharp movement up the sheet (*i.e.*, to the West) preceding a larger movement down the sheet. The slope of the downward movement suddenly fell off about half-way down.

At Eskdalemuir the commencing movement was oscillatory in N and E, the downward movement in N being relatively considerable. The E trace presents two summits, the connecting ridge showing a very slight dip. It is the second summit which corresponds in time with the summit in N; the earlier summit in E corresponds with a reduction in the slope of the N trace. So far as can be seen, V had a uni-directional movement down the sheet, which began and ended synchronously with the second movement in N, but it may have been preceded by a movement up the sheet too small for recognition.

At Sitka the V trace at the time of the s.c. was invisible. The movement appeared oscillatory in H and D. The first movement, down the sheet in both elements, was noticeably more rapid than the movements in somewhat numerous pulsations which preceded it, and so was presumably really part of the s.c. The D trace shows two summits, the second a trifle the higher; but the first corresponds in time with the summit of the H trace, and so has been regarded as marking the end of the s.c. The second summit in the D trace has a corresponding but relatively insignificant peak on the H trace. Both curves then show a rapid fall carrying them below their undisturbed levels, and irregular oscillations ensue.

The results derived from the curve measurements are given in Table CXXX.

TABLE CXXX.—S.c. Movements on October 20, 1912.

Station.	Movement.	$\overline{H}$.	T.	ψ.	χ.	Duration.
		γ	γ	°	°	Minutes.
Antarctic	First	38·0	39·9	232	17 *a*	1
"	Second	32·2	34·0	42	19 *b*	2·5
Mauritius	Principal	17	—	—	—	4
Buitenzorg	"	28·0	28·1	350	5 *a*	6
Alibag	"	22·2	22·4	349	7 *a*	6
Honolulu	"	7·4	8·1	333	23 *b*	1·75
		or 12·5	12·9	26	14 *b*	6
Helwan	"	22·1	23·3	351	19 *a*	5·5
Agincourt	First	8·4	—	226	—	2
"	Second	29·9	—	35	—	8
Eskdalemuir	First	7·3	7·3	167	0	1·5
"	Second	36·3	36·5	346	5 *a*	6
Sitka	First	3·6	—	170	—	0·5
"	Second	21·2	—	342	—	1·5
"	Third	32·9	—	153	—	7

The unquiet conditions which had prevailed in the Antarctic for 3 hours before the s.c. developed further after it, and the curves were decidedly oscillatory until 8 hours after the s.c., when quiet conditions once more prevailed. The s.c. occurred between 5 h. and 6 h. on October 21 in the time of 180° E., and the ranges on that day, viz., 180γ in N′, 110γ in E′ and 122γ in V were in no way remarkable. A return to quietness about 8 hours after the s.c. seems fairly characteristic of most stations. The disturbances which followed the s.c. were in general only sufficient to prevent the day being regarded as a quiet one.

Section 77.—Table CXXXI, p. 246, is intended to summarise the results as to the directions of the s.c. movements. Those movements which seem preliminary or subsidiary to the principal ones are in ordinary type, the principal movement or movements being in heavy type. A plus sign means in ΔH an increase of horizontal force, in ΔD an increase of easterly or decrease of westerly declination, in ΔN a force to geographical North, in ΔE a force to geographical East, in ΔV a force directed downwards on a north pole. The minus sign means the opposite. A sign of interrogation means that for some reason, usually the smallness of the apparent movement, the existence of the movement in question or its connection with the true s.c. movement is doubtful.

There is inevitably some arbitrariness in the distinctions drawn. Sooner or later any sensible departure from the normal is removed, and whether one regards a movement as oscillatory or not is partly a question of the personal equation. In the Antarctic the oscillatory character of the s.c. movement would probably be admitted by all; because while the first movement was usually the smaller and took the least time, the rates of change in the two movements were fairly similar, and the amplitudes not so widely dissimilar. Again at Alibag few would probably regard the H movements as oscillatory, because while a sensible fall from the summit attained during the s.c. movement sometimes took place in a short time, the return movement took a long time, sometimes several hours, to neutralise the commencing movement. But the description of the V movement as normally oscillatory at Buitenzorg, but unidirectional at Alibag and Honolulu, is more arbitrary.

At Alibag and Honolulu the V trace was in general visibly cup-shaped, which implies that after a comparatively short time a recovery had set in comparable in amplitude with the commencing movement. But as a rule the depression produced by the commencing movement was not wholly removed for a considerable time, and the recovery generally slowed off markedly before the undisturbed position was reached. At Buitenzorg, on the other hand, the second V movement usually set in promptly and apparently before the commencing N movement was finished, and it was usually considerably larger than the first movement. It did not stop when the undisturbed level was reached, and so could not be regarded as a mere recovery.

At Buitenzorg declination was only about 0° 50′ East of North, so practically change in N represented change in H, and change in E change in easterly declination. Thus results at Buitenzorg, Alibag, Honolulu and Helwan are practically directly comparable. At these stations the disturbing force in the horizontal plane is very largely changed in H, and one's attitude to the phenomena is naturally determined almost entirely by the H curve. This is more especially the case owing to the fact that the D changes at Alibag, Honolulu and Helwan appear on optical comparison to be even smaller than they actually are, owing to the insensitiveness of the D magnetographs as measurers of force. At Alibag in particular 1 mm. represented $11 \cdot 0\gamma$ in the D trace, as compared with $4 \cdot 6\gamma$ in the H trace. Even with the exceptionally good definition in the copies of the Alibag curves received, movements in D of the order of 1γ might easily escape detection, and no very exact measurement can be expected of their duration or amplitude.

At Agincourt the s.c. movements were usually by no means large even in H, and they exhibited much more diversity of character than at the stations in lower latitudes. Whether this variability of type is a natural characteristic of Agincourt, or merely a peculiarity of these particular disturbances, I am unable to say. The s.c. phenomena in 1911 and 1912 at Eskdalemuir unquestionably showed less uniformity of type than used generally to prevail at Kew Observatory in days prior to artificial disturbances. Eskdalemuir is, however, very decidedly more Arctic than Kew in the character of its magnetic disturbances, and the fact that the Eskdalemuir magnetographs record N and W instead of H and D may tend to make s.c. records more complicated. Oscillations were undoubtedly the rule at Eskdalemuir and Sitka, but the first movement was usually very short in duration, and of small amplitude compared with the second.

A point to bear in mind, especially as regards ΔE, is that the relation of geographical co-ordinate axes to space depends not merely on the hour of the day, but also on the latitude and longitude. The times of occurrence of s.c. movements are at least practically identical for all stations, but at places like the Antarctic station and Eskdalemuir (differing 170° in longitude), Buitenzorg and Agincourt (differing 186° in longitude), and Sitka and Helwan (differing 167° in longitude) a direction in space which is East at one station is not far from West at the other.

A remarkable feature in Table CXXXI is that the disturbing vertical force during the principal movement is normally downwards at Honolulu and Sitka, whereas at Alibag, Helwan and Eskdalemuir it is upwards. It is also noteworthy that there seems nothing at the other stations corresponding to the fundamental difference in type exhibited in the Antarctic by certain s.c's, those for instance of April 8 and April 9, 1911.

Section 78.—Tables CXXXII to CXXXV, pp. 247 to 250 present for the several stations an analysis of the disturbing forces to which the s.c. movement or movements may be assigned. ΔN, ΔE and ΔV represent components on the north pole of a magnet directed respectively to geographical North, to geographical East, and downwards. ΔX, ΔY and ΔZ denote components relative to three axes fixed in the earth; z denotes the earth's polar axis, the positive direction being from South to North; x and y are directions perpendicular to z, y being in the meridian of Greenwich, and x 90° East of Greenwich; ϕ is $\tan^{-1} \Delta X/\Delta Y$, and θ is $\cos^{-1} (\Delta Z/\Delta R)$, where $\Delta R^2 = \Delta X^2 + \Delta Y^2 + \Delta Z^2$. The s.c's are numbered chronologically 1 to 13 to facilitate reference.

Table CXXXII gives details for both the movements constituting the s.c. in the Antarctic. It should be noticed that (ϕ, θ) and (180° + ϕ, 180°−θ) represent the two directions of one and the same straight line. Obviously s.c's Nos. 1, 3, 4, 6, 8, 9, 10 and 13 form a natural group, and s.c's Nos. 2, 5 and 12 another group, with opposed characteristics. In the first group, N, E and V all fall in the first movement and rise in the second; in the second group the exact opposite holds, except that in the first movement of Nr. 5 ΔN instead of a positive has a very small negative value. On comparing the mean results obtained for the two groups, it will be recognised that we have an approach to movements in a single straight line. It is as if the difference between the two groups consisted only in the order of succession of the two phases. S.c's Nos. 7 and 11 are in some ways intermediate between the two groups, but they show more resemblance to the more numerous group.

The first phase of s.c's Nos. 1, 3, &c., and the second phase of s.c's, Nos. 2, 5 and 12 represent what was called a Type A disturbance in the discussion of the Antarctic curves of 1902–03; the other phase in either case represents what was called a Type B disturbance. In 1902–03 the only two s.c's of which the records were undoubtedly complete were those of May 8 and August 20, 1902. On a third occasion, August 25, 1903, the H trace may have extended sensibly above the level where it became invisible on the sheet, but calculations were made which assumed the visible trace complete. The results originally found were given in Table LXVI of the 1902–03 volume, but the figures given there for ΔV on May 8 and August 20, 1902, were in error. The V instrument went through various vicissitudes in 1902, and on the two occasions in question there was an unusually large parallax between the V curve and the base line. This was overlooked, the consequence being that what was really the first phase in the V movement was supposed to be the second. On re-examining the curves I noticed this oversight, and have accordingly re-calculated the values of ΔX, ΔY, ΔZ, ϕ and θ. The s.c. of May 8, 1902, was clearly of the same type as that of April 8, 1911 ; while the s.c. of August 20, 1902, was of the opposite type. The s.c. of August 25, 1903, bore most resemblance to the group in which the type A movement came first, but in one respect it was abnormal. The s.c. occurred at a moment when the curves were otherwise considerably disturbed. The first s.c. movement in D was down the sheet, and the swing had apparently just stopped when the pre-existing disturbance re-asserted itself, the result being a nearly quiescent state, followed shortly by a further rapid movement down the sheet. The mean values given in Table LXVI of the old discussion included the s.c. of August 25, 1903, while its exclusion may be desirable for the reasons just stated. I have accordingly repeated the calculations—a course necessary in any case owing to the changes in the data for May 8 and August 20, 1902—both when August 25, 1903, is included and when it is excluded. The results are given below, with the corresponding results from the s.c's of 1911–12, omitting the two of nondescript type Nos. 7 and 11.

	Type A (Phase with ΔZ negative).						Type B (Phase with ΔZ positive).					
	ΔX	ΔY	ΔZ	ΔR	ϕ	θ	ΔX	ΔY	ΔZ	ΔR	ϕ	θ
	γ	γ	γ	γ	°	°	γ	γ	γ	γ	°	°
1902–03 (3 s.c's)	+26·1	+57·4	−35·3	72·3	24	119	−18·2	−33·0	+21·0	43·1	209	61
1902–03 (2 s.c's)	+31·7	+28·5	−14·7	45·1	48	109	−33·2	−28·5	+12·0	45·4	229	75
1911–12 (11 s.c's)	+43·1	+29·9	−22·8	57·2	55	113	−57·3	−37·1	+27·8	73·7	237	68

For comparative purposes significance attaches mainly to the values of ϕ and θ, because the amplitude varies immensely from one s.c. to another, and the relative magnitude of the A and B disturbances depends on the proportion of cases in which A is the first or the second movement.

The positions of the stations were slightly different, 77° 51′ S. and 166° 45′ E. in 1902–03, but 77° 38′ S. and 166° 24′ E. in 1911–12. We should certainly not expect so small a difference in site to exert much influence, but considering the comparative proximity of the south magnetic pole we should not expect identical values of ϕ and θ, even in the case of the same disturbances.

When consulting the 1902–03 volume it should be noticed that in Table LXVI,

ΔV was counted positive when the vertical force increased numerically, thus the signs require reversal for comparison with the results in the present volume.

Three other s.c's occurring respectively on November 6, 1902, April 5 and December 13, 1903, were imperfectly recorded. On November 6, 1902, the D movement was too rapid to leave a visible record. On April 5, 1903, the first phase seems completely shown, though the D and H traces are very faint, but the second H movement went beyond the limits of registration. On these two occasions the s.c., so far as can be seen, was clearly of the same type as that of April 9, 1911. On December 13, 1903, the H magnetograph was out of action. Judging by the traces of the other elements, the s.c. was of the same type as that of April 8, 1911.

In the case of Buitenzorg and Alibag, Table CXXXIII, ΔX and ΔY are so small compared with ΔZ, that little weight attaches to values of ϕ for individual s.c's. This is especially true of Buitenzorg. At Alibag by treating 3° on June 30 as 363° an arithmetic mean can fairly be calculated for ϕ, and the little difference between it and the corresponding mean derived from the algebraic mean values of ΔX and ΔY encourages the hope that the results possess some significance. They indicate that the commencing movement has in general a westerly component. It must, however, be acknowledged that the corresponding mean value obtained for ϕ in 1902–03, from a smaller number of s.c's, was very different, being 184°. The mean value obtained for θ from the s.c's of 1902–03 was 11°, and so accorded much better with the results in Table CXXXIII. It is interesting to notice that so far as θ is concerned there is no decided difference at either Buitenzorg or Alibag between the two groups of s.c's for which such opposite results were obtained in the Antarctic.

At Honolulu and Helwan, Table CXXXIV, there is again no special peculiarity in s.c's Nos. 2, 5 and 12. At Honolulu the component perpendicular to the meridian is usually small, but on the whole easterly; at Helwan it is unmistakably westerly. The value of ϕ is less variable, but the value of θ more variable at these than at the more southern stations. The amplitudes rule distinctly smaller at Honolulu than at the other stations.

At Eskdalemuir and Sitka, Table CXXXV, the s.c. movements were generally oscillatory, but the movement with ΔN or ΔH positive was usually very dominant and it alone is dealt with in the table. The amplitude is generally greater at Eskdalemuir and Sitka than at Buitenzorg or Alibag, but there are exceptions to this rule, *e.g.*, Nos. 7 and 12 at Eskdalemuir, and No. 11 at Sitka. The mean values of ϕ and θ at Eskdalemuir are fairly similar to the values obtained for Kew from 4 s.c's in 1902–03, viz. $\phi = 220°$, $\theta = 62°$.

Section 79.—A study of the hours of occurrence of the s.c's discloses a curious feature in the Antarctic s.c's. They can be arranged in three groups as has been done in Table CXXXVI, p. 251.

If it is purely accidental, it is truly remarkable that all the s.c's in which the B movement came first occurred between 21 h. and $23\frac{1}{2}$ h., while all the s.c's in which the A movement came first occurred between $11\frac{1}{3}$ h. and $17\frac{1}{3}$ h. Also, considering the number of the s.c's, the non-occurrence* of a single one between 4 h. 42 m. and 11 h. 21 m., between 17 h. 20 m. and 21 h. 3 m., or between 23 h. 25 m. and 4 h. 8 m., seems a little curious. It certainly looks as if the hour of the day had a decided influence on the type of the Antarctic s.c.

At the other stations with the possible exception of Sitka, there is at least no conspicuous difference between the s.c's which occur at different hours of the day. At Sitka s.c. No. 2 has an exceptionally large value of ΔE, and as no traces of Nos. 5 and 12 were received, they may have exhibited the same peculiarity.

Our discussion of s.c's will have shown that they are not such simple phenomena as the records from stations in low latitudes are apt to suggest; but they undoubtedly afford a promising field for investigation. Their study would be facilitated by the existence of magnetographs having a more open time scale, and greater sensitiveness than is common at present. This is especially true of D magnetographs in tropical latitudes. There is also at present a lack of information as to the characteristics of s.c's in high northern latitudes, or as to the influence of a big difference of longitude in high latitudes both North and South. We now know beyond a shadow of a doubt that s.c's are much larger in the Antarctic than in temperate or tropical latitudes, but we do not know whether the Arctic shares the pre-eminence of the Antarctic. The want of the moment seems to be fresh facts, rather than speculations as to the cause of the phenomena. We do not at present have the information necessary to put theory to an adequate test.

* Subsequent investigation showed, however, two cases that may have been s.c.'s, which occurred between 7 h. and 8 h. G.M.T. The first on December 14, 1911, at 7 h. 58 m., was the more doubtful of the two. It appeared to be of the dominant s.c. type, but the first movement down the sheet was small in E′ and V and hardly represented in N′. The second case occurred on December 26, 1911, at 7 h. 35 m. There were synchronous movements at Eskdalemuir resembling an s.c. In E′ the disturbance was clearly of the dominant s.c. type, but the movement down the sheet was only about a tenth of the subsequent movement up the sheet. The movements in N′ and V seemed also of the dominant s.c. type, but oscillations were taking place at the time in N′, and the first movement in V was very small.

Table CXXXI.—Directions of s.c. Movements.

Date.	Antarctic.			Buitenzorg.			Alibag.			Honolulu.			Helwan.			Agincourt.		Eskdalemuir.			Sitka.		
	ΔN′	ΔE′	ΔV	ΔN	ΔE	ΔV	ΔH	ΔD	ΔV	ΔH	ΔD	ΔV	ΔH	ΔD	ΔV	ΔH	ΔD	ΔN	ΔE	ΔV	ΔH	ΔD	ΔV
1911. April 8....	−+	−+	−+	+	+−	−+	+	−	−	+	+−	+	+	−	−	+	+−	+−+	−+−	+−	−+	+−	−+
„ 9....	+−	+−	+−	+	−+	−+	No trace			+	−	+	+	−	−	−+	+−	+	−	−	−+	−+	+−
May 29	−+	−+	−+	+	−	−+	+	−	−	+	+−	+	+	−	−	+−	−+	−+	+−	+−?	+	+−	−+?
June 9	−+	−+	−+	+	−	−+	+	−	−	+	+−	+	+	−	No trace	No trace		+	−	−	−+	+−	−+
„ 30	+−	+−	+−	−+	?	−+	−+?	+−?	+−?	+	−+	+	No trace			−+	−+−+	−+	+−	−	No trace		
Aug. 19	−+	−+	−+	+	+−	−+	+	−	−	No trace			+	−	−	+	−	+−+	−+−	−	−+	+−	+
Oct. 2....	+−	−+−+	−+−+	+	+−	−+	No trace			+	−+	+	+	No visible change	−	+	−+?	+	+−	+−?	−+	+−	−+
Nov. 8	−+	−+	−+	+	+−	−+	+	−	−	+	+−?	+	+	−	−	+−	+−+	+−+	−+−	−	+	−	+
„ 12	−+	−+	−+	+−+	−+−	−+	+	−	−	+	+−?	+	+	−	−	Obscured by hour break		−+	−	No visible change	No trace		
Dec. 10	−+	−+	−+	+	−	−+	+	−	−	+	−	+	+	−	−	+	+	−+	−	−	+−	+−	−+?
1912. Jan. 17	+−	−+	−+	+	−	−+	+	−	−	+	−	+	+	−	−	+	−+	+	−	−	+	−	+?
Sept. 30	+−	+−	+−	+	−+−	−+	+	−	−	−+?	+?	+	+	−	−	−+	−?+?	−+?	−	−	No trace		
Oct. 20	−+	−+	−+	+	+−?	−+	+	−	−	+	−	+	+	−	−	−+	−+	−+	+−	−	−+	+−	Trace too faint

Table CXXXII.—Analysis of s.c. Movements in Antarctic.

Date.	No.	First Movement.								Second Movement.								
		ΔN	ΔE	ΔV	ΔX	ΔY	ΔZ	ϕ	θ	ΔN	ΔE	ΔV	ΔX	ΔY	ΔZ	ϕ	θ	Hour G.M.T.
		γ	γ	γ	γ	γ	γ	°	°	γ	γ	γ	γ	γ	γ	°	°	h. m.
1911.																		
April 8....	1	− 2·9	−111·3	−30·4	+109·0	+22·6	−30·3	78	105	+ 70·6	+216·2	+65·4	−197·2	−104·2	+79·0	267	71	11 21
,, 9....	2	+31·2	+ 52·4	+14·5	− 44·5	−38·9	+20·8	229	71	−119·4	− 87·7	−25·9	+ 59·1	+128·5	−50·8	25	110	22 21
May 29	3	−21·9	− 15·9	− 6·8	+ 10·8	+23·1	−11·3	25	114	+ 36·8	+ 49·9	+25·9	− 41·4	− 41·3	+33·2	225	60	14 34
June 9	4	−10·5	− 14·4	− 4·6	+ 11·8	+12·4	− 6·7	44	111	+ 12·2	+ 20·5	+ 6·8	− 17·5	− 15·0	+ 9·3	229	68	16 31
,, 30	5	− 0·9	+ 25·9	+11·4	− 26·0	− 2·9	+11·0	264	67	− 4·2	− 30·5	−14·5	+ 29·4	+ 8·1	−15·1	75	116	21 50
August 19	6	− 9·9	− 24·1	− 8·4	+ 21·6	+13·3	−10·3	58	112	+ 26·1	+ 77·1	+22·1	− 70·0	− 38·3	+27·2	241	71	12 16
October 2	7	+ 8·3	− 12·6	− 4·6	+ 14·4	− 5·9	− 2·7	112	100	+ 6·6	+ 24·4	+ 8·4	− 22·6	− 10·2	+ 9·6	246	69	4 8
November 8	8	− 2·8	− 35·6	−10·7	+ 34·5	+ 8·8	−11·0	76	107	+ 34·4	+ 82·7	+19·0	− 73·4	− 48·1	+25·9	237	74	13 43
,, 12....	9	−15·5	− 39·2	−13·7	+ 35·2	+21·1	−16·7	59	112	+ 31·7	+ 56·4	+25·9	− 48·8	− 37·9	+32·1	232	63	15 5
December 10....	10	− 5·5	− 46·3	−15·2	+ 44·5	+12·9	−16·0	74	109	+ 14·1	+ 69·7	+35·0	− 66·3	− 22·5	+37·2	251	62	15 39
1912.																		
January 17	11	+27·3	− 29·5	− 9·9	+ 35·4	−21·0	− 3·8	121	95	− 45·4	+ 51·9	+14·5	− 61·6	+ 33·9	+ 4·5	299	86	4 42
September 30....	12	+27·6	+ 36·3	+ 7·9	− 29·3	−33·1	+13·6	222	73	− 41·3	−103·2	−58·6	+ 93·8	+ 51·2	−66·1	61	122	21 36
October 20	13	−23·5	− 29·9	−11·9	+ 24·3	+26·8	−16·7	42	115	+ 24·0	+ 21·4	+11·1	− 15·8	− 25·5	+16·0	212	62	17 20
Means from Nos. 1, 3, 4, 6, 8, 9, 10, 13 { Algebraic		−11·6	− 39·6	−12·7	+ 36·5	+17·6	−14·9	64	110	+ 31·2	+ 74·2	+26·4	− 66·3	− 41·6	+32·5	238	67	
Means from Nos. 1, 3, 4, 6, 8, 9, 10, 13 { Arithmetic....		—	—	—	—	—	—	57	111	—	—	—	—	—	—	237	66	
Means from Nos. 2, 5, 12 .... { Algebraic		+19·3	+38·2	+11·3	−33·3	−25·0	+15·1	233	70	− 55·0	− 73·8	−33·0	+ 60·8	+ 62·6	−44·0	44	117	
Means from Nos. 2, 5, 12 .... { Arithmetic		—	—	—	—	—	—	238	70	—	—	—	—	—	—	54	116	
1902 { May 8		−14	− 25	− 6	+ 21	+18	− 9	50	108	+ 25	+ 45	+ 9	− 38	− 32	+14	230	74	
1902 { August 20		+19	+ 33	+ 6	− 28	−24	+10	229	75	− 32	− 50	−14	+ 42	+ 39	−20	47	110	
1903 August 25		+52	− 2	+29	+ 12	−43	+29	164	49	−123	− 40	−52	+ 15	+115	−77	7	123	

TABLE CXXXIII.—Analysis of s.c. Movements at Buitenzorg and Alibag.

Date.	No.	Buitenzorg.								Alibag.							
		ΔN	ΔE	ΔV	ΔX	ΔY	ΔZ	ϕ	θ	ΔN	ΔE	ΔV	ΔX	ΔY	ΔZ	ϕ	θ
1911.		γ	γ	γ	γ	γ	γ	°	°	γ	γ	γ	γ	γ	γ	°	°
April 8	1	+51·5	−12·3	−3·5	+12·5	+9·1	+50·7	54	17	+38·5	−12·6	−11·2	−5·4	+11·5	+40·0	335	18
„ 9	2	+18·7	+ 3·7	+2·9	− 1·8	−3·3	+18·9	209	12	—	—	—	—	—	—	—	—
May 29	3	+19·2	− 3·4	+2·9	+ 0·3	+3·4	+19·4	5	10	+16·1	− 2·0	− 2·8	−3·0	+ 1·2	+16·2	292	11
June 9	4	+12·5	− 2·5	+2·9	− 0·7	+2·8	+12·7	346	14	+11·5	− 2·0	− 2·8	−1·6	+ 1·6	+11·8	315	10
„ 30	5	+ 8·1	0·0	+1·4	− 0·4	+0·1	+ 8·2	284	3	+ 7·4	− 2·1	− 3·3	+0·1	+ 2·2	+ 8·1	3	15
August 19	6	+40·7	− 3·7	+2·6	+ 3·1	+2·9	+40·7	47	7	+18·5	− 4·1	− 4·6	−2·7	+ 3·5	+19·0	322	13
October 2	7	+16·6	− 2·9	−1·5	+ 4·1	+1·8	+16·3	66	15	—	—	—	—	—	—	—	—
November 8	8	+22·4	− 3·1	+1·5	+ 1·9	+2·7	+22·4	35	9	+15·1	− 1·5	− 2·3	−3·0	+ 0·7	+15·0	283	13
„ 12	9	+13·1	− 2·8	−0·9	+ 3·1	+2·0	+12·9	57	16	+ 9·2	− 1·0	− 1·9	−1·4	+ 0·6	+ 9·3	293	8
December 10	10	+16·3	− 2·5	+1·2	+ 1·4	+2·2	+16·3	32	9	+10·6	− 1·5	− 1·9	−2·0	+ 1·0	+10·6	297	13
1912.																	
January 17	11	+17·9	0·0	+2·0	+ 0·1	0·0	+18·0	90	0	+17·4	− 1·9	− 3·7	−2·5	+ 1·2	+17·7	296	9
September 30	12	+14·1	− 1·9	+3·1	− 0·8	+2·2	+14·4	340	10	+13·7	− 1·5	− 0·9	−3·8	+ 0·4	+13·3	276	15
October 20	13	+27·5	− 5·0	−2·5	+ 6·9	+3·1	+27·0	66	16	+21·9	− 4·1	− 3·8	−5·4	+ 2·6	+21·6	296	15
Means from all complete { Algebraic		+21·4	− 2·8	+0·9	+ 2·3	+2·2	+21·4	46	9	+16·4	− 3·1	− 3·5	−2·8	+ 2·4	+16·6	311	12
Means from all complete { Arithmetic....		—	—	—	—	—	—	—	10	—	—	—	—	—	—	306	13

TABLE CXXXIV.—Analysis of s.c. Movements at Honolulu and Helwan.

Date.	No.	Honolulu.								Helwan.							
		ΔN	ΔE	ΔV	ΔX	ΔY	ΔZ	φ	θ	ΔN	ΔE	ΔV	ΔX	ΔY	ΔZ	φ	θ
1911.		γ	γ	γ	γ	γ	γ	°	°	γ	γ	γ	γ	γ	γ	°	°
April 8	1	+ 1·4	+3·6	+13·0	+5·5	+23·2	+24·5	13	44	+40·4	−12·3	−12·2	−15·5	−1·7	+41·1	264	21
„ 9	2	+14·7	−0·2	+ 4·1	+3·6	+ 8·4	+12·2	23	37	+33·2	− 8·4	−10·9	−10·9	−1·7	+34·2	261	18
May 29	3	+ 8·0	+0·4	+ 2·6	+1·6	+ 5·1	+ 6·5	17	40	+ 9·8	− 8·3	− 3·7	− 8·0	+2·9	+10·3	290	39
June 9	4	+ 7·4	+2·1	+ 2·3	−0·1	+ 5·3	+ 6·1	−1	41	—	—	—	—	—	—	—	—
„ 30	5	+ 6·1	+1·0	+ 2·6	+0·8	+ 4·7	+ 4·7	10	45	—	—	—	—	—	—	—	—
August 19	6	—	—	—	—	—	—	—	—	+13·8	− 9·3	− 6·2	− 8·7	+3·6	+15·0	292	33
October 2	7	+ 5·9	+3·6	+ 3·4	−1·4	+ 6·3	+ 4·3	−13	56	—	—	—	—	—	—	—	—
November 8	8	+12·4	−0·5	+ 3·1	+3·2	+ 6·7	+10·4	26	36	+13·5	− 1·5	− 6·2	− 2·0	−0·4	+14·8	259	7
„ 12	9	+ 5·8	+0·6	+ 1·8	+0·9	+ 3·7	+ 4·8	14	38	+ 8·1	− 0·8	− 3·7	− 1·1	−0·3	+ 8·9	255	0
December 10	10	+ 6·0	−0·7	+ 1·4	+2·0	+ 3·0	+ 5·1	34	35	+ 9·3	− 3·0	− 3·7	− 3·3	+0·3	+ 9·9	275	18
1912.																	
January 17	11	+ 8·7	+3·2	+ 3·5	−0·6	+ 7·2	+ 6·8	−5	47	+ 9·3	− 5·6	− 3·7	− 5·5	+1·7	+ 9·9	287	31
September 30	12	+ 9·3	+2·5	+ 3·1	0·0	+ 6·7	+ 7·5	0	42	+16·4	− 3·3	− 6·1	− 4·3	−0·7	+17·3	261	14
October 20	13	+11·3	+5·4	+ 3·1	−2·4	+ 8·5	+ 9·4	−16	43	+21·8	− 3·6	− 7·4	− 5·4	−1·9	+22·6	251	14
Means from all complete	Algebraic	+10·6	+1·75	+ 3·7	+1·1	+ 7·4	+ 8·5	8	41	+17·6	− 5·6	− 6·4	− 6·5	+0·2	+18·4	272	19
	Arithmetic....	—	—	—	—	—	—	9	42	—	—	—	—	—	—	269	19

TABLE CXXXV.—Analysis of s.c. Movements at Eskdalemuir and Sitka.

Date.	No.	Eskdalemuir.								Sitka.							
		ΔN	ΔE	ΔV	ΔX	ΔY	ΔZ	ϕ	θ	ΔN	ΔE	ΔV	ΔX	ΔY	ΔZ	ϕ	θ
1911.		γ	γ	γ	γ	γ	γ	°	°	γ	γ	γ	γ	γ	γ	°	°
April 8	1	+50·1	−43·2	−4·7	−41·0	−40·9	+32·4	225	61	+83·1	− 5·0	+10·4	+56·5	+50·1	+36·5	48	64
„ 9	2	+72·6	−22·5	−9·3	−19·4	−55·6	+49·0	199	50	+11·1	+36·0	− 5·2	−21·0	+29·9	+10·4	325	74
May 29	3	+59·6	−34·6	−5·7	−32·0	−47·6	+38·6	214	56	+12·1	− 7·4	+ 5·2	+14·4	+ 4·0	+ 2·2	74	82
June 9	4	+18·3	− 8·6	−2·9	− 7·8	−13·8	+12·8	209	51	+ 7·9	−13·6	+ 4·7	+16·1	− 3·0	+ 0·4	152	89
„ 30	5	+20·1	− 9·5	−2·9	− 8·7	−15·4	+13·8	209	52	—	—	—	—	—	—	—	—
August 19	6	+26·4	−21·6	−4·0	−20·5	−20·6	+18·3	225	58	+41·0	− 5·5	+ 7·4	+30·9	+23·5	+16·1	53	67
October 2	7	+ 8·7	+ 4·3	+0·5	+ 4·7	− 7·2	+ 4·5	147	71	+27·1	+ 5·7	+ 3·1	+13·1	+21·4	+12·1	31	64
November 8	8	+16·6	−25·1	−2·0	−24·4	−13·9	+11·1	240	68	+18·7	−11·5	+ 5·2	+21·2	+ 5·1	+ 5·8	76	75
„ 12	9	+ 9·6	− 5·2	0·0	− 4·8	− 8·2	+ 5·5	210	60	—	—	—	—	—	—	—	—
December 10	10	+15·7	+ 3·5	−2·2	+ 4·1	−11·4	+10·7	160	49	+ 3·1	− 6·2	+ 2·1	+ 7·0	− 1·7	− 0·1	104	91
1912.																	
January	11	+ 8·7	−12·1	−1·8	−11·7	− 6·8	+ 6·4	240	65	+11·7	+ 2·0	+ 1·0	+ 5·9	+ 8·8	+ 5·5	34	62
September 30	12	+22·8	− 8·7	−5·4	− 7·8	−16·1	+17·4	206	46	—	—	—	—	—	—	—	—
October 20	13	+35·3	− 8·6	−3·3	− 7·1	−27·6	+22·8	194	51	+20·2	− 6·4	—	—	—	—	—	—
Means from all complete	Algebraic	+28·0	−14·8	−3·4	−13·6	−21·9	+18·7	212	54	+24·0	− 0·6	+ 3·8	+16·0	+15·3	+ 9·9	46	66
	Arithmetic....	—	—	—	—	—	—	206	57	—	—	—	—	—	—	—	74

TABLE CXXXVI.—Times of Occurrence of s.c. Movements of Different Types.

S.c's with Type A movement first.		S.c's with Type B movement first.		Intermediate s.c's.	
Date.	Hour G.M.T.	Date.	Hour G.M.T.	Date.	Hour G.M.T.
	h. m.		h. m.		h. m.
May 8, 1902... ...	11 59	August 20, 1902 ...	21 3	October 2, 1911 ...	4 8
November 6, 1902 ...	15 52	April 5, 1903 ...	23 25	January 17, 1912 ...	4 42
December 13, 1903...	12 29	August 25, 1903 ...	22 57		
April 8, 1911 ...	11 21	April 9, 1911 ...	22 21		
May 29, 1911 ...	14 34	June 30, 1911 ...	21 50		
June 9, 1911... ...	16 31	September 30, 1912	21 36		
August 19, 1911 ...	12 16				
November 8, 1911 ...	13 43				
November 12, 1911...	15 5				
December 10, 1911...	15 39				
October 20, 1912 ...	17 20				

CHAPTER XI.

SHORT PERIOD DISTURBANCES, INCLUDING THOSE OF THE "SPECIAL TYPE."

Section 80.—In the discussion of the 1902–03 data a separate chapter (Chap. X., p. 186) was devoted to the " special type of disturbance," examples of which were shown in Plates XXVII (June 19, 1903), XXVIII (June 28, 1903), XXIX (June 29, 1903), XXX (July 26, 1903) and XXXI (August 17, 1903). The difference in the magnetograph arrangements makes comparison of the old and new records difficult, but with the aid of the accompanying Fig. 4, a general idea of their inter-relationships can be easily obtained.

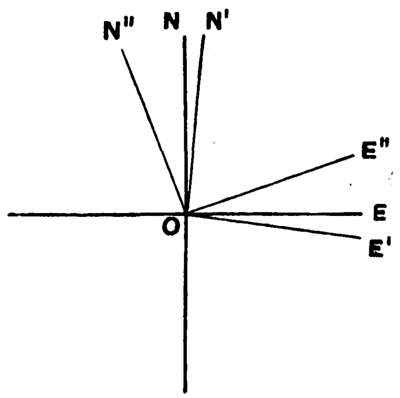


FIG. 4.

H and D magnetographs may be regarded as measuring changes of force respectively in and perpendicular to the magnetic meridian. The mean position of the magnetic meridian at the observing hut in 1902–03 was 152° 40′ East of North. Thus a rise of H and a rise of D may be regarded as increases of force, the one along a line 27° 20′ East of South, the other along a line 27° 20′ South of West. In 1902–03, however, D and H both diminished with movement up the sheet. Thus in the 1902–03 magnetograms, if we suppose the magnetic meridian the same as in the absolute hut, movement up the sheet in D means force in the direction OE″ in the figure, 27° 20′ North of East; while movement up the sheet in H means force in the direction ON″, 27° 20′ West of North. In the magnetograms of 1911–12 movement up the sheet in E′ means force in the direction OE′ in the figure, 7° 36′ South of East, while movement up the sheet in S′ means force in the direction ON′, 7° 36′ East of North. The inclination 34° 56′ of OE″ to OE′ (or ON″ to ON′) is not negligible; still in a rough way movement up the sheet in the D and H curves of 1902–3 answers to movement up the sheet in the E′ and N′ curves of 1911–12. But movement up the sheet in the V trace of 1902–03 meant numerical increase of V, and so answered to movement down the sheet in the V trace of 1911–12.

Plates XXVII and XXIX of 1902–03 represent the usual form of the "special type." They show in D and H movements up the sheet, followed by movements of similar size down the sheet. During the first movement of D or H, or as it was called the first phase, there is a small movement of V down the sheet (which in the 1911–12 curves would have been movement up the sheet), and during the second D and H movements (or second phase) there is a considerably larger movement of V up the sheet (down the sheet in the 1911–12 traces). The result is to leave V numerically enhanced above its original value, and in the two cases mentioned the recovery in that element was slow, and seemed hardly an essential part of the phenomenon. The intermediate Plate XXVIII of 1902–03 shows, however, a case in which, while the D and H movements are much as in Plates XXVII and XXIX, the recovery in V after the second phase is fairly rapid, and is in fact much more prominent than the change occurring during the first phase. If in this case we attached special importance to the phenomena in V, we should regard the disturbance as one having three phases, the first and last representing (numerical) fall in V, the intermediate numerical rise. In Plate XXX of 1902–03 the phenomena in D and V are much as in Plate XXVII, except that the first phase movement in V is very small; but the H movements are exactly the opposite, the first phase movement being down, the second phase movement up the sheet. This was by no means the only example of reversal of direction of movement. It appears in 17 of the 82 disturbances of the "special type" enumerated on pp. 187 and 188 of the 1902–03 volume. The direction of the D movement was reversed in only one of the 82 cases. The first phase V movement, though several times zero, was actually reversed in only two cases, but usually it was so small that the sign possesses little significance. In the second phase there was invariably a (numerical) rise in V.

The attitude adopted to the "special type" disturbance in 1902–03 was determined mainly by the D trace. Owing to the much lower sensitiveness of the V magnetograph, the V movements usually made little appeal to the eye, and the existence of a large temperature coefficient in the magnet, and large fluctuations of temperature in the magnetograph chamber, rendered its indications less trustworthy as a guide. The sensitiveness of the H instrument was high, but the trace was apt to go beyond the limits of registration during disturbed times, thus chief regard was paid to the D trace when deciding the times of beginning and ending of the phases. This no doubt influenced the results obtained. In the Antarctic minor oscillations are usually superposed on the larger ones. Let us suppose two traces, say D and H, both executing a general movement up the sheet, due to a principal force system, which, if it acted alone, would bring the two traces simultaneously to their highest points. Suppose that at the same time a secondary field tends to produce short-period oscillations of varying size and duration, which are not exactly in phase in the two elements. The consequence is that several summits of different heights will appear in the traces, and the chances are that the absolutely highest peaks in the two will not synchronise in time. If we regard the phase as terminating when the highest peak in the D trace is reached, we shall get a larger value for (D movement/H movement) than if we regard the end of the phase as determined by the highest summit on the H trace.

Plate XXXIV for July 12, 1911, shows a disturbance fairly representative of what was considered normal in the "special type" disturbance of 1902–03. In the horizontal components the up and down movements are of similar size; in V, however, the first movement is relatively small. After the second movements there is some recovery in N′ and V, giving the traces something of the bay form, but the V trace remains down the sheet (*i.e.*, V is numerically enhanced) for several hours. In this case the minor oscillations are relatively small, still they exist, and the times one would assign for the end of the first phase from separate consideration of the three traces would not be identical. The highest summit in the V trace precedes the highest summits in the other traces. In 1911–12 this was in fact the rule rather than the exception. There are three nearly equal peaks in N′, and three nearly equal peaks in E′. The third and slightly highest peak in E′ occurred 3 or 4 minutes after the third peak in N′, and 9 or 10 minutes after the summit in V; and the values of N′ and V which correspond to it in time are widely different from those answering to the highest peaks in the N′ and V traces. On the other hand, the values of E′ and N′ which correspond in time with the summit in V are much below the values answering to the highest peaks in these elements. In this case the middle peak in N′ seems the fairest to take as representing the end of the first phase. It corresponds with peaks in E′ and V which are lower, but not so very much lower, than the highest peaks in these elements.

There is obviously in this instance a similar difficulty in fixing the exact end of the second phase. The lowest point in the E′ trace did not present itself until nearly 21 h. There are corresponding dips in the N′ and V traces. So far as N′ is concerned, it would not much matter whether we took this dip or one occurring 35 minutes earlier, but the V trace shows a marked recovery during these 35 minutes. Thus the earlier dip in the N′ trace, with the corresponding lowest point in the V trace, seems the more natural end to the second phase. Accepting it, however, we get a considerably smaller E′ change during the second phase, than if our choice had been determined by consideration of the E′ trace alone. There are many, especially of the smaller disturbances, which present less possibilities of choice, but there are comparatively few in which only one choice is possible. Some of the larger disturbances of the type are much less simple than that of July 12, 1911, and it is principally these that are reproduced in the plates. In preparing the list of disturbances which was circulated amongst observatories, with a request for copies of the curves, the larger Antarctic disturbances were naturally selected.

Section 81.—Plates XXVIII to XL include copies of short-period disturbances* of the "special type" or analogous types recorded in the Antarctic and at co-operating stations. The disturbances of April 30, July 12 and 20, 1911, and June 2, 1912, in Plates XXVIII,

* The hours of occurrence will be found in Table CXXXVII, p. 273.

XXXIV and XXXVIII, illustrate the more common form of the "special type." In each case there are first up then down movements in all the traces. The up and down movements in E′ and N′ are of the same order of magnitude, but the up movement in V is relatively small. In E′ there are only the two prominent movements or phases. In N′, however, a third movement in the same direction as the first is clearly apparent in three out of the four cases, and the second movement is decidedly larger than the first. In V a third movement exceeding the first in size is seen in all four cases, and in Plates XXVIII and XXXVIII (June 2) the most prominent phenomenon in the V trace is undoubtedly the bay formed by the second and third movements. The average disturbance of the "special type" differs from those shown in Plates XXVIII, XXXIV and XXXVIII (June 2) chiefly in that it is smaller in magnitude and shorter in duration. The disturbance on July 20, 1911, however, is of a less simple character than the others classed with it. The commencement of the second phase in E′ and N′ seems delayed. The N′ trace, in fact, suggests that a second wave, as it were, rolled in before the first had subsided.

Plates XXXVI (April 5), XXXVIII (May 13), XXXIX and XL show another variant of the "special type." The distinctive feature is that the N′ movements are the opposite of those in the more usual form, the first being down, the second up the sheet. The E′ movements are of the usual kind, the rise coming first. There are so many minor irregularities that it is difficult to say whether the characteristic first phase movement in V up the sheet is represented or not. It seems to be indicated in the April 5 curve, where the bay is inconspicuous. In the other three cases the bay is the most prominent phenomenon in V.

Plates XXIX, XXX, XXXI, XXXII, XXXIII, XXXV, XXXVI (August 24), and XXXVII show the remainder of the most prominent short-period disturbances recorded in the Antarctic. All present some of the features of the disturbance of the "special type," but whether they should be regarded as examples of it or not is doubtful. In each case there is a bay in V, which if not an essential is, at least, a common feature in the "special type." On these eight occasions the outstanding feature in the E′ traces is the existence of one or more deep narrow bays. On May 16, 1911, 4 h.–8 h., and May 5, 1912, the most natural interpretation of the phenomena is that two independent disturbances succeeded one another after a short interval, the second being the larger. If we take the later of the two disturbances on May 16, 1911, as an example, its commencement distinctly suggests the "special type." We have a sharp rise and fall in E′, with a slight rise and larger fall in N′, a small rise in V and then a large fall. But the fall in E′ carries the trace far below its original level, and this fall and the subsequent recovery constitute by far the most notable feature of the disturbance. The bay they form has analogous bays in the N′ and V traces, but still the departure of these traces from the form characteristic of the ordinary "special type" disturbance is hardly fundamental. Very similar remarks apply to the disturbances of May 21, July 3, and August 24, 1911. On June 5, July 11 and 31, 1911, and the first disturbance of May 5, 1912, there is much irregular disturbance, but in all cases the narrow bays in the E′ traces and the bay in V are essentially phenomena of the same kind as on May 16, 1911. The second disturbance on May 5, 1912, between 10 h. and 13 h., has some special features. The E′ trace has a deep narrow bay, but this is hardly represented in N′ or V. Again, while the E′ trace is not suggestive of the ordinary "special type," the N′ trace unquestionably is, and the V trace is remarkable only in that the recovery is more rapid and complete than usual.

Before proceeding further it will be well to consider the 16 short-period disturbances illustrated in the plates individually in the light afforded by the corresponding records from the co-operating stations. In all cases in the plates the arrow shows the direction of the forces acting on the north pole of a magnet. It indicates the direction of increase in H or N, in easterly declination or E, and in V force directed towards the earth's centre.

Section 82.—April 30, July 12, 20, 1911, and June 2, 1912, Plates XXVIII, XXXIV and XXXVIII. These disturbances, it will be noticed, fall between 6 h. and 9 h., or 7 h. and 10 h., G.M.T. Let *u* and u represent respectively large and small movements up the sheet, *d* and d large and small movements down the sheet, and let l represent a portion of level or nearly level curve. Then, neglecting short-period oscillations and small changes of level, we might in general terms describe the several Antarctic disturbances as follows :—

Date.	E′.	N′.	V.
April, 30, 1911	*u d* l	*u d* u l	u *d u*
July 12, 1911	*u d* l	*u d* u l	u *d* u
July 20, 1911	*u d*	*u* l *d* l	u *d u*
June 2, 1912	*u d* l	*u d* u l	u *d u*

It should be noticed that *u* (or u) represents a force on a north pole directed, easterly, northerly or towards the earth's centre. The residual effect at the end of the time included in the plates consists in the main in a depression of the V trace down the sheet, representing a numerical increase in V above its original value.

For Mauritius only H and D traces were available. On each occasion the H trace showed a decided bay, representing a diminished value of H. On July 12, 1911, and June 2, 1912, the bay was rather a shallow one. The D trace showed very little sign of disturbance except on July 12, 1911, when the easterly movement normal at the hour was interrupted by a westerly movement, leading to a decided bay on the curve.

At Buitenzorg, as the plates will show, the prominent feature on each occasion is the bay, depression, in the N curve. The lack of symmetry in the bays may reasonably be ascribed to the fact that the ordinary diurnal variation during the hours included would naturally bring the trace down the sheet. The E traces would naturally, in virtue of the regular diurnal variation, be convex upwards, but the disturbance tended apparently to produce a very small bay, or what may be called a dimple. There is also in general a suggestion of a bay in the V trace, which was naturally nearly level at that time of day.

At Alibag a shallow bay, depression, is distinctly visible in all the H traces. The phenomena are closely similar to those at Mauritius. D and V traces were available only for July 20, 1911, when they showed little sign of disturbance.

Honolulu and Helwan curves were available only for April 30, 1911. At Honolulu the H trace showed sensible irregular disturbance, tending on the whole to form a bay (depression). The D trace was practically quiet, and the V trace only a little less so. All the Helwan curves show irregular wavelike movements. There is a decided bay in H, similar to that at Alibag.

For Agincourt H and D traces were available except for July 12, 1911. The H trace shows a distinct bay, or depression, in H on April 30 and July 20, 1911, but the exact opposite or what we may for brevity call a hump on June 2, 1912. The D trace shows humps—representing at Agincourt a westerly followed by an easterly movement—but the hump on April 30, 1911, is small and accompanied by oscillations, while that on June 2, 1912, has a large indentation.

At Eskdalemuir all the N curves show distinct bays, *i.e.*, depressions of N. The movements in the other elements especially V are mostly trifling, but the E trace of April 30 shows a moderate hump, the chief movement in which represents a force directed to the west.

For Sitka there were no traces for June 2, 1912. The principal movements on the other occasions, in the notation already employed for the Antarctic, were as follows :—

Date.	H.	D.	V.
April 30, 1911	*u d u*	*d u d u*	d *u d*
July 12, 1911	*u d u*	d u d u	*u* d
July 20, 1911	*u d*	*d u*	*u* d

Here u (or *u*) means a rise in H, but a fall in V, and a westerly movement in declination.

Short period oscillations of considerable size accompanied the larger movements. The H movements at Sitka are of a less simple type than those at the other co-operating stations. In general there is a hump and a bay, the former usually the more prominent. The general consequence of the D movements is the production of bays, a single bay (*i.e.*, an easterly followed by a westerly movement) on July 20, but a double bay on April 30 and July 12. The prominent feature in V is a hump (first fall then rise of force urging a north pole towards earth's centre).

The Sitka movements, though notably less than those in the Antarctic, are much larger than the movements at any intermediate station.

April 5, *May* 13, *June* 3 *and August* 1, 1912. *Plates XXXVI, XXXVIII, XXXIX and XL.*

Section 83.—Using the same notation as before, the movements in the Antarctic curves may be described as follows :—

Date	E′	N′	V
April 5, 1912	*u d*	*d u*	l (or u) *d* u
May 13, 1912	*u d* u	*d u*	l *d* u
June 3, 1912	*u d*	l *d u*	l *d* u
August 1, 1912	*u d*	*d* u *d u*	l *d u*

In all cases numerous short-period oscillations were superposed on the principal movements. The general impression left is that of a hump in E′, and bays in N′ and V. The first, and principal, movement in V down the sheet seems to lag behind the first movements in the other elements. At the end of the time represented in the plates the V trace remains depressed, *i.e.*, the element is numerically enhanced.

There were no Mauritius curves for April 5. For the other three days there were H and D curves, but the D trace on May 13 was almost invisible, and that on June 3 too faint for measurement. In all cases the H trace showed a decided bay (depression). On June 3 and August 1 the westerly movement normal to the hour was neutralised or slightly reversed for a time. On May 13 the effect of the disturbance was to very sensibly reduce the D movement natural to the three hours below its normal value.

At Buitenzorg, where there was no trace for any element on April 5, the prominent feature in every case is the bay in the N curve. The E curve on June 3 exhibits a regular convexity representing presumably the regular diurnal inequality. On May 13 and August 1 the E trace is visibly disturbed during part of the time. The V trace shows a decided bay on May 13 and on June 3, and a hump followed by a bay on August 1.

No Alibag curves were available except for May 13 and June 3, and on the former occasion only H was represented. The only movements worth mentioning are the bays in the H curves.

There were no Honolulu traces, and none from Helwan except for August 1.

At Helwan on August 1 there was a decided bay, depression, in the H curve, and the D curve was slightly undulatory.

Agincourt H and D traces were available except for April 5. The movements were of a considerable size, but of irregular character. On May 13 the H trace shows a succession of large oscillations, while the D trace shows one large and numerous minor oscillations, which do not seem in phase with those in H. The principal movements synchronize with the large bay in the Antarctic N′ curve. On June 3 there is a narrow but fairly deep bay in H, and a corresponding hump in D, which answer roughly in time to the up movement and the faster part of the down movement in the Antarctic E′ curve. During the subsequent time, when the principal Antarctic N′ and V movements occurred, the Agincourt curves show only minor oscillations. On August 1 the main feature at Agincourt is a hump in the D curve. The H trace suggests a succession of irregular waves.

At Eskdalemuir the N traces all show bays, those on May 13 and August 1 of considerable depth. The E traces also show decided movements of an undulatory character; on April 5 and August 1 the hump is the prevailing feature; on May 13 the appearance of the curve is rather that of a double bay, with an intermediate higher portion of trace. The V trace shows on May 13 a fairly deep bay, and on August 1 a small dimple towards the end of the time; on April 5 it is practically undisturbed.

Sitka is represented only on August 1, when the traces were somewhat highly disturbed. The principal features are a hump in H, and bays in D and V. The bay in V is narrow and deep, and bears no resemblance to that in D. The H and D traces have a considerable general resemblance to the Antarctic E′ and N′ traces respectively. But if, as is more natural, we compare H with N′ and D with E′, we find the corresponding curves at the two places more nearly the inverse of one another. The principal V movement had finished at Sitka before that in the Antarctic commenced.

It will have been observed that except in the Antarctic the phenomena presented by the disturbances of April 5, May 13, June 3 and August 1, 1912, are closely similar to those exhibited by the disturbances of April 30, July 12 and 20, 1911, and June 2, 1912.

May 16 *and* 21, *June* 5, *July* 3, 11, 31, *August* 24, 1911, *and May* 5, 1912.—*Plates XXIX, XXX, XXXI, XXXII, XXXIII, XXXV, XXXVI and XXXVII.*

Section 84.—The Antarctic traces next to be discussed have as a general characteristic a series of very sharp deep depressions in the E′ curves, and generally also in the N′ and V curves. On two of the occasions, May 16, 1911, and May 5, 1912, there were what seem two independent disturbances, the second of the two being in each case much the larger. Using a suffix $_r$ to indicate a specially rapid motion, and employing 0 to represent short period oscillations, the principal movements in the Antarctic may be described as follows :—

Date.	E′	N′	V
May 16 (2 h.–4 h.), 1911 ...	u d_r u_r d	d u	0 d u_r
,, 16 (4 h.–8 h.), 1911 ...	u d_r u_r	u d 0 u	u d_r u_r
,, 21, 1911	u 0 d_r u_r	u d u	l d u
June 5, 1911	u d 0 d u 0	0	0 d u
July 3, 1911	u d_r u_r 0	u d u 0	u (or l) d_r u_r 0
,, 11, 1911	u d_r u_r 0	u d_r u_r d u	d 0 u
,, 31, 1911	u 0	u 0	u (or l) d_r 0 u
August 24, 1911	u d_r u_r 0	u d u_r 0	u d_r u_r 0
May 5 (8 h.–10 h.), 1912 ...	0 d_r u_r 0	u d_r u_r 0	d_r u_r d u
,, 5 (10 h.–13 h.), 1912	d 0 d_r u_r 0	u d u	l d u

The disturbances of May 16 and July 3, 1911, were the most striking recorded in the Antarctic during 1911 and 1912. On May 16 the V trace seems to have just got off the sheet at the lowest point, so that the measured change in V may have been slightly exceeded. A quick run was in progress during the latter part of the second disturbance on May 16, and the corresponding part of the curve in Plate XXIX has been drawn from measurements made on the quick run curve. It does not fully show the shorter period oscillations. It will be noticed that in this third group of short-period disturbances, as in the two previous groups, there is always a bay in V, and the recovery from the depression in the V trace is not completed within the time included in the plates, except for the later disturbance of May 5, 1912. Thus the general tendency is to leave V numerically enhanced, after the disturbance in the horizontal field seems to be completed.

At Mauritius the main feature is a bay or succession of bays (depressions) in H. The H curves are generally similar to the N curves at Buitenzorg and the H curves at Alibag. On May 16 the H record did not begin until 4 h. Between 4 h. and 8 h. there seemed to be really two bays, the second and deeper appearing before the recovery from the first was complete. Generally speaking, the bays are of a rounded character, and not similar to the very deep bays in the Antarctic traces. The bay between 10 h. and 13 h. on May 5, 1912, was the deepest. The fall and recovery were both rapid, as at Alibag. The D traces showed some signs of disturbance, but usually the principal feature was the regular diurnal variation.

At Buitenzorg the outstanding feature in each case is a bay or succession of bays in the N curves. On May 16, 1911, there are a succession of bays, the largest partly synchronising with the very deep bay in the Antarctic E′ curve. The bays in the Buitenzorg N curves generally last during the greater part of the disturbance shown by the Antarctic curves, and do not show any very exceptional development during the specially rapid Antarctic movements. On July 3, 1911, however, the bay at Buitenzorg is of shorter duration than usual, and the recovery is unusually rapid. The Buitenzorg E and V curves are much quieter, but all show minor disturbance, usually of an oscillatory character. On May 21, 1911, there are decided bays in both curves, especially the V curve. There are also minor bays or dimples in the V trace on July 3, 11 and August 24, 1911, and during the second disturbance of May 5, 1912. On the latter occasion there is also a distinct bay in the E curve.

All the Alibag H traces show bays, corresponding in time to those in the Buitenzorg N traces. The Alibag D and V traces, so far as available, show very little visible sign of disturbance, as compared even with the Buitenzorg E and V traces. The difference is probably largely due to the difference in sensibility of the magnetographs.

Honolulu traces were available only for May 21, July 3 and August 24, 1911, and for May 5, 1912. On all these occasions, the most prominent feature is a hump on the H curve—*i.e.*, an *elevation* of H—corresponding generally in time with the bays on the Buitenzorg N and Alibag H curves. The D traces at Honolulu show very little sign of disturbance. The V traces are a little more disturbed. That for July 3, 1911, shows a small bay, synchronous with the principal Antarctic movements, while the traces for August 24, 1911, and May 5, 1912, show very sensible undulations.

Helwan traces were available for May 16, June 5 and August 24, 1911, and May 5, 1912. The H traces show shallow bays, corresponding in time with those in the Buitenzorg N and Alibag H curves. On May 16 and June 5 there are only minor irregularities in the D and V traces. On August 24 the V trace was very faint; the D trace is practically undisturbed.

Agincourt D and H traces were available for all the disturbances, except that of May 21, 1911. On May 16, 1911, the traces were highly disturbed; but the movements are very irregular and it is difficult to see their relation to those elsewhere. The Agincourt time scale is intermediate between the ordinary Adie and Eschenhagen scales, so superposition of the Agincourt traces and those from anywhere else is less helpful than usual in the detection of resemblances. The most uniform prominent feature in the other disturbances at Agincourt is a hump (swings first to West then to East) in the D trace, corresponding in time in a general way with the largest Antarctic movements.

There is a certain resemblance between the Agincourt D and Antarctic E′ traces, implying that easterly force in the Antarctic was accompanied on the whole by westerly force at Agincourt. (The second disturbance on May 5, 1912, is, however, an exception to this.) But there seems nothing at Agincourt corresponding to the large rapid oscillations in the Antarctic. For instance, on July 3, 11 and August 24, 1911, we have on the Agincourt D curve a large hump, with an almost smooth contour, at the time of large rapid E′ oscillations in the Antarctic. The phenomena exhibited by the Agincourt H curves are more irregular. On July 11, 1911, the prominent feature is a hump, the greater part of which anticipates the hump in the D curve and the larger movements in the Antarctic. On July 31 and August 24, 1911, and during the second disturbance of May 5, 1912, there were decided bays, that of August 24 being of considerable depth; while the disturbance of June 5, 1911, may be regarded as a double bay.

Disturbance was less at Eskdalemuir than at Agincourt. On May 16 and June 5, 1911, the movements, which are chiefly exhibited by the N and E curves, are of an irregular undulatory type, and the same is true generally of the other E curves.

The N curves, whilst also exhibiting numerous minor oscillations, show a decided tendency to form bays, but all these are shallow. The Eskdalemuir V traces show little signs of disturbance, some being practically straight lines; but on May 16, 1911, there are sensible undulations.

Sitka curves were available for all the disturbances of the group, except that of June 5, 1911. On May 16, 1911, trace was lacking during two short intervals, and as at Agincourt and Eskdalemuir the movements shown were of an unusually irregular character. On this occasion the movements which synchronised with the deep narrow bay in the Antarctic curves, though considerable, were not more prominent than the others. In fact the largest V movements and some of the largest movements in the other elements occurred a considerable time later than the principal movements in the Antarctic. On all the other occasions a characteristic and prominent feature at Sitka is the hump on the V trace. On May 21, 1911, and May 5, 1912, the range in V at Sitka exceeded that in either of the horizontal components; in fact on the latter occasion it slightly exceeded the range of the Antarctic V movement. A hump on the Sitka V trace and a bay in the Antarctic V trace both represent a force on the north pole of a magnet outwardly directed from the earth's centre; so in a way the principal V movements at the two places had the same sense. But there seems no equivalent in the Sitka traces to the very rapid V oscillations which form the deep bays in the Antarctic on July 3 and August 24, 1911, and May 5, 1912.

On July 3, 11 and August 24, 1911, there is a certain general resemblance between the Sitka H and Antarctic N′ curves, but the hump on the Sitka H curve on July 3 persists during part of the rapid fall in N′ in the Antarctic. On May 21, 1911, and May 5, 1912, we have on the contrary bays in the Sitka H curves synchronising with humps in the Antarctic N′ curves.

The Sitka D trace has a certain resemblance to the Antarctic E′ trace on May 21 and August 24, 1911, and during both disturbances of May 5, 1912; but on July 3 and 11, 1911, the traces are more like the inverse of one another. In no case does there seem any large rapid oscillation at Sitka to correspond to the large rapid oscillations in the Antarctic.

Section 85.—The examination of the short-period disturbances included in Plates XXVIII to XL shows that except in the Antarctic the disturbances were all essentially of the same kind. The most prominent feature at Mauritius, Buitenzorg, Alibag, Helwan and Eskdalemuir is a depression in H or N, which lasts during the principal Antarctic movements, but seems independent of their particular character. Honolulu differs from the stations previously mentioned only in that H is elevated instead of being depressed. This somewhat remarkable reversal of H movements at Honolulu was also seen in some of the longer storms presently to be described. Agincourt is intermediate in latitude between Helwan and Eskdalemuir, but the phenomena at Agincourt are quite unlike those at Eskdalemuir or at the more southern stations. In the first place, at Agincourt the D movements generally exceed those in H; and as declination at Agincourt is only about 5° W., the difference between D and E traces therr would be insignificant. Then, while there are bays in some of the Agincourt H traces, this is by no means always the case, and a more characteristic feature is a hump in the D trace, implying a deflection of the magnet to the West of its normal position during the height of the disturbance.

The disturbances at Sitka, the most northerly of the stations, are in every case nearest in amplitude to those in the Antarctic. Also, as in the Antarctic, it is the Sitka V trace which exhibits the greatest uniformity of type. There are in fact only two cases, May 16, 1911, and August 1, 1912, in which a hump is not conspicuous in the Sitka V trace.

There is nothing at any of the co-operating stations which suggests any special magnetic activity during the very large, rapid oscillations seen in the Antarctic on some occasions, notably May 16 and 21 and July 3, 1911. Thus these would seem to have been much more local in their incidence than the other movements.

The fact that the disturbances appear first to diminish as we recede from the Antarctic, and then increase—notably in the American stations—may raise a doubt whether the disturbances at Agincourt and Sitka were really connected with those seen in the Antarctic. But while disturbance at these stations is not so rare an event as to preclude the possibility of occasional accidental coincidences, it seems quite beyond the range of possibility that there should be on every single occasion an accidental coincidence of disturbance in the Antarctic and at Sitka. It will be remembered that a parallel phenomenon appeared in the case of sudden commencements, the amplitude tending to be decidedly greater at Eskdalemuir and Sitka than it was at Alibag or Helwan.

Section 86.—It was originally intended to take measurements from which the amplitudes and directions of the disturbance vectors might be found representing the changes in the elements in corresponding given intervals of time at the several stations. But after consideration this was not done. The frequency and considerable amplitude of the shorter period oscillations at some of the stations would have interfered with the accuracy of the results, because small errors in the time would in many instances have caused serious errors in the measurements. Another consideration was that at some of the stations most of the disturbances occurred at hours when the normal diurnal changes were rapid, and no satisfactory allowance could have been made for these changes, without an onerous investigation for which adequate material was not available. When a disturbance lasts only a few minutes, as was the case with the s.c's, the neglect of the regular diurnal variation is unlikely to have serious consequences, but it is otherwise when a disturbance lasts several hours, unless its range is very large compared with that of the diurnal inequality throughout the included time.

As, however, some idea of the relative magnitude of the disturbance experienced at different stations was highly desirable, exact measurements were made of the difference between the greatest and least ordinates which were met with during each disturbance. The resulting ranges are given in Table CXXXVII, p. 273, along with ranges during the included hours derived from the regular diurnal inequality. The latter are given in smaller type and are enclosed in parentheses.

Some of the inequality data were derived from information for individual months of 1911 and 1912, as published or as specially communicated by some of the observatories. Other inequality data represent means from a period of years. They should in no case be regarded as more than an approximation to the range to be expected in the average day's curve between the hours stated. At certain hours, a range derived from hourly readings—even when these represent readings at the exact hour from unsmoothed curves—is practically certain to be an underestimate of the true range, because the extreme values even in the regular diurnal variation do not naturally present themselves at exact hours G.M.T.

On the other hand, it must not be taken for granted that equality or approximate equality between the range actually measured and that derived from the regular diurnal inequality necessarily implies that disturbance was non-existent or very small. Take, for instance, the case of N at Buitenzorg on July 11, 1911. According to Table CXXXVII the observed and calculated ranges were respectively 30γ and 27γ, the difference 3γ being insignificant. But a glance at Plate XXXIII shows that the disturbance at Buitenzorg was really considerable. The disturbance caused a very decided bay or depression in N. But at that hour of the day there is naturally rather a rapid fall in N, and the lowest point reached during the bay represented a value of N but little lower than would naturally have been attained somewhat later in the day, but still within the time covered by the disturbance. Again the disturbance movement may be in the opposite direction to that normal at the hour, and the measured range in that case may be even less than that encountered during the same period of an undisturbed day. Further, it must be remembered that the interval, whether 2, 3 or 4 hours, to which the disturbance is assigned was naturally longer, on the average fully twice as long as the interval between the extreme readings.

The mean ranges given at the foot of Table CXXXVII were derived only from those disturbances in which traces were available of all the elements, except V at Mauritius and Agincourt. The Antarctic station and Eskdalemuir are the only stations for which there are data for all of the disturbances. The results from the other stations are not strictly comparable, as different disturbances are lacking at different stations, and the amplitudes vary considerably. Still the data at the foot of the table give a very fair general idea of the extent to which the different stations were affected by disturbances of the kind, and of the relative importance of the contribution from the regular diurnal variation. It is clear that at Honolulu, Agincourt and Sitka, as well as in the Antarctic, the neglect of the diurnal inequality would make little difference, and at Eskdalemuir it would not be serious, but it would be otherwise at Mauritius, Buitenzorg, Alibag, and Helwan, especially in the case of the declination or the easterly component.

The table helps to confirm what has been incidentally said as to the large amplitudes experienced at Agincourt, and still more at Sitka. At Mauritius and Honolulu, on the other hand, the amplitudes seem decidedly less than for stations whose latitude is either lower or higher.

It seems pretty clear that at the tropical stations disturbances of the kind illustrated tend to have the disturbing forces acting nearly in the magnetic or astronomical meridian, just as we found with the s.c's, but in the higher latitudes this is not the case. The vertical component increases notably in relative importance in the higher latitudes.

Section 87. To get a clearer idea of the relative importance of the different disturbances, the value was calculated of $\sqrt{\Delta H^2 + \Delta D^2 + \Delta V^2}$ $\sqrt{\Delta H^2 + \Delta D^2}$ at Mauritius and Agincourt) or $\sqrt{\Delta N^2 + \Delta E^2 + \Delta V^2}$, where ΔH, ΔD, &c.,

represent the ranges in the several elements given in Table CXXXVII. This was done both for the disturbance figures and for the inequality figures. The results are given in Table CXXXVIII, p. 275, the inequality data being in smaller type and enclosed in parentheses. The quantity tabulated—or perhaps better its square—gives a more accurate idea of the general intensity of the disturbance than is derivable from the range of any one element.

The order in which the disturbances present themselves when arranged according to magnitude varies a good deal at different stations. In particular, while the disturbance of July 3, 1911, comes first in the Antarctic, elsewhere it is rather below than above the average. The second disturbances on May 16, 1911, and May 5, 1912, are rather outstanding at all the stations, especially the more northern ones.

In comparing different stations, allowance must be made for the omission of V at Mauritius and Agincourt. Notwithstanding the absence of V, the Mauritius value is in every case larger than that for Honolulu, and the Agincourt value exceeds that for Eskdalemuir in 12 out of 15 cases. The smallness of the Honolulu figures is not improbably associated with the fact that the disturbances occurred at hours when the regular diurnal changes there were very slow. At Helwan, on the other hand, the disturbances occurred at times when the regular diurnal changes are rapid; but in spite of that the Helwan disturbance figure is usually a good deal lower than the corresponding Eskdalemuir figure. What is perhaps more surprising is that the Helwan figure is in every case but one less than that for Buitenzorg. The Antarctic figure is pre-eminent in every case, and the Sitka figure is invariably second.

Section 88.—Measurements were made of the Antarctic curves at some of the more prominent points which seemed to correspond in time on the traces of the three elements, with a view to seeing the direction and amplitude of the vectors to which the changes of force in the intervals considered might be assigned. The results appear in Table CXXXIX, p. 276, where $\overline{\overline{H}}$, T, ψ, χ, a, b, have the same meaning as in Table CXXX. It gives the times (in the time of 180° E.), as shown on the N′ traces, answering to the beginning and end of each interval for which the change in force was measured. There were small (nearly constant) differential parallax errors for the three elements, the N′ trace seeming to lag behind the E′ and V traces by about 0·6 mm. and 0·9 mm. respectively, on the average. These differences were determined from the relative positions of the three traces at the end or beginning of each day's record, and were allowed for in the identification of corresponding points on the curves.

It must be remembered that the direction of the resultant disturbing force was in general by no means constant during the interval dealt with. There were practically always minor oscillations superposed on the general movement in the trace of each element, and the intermediate oscillations were sometimes far from negligible. Thus the angles appearing in Table CXXXIX represent only a species of average direction of the disturbance vector for the times stated. In a good many cases the change of ordinate measured in one or even two of the traces was less than would have been obtained by selecting a shorter period of time, wholly included within the period selected. The highest and lowest points attained were seldom reached simultaneously in the three traces, and the choice made of the interval in any particular case was necessarily more favourable to a large range in one element than in the others. The case of April 30, 1911, will serve as an example of this. Two sets of results are given as alternatives for the first phase. The first alternative took as the end of the first phase a prominent peak (almost the highest) in E′. This had a corresponding peak in N′, which though also prominent fell short of the highest by about 1·5 mm. (13γ). A corresponding point is recognisable in the V trace, though somewhat insignificant, which is about 7 mm. (53γ) below the highest point of that trace. The second alternative took a point in V only 0·6 mm. (5γ) below the highest peak in that curve, which had corresponding peaks in the E′ and N′ curves. This N′ peak is a trifle higher than that given by the first choice, but the new E′ peak is lower than that first selected by 5·5 mm. (35γ). If our choice had been determined by V alone, we should have taken the highest peak which was reached about four minutes after the disturbance began, but this would have given on the E′ trace a point short of the summit employed in the first choice by 14·5 mm. (95γ).

In this particular case the end of the second phase was determined mainly from consideration of the V trace, which moved up the sheet smartly after the lowest point was passed. A later time—*i.e.*, a longer interval—would have been obtained if we had taken the lowest point on the N′ trace, and a still later time if we had taken the lowest point on the E′ trace. In either case we would have increased the horizontal and reduced the vertical component, and so got a smaller value for χ.

The first pair of entries under May 16, 1911, refer to the earlier disturbance on that date. The intervals were selected from consideration of the E′ trace; but in this instance the lowest points appeared simultaneously on the three traces. The downward movement was arrested, and even reversed for a few minutes, and a possible alternative would have been to take the time—12 minutes from the start—when the downward movement was resumed as the commencement of the deep bay. This would have given a very appreciably reduced amplitude to the fall, but by reducing its duration to 17 minutes would have given a greater mean rapidity of change.

In the second disturbance on May 16 the initial changes were of the type usually presented by the first phase of the special disturbance. There then set in what resembled at first the ordinary second phase movement, only it resulted in a deep bay. Here again, exactly as with the earlier disturbance of the day, there was a sensible arrest of the downward movement—especially in the E′ trace—and an alternative choice would have given for the deep bay a smaller fall, but an increased mean rate of fall. The final part of the fall in E′ was quite exceptionally rapid, amounting to 325γ in three minutes, or an average rate of 108γ per minute. In the measurement of so short a time interval there is of course a possibility of error, but the turning points used were very clearly shown, and the error could hardly have exceeded the equivalent of 0·1 mm., *i.e.*, 0·3 minute. The rise was interrupted by oscillations. During part of it there was a rise of 420γ in the course of 13 minutes.

On May 21, 1911, there was apparently an ordinary first phase-movement, well shown in both E′ and N′, followed by what seemed at first the ordinary second-phase movement. But after this had been in progress for some 15 minutes, there was a sharp reversal in E′ and N′. In E′ the reversal brought the curve nearly up to the level attained at the end of the first phase. In this instance it seemed more natural to regard the steep bay as commencing with this second summit in E′. In 6 minutes E′ had fallen 357γ, giving a mean rate of 60γ per minute. In the course of the next 3 minutes there was a large oscillation in E′, not clearly shown in the original owing to faintness of trace. This brought E′ back to nearly the level of the lowest point, and the lowest level in the N′ trace answers to this second point in E′. In this instance it seemed fairest to omit the 3 minutes occupied by the E′ oscillation, regarding the downward movement in the bay as terminating with the commencement of the oscillation, and the upward movement as beginning with its termination.

The movements on June 5, 1911, described as first and second phases, are hardly normal examples of the "special type"; and they were followed by a series of oscillatory movements, one of which, so far as E′ and V are concerned, might fairly have been described as a deep bay. In fact, the disturbance in N′ hardly suggested the ordinary "special type," but rather a succession of independent oscillations.

The disturbance of July 3, 1911, presented features somewhat similar to those of the larger disturbance of May 16; but if any time intervened between the end of the first phase—which appeared a normal example of the special type—and the descent proper into the deep bay it was only a few minutes at most. In this case E′ fell 617γ in 13 minutes. During the first 6 minutes there was an arrest and reversal of the E′ movement, and during the remaining 7 minutes there was a fall of 588γ, giving an average rate of 84γ per minute. During the first 5 minutes of the rise there was a large oscillation; the rise during the last 8 minutes amounted to 495γ, giving a mean rate of 62γ per minute.

On July 11, 1911, the major part of the fall recorded took place in the last 6 minutes. The commencing movements in E′ and V were suggestive of the "special type," but the first movement in N′ was down the sheet, and the general impression produced by the traces was rather that of a succession of waves.

July 12, 1911, was a fairly normal example of the "special type." The time assigned for the end of the second phase was based on the N′ and V curves; the E′ curve would have suggested a longer interval.

On July 20 and July 31, 1911, the disturbances at the commencement seemed fairly normal examples of the "special type," and limits could fairly be assigned to the first phase, though on July 20 the E′ trace suggested a longer interval than that taken. But in both instances the subsequent course of the curves suggested the intervention of disturbance of a different type.

On August 24, 1911, the earlier part of the disturbance seems of the usual "special type," the only difficulty being to ascribe a definite time for the end of the first phase.

The time selected is that suggested by the N′ curve. The extreme summit in V appeared 12 minutes earlier and that in E′ 15 minutes later. The points in the N′ and V traces corresponding to the highest point in E′ are easily recognisable, and may fairly be regarded like it as marking the commencement of the fall, which initiates the deep narrow bay, particulars of which appear in the table. During the recovery, forming the other half of the bay, there were numerous oscillations. The time assigned as the end of the bay is that suggested by the E′ curves. By extending the duration of the bay by 14 minutes we should get larger rises in N′ and V, but a much smaller mean rate of rise in all the elements. Any choice must be arbitrary as the curves remained somewhat highly disturbed for many hours.

The figures for May 5, 1912, in Table CXXXIX refer to the first and smaller of the two disturbances. The E′ and V traces suggest the commencement of a disturbance of the "special type" shortly after 20 h., and after rising a little the V trace proceeded, though slowly, to go down the sheet in the usual way; but after reaching its summit, the E′ trace showed no marked tendency to come down the sheet, until nearly an hour had elapsed, and the N′ trace gave no indication of special disturbance until nearly 21 h. Thus the deep bay in the three traces was the only thing suggesting itself for measurement.

On June 2, 1912, the time selected as the end of the first phase gives the full extent of the initial rise in V. The highest summits in the E′ and N′ curves appeared a few minutes later, but not simultaneously, and the selection of either as the limit to the phase would have failed to indicate the true nature of the commencing V movement. Similarly the time selected as the end of the second phase shows the full fall only in V. By extending the second phase 24 minutes, we should have considerably increased the falls in E′ and N′, but have included a large part of the recovery in V. If the alternatives indicated had been selected, there would naturally have resulted considerably smaller values for χ in both phases.

The E′ and V traces on June 3 and August 1, 1912, present several of the features of the "special type," but the N′ traces were peculiar, and the vector in Table CXXXIX, during what has been called the first phase, lies in a different quadrant from that usual in "special type" disturbances.

The seven deep bays included in Table CXXXIX appear fairly similar in type. The results obtained by taking the mean values of ΔE′, ΔN′ and ΔV and calculating a resultant force therefrom—which we may regard as an algebraic mean—and the results obtained by taking the arithmetic means of the values of $\overline{\overline{\mathrm{H}}}$, T, ψ and χ given in Table CXXXIX are as follows:—

Deep Bays.	$\overline{\overline{\mathrm{H}}}$.	T.	ψ.	χ.
	γ	γ	°	°
Fall { Algebraic mean	359	454	251	38 *a*
Fall { Arithmetical mean	363	464	247	39 *a*
Rise { Algebraic mean	293	343	74	31 *b*
Rise { Arithmetical mean	299	350	70	31 *b*

From either point of view, the rise is decidedly less than the fall. The components of the rise and fall movements in the horizontal plane are nearly directed oppositely to one another. The recovery, however, in the horizontal components exceeds on the average that in the vertical component. Thus the inclination of the resultant vector below the horizon in the rise is less than the corresponding inclination above the horizon in the fall.

Section 89.—Particulars of the more normal examples of the special type of disturbance, omitting any already discussed in Table CXXXIX, are given in Table CXL, p. 277. The end of the first phase and the durations of the two phases supply complete information as to the times. Only such disturbances were included as gave a plus sign, or zero value, to the commencing movements in both E′ and N′. In fixing the times, chief regard was had to the E′ and N′ traces. If the V trace had served as the criterion, the duration of the first phase would in many cases have been shortened. The dates to which an asterisk is attached are occasions in which the maximum appeared in the V trace before the time accepted as the end of the first phase. In all such cases the value of ΔV assigned to the first phase would have been algebraically larger, and that assigned to the second phase numerically larger, if the end of the first phase had been fixed by consideration of the V trace alone.

The means from the 30 occasions of 1911, the 28 of 1912 and the combined 58 are given at the foot of the table.

In the 1902–04 volume analogous particulars are given in Table LXIX, pp. 187 and 188, for 82 examples of the "special type." The mean durations given there were 17·0 minutes for the first and 20·5 minutes for the second phase. Thus, in either case, the second phase appears to be the longer, but its excess appears to be greater for the later period.

In 1902–03 a considerable proportion of the records were not quite complete, owing to loss of trace, and this naturally was especially true of the larger disturbances. In 1911–12 all the records were complete. There was thus a possibility that any comparison between complete records of the two epochs might be misleading through the absence of an undue proportion of the larger disturbances of 1902–03. Again no disturbance was included in Table CXL in which $\Delta N'$ had a negative sign in the first phase. On the other hand in Table LXXII (1902–04 vol.), which dealt with those disturbances of 1902–03 of which records were complete, some disturbances were included in which the sign of ΔH in the first phase was abnormal, while all disturbances happening between October and March were excluded. Accordingly a variety of results obtained for the representative disturbance are included in Table CXLI, p. 278. They are calculated from the arithmetic mean of the values of $\Delta E'$, $\Delta N'$ and ΔV for certain specified groups of disturbances of the special type. For 1911 and 1912 data are given from all the disturbances of the separate years, and for the two combined, and also for half the disturbances—15 for 1911, 14 for 1912, and 29 for the two years combined—including those in which the amplitude of disturbance was least. Two sets of results are also given for 1902–03, the first being the mean results given in Table LXXII of the old volume, and the second mean results from 50 disturbances including all for which the record was complete, and in which the first-phase movement in H had the ordinary sign.

The values obtained for ψ in both phases are greater for the 29 smaller disturbances of 1911–12 than for the whole 58, but as there is a difference in this respect between 1911 and 1912, the result may be accidental. In any case, the absence of the larger disturbances in 1902–03 affords no explanation of the smaller values obtained then for ψ. The divergence between the earlier and later results would be increased if we supposed the value of H in the magnetograph room in 1902–03 to be over-estimated, because any such error would have entailed a corresponding overestimate of the component of disturbing force perpendicular to the magnetic meridian, and so increased the estimated value of ψ.

In 1911–12 the smaller disturbances show a larger value for χ in the first phase, and a smaller value in the second phase, in both respects showing a closer approach than the larger disturbances to the 1902–03 results.

It will be noticed that the disturbances included in Table CXL are confined to a limited part of the day. All the times assigned for the end of the first phase are included between 17 h. and 24 h. Of the 58 disturbances, 20 occur between 19 h. and 20 h., 17 between 20 h. and 21 h., 10 between 21 h. and 22 h., 8 between 18 h. and 19 h., 2 between 23 h. and 24 h., and 1 between 17 h. and 18 h. Also all but 6 of the occurrences are found between March and September; and May and June between them supply 25 out of the 58. In 1902–03 the large majority of the disturbances of the "special type" took place in May, June, July, or August, and the end of the first phase presented itself in fully half between 8 p.m. and 10 p.m. L.M.T. Thus the phenomenon seems to be mainly developed in winter, and in the late evening, *i.e.*, at a season and at a time of the day when Antarctic conditions are normally quieter than usual. Some allowance, however, should be made for the fact that during a naturally disturbed time a disturbance of the kind would not so readily catch the eye, and also there would be more chance of its being obscured by the superposition of irregular disturbances from an independent source.

The first phase in the special type and the rise in the deep bays included in Table CXXXIX present some features in common, and the same is true of the second phase in the special type and the fall in the deep bays. On the average, however, the vectors calculated for the first and second phases, especially the first phase, make a smaller angle with the horizontal plane, and the horizontal components of the first and second phase vectors have a smaller inclination to the magnetic meridian.

"Repetitions" of Disturbances.

Section 90.—The fact that disturbances closely resembling one another sometimes happen about the same hour of successive days, or after an interval of two or more days, seems to have been first noticed by Señor Capello in the Lisbon curves. The phenomenon has since been observed at other places. Describing it in his celebrated article dealing with "Terrestrial Magnetism" in the 9th edition of the 'Encyclopædia Britannica,' Balfour Stewart employed language almost prophetic of that now used in connection with radio-activity. Elsewhere I have described a number of examples of the phenomenon at Kew Observatory. In discussing these, I pointed out the difficulty of deciding whether any real connection existed between the successive disturbances. If disturbances of a certain type tend to occur near fixed hours of the day, and if they are fairly numerous, we should naturally expect occasional examples of apparent repetitions. In meteorology we have at some stations an almost regular development of thunderstorms in certain afternoon hours, at certain seasons of the year. An apparent repetition of a thunderstorm in such a case presumably means only that the same consequence has followed from similar causes; it does not imply any specially close connection between the storms on consecutive days. But it is difficult to be certain that the absence of a storm on a particular day would be without prejudice to the occurrence of a storm on the next.

Plate XLI contains examples of "repetitions" in the Antarctic. Curves for the same element, whether E′, N′ or V, from the different occasions are juxtaposed, to assist the eye in gauging their similarity. The resemblance between curves 1 and 2 of Fig. A, belonging respectively to July 16 and July 17, 1911, is particularly close.

The commencements in the E′ traces are sharp, and the times shown are 17 h. 30 m. (time of 180° E.) on July 16, and 17 h. 33 m. on July 17. As the times of stopping registration are recorded only to the nearest minute, the differential error between the two days' curves may amount to one or two minutes. But, in any case, we have in this instance two disturbances quite extraordinarily alike in both duration and amplitude in all three elements, following one another at an interval of almost exactly 24 hours. So far as the E′ and V traces are concerned, these two disturbances are quite of the ordinary special type, but the N′ movements are exactly the opposite of those usual, consequently the disturbances are not included in Table CXL.

The remaining disturbances in Fig. A are numbered 3, 4 and 5. The resemblance between Nos. 1 and 3, especially in the N′ and V curves, is particularly close. The E′ disturbance No. 3 is, however, distinctly larger than the others. Nos. 4 and 5 were originally selected as an independent example of a "repetition" exhibiting an interval of approximately 48 hours (more exactly 49 h. 4 m.). It was then noticed that the E′ and V traces No. 4 bore a remarkable resemblance to the corresponding traces Nos. 1 and 2. The N′ traces Nos. 4 and 5, especially 5, show a transition towards the ordinary "special type" form, and the two disturbances are in fact included in Table CXL. The juxtaposing of the five sets of traces was done partly with the object of bringing this transition clearly out. No. 5, it will be noticed is decidedly smaller, especially in V, than No. 4, and its duration appears to be less. Still the resemblance appeals at once to the eye. The curves of both days, it may be added, contained no disturbance at all comparable in size with those shown, for a number of hours on either side of them. The intervening day, June 14, 1912, was more disturbed. It contained a disturbance commencing about two hours *earlier* than that on June 13, which bore some resemblance to the "special type." The N′ trace, however, showed only a bay, somewhat similar to, but shallower than the bays in Nos. 1 and 2, and the general appearance of the curves would not naturally suggest a connection with Nos. 4 and 5.

Fig. B, Plate XLI, similarly juxtaposes traces of the curves for the same elements from four days, two of these, May 2 and 3, 1911, being successive days. These four disturbances are included in Table CXL.

May 2 was a considerably more disturbed day than May 3, and the disturbance on May 2, *i.e.*, No. 1, is considerably the larger, especially in V. Still the general resemblance of the disturbances is sufficiently striking in view of their occurrence on successive days, at an interval approaching 24 hours (more exactly 22 h. 40 m.). It will be seen, however, that the resemblance between Nos. 1 and 2 is less close than between either Nos. 2 and 3, or Nos. 2 and 4. The interval between Nos. 2 and 3 was about two days (more exactly 47 h. 20 m.). But No. 4, whose resemblance to No. 2 is at least as close as that of No. 3, followed seven weeks later (very nearly at the same hour as No. 2), and can hardly be supposed to be directly associated with any of the other disturbances in Fig. B, unless it be a "repetition" of No. 1 according to the 27-day period, with the intermediate "repetition" missing.

The afternoon of May 4, the day intermediate between disturbances Nos. 2 and 3, was quieter than that of either of the adjacent days, and it exhibits no disturbance the least resembling Nos. 2 and 3, in fact no disturbance of any kind at all approaching them in magnitude. The absence of disturbance on the intermediate day is an obvious difficulty in the way of accepting any direct connection between disturbances Nos. 2 and 3.

All the disturbances shown in Plate XLI, except in No. 3, Fig. A, occurred when the sun was below the horizon, but apparent "repetitions" are not infrequently observed during day hours at Kew, and their non-recognition during the Antarctic midsummer might well arise from the fact that disturbances were then so numerous, and oscillations so rapid, that recognition of resemblances was much less easy.

TABLE CXXXVII.—Ranges During Short-Period Disturbances.

Date.	Time. G.M.T.	Antarctic.			Mauritius.		Buitenzorg.			Alibag.		
		$\Delta N'$	$\Delta E'$	ΔV	ΔH	ΔD	ΔN	ΔE	ΔV	ΔH	ΔD	ΔV
1911.		γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
April 30	7 h.–10 h.	143 (40)	234 (15)	287 (13)	24 (10)	27 (23)	75 (17)	13 (6)	28 (12)	43 (19)	—	—
May 16	2 h.–4 h.	155 (10)	202 (21)	301 (13)	—	21 (5)	22 (7)	10 (5)	6 (8)	22 (19)	—	—
,, 16	4 h.–8 h.	276 (33)	559 (17)	388 (18)	25 (4)	29 (17)	68 (27)	13 (20)	8 (3)	17 (10)	—	—
,, 21	9 h.–12 h.	250 (21)	373 (19)	337 (3)	40 (13)	15 (11)	48 (7)	15 (10)	18 (9)	56 (13)	20 (24)	7 (6)
June 5	7 h.–10 h.	77 (24)	324 (17)	235 (10)	40 (10)	14 (16)	73 (14)	18 (7)	24 (12)	38 (21)	—	—
July 3	7 h.–10 h.	242 (25)	617 (10)	426 (23)	16 (4)	23 (18)	35 (20)	11 (9)	13 (13)	18 (15)	11 (12)	9 (17)
,, 11	6 h.–9 h.	126 (35)	189 (8)	265 (20)	21 (5)	11 (10)	30 (27)	18 (18)	8 (8)	15 (9)	12 (19)	16 (13)
,, 12	7 h.–10 h.	125 (25)	154 (10)	113 (23)	15 (4)	14 (18)	35 (20)	10 (9)	8 (13)	—	—	—
,, 20	6 h.–9 h.	97 (35)	163 (8)	169 (20)	17 (5)	15 (10)	34 (27)	26 (18)	9 (8)	14 (9)	11 (19)	25 (13)
,, 31	8 h.–10 h.	135 (20)	198 (9)	218 (11)	16 (2)	32 (15)	31 (10)	4 (4)	11 (10)	24 (14)	—	—
August 24	8 h.–10 h.	233 (12)	234 (11)	285 (8)	28 (5)	23 (20)	25 (11)	7 (4)	10 (9)	16 (16)	—	—
1912.												
April 5	3 h.–5 h.	93 (15)	103 (10	59 (12)	—	—	—	—	—	—	—	—
May 5	8 h.–10 h.	144 (9)	151 (9)	211 (6)	34 (8)	19 (12)	58 (10)	11 (4)	24 (12)	56 (11)	15 (18)	10 (15)
,, 5	10 h.–13 h.	398 (9)	262 (13)	263 (8)	63 (8)	21 (8)	54 (3)	20 (9)	22 (4)	68 (7)	23 (13)	9 (6)
,, 13	0 h.–3 h.	225 (11)	191 (17)	82 (7)	16 (7)	—	32 (18)	19 (15)	18 (6)	27 (11)	—	—
June 2	6 h.–9 h.	102 (21)	176 (5)	152 (12)	7 (7)	8 (9)	25 (18)	8 (13)	7 (6)	11 (11)	—	—
,, 3	5 h.–8 h.	78 (24)	196 (11)	272 (11)	19 (6)	—	42 (19)	14 (15)	9 (2)	23 (4)	22 (26)	13 (13)
August 1	3 h.–6 h.	142 (16)	248 (13)	261 (14)	22 (5)	19 (25)	52 (8)	28 (12)	17 (8)	24 (20)	—	—
Numerical mean		169 (21)	254 (12)	240 (13)	26 (6)	19 (15)	43 (15)	14 (10)	14 (8)	36 (10)	16 (19)	13 (12)
Number of days mean taken from		18	18	18	14	14	17	17	17	7	7	7

TABLE CXXXVII—*continued.*

Date.	Time. G.M.T.	Honolulu.			Helwan.			Agincourt.		Eskdalemuir.			Sitka.		
		ΔH	ΔD	ΔV	ΔH	ΔD	ΔV	ΔH	ΔD	ΔN	ΔE	ΔV	ΔH	ΔD	ΔV
		γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
1911.															
April 30	7 h.–10 h.	16 (1)	12 (0)	6 (0)	21 (24)	35 (41)	12 (8)	32 (15)	16 (20)	54 (23)	50 (6)	18 (2)	140 (4)	159 (1)	100 (8)
May 16	2 h.–4 h.	—	—	—	14 (2)	18 (15)	3 (3)	53 (5)	69 (2)	51 (2)	21 (3)	28 (0)	66 (3)	90 (12)	21 (0)
,, 16	4 h.–8 h.	—	—	—	37 (14)	29 (22)	26 (22)	111 (7)	131 (10)	81 (14)	83 (17)	27 (7)	127 (5)	150 (5)	135 (2)
,, 21	9 h.–12 h.	17 (3)	11 (3)	5 (1)	—	—	—	—	—	57 (12)	46 (34)	11 (7)	112 (4)	90 (2)	151 (6)
June 5	7 h.–10 h.	—	—	—	27 (23)	28 (35)	8 (10)	62 (1)	94 (13)	53 (15)	33 (9)	5 (4)	—	—	—
July 3	7 h.–10 h.	20 (2)	11 (1)	6 (1)	—	—	—	32 (2)	66 (13)	23 (22)	19 (8)	6 (4)	45 (5)	111 (2)	61 (6)
,, 11	6 h.–9 h.	—	—	—	—	—	—	38 (2)	43 (10)	31 (21)	19 (3)	6 (2)	82 (4)	103 (5)	43 (4)
,, 12	7 h.–10 h.	—	—	—	—	—	—	—	—	31 (22)	26 (8)	10 (4)	69 (5)	44 (2)	42 (6)
,, 20	6 h.–9 h.	—	—	—	—	—	—	28 (2)	63 (10)	39 (21)	16 (3)	8 (2)	68 (4)	115 (5)	56 (4)
,, 31	8 h.–10 h.	—	—	—	—	—	—	20 (2)	50 (13)	36 (15)	23 (8)	5 (3)	80 (3)	61 (2)	49 (3)
August 24	8 h.–10 h.	28 (2)	14 (0)	12 (1)	24 (20)	9 (19)	—	37 (1)	82 (15)	44 (17)	34 (11)	8 (6)	77 (3)	117 (4)	79 (1)
1912.															
April 5	3 h.–5 h.	—	—	—	—	—	—	—	—	23 (1)	24 (3)	4 (2)	—	—	—
May 5	8 h.–10 h.	29 (2)	14 (1)	10 (2)	21 (20)	35 (21)	28 (3)	35 (5)	33 (9)	55 (15)	34 (12)	7 (6)	69 (2)	115 (1)	53 (1)
,, 5	10 h.–13 h.	40 (2)	13 (5)	11 (1)	63 (10)	44 (7)	33 (16)	55 (12)	141 (15)	85 (10)	70 (27)	9 (4)	221 (3)	173 (9)	282 (2)
,, 13	0 h.–3 h.	—	—	—	—	—	—	95 (3)	255 (9)	74 (4)	37 (3)	70 (4)	223 (14)	108 (14)	153 (6)
June 2	6 h.–9 h.	—	—	—	—	—	—	30 (3)	46 (5)	19 (16)	19 (3)	3 (3)	—	—	—
,, 3	5 h.–8 h.	—	—	—	—	—	—	33 (2)	56 (2)	36 (15)	43 (9)	7 (1)	—	—	—
August 1	3 h.–6 h.	—	—	—	33 (15)	19 (15)	12 (6)	39 (2)	71 (4)	69 (4)	61 (4)	18 (4)	109 (3)	161 (3)	148 (3)
Numerical mean		25 (2)	12 (2)	8 (1)	31 (15)	30 (22)	17 (10)	47 (4)	81 (10)	48 (13)	37 (10)	14 (3)	106 (4)	114 (5)	98 (4)
Number of days mean taken from		6	6	6	7	7	7	15	15	18	18	18	14	14	14

TABLE CXXXVIII.—Short-Period Disturbances. Values of $(\Delta N^2 + \Delta E^2 + \Delta V^2)^{\frac{1}{2}}$ or Similar Quantity (Unit 1γ).

Date.	Time. G.M.T.	Antarctic.	Mauritius.	Buitenzorg.	Alibag.	Honolulu.	Helwan.	Agincourt.	Eskdalemuir.	Sitka.
1911.										
April 30	7 h.–10 h.	397 (45)	36 (25)	81 (22)	—	21 (1)	43 (48)	36 (25)	76 (24)	234 (9)
May 16	2 h.–4 h.	394 (27)	—	25 (12)	—	—	23 (15)	87 (5)	62 (4)	114 (12)
,, 16	4 h.–8 h.	734 (41)	38 (17)	70 (34)	—	—	54 (34)	172 (12)	119 (23)	238 (7)
,, 21	9 h.–12 h.	561 (28)	43 (17)	53 (15)	60 (29)	21 (4)	—	—	74 (37)	208 (8)
June 5	7 h.–10 h.	408 (31)	42 (19)	79 (20)	—	—	40 (43)	113 (13)	63 (18)	—
July 3	7 h.–10 h.	788 (35)	28 (18)	39 (25)	23 (26)	24 (2)	—	73 (13)	30 (18)	134 (8)
,, 11	6 h.–9 h.	349 (41)	24 (11)	36 (33)	25 (19)	—	—	57 (10)	37 (21)	139 (8)
,, 12	7 h.–10 h.	228 (35)	21 (18)	37 (25)	—	—	—	—	42 (24)	92 (8)
,, 20	6 h.–9 h.	254 (41)	23 (11)	44 (33)	31 (19)	—	—	69 (10)	43 (21)	145 (8)
,, 31	8 h.–10 h.	324 (25)	36 (15)	33 (15)	—	—	—	54 (13)	43 (17)	112 (5)
August 24	8-h.–10 h.	436 (18)	36 (21)	28 (15)	—	34 (2)	—	90 (15)	56 (21)	161 (5)
1912.										
April 5	3 h.–5 h.	151 (22)	—	—	—	—	—	—	34 (4)	—
May 5	8 h.–10 h.	297 (14)	39 (14)	64 (16)	59 (27)	34 (3)	49 (29)	48 (10)	65 (20)	144 (2)
,, 5	10 h.–13 h.	544 (18)	67 (11)	62 (10)	72 (16)	43 (5)	84 (20)	151 (19)	110 (29)	398 (10)
,, 13	0 h.–3 h.	306 (21)	—	41 (24)	—	—	—	272 (9)	108 (6)	291 (21)
June 2	6 h.–9 h.	254 (25)	11 (11)	27 (23)	—	—	—	55 (6)	27 (17)	—
,, 3	5 h.–8 h.	344 (29)	—	45 (24)	34 (24)	—	—	65 (3)	57 (18)	—
August 1	3 h.–6 h.	387 (25)	29 (25)	61 (16)	—	—	40 (22)	81 (4)	94 (7)	244 (5)

TABLE CXXXIX.—Short-Period Disturbances. Analysis of Antarctic Movements.

Date.	Approximate Times. (Time of 180° E) From.	To.	Interval (Minutes).	Nature of movement.	H.	T.	ψ.	χ.
1911.	h. m.	h. m.			γ	γ	°	°
April 30...	19 34	20 8	34	First phase, first alternative ...	211	215	73	11 *a*
,, 30...	19 34	19 57	23	First phase, second alternative ...	157	157	60	4 *b*
,, 30...	20 8	20 25	17	Second phase, first alternative ...	168	285	250	54 *a*
,, 30...	19 57	20 25	28	Second phase, second alternative	138	314	240	64 *a*
May 16 ...	14 32	15 1	29	Fall in deep bay	211	369	258	55 *a*
,, 16 ...	15 1	15 11	10	Rise in deep bay	204	267	79	40 *b*
,, 16 ...	16 20	16 36	16	First phase	177	180	86	10 *b*
,, 16 ...	16 36	17 17	41	Fall in deep bay	583	701	261	34 *a*
,, 16 ...	17 17	17 47	30	Rise in deep bay	505	568	84	27 *b*
,, 21 ...	21 9	21 50	41	First phase	192	196	39	11 *a*
,, 21 ...	22 13	22 19	6	Fall in deep bay	381	433	257	28 *a*
,, 21 ...	22 22	22 52	30	Rise in deep bay	331	347	83	18 *b*
June 5 ...	19 39	20 3	24	First phase	114	114	78	0
,, 5 ...	20 3	20 32	29	Second phase	205	293	259	46 *a*
July 3 ...	19 49	20 9	20	First phase	167	167	68	1 *a*
,, 3 ...	20 9	20 22	13	Fall in deep bay	663	780	256	32 *a*
,, 3 ...	20 22	20 35	13	Rise in deep bay	510	623	75	35 *b*
,, 11 ...	18 39	19 5	26	Fall in deep bay	219	312	243	45 *a*
,, 11 ...	19 5	19 16	11	Rise in deep bay	180	226	65	37 *b*
,, 12 ...	19 38	19 51	13	First phase	151	151	61	4 *b*
,, 12 ...	19 51	20 16	25	Second phase	148	183	224	36 *a*
,, 20 ...	18 36	18 46	10	First phase	101	102	64	9 *b*
,, 31 ...	20 0	20 15	15	First phase	111	111	55	6 *b*
August 24	20 8	20 36	28	First phase	170	171	48	4 *b*
,, 24	20 36	21 2	26	Fall in deep bay, first alternative	311	410	230	41 *a*
,, 24	20 52	21 2	10	Fall in deep bay, second alternative.	299	377	239	38 *a*
,, 24	21 2	21 13	11	Rise in deep bay	221	251	63	28 *b*
1912.								
May 5 ...	21 17	21 34	17	Fall in deep bay	190	242	228	38 *a*
,, 5 ...	21 34	21 39	5	Rise in deep bay	142	171	38	34 *b*
June 2 ...	18 53	19 3	10	First phase	115	117	73	8 *b*
,, 2 ...	19 3	19 27	24	Second phase	103	182	242	55 *a*
,, 3 ...	17 11	17 51	40	First phase	187	187	95	1 *a*
,, 3 ...	17 51	18 32	41	Second phase	136	163	257	34 *a*
August 1	15 14	16 17	63	First phase	195	196	106	5 *a*
,, 1	16 17	16 52	35	Second phase	261	349	257	41 *a*

TABLE CXL.—Analysis of Antarctic Disturbances of the "Special Type."

Date	End of first phase. Time of 180° E.	First Phase.				Second Phase.			
		Duration.	ΔN′.	ΔE′.	ΔV.	Duration.	ΔN′.	ΔE′.	ΔV.
1911.	h. m.	Mins.	γ	γ	γ	Mins.	γ	γ	γ
February 20*	20 37	13	+ 19	+ 34	+ 2	34	− 30	− 48	− 23
April 10* ...	21 48	13	+ 85	+ 70	+ 8	14	− 38	− 52	− 24
,, 26 ...	19 5	15	+107	+ 99	+12	22	− 97	− 78	− 45
May 2* ...	20 32	13	+ 37	+ 52	− 8	38	− 48	−105	− 78
,, 3* ...	19 9	10	+ 25	+ 47	+ 2	29	− 28	− 43	− 24
,, 5 ...	18 30	10	+ 11	+ 61	+ 8	25	− 24	− 59	− 38
,, 8* ...	20 10	18	+ 46	+109	+ 8	36	− 30	− 96	− 49
,, 12 ...	17 7	12	+ 35	+ 98	+16	15	− 46	− 66	− 33
,, 13 ..	19 40	7	+ 8	+ 32	+ 6	17	− 4	− 20	− 16
,, 13 ..	20 9	12	+ 21	+ 45	+ 8	16	− 15	− 40	− 26
,, 19 ..	20 10	9	+ 64	+ 47	+15	35	− 42	−120	−154
,, 20 ..	20 34	9	+ 37	+ 70	+ 9	24	− 28	− 40	− 38
,, 23* ...	18 49	15	0	+ 71	− 2	21	− 13	− 78	− 18
,, 29* ...	18 24	15	+ 22	+ 72	+ 6	16	− 40	− 66	− 30
June 10* ..	19 16	7	+ 91	+104	+19	30	− 41	−107	− 45
,, 13 ..	19 10	6	+148	+102	+32	12	− 78	− 28	− 53
,, 13 ...	19 26	4	+ 75	+ 71	+24	17	−146	− 97	− 96
,, 16* ..	18 22	13	+ 41	+ 71	+ 8	22	− 52	− 66	− 25
,, 23* ...	19 29	4	+ 41	+ 48	+10	23	− 39	− 56	− 49
,, 25 ...	19 20	12	+ 14	+ 38	+ 3	24	− 24	− 42	− 19
,, 27 ...	20 32	5	+ 16	+ 15	+ 3	11	− 15	− 14	− 9
July 2 ...	20 11	59	+131	+106	+ 4	19	− 55	− 47	− 40
,, 18* ..	19 16	40	+ 81	+128	−15	27	− 49	− 84	− 47
,, 22* ...	21 29	22	+ 87	+ 61	− 5	33	− 76	− 69	− 79
August 3* ...	21 7	28	+ 95	+ 57	− 8	40	− 87	− 66	− 47
,, 14 ...	23 52	14	+ 58	+ 27	+ 2	28	− 55	− 29	− 30
,, 28* ...	18 59	18	+ 67	+ 88	0	22	− 76	− 84	− 49
,, 31* ...	20 20	28	+138	+123	− 4	37	−114	− 67	− 80
September 13*	21 55	27	+148	+ 59	− 9	42	−136	− 70	− 49
October 20* ...	19 57	18	+ 95	+130	− 5	30	−106	−106	− 40
1912.									
January 13* ...	18 51	26	+184	+301	+14	48	−162	−337	−113
February 12 ...	21 10	15	+ 75	+ 41	+ 8	37	− 57	− 85	− 32
,, 15 ...	21 41	10	+ 31	+ 30	+ 6	18	− 30	− 26	− 16
March 2 ...	19 52	9	+ 30	+ 32	+ 6	28	− 48	− 42	− 24
,, 15 ...	21 34	11	+ 49	+ 48	+ 6	18	− 32	− 39	− 23
,, 21* ...	21 57	35	+ 75	+ 58	− 9	27	− 61	− 77	− 29
,, 24 ...	19 9	10	+ 10	+ 40	+ 8	36	− 20	− 39	− 16
,, 24 ...	20 11	26	+ 40	+ 26	+ 6	25	− 32	− 29	− 10
,, 30 ...	18 37	15	+ 8	+ 78	+ 8	14	− 27	− 32	− 25
May 2* ...	19 3	27	+ 27	+ 74	0	23	− 17	− 57	− 29
,, 8... ...	21 48	24	+ 22	+ 47	− 4	24	− 37	− 65	− 48
,, 26... ...	20 59	20	+ 48	+ 45	− 2	31	− 42	− 37	− 30
June 8* ...	19 8	19	+ 34	+131	− 2	26	− 70	−123	− 76
,, 13... ...	18 24	10	+ 1	+ 39	+ 2	12	− 16	− 29	− 24
,, 15... ...	19 24	7	+ 10	+ 24	+ 5	12	− 9	− 14	− 10
,, 27* ...	20 48	23	+ 32	+ 51	0	27	− 87	− 68	−103
July 17... ...	20 58	18	+ 20	+ 38	+ 3	23	− 20	− 30	− 17
,, 20* ...	19 40	16	+ 27	+ 74	+ 8	24	− 31	− 27	− 36

TABLE CXL.—*continued.*

Date.	End of first phase. Time of 180° E.	First Phase.				Second Phase.			
		Duration.	ΔN′.	ΔE′.	ΔV.	Duration.	ΔN′.	ΔE′.	ΔV.
1912.	h. m.	Mins.	γ	γ	γ	Mins.	γ	γ	γ
August 7 ...	20 12	12	+ 36	+ 45	+ 2	34	− 38	− 59	− 24
,, 19 ...	21 9	7	+ 88	+ 79	+17	24	− 40	− 65	− 63
,, 20* ...	20 38	16	+ 29	+ 28	+ 2	17	− 25	− 23	− 13
,, 22* ...	19 37	16	+ 25	+ 54	− 1	29	− 55	− 52	− 43
,, 24 ...	20 20	22	+ 75	+ 59	+ 8	30	− 68	− 46	− 36
September 2 ...	19 54	7	+ 20	+ 23	+ 7	20	− 20	− 32	− 14
,, 2 ...	20 38	24	+ 33	+ 27	+ 8	34	− 25	− 32	− 13
,, 8*...	19 45	12	+ 42	+ 66	+10	49	− 36	− 56	− 40
,, 14 ...	23 9	15	+ 19	+ 48	+11	20	− 28	− 51	− 23
October 14* ...	19 53	19	+ 46	+ 95	− 2	37	− 60	−103	− 78
Means, 1911 (30 cases) ...		15·9	+61·5	+71·2	+4·9	25·3	−54·4	−64·7	−45·1
,, 1912 (28 cases) ...		16·8	+40·6	+60·7	+4·4	26·7	−42·6	−59·8	−35·8
,, 2 years (58 cases) ...		16·3	+51·4	+66·2	+4·7	26·0	−48·7	−62·3	−40·6

TABLE CXLI.—Disturbances of the "Special Type." Mean Results.

—	—	Number.	First Phase.					Second Phase.				
			Duration.	$\bar{H}$.	T.	ψ.	χ.	Duration.	$\bar{H}$.	T.	ψ.	χ.
			Mins.	γ	γ	° ′	° ′	Mins.	γ	γ	° ′	° ′
All the disturbances.	1911	30	15·9	94·1	94·2	56 47	3 0 *b*	25·3	84·5	95·8	237 33	28 5 *a*
	1912	28	16·8	73·1	73·2	63 49	3 28 *b*	26·7	73·5	81·7	242 7	26 0 *a*
	Two years	58	16·3	83·8	84·0	59 44	3 12 *b*	26·0	79·1	88·9	239 35	27 11 *a*
The smaller disturbances.	1911	15	11·6	60·2	60·4	65 8	4 18 *b*	22·5	57·8	65·1	243 56	27 19 *a*
	1912	14	13·9	44·3	44·6	60 16	6 26 *b*	23·4	42·9	46·7	240 54	23 9 *a*
	Two years	29	12·7	52·5	52·7	63 9	5 11 *b*	22·9	51·1	56·6	241 52	25 25 *a*
April–Sept. normal.	1902–3	51	—	62·8	63·1	48 33	5 35 *b*	—	55·2	59·1	223 28	20 47 *a*
	1902–3	50	—	72·1	72·6	41 47	6 23 *b*	—	65·7	70·8	217 42	21 48 *a*

CHAPTER XII.

DISTURBANCES OF LONGER PERIOD, OCCURRING DURING 1911.

Section 91.—As has been already explained, the Antarctic curves were at an early stage submitted to a general scrutiny, as a result of which a number of disturbances were selected for discussion. Applications made for copies of the records obtained elsewhere of these disturbances were liberally responded to by the authorities in charge of the observatories at Mauritius, Buitenzorg, Alibag, Honolulu, Helwan, Agincourt and Sitka. Before making the appeal, the sudden commencements and short period oscillations had been sufficiently studied to enable a fairly definite programme for their treatment to be drawn up, in advance of the response to the appeal. But the question of what should be done in the matter of disturbances lasting many hours, was left over for final consideration until after the reception of curves from the co-operating stations. In the Antarctic itself, except at midwinter, disturbance is so generally present that it is hardly possible from a study of the Antarctic curves alone to specify a time for the end of a disturbance, or a time for the beginning of those disturbances which do not have sudden commencements. The difference between disturbed and quiet times is much more patent at stations in low latitudes. But even in low latitudes there is the difficulty that comparatively quiet interludes frequently present themselves during magnetic storms, and what one man might regard as a single storm, may be regarded by another man as representing two or more storms. There is thus inevitably a good deal that is arbitrary in the choice that has been made in the present case. It was partly determined by the material available. In some cases, it was a choice between a shorter period for which records were available from all or most of the co-operating stations, and a longer period for which complete records were available from only a few of the stations. Again, when disturbance continued for a very long time, there were advantages in treating parts of it separately. There might be different phenomena of special interest occurring during the same storm, but at a considerable interval of time apart, and some of these might be more in evidence at some of the stations than others. It was found convenient in all cases to have exact hours G.M.T. for the commencement and ending of the times dealt with, as this enabled an estimate to be made of the range of the regular diurnal inequality during the interval. This entailed occasionally—*e.g.*, in cases of sudden commencements—the inclusion of small portions of quiet curves, but so far at least as the ranges during the disturbances were concerned this was immaterial.

After selecting the interval of time to be discussed, the next step was to measure the extreme ordinates of the several elements during the interval, and determine their times of occurrence. For each such interval a table of results is given, including the times of maximum and minimum, the range of the disturbance—*i.e.*, the difference between the extreme ordinates—and the range of the regular diurnal inequality within the interval. The remarks made as to the diurnal inequality ranges during the discussion of the short period disturbances apply also to the disturbances of longer period. By the maximum is meant the numerically largest value of H, the algebraically largest value of N, of the easterly declination or easterly component of force, and of the vertical component directed downwards on a north pole.

Following the table there is a discussion of the more prominent features of the curves at the several stations proceeding from south to north, and there are usually some final remarks on the disturbance as a whole. The Antarctic curves for the* interval concerned are reproduced in a plate.

Section 92.—The disturbance really began with an s.c. about 11 h. 21 m. on April 8th, which has been already described.

In the Antarctic large oscillations continued for some three hours after the s.c. During this time there was a range of 244γ in V, exceeding the corresponding ranges for the other elements. A quieter though by no means quiet time followed from 14 h. to 20 h. There was a large bay-like movement in E′ between 20 h. and 24 h. of the 8th, followed immediately by another similar movement lasting to 3½ h. on the 9th. Large comparatively regular movements ensued until 14 h., when there was an approach to normal conditions.

At Mauritius on the 8th after 14 h. there was little disturbance in H until after 19 h, when long period oscillations became prominent and remained so until 6 h. on the 9th. From 6 h. to 8 h. on the 9th the H trace was nearly level. A fall began about 8 h. 20 m. which continued practically without interruption until 12 h., the total fall in this interval amounting to 80γ. Between 12 h. and 14½ h. on the 9th there was a steady rise amounting to 48γ, followed by a quiet time. The changes described represent a bay (depression in H) lasting about 6 hours and centring at 12 h. The D range assigned to Mauritius in Table CXLII may be an underestimate, as trace was lacking from about 2¼ h. to 7 h. on the 9th. On the trace available the largest D movements occurred between 20 h. on the 8th and 2 h. on the 9th. The largest continuous movement in one direction, lasting from 0 h. 55 m. to 1 h. 35 m. on the 9th, represented an easterly swing whose force equivalent was 46γ.

At Buitenzorg considerable disturbance prevailed for 2 or 3 hours after the s.c., but from 14 h. to 18 h. on the 8th the N curve was unquiet rather than disturbed, and the D and V traces showed little sign of disturbance. After 19 h. on the 8th the disturbance in N gradually increased. While there were short period oscillations, what appealed more to the eye, especially after 2 h. on the 9th, was the large size of the gradual movements across the sheet. The disturbance in E and V was comparatively trifling.

* The reproductions differ from those of the Sc's and short storms in that the parallax errors (*see* p. 265) have not been corrected.

Very similar remarks apply to Alibag, Honolulu and Helwan. At all these stations the disturbance in H was much more prominent than that in D or V. The V traces in particular showed little irregular movement. The particulars in Table CXLII as to the hours of maximum and minimum and the ranges in the several elements at Honolulu and Helwan are derived from the official publications of these observatories.

TABLE CXLII.—11 h. April 8 to 15 h. April 9, 1911. Plate XLII.

Station.	Element.	Time (G.M.T.) of Maximum.	Time (G.M.T.) of Minimum.	Disturbance Range.	Inequality Range.
		h. m.	h. m.	γ	γ
Antarctic	N′	11 10 (9th)	1 57 (9th)	652	133
	E′	9 29 (9th)	22 53 (8th)	518	81
	V	21 43 (8th)	12 30 (9th)	274	46
Mauritius	H	11 35 (8th)	12 0 (9th)	159	23
	D	7 40 (9th)	21 20 (8th)	57	32
Buitenzorg	N	11 27 (8th)	11 59 (9th)	276	41
	E	22 50 (8th)	11 27 (8th)	50	25
	V	11 50 (8th)	1 45 (9th)	47	22
Alibag	H	11 35 (8th)	12 0 (9th)	191	49
	D	22 25 (8th)	7 0 (9th)	44	46
	V	1 35 (9th)	11 25 (8th)	28	31
Honolulu	H	11 24 (8th)	5 51 (9th)	206	18
	D	19 43 (8th)	0 18 (9th)	66	47
	V	8 28 (9th)	22 32 (8th)	43	21
Helwan	H	11 23 (8th)	12 7 (9th)	188	34
	D	23 12 (8th)	11 23 (8th)	88	43
	V	5 26 (9th)	11 20 (8th)	44	20
Agincourt	H	23 5 (8th)	8 40 (9th)	500+	33
	D	1 40 (9th)	9 0 (9th)	368	62
Eskdalemuir... ...	N	2 44 (9th)	5 29 (9th)	261	49
	E	2 36 (9th)	5 27 (9th)	227	41
	V	21 48 (8th)	1 57 (9th)	216	26
Sitka	H	6 11 (9th)	8 12 (9th)	1014+	28
	D	? (9th)	5 18 (9th)	452+	41
	V	3 23 (9th)	9 5 (9th)	759	17

The disturbance at Agincourt was much larger than at the stations in lower latitudes, and of a different type. D, though not as highly disturbed as H, was highly disturbed, and both traces were highly oscillatory. The H trace really went off the sheet for a short time, so the time of the minimum is only approximate, and the range shown was exceeded, though probably only slightly.

So far as the components in the horizontal plane are concerned, Eskdalemuir seemed to occupy an intermediate position between Helwan and Agincourt. The large comparatively slow movements were the most prominent feature, but shorter period oscillations were also in evidence. Also the disturbance in E and V at Eskdalemuir was not much smaller than in N.

At Sitka the disturbance was extremely large during the later part of the time. Near the beginning the disturbance in Sitka was not very striking. The amplitude of the s.c. was only about a quarter of that in the Antarctic. Between 14 h. and 19 h. on the 8th there were numerous oscillations at Sitka, such as one does not see on a really quiet day, but their amplitude was small. Later in the 8th and during the morning of the 9th the traces were highly oscillatory. The high sensitiveness of the magnetographs led to crossing and recrossing of the traces from the several elements, and no doubt tends to give an exaggerated impression of the oscillatory character of the disturbance. But from 4 h. to 13 h. on the 9th disturbance was conspicuously larger at Sitka than in the Antarctic. In the course of just over two hours, as the figures in Table CXLII tell us, there was a range of at least 1014γ in H, and as the trace was off the sheet for some time the complete range may have been appreciably greater. This is much in excess of the largest range, 652γ in N′, recorded during the whole storm in the Antarctic. The data as to times and ranges at Sitka are derived from the official publication of the observatory, so there can be no doubt of their substantial accuracy.

As at Agincourt, D was also highly disturbed at Sitka. The trace was off the sheet for nearly an hour in all between 9 h. 48 m. and 12 h. 12 m. on the 9th, and the range shown may have been largely exceeded. As at Eskdalemuir, the range in V was of the same order as those of the horizontal components, and it was considerably more than double the range of V in the Antarctic.

The large size of the Sitka and Agincourt movements, as compared with those at Eskdalemuir, may suggest that local time, *i.e.*, the position of the sun, had a good deal to do with the matter, the Sitka movements being mainly developed during the late evening and early morning, and so at the time when aurora is most in evidence. But local time at Sitka differs from that at Honolulu by only $1\frac{1}{2}$ hours, and the Honolulu movements are very similar in size to those at Alibag and Helwan. Thus it would seem to have been as much a question of latitude as of local time.

In view of the pre-eminent size of the movements at Sitka towards the end of the storm, the insignificance of the s.c. movement there as compared with that in the Antarctic seems worthy of notice. In this case, at least, any inference that might have been drawn from the size of the s.c. as to the size of the ensuing disturbance would have been very wide of the mark.

It will be seen that there is little obvious relation between the turning points in the several elements at the different stations, except when these presented themselves during the s.c.

Section 93.—This disturbance really began with an s.c. at about 22 h. 21 m. on April 9, which has been already described.

The Antarctic curves by themselves are more suggestive of a succession of short independent disturbances, with quiet interludes, than of a single long continued disturbance. The more disturbed times there were roughly from 22 h. 21 m. to 24 h. on the 9th, from $1\frac{1}{2}$ h. to $7\frac{1}{2}$ h., from $9\frac{1}{2}$ h. to 11 h. and from 13 h. to 15 h. on the 10th. If one had only the Antarctic curves to refer to, one would not naturally associate the s.c. with the two last of these intervals, which include a disturbance of the special type near 10 h. In fact the Antarctic curves taken alone suggest that what promised at 2 h. on April 10 to be a large storm had been nipped in the bud by 6 h. The movements ascribed to the Antarctic in Table CXLIII are about thrice as large as those of the normal day at the same season. This implies of course considerable disturbance, but nothing very exceptional.

TABLE CXLIII.—22 h. April 9 to 16 h. April 10, 1911. Plate XLII.

Station.	Element.	Time (G.M.T.) of Maximum.	Time (G.M.T.) of Minimum.	Disturbance Range.	Inequality Range.
		h. m.	h. m.	γ	γ
Antarctic	N′	14 20 (10th)	3 30 (10th)	368	133
	E′	5 40 (10th)	23 15 (9th)	238	77
	V	23 30 (9th)	10 30 (10th)	134	46
Mauritius	H	9 45 (10th)	22 21 (9th)	42	21
	D	23 10 (9th)	5 25 (10th)	29	32
Buitenzorg	N	3 0 (10th)	10 20 (10th)	75	41
	E	3 35 (10th)	3 0 (10th)	21	25
	V	3 20 (10th)	22 25 (9th)	33	22
Alibag	H	6 50 (10th)	13 30 (10th)	59	48
Honolulu	H	9 44 (10th)	3 35 (10th)	46	18
	D	15 50 (10th)	23 25 (9th)	25	26
	V	4 0 (10th)	23 10 (9th)	19	15
Helwan	H	9 40 (10th)	13 55 (10th)	51	34
	D	6 40 (10th)	12 55 (10th)	49	43
	V	3 35 (10th)	9 50 (10th)	21	20
Agincourt	H	22 26 (9th)	14 15 (10th)	117	30
	D	4 0 (10th)	3 25 (10th)	121	31
Eskdalemuir... ...	N	22 30 (9th)	3 42 (10th)	145	43
	E	22 52 (9th)	3 18 (10th)	73	41
	V	14 47 (10th)	23 30 (9th)	37	22
Sitka	H	3 10 (10th)	14 21 (10th)	202	28
	D	3 55 (10th)	3 25 (10th)	120	34
	V	3 38 (10th)	14 21 (10th)	207	17

At Mauritius the ranges recorded in Table CXLIII may have been exceeded as the traces received stopped at 13 h. on the 10th. After the s.c. the H trace remained elevated in a crest, the highest point in which appeared at 23 h. 20 m. A decline followed until 24 h. During this time there was a moderate bay, easterly deflection, in D. From 0 h. to 3 h. on the 10th quietness prevailed. Between 3 h. and 5 h. the H and D traces both showed oscillations, and there was a fall of 21γ in H between 9 h. 45 m. and 10 h. 20 m.

The traces received from Buitenzorg stopped at 11 h. 30 m. on the 10th, and so did not include the movements near 14 h., which at some stations were the most prominent. The movements associated with the s.c. were not large and had practically subsided by $23\frac{1}{2}$ h. on the 9th. During the next two hours the curves showed little sign of disturbance. Subsequently there were considerable movements, especially in N.

For Alibag only the H trace was available, and it did not commence until $3\frac{1}{2}$ h. on the 10th. Thus the range in Table CXLIII may have been exceeded. There was a good deal of minor disturbance from 6 h. until 15 h., when conditions became of normal quietness.

At Honolulu the movements associated with the s.c., which was not very large, subsided in about an hour, and for several hours subsequently conditions were quiet. There was a pretty prominent bay in H from about $2\frac{1}{2}$ h. to $4\frac{1}{2}$ h. on the 10th, and a hump from about $9\frac{1}{2}$ h. to $10\frac{1}{2}$ h., the latter synchronising with the special disturbance in the Antarctic. The amplitudes of the movements, as Table CXLIII shows, were not large, but the disturbance is entered on the Honolulu list as a storm of class 1 (the lowest), and is assigned a duration of 26 hours. This is a good deal longer than the estimate accepted here. It includes a long quiet interval commencing about 15 h. on the 10th.

At Helwan after the s.c. subsided there were only minor movements, and from 16 h. to 20 h. on the 10th the traces were exceedingly quiet.

At Agincourt the s.c. movement itself was large in H. The subsequent movements in H though not very large were numerous, and both the H and D curves were distinctly disturbed until about 16 h. on the 10th, when a quiet time lasting 4 or 5 hours set in.

At Eskdalemuir the s.c. movement in N was very large. The disturbances which followed in N and E were not large, but they continued with little intermission until 16 h. on the 10th. Near 10 h., during the special disturbance in the Antarctic, there was no noticeable bay, but there were numerous oscillations in the N and E curves. The largest bay-like movements appeared in N from 3 h. to 5 h. and in E from 2 h. to 4 h. on the 10th, times at which there were large movements in the Antarctic.

The traces received from Sitka stopped at 18 h. on the 10th. As, however, the duration assigned to the storm in the Sitka list puts its termination at about $16\frac{1}{2}$ h., a quiet interval presumably ensued then as at Agincourt and Eskdalemuir. There was a good deal of disturbance at Sitka from 2 h. to 5 h. of the 10th, the time of chief activity in the Antarctic, and minor movements from $9\frac{1}{2}$ h. to $10\frac{1}{2}$ h. during the disturbance of the "special type" in the Antarctic, but the most prominent movements in H and V occurred from 13 h. to 16 h. There was then a deep regular bay in H, and a pyramid-shaped movement in V, the range of the elements during the three hours being 144γ in H and 127γ in V. During this time there was a smaller but still fairly conspicuous bay in the H curves at Agincourt, Helwan and Alibag. The ranges during the three hours were as follows:—44γ in H at Agincourt, 28γ in H at Helwan, 23γ in H at Alibag, 56γ in N at Eskdalemuir, and in the Antarctic 106γ in N′ and 124γ in E′.

The magnetic storm of April 9 to 10 was everywhere considerably less than that of April 8 to 9. The two disturbances had, however, several common features. They were larger in the Antarctic and at Sitka than at any of the intermediate stations. The s.c. and the commencing movements were much larger in the Antarctic than at Sitka, but towards the end of the storm the disturbance was larger at Sitka than in the Antarctic. At most of the stations the disturbance in V was very small compared with that in the horizontal components, but this was not the case in the Antarctic and at Sitka. Moreover the range of the V disturbance at Sitka exceeded that in the Antarctic.

Section 94.—The curves generally were very quiet from 16 h. to 18 h. on April 10. But there then ensued a somewhat striking set of movements, possessing somewhat unusual features at Alibag and Helwan. Records were not available from Mauritius, Buitenzorg, Honolulu or Sitka, and only H traces from Alibag.

TABLE CXLIV.—20 h. April 10 to 3 h. April 11, 1911. Plate XLII.

Station.	Element.	Times of		Disturbance Range.	Inequality Range.
		Maximum.	Minimum.		
		h. m.	h. m.	γ	γ
Antarctic	N′	20 48 (10th)	0 17 (11th)	322	71
	E′	20 55 (10th)	0 20 (11th)	208	57
	V	21 25 (10th)	2 55 (11th)	82	19
Alibag	H	0 25 (11th)	1 30 (11th)	47	12
Helwan	H	0 25 (11th)	1 30 (11th)	68	7
	D	22 25 (10th)	0 55 (11th)	14	3
	V	1 5 (11th)	0 15 (11th)	23	2
Agincourt	H	20 30 (10th)	0 5 (11th)	84	17
	D	22 15 (10th)	0 5 (11th)	109	34
Eskdalemuir... ...	N	23 40 (10th)	1 10 (11th)	63	15
	E	0 30 (11th)	20 20 (10th)	95	10
	V	20 50 (10th)	0 30 (11th)	86	23

In the Antarctic the disturbance seemed to have died down by 2 h. on the 11th. The N′ and E′ curves showed two bays, one of short duration between 20 h. and 21 h. on the 10th, the second lasting from about 21 h. on the 10th to 1 h. 40 m. on the 11th. The recovery from the second depression was very rapid in both elements. The disturbance in V was comparatively small.

The H traces at Alibag and Helwan were remarkably alike, and somewhat resembled the movements including the crest usually seen on the occasions of s.c's at these stations, only taken in the reverse order; *i.e.*, the rise to the maximum was slow, and the fall from it very rapid. The preceding and succeeding portions of trace being very quiet, the disturbance has a very isolated appearance. At Helwan, and presumably also at Alibag, the D movement was relatively small. The V movement at Helwan, though only a third of that in H, was well marked, and also suggestive of the ordinary s.c. movement reversed.

At Agincourt, as at Alibag and Helwan, the largest movement occurred towards the end of the disturbance. But the main H movement at Agincourt was a depression, and the D range exceeded that of H. The disturbance, however, lasted shorter in D than in H, the D trace being very quiet except between 22 h. on the 10th, and $1\frac{1}{2}$ h. on the 11th.

At Eskdalemuir the disturbance in N was somewhat irregular, the element being sometimes above and sometimes below the value normal to the hour. The E and V movements were much more regular, both traces showing decided bays, representing easterly force in the one case, and depression of vertical force in the other. The maximum of easterly force appeared simultaneously with the maximum depression in V. The depression in V was of a size one usually finds only with larger disturbance in the horizontal components. It had not completely disappeared by 3 h. on the 11th.

Section 95.—Conditions were generally quiet throughout the earlier hours of May 14, 1911, and the disturbance developed so gradually at all the stations that it is difficult to assign a time for its commencement. The times assigned in the official Honolulu and Sitka lists were respectively $16\frac{1}{2}$ h. and 17 h. on the 14th. Here 16 h. has been accepted because Antarctic conditions were particularly quiet from 14 h. to 16 h., while decided disturbance was seen there and at Eskdalemuir between 16 h. and 17 h. Normal quietness was not restored for several days. The duration assigned to the disturbance was, in fact, 70 hours at Honolulu, and 72 hours at Sitka. There was, however, a very decided lull throughout the afternoon of the 15th, and in the Antarctic after 11 h. on the 15th it was fairly quiet for several hours. Accordingly 11 h. on the 15th has been accepted here for the end of the disturbed period.

In the Antarctic no great activity was displayed before 19 h. on the 14th, or after 7 h. on the 15th, and E′ was much more disturbed than the other elements. The E′ trace showed a large fall interrupted by oscillations between 21 h. and $23\frac{1}{2}$ h. on the 14th, and a large rise also interrupted by oscillations between the latter hour and $5\frac{1}{2}$ h. on the 15th.

At Mauritius conditions were quiet until 17 h. on the 14th, when disturbance appeared in the H trace. The D trace was practically undisturbed until 22 h. The H trace showed many oscillations of short period, especially near midnight, when the activity of disturbance in that element appeared greatest. There was also considerable disturbance between 5 h. and 9 h. of the 15th. The maximum and minimum of H at Mauritius appeared simultaneously with the maximum and minimum of N at Buitenzorg, but the range at Mauritius was only 40 per cent. of that at Buitenzorg. Short-period oscillations were much less conspicuous in the Mauritius

D trace, but it showed two considerable slow oscillations. Between 22 h. on the 14th and $1\frac{1}{4}$ h. on the 15th there were swings of 5′ to the East and $6\frac{3}{4}$′ to the West; while between $1\frac{1}{4}$ h. and 5 h. 25 m. there were swings of 9′ to the East and $4\frac{1}{4}$′ to the West. In terms of force the D range at Mauritius exceeded the E range at Buitenzorg and the D range at Honolulu, but the H range at Mauritius was much less than the H or N ranges recorded at the other stations.

TABLE CXLV.—16 h. May 14 to 11 h. May 15, 1911. Plate XLIII.

Station.	Element.	Times of Maximum.	Times of Minimum.	Disturbance Range.	Inequality Range.
		h. m.	h. m.	γ	γ
Antarctic	N′	9 11 (15th)	23 28 (14th)	237	67
	E′	5 34 (15th)	23 31 (14th)	484	54
	V	0 33 (15th)	6 37 (15th)	236	32
Mauritius	H	21 40 (14th)	6 5 (15th)	55	20
	D	4 10 (15th)	1 15 (15th)	61	28
Buitenzorg	N	21 40 (14th)	6 5 (15th)	140	41
	E	23 25 (14th)	4 50 (15th)	43	22
	V	21 50 (14th)	2 45 (15th)	38	18
Honolulu	H	21 39 (14th)	4 8 (15th)	147	19
	D	19 32 (14th)	0 12 (15th)	57	46
	V	7 36 (15th)	23 31 (14th)	33	20
Helwan	H	21 41 (14th)	7 19 (15th)	112	30
	D	5 30 (15th)	10 57 (15th)	79	51
	V	23 35 (14th)	10 53 (15th)	36	23
Agincourt	H	21 35 (14th)	4 20 (15th)	250	29
	D	3 50 (15th)	0 45 (15th)	231	47
Eskdalemuir... ...	N	22 45 (14th)	23 23 (14th)	192	50
	E	1 10 (15th)	3 10 (15th)	115	36
	V	17 32 (14th)	4 9 (15th)	165	22
Sitka	H	4 26 (15th)	0 2 (15th)	586	24
	D	8 28 (15th)	4 0 (15th)	261	56
	V	3 41 (15th)	8 6 (15th)	361	13

At Buitenzorg conditions had been very quiet from 13 h. to 16 h. on the 14th. After 18 h. the N trace showed a good many oscillations, but the movements did not become large until 22 h. From then until 8 h. on the 15th there was a succession of rounded movements, superposed on which were numerous minor oscillations. The E and V curves, while distinctly unquiet after 20 h. on the 14th, were much less disturbed than N.

At Honolulu the H trace showed an almost unbroken fall from $22\frac{1}{2}$ h. on the 14th to 4 h. on the 15th, followed by a succession of rounded movements, constituting on the whole a gradual recovery. The H disturbance was similar in type to that in N at Buitenzorg, and of very similar amplitude. The Honolulu D trace was not much disturbed, and the V trace, though showing numerous small oscillations, was unquiet rather than disturbed.

Helwan was decidedly less disturbed than Buitenzorg or Honolulu. In H there was a good deal of oscillation, and a pretty rapid fall near 24 h. The ranges in D and V were only about 50 per cent. in excess of those of the average day.

At Agincourt the disturbance was much larger than at Helwan, or even at Buitenzorg and Honolulu, and it was nearly as large in D as in H. Both the H and the D traces showed a considerable number of large oscillations, but the H trace exhibited a greater tendency than the D to small short-period oscillations. The H trace had become distinctly unquiet by 19 h. on the 14th. The larger movements occurred between 23 h. on the 14th and 10 h. on the 15th, both in H and D. The latter element, in fact, showed little disturbance outside these limits of time. The large movements in H had as their general effect a large fall, as in H at Honolulu and in N at Buitenzorg, but this was more interrupted by temporary recoveries at Agincourt than at the other stations. The H trace continued to show numerous small oscillations after 11 h. on the 15th.

At Eskdalemuir the disturbance in the horizontal components was intermediate in size between those experienced at Buitenzorg and Agincourt; but the disturbance in V was of a quite different order from that at Buitenzorg, Honolulu or Helwan. Small oscillations became visible in the N trace about 15 h. on the 14th, and gradually increased in amplitude. There was no large movement, but on the whole a gradual rise in N until 22 h. 45 m. There then ensued a rapid fall of 192γ in less than 40 minutes. Some recovery followed, but the element remained markedly depressed for a number of hours. The rapid fall in N after 23 h. was accompanied by a considerable rise in E, but the E movements were smaller than those in N. There were no large movements in either element after 7 h., but minor oscillations persisted in both traces throughout the afternoon of the 15th, and were eventually followed by larger movements. The V trace at Eskdalemuir was practically quiet until after 22 h. on the 14th, when a considerable fall occurred. Some recovery followed, but the element remained considerably depressed until 9 h. on the 15th. Throughout the whole time there was hardly any trace of rapid V oscillations, the movements shown being slow and regular.

At Sitka conditions had been quiet for some hours prior to 16 h. on the 14th. Numerous rapid oscillations then appeared, but they were of small size until 23 h. on the 14th. From that hour until 10 h. on the 15th there were numerous oscillatory movements of considerable size especially in H, the traces from the different elements crossing and recrossing, so that details are difficult to make out. The disturbance subsided very rapidly after 10 h. on the 15th, and several nearly quiet hours followed. As Table CXLV shows, the disturbance had a decidedly larger range at Sitka than in the Antarctic, in the vertical as well as in the horizontal plane.

The disturbance did not present any very striking features. Except in high latitudes the principal feature was a fall in H or N, which commenced late on the 14th. The maximum values in H or N were reached simultaneously, or very nearly so, at Mauritius, Buitenzorg, Honolulu, Helwan and Agincourt; but the fall continued longer at some of these stations than others. In lower latitudes the disturbance was mainly in H or N, but in higher latitudes the changes in V were of the same order as those in the other elements. The North American stations were more disturbed than the other co-operating stations, and the changes in declination experienced there were very considerable.

Section 96.—In the Antarctic conditions had been quiet for some hours prior to 16 h. on June 4, 1911. Shortly after 16 h. decided disturbance appeared. Between 16 h. 25 m. and 17 h. 0 m. N′ rose 40γ. During the next two hours there were only small vibrations in N′. These became larger after 19 h., but the disturbance was never very striking. The disturbance in E′ was much larger. Between 16 h. 35 m. and

TABLE CXLVI.—16 h. to 24 h. June 4, 1911. Plate XLIII.

Station.	Element.	Times of Maximum.	Times of Minimum.	Disturbance Range	Inequality Range.
		h. m.	h. m.	γ	γ
Antarctic	N′	17 0	23 25	136	39
	E′	16 35	20 17	187	13
	V	23 35	20 15	56	20
Mauritius	H	16 35	19 25	74	8
	D	23 0	19 40	24	6
Buitenzorg	N	16 30	19 50	60	14
	E	19 45	16 5	20	13
	V	23 20	20 5	20	5
Alibag	H	16 35	20 0	65	4
Honolulu	H	16 40	23 25	46	10
	D	18 18	22 58	71	50
	V	17 40	19 57	36	23
Helwan	H	16 30	19 35	70	7
	D	20 50	16 30	49	13
	V	19 40	22 55	25	3
Agincourt	H	20 25	20 0	99	34
	D	23 25	19 45	100	28
Eskdalemuir... ...	N	19 4	19 59	98	17
	E	23 22	18 18	120	25
	V	19 38	23 0	110	12
Sitka	H	16 1 ?	18 46	$\nless$134	20
	D	17 31	20 48	126	55
	V	—	—	>45	14

18 h. 35 m. E′ fell 149γ. Between 19 h. and 21 h. there were some considerable oscillations, including a fall of 139γ and rise of 120γ between 20 h. 5 m. and 20 h. 35 m. In the V trace there was a considerable development of short-period oscillations between 19 h. and 23 h., but their amplitude was small. The disturbance in N′ and E′ showed no very marked subsidence until after 4 h. on June 5.

At Mauritius conditions had been fairly quiet until 16 h. on the 4th. A small oscillation then occurred in H, and after its subsidence a prolonged fall set in. This continued at a nearly uniform rate between 17 h. and 18½ h. From then until 22 h. 20 m. the trace remained markedly depressed, though there were several sharp oscillations, especially near 20 h. Between 22 h. 25 m. and 23 h. there was a smart rise of 40γ. There is thus a very marked bay (depression of H) extending from about 16½ h. to 23 h. The curve from 17 h. to 23 h. stands out conspicuously from what precedes or follows, suggesting a well-marked isolated disturbance lasting from six to seven hours. Between 23 h. and 24 h. there was a slight fall in H. The D trace was much less disturbed. There was, however, rather a smart oscillation between 19 h. 40 m. and 20 h. 20 m., consisting of swings of 2′ to the East and 1½′ to the West. Between 22 h. 15 m. and 22 h. 55 m. there was an easterly movement of 2½′.

At Buitenzorg the N trace shows a small oscillation shortly after 16 h., corresponding to the oscillation described in the Mauritius H curve. There was a conspicuous bay (depression of N) between 16½ h. and 23½ h. During its incidence there were numerous short-period oscillations, especially between 18 h. and 21 h. The E trace was comparatively quiet, but between 19 h. 5 m. and 20 h. 30 m. there was a rise of 18γ and an equal fall. The V trace contained a few small oscillations. All three curves show a summit at about 23 h. 20 m.

At Alibag the H trace closely resembled that at Mauritius. There was a close correspondence at the two stations between the records of a small oscillation shortly after 16 h., and other oscillations occurring between 18 h. and 21 h. The depression of H ended, as at Mauritius, with a sharp rise, amounting to 33γ, between 22 h. 30 m. and 23 h.

At Honolulu, as at Mauritius and Alibag, there was a somewhat prominent short-period oscillation shortly after 16 h. Also after 16 h. 40 m. a decided fall set in in H. Short-period oscillations were again most prominent between 19 h. and 20½ h. But the minimum in H was reached much later than at Mauritius and Alibag, and the subsequent recovery was comparatively inconspicuous. Thus the disturbance between 16 h. and 24 h. has a much less distinctive appearance than at Mauritius, Buitenzorg or Alibag.

The resemblance between the H traces at Helwan and Alibag was very close. This is true equally of the small short-period oscillations and the larger slow movements. At Helwan the rise in H between 22 h. 25 m. and 23 h. amounted to 40γ, and it was followed between 23 h. and 24 h. by a fall of 23γ. The Helwan D trace contained some decided oscillations, including the following between 19 h. 20 m. and 21 h. 30 m.: 2′ W, 2¼′ E, 1¼′ W, 2¼′ E and finally 2¼′ W. The Helwan V trace also showed oscillations, especially after 19 h., including the following between 19 h. 40 m. and 20 h. 40 m.: -9γ, $+7\gamma$, -14γ and $+9\gamma$. Between $22\frac{1}{2}$ h. and 24 h. there was a fall of 15γ and rise of 12γ. Parts of the D and V curves showed considerable resemblance, easterly movements going with increase of V, but between $22\frac{1}{2}$ h. and 24 h. easterly movement went with fall in V. All three Helwan curves showed the small oscillation shortly after 16 h., synchronous apparently with the oscillation described in the H curves at Mauritius and Alibag and the N curve at Buitenzorg. The amplitudes of the two movements at Helwan were: in H, -7γ and $+10\gamma$; in D, $0'\cdot5$ E and $0'\cdot5$ W; in V, $+4\gamma$ and -3γ.

The curves received from Agincourt did not commence until 16 h. 40 m., and so did not cover the time of the special small oscillation near 16 h. There were three considerable oscillations in H, in immediate succession, between 19 h. 15 m. and 20 h. 40 m. The third and largest, which commenced at 20 h. 0 m., consisted of a rise of 99γ and fall of 80γ. Between 22 h. 50 m. and 23 h. 15 m. H fell 47γ. The Agincourt D trace, though having an equal or slightly larger range, was really considerably less disturbed than the H trace, being much less oscillatory. The principal movements were the following: $10'$ to West between 19 h. 15 m. and 19 h. 25 m., $13'$ to East between 19 h. 45 m. and 20 h. 15 m., and $9'$ to East between 22 h. 55 m. and 23 h. 25 m.

At first sight the N curve at Eskdalemuir seems quite unlike the H curves at Mauritius, Alibag and Helwan. The small oscillation just after 16 h. cannot with certainty be identified at Eskdalemuir, and N shows a decided tendency to rise prior to 19 h., whereas the H traces at Mauritius, Alibag and Helwan all show a marked fall. There is, however, a pretty close parallelism between the conspicuous oscillations that appear at all the stations after 19 h., rise in N at Eskdalemuir going with rise in H at the other stations. A conspicuous difference comes in after $22\frac{1}{2}$ h. Between that hour and 24 h. there is a prominent *double* oscillation in N at Eskdalemuir, the changes being $+39\gamma$, -63γ, $+74\gamma$ and -58γ, whereas at the other stations there is only a single oscillation. Also at Eskdalemuir the last fall in N continues until 0 h. 20 m. on the 5th, and is immediately followed by a decided rise. The E trace at Eskdalemuir does not resemble the D trace at Helwan. After 17 h. it shows a succession of oscillations. Between 22 h. 40 m. and 24 h. E rose 80γ and fell 59γ. The fall continued until about 0 h. 8 m. on the 5th, and was followed by a decided rise. The changes in V at Eskdalemuir followed the course usual there in magnetic storms. There was a continuous rise amounting in all to 63γ between 17 h. and 19 h. 38 m., when the maximum was reached. A slow decline then set in, interrupted only by a slight temporary increase about $20\frac{1}{2}$ h. The decline greatly accelerated about $22\frac{1}{2}$ h., the fall in the half-hour preceding the minimum at 23 h. amounting to 56γ. Between 23 h. 0 m. and 23 h. 30 m. there was a smart recovery, amounting to 34γ, which restored the element to near its normal value.

No curves were received from Sitka. But the data in the official publication—which have been utilised in Table CXLVI—show that a considerable disturbance was experienced, the range in D being $27'\cdot6$ ($=126\gamma$), and that in H being at least

134γ. The disturbance in the horizontal plane would thus appear to have been a little larger at Sitka than at either Eskdalemuir or Agincourt, but not quite so large as in the Antarctic. During this storm there is less difference than usual between the amplitude in different latitudes.

Section 97.—The disturbance on June 9–10, 1911, had a sudden commencement, already described, which was everywhere of unusually small amplitude. The disturbance appears in both the Honolulu and Sitka lists, the durations assigned being respectively 134 and 137 hours, or over five days. There was, however, a distinct lull in the afternoon hours of the 10th, and the disturbance is regarded here as ending at 12 h. on that day. The sudden commencement was at 16 h. 31 m. of the 9th.

In the Antarctic conditions had been very quiet for seven or eight hours prior to the s.c. They became less quiet after that event, but there was no considerable disturbance until 20 h. on the 9th. The largest movements occurred between 3 h.

TABLE CXLVII.—16 h. June 9 to 12 h. June 10, 1911. Plate XLIV.

Station.	Element.	Times of Maximum.	Times of Minimum.	Disturbance Range.	Inequality Range.
		h. m.	h. m.	γ	γ
Antarctic	N′	7 24 (10th)	2 20 (10th)	258	60
	E′	4 10 (10th)	23 1 (9th)	375	60
	V	20 35 (9th)	5 58 (10th)	184	31
Mauritius	H	20 25 (9th)	7 30 (10th)	42	21
	D	3 45 (10th)	8 25 (10th)	42	20
Buitenzorg	N	20 25 (9th)	7 25 (10th)	114	32
	E	7 20 (10th)	3 20 (10th)	25	19
	V	20 30 (9th)	1 35 (10th)	24	14
Alibag	H	20 25 (9th)	1 15 (10th)	51	33
	D	2 20 (10th)	17 10 (9th)	41	43
	V	1 40 (10th)	4 35 (10th)	52	30
Honolulu	H	20 26 (9th)	6 14 (10th)	100	13
	D	18 15 (9th)	23 10 (9th)	83	50
	V	17 39 (9th)	21 39 (9th)	41	23
Helwan	H	20 25 (9th)	7 25 (10th)	87	26
	D	4 5 (10th)	10 15 (10th)	56	47
Agincourt	H	21 25 (9th)	5 5 (10th)	200	34
	D	5 45 (10th)	7 25 (10th)	205	66
Eskdalemuir... ...	N	20 24 (9th)	7 27 (10th)	115	44
	E	22 20 (9th)	20 23 (9th)	124	41
	V	22 25 (9th)	1 23 (10th)	92	21
Sitka	H	4 5 (10th)	7 49 (10th)	160	20
	D	4 54 (10th)	1 5 (10th)	173	56
	V	3 56 (10th)	7 49 (10th)	302	17

and 9 h. on the 10th, including between 7 h. and 8 h., a disturbance which appears amongst those of the special type in Table CXL. After this there was at least an abatement of the disturbance for several hours. There was a marked recrudescence between 17 h. and 20 h. on the 10th, subsequent to which there was loss of trace for several hours. As Table CXLVII shows, disturbance in the Antarctic was larger in E′ than in the other elements, but was considerable in all.

At Mauritius the s.c. in H led to a nearly level crest, which persisted until fully 18 h. 45 m. on the 9th, when there was a fall of 7γ and some slow oscillations. Besides several small but sharp oscillations of short period, the H curve exhibited the following rather prominent oscillations of longer period :—

Between 20 h. 5 m. and 20 h. 45 m. of the 9th a rise of 13γ and fall of 13γ.
,, 21 h. 20 m. and 22 h. 20 m. ,, ,, ,, a fall of 14γ and rise of 16γ.
,, 7 h. 10 m. and 8 h. 20 m. ,, ,, 10th a fall of 17γ and rise of 11γ.

The D trace at Mauritius was comparatively smooth. There was on the whole a decided easterly movement, in all $4\frac{1}{2}'$, from 0 h. 45 m. to 3 h. 45 m. on the 10th, and a decided westerly movement, in all $5\frac{1}{2}'$, between 4 h. 30 m. and 8 h. 25 m. These movements are somewhat suggestive of the ordinary diurnal variation, but amplified about four times.

Buitenzorg shows similar phenomena to Mauritius. While the crest after the s.c. lasted, the changes in N were small. On the subsidence of the crest the movements became much more lively. There were several rounded wave-like movements, having superposed on them numerous short-period oscillations. From 0 h. to 7 h. 25 m. on the 10th the general trend in N was downwards. There was more disturbance in the D and V curves than is suggested by the comparatively small excess in the ranges observed over those derived from the regular diurnal inequality.

At Alibag the disturbance in H was really larger than the range suggests. The changes due to the disturbance were mainly in the direction opposite to those caused by the regular diurnal variation. To the eye, the D and V traces appear almost quite smooth, except for trifling bays between 1 h. and 2 h. on the 10th. The disturbance seems to have slightly reduced the ordinary D range, while increasing that of V.

Disturbance was more in evidence at Honolulu, especially in H. For two hours after the s.c. there was a crest on the H curve, and during this time there was little oscillation. From 20 h. on the 9th to $2\frac{1}{2}$ h. on the 10th there was a large fall in H, and from $6\frac{1}{2}$ h. to 8 h. on the 10th there was a rapid rise. After 10 h. on the 10th the trace was unrestful rather than disturbed. The D trace gave little sign of oscillation at any time, but the range was considerably above the normal.

At Helwan the H trace was as usual considerably more disturbed than the D. The excess in its range over the corresponding range at Alibag is, however, partly explained by the smaller opposition that existed at Helwan between the directions of the disturbing forces and those producing the regular diurnal variation. The Helwan D trace shows more signs of disturbance than the corresponding trace at Alibag, and more than the range suggests.

Agincourt was much more disturbed than stations in corresponding latitudes in Europe. H was actively disturbed from 20 h. on the 9th to 8 h. on the 10th, D from 1 h. to 8 h. on the 10th. Prior to 1 h. on the 10th D was much less disturbed than H, but subsequently the D movements were the larger. After 8 h. on the 10th, only small oscillations were recorded for a number of hours. From 1 h. to 7 h. on the 10th, H was depressed a good deal below its normal value, but a rapid recovery then took place. In the course of 70 minutes, between 6 h. 50 m. and 8 h. on the 10th, the declination needle swung first 38′ to the West and then 29′ to the East. The subsidence of disturbance on the termination of this movement was a striking feature of the curve.

At Eskdalemuir the N and E traces suggest a single disturbance, lasting uninterruptedly from the s.c. on June 9, until the forenoon of June 12 or even later, but there was a comparative lull before noon on the 10th. Up to 20 h. on the 9th, conditions were comparatively quiet, disturbance being greatest between 20 h. on the 9th, and 4 h. on the 10th. The N movements throughout were numerous, and irregular rather than large. The disturbance in V was largest between 22 h. on the 9th, and 3 h. on the 10th, there being a well-marked depression between 1 h. and 3 h. on the 10th. Up to 22 h. on the 9th and subsequent to 8 h. on the 10th the V trace was practically smooth.

At Sitka the outstanding feature was a large rise and fall in V between 6 h. 50 m. and 8 h. 30 m. on the 10th. This accounted for the greater part of the range which, as Table CXLVII shows, considerably exceeded the range of V in the Antarctic. This large V oscillation partly synchronised with the large D oscillation at Agincourt. The Sitka H and D traces showed considerable ranges, but not so large as those at Agincourt. The principal feature in the H and D traces at Sitka was the persistence of rapid small oscillations. There were no large movements until after 20 h. on the 9th.

Section 98.—The disturbance began with an s.c. about 21 h. 50 m. on June 30, which has been already described.

While the commencement is definite enough, opinions might well differ as to the termination. The estimates of duration made at Honolulu and Sitka were respectively 40 and 43 hours. There was, however, at least a lull at all the stations, including the Antarctic, for several hours during the forenoon of July 1, so it was decided to limit the comparison to the 12 hours ending at 9 h. on July 1.

In the Antarctic the s.c. movement was very small in N′, and in E′ and V it took the shape of a simple oscillation, the to and fro movements being practically equal. During the next two or three hours, the traces were but little more disturbed than before the s.c. The largest movements occurred between 5 h. and 8 h. on July 1, E′ being considerably the most disturbed element. A comparatively quiet time followed after 8 h.

The H trace received from Mauritius ended at 8 h. 20 m. on the 1st, so the range shown in Table CXLVIII may have been slightly exceeded. The disturbance was a very trifling one in H and even more so in D.

At Buitenzorg the disturbance was trifling for three hours after the s.c.

Subsequently the traces, especially the N trace, showed numerous small oscillations. There was a considerable fall in N after 5 h. on July 1. The E and V traces throughout were only slightly disturbed.

At Alibag the range in H was not very greatly in excess of the normal, but small oscillations were conspicuous after 1 h. on July 1. The D and V traces showed almost no signs of disturbance.

At Honolulu the H trace was very sensibly disturbed after 1 h. on July 1. The largest movement, a fall of 30γ, occurred later between 4 h. 55 m. and 5 h. 55 m. The D trace showed little disturbance, and the V trace was unquiet rather than disturbed.

At Agincourt within the time interval considered H had a considerably smaller range than D. The s.c. movement itself in H was considerable, and it was immediately followed by numerous small oscillations of short period. These oscillations persisted with little intermission until 12 h. on July 2, but there was a decided lull from 9 h. to 10 h. on July 1. The s.c. movement in D was very small, but there was a conspicuous double oscillation between 5 h. and $7\frac{1}{3}$ h. on July 1.

At Eskdalemuir the N and E traces were more disturbed than the ranges in Table CXLVIII suggest. Both traces showed numerous small oscillations. The V trace resembled that of a quiet day, but the range was augmented.

TABLE CXLVIII.—21 h. June 30 to 9 h. July 1, 1911. Plate XLIV.

Station.	Element.	Times of Maximum.	Times of Minimum.	Disturbance Range.	Inequality Range.
		h. m.	h. m.	γ	γ
Antarctic	N′	8 59 (1st)	5 43 (1st)	343	52
	E′	6 32 (1st)	0 10 (1st)	229	48
	V	22 47 (30th)	6 38 (1st)	134	33
Mauritius	H	4 50 (1st)	22 25 (30th)	22	17
	D	23 5 (30th)	7 30 (1st)	18	19
Buitenzorg	N	3 10 (1st)	8 40 (1st)	99	34
	E	0 20 (1st)	3 30 (1st)	37	26
	V	5 15 (1st)	9 0 (1st)	22	12
Alibag	H	5 10 (1st)	22 40 (30th)	43	29
	D	3 0 (1st)	7 20 (1st)	37	38
	V	2 50 (1st)	7 15 (1st)	35	23
Honolulu	H	0 56 (1st)	6 5 (1st)	57	13
	D	5 40 (1st)	23 27 (30th)	30	20
	V	6 25 (1st)	21 50 (30th)	21	13
Agincourt	H	21 55 (30th)	8 40 (1st)	58	17
	D	6 0 (1st)	0 15 (1st)	91	30
Eskdalemuir... ...	N	22 0 (30th)	8 20 (1st)	41	32
	E	23 40 (30th)	6 20 (1st)	60	21
	V	23 40 (30th)	8 0 (1st)	25	14

Section 99.—Subsequent to 9 h. on July 1, as has been already mentioned, several considerable movements occurred. One of the largest of these took place between 14 h. and 17 h. on July 1. The ranges during these hours on the traces available, and the corresponding diurnal inequality ranges, were as follows :—

TABLE CXLIX.—14 h.-17 h. July 1, 1911. Plate XLIV.

Range.	Antarctic.			Alibag.			Honolulu.			Agincourt.		Eskdalemuir.		
	N′	E′	V	H	D	V	H	D	V	H	D	N	E	V
	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
Disturbance ...	179	173	68	47	11	9	31	20	13	89	148	193	104	47
Inequality ...	3	17	10	3	2	4	1	18	5	10	41	20	10	14

In the Antarctic a rise and fall in N′ were succeeded by a second rise and fall. E′ also showed a double oscillation, the fall preceding the rise. These movements were somewhat larger than those in adjacent hours, but of similar type. The V movements during the three hours were irregular and not specially large. At the other stations the movements had a distinctive appearance and were much larger than those in adjacent hours.

At Alibag there was a deep bay in the H curve, the fall and subsequent rise being approximately equal. The D and V movements were small. At Honolulu a decided fall in H was followed by a considerably larger rise and a gradual return to the normal value. The D trace showed a decided bay, an easterly movement being followed by a nearly equal westerly movement. V showed a slight rise. At Agincourt there was a deep bay in the H curve, the commencing movement being a fall, and the subsequent recovery being at first very rapid. The declination movement at Agincourt was rather striking. A movement of 12′ to the East was followed by a rapid movement of 31′ to the West. At Eskdalemuir the N movements were considerably the largest. In about an hour from $14\frac{1}{2}$ h. to $15\frac{1}{2}$ h. there was a rise of 148γ and a fall of 193γ. This was followed by a considerable recovery. The chief movements in E occurred between 14 h. and 16 h., a fall in E—equivalent to westerly movement in the declination needle—being followed by a somewhat larger rise. V was practically undisturbed except from 15 h. to 16 h., when a rise of 44γ occurred. This was the most considerable change in V during the 48 hours following the s.c. on June 30.

Section 100.—The disturbance of July 28–29, 1911, is one as to whose commencement and duration very different views might be entertained. The Honolulu and Sitka lists both include a storm whose commencement is put at about 23 h. on July 27, but its duration was estimated at 36 hours at Honolulu as compared with 82 hours at Sitka. At Eskdalemuir, the afternoon of the 27th would hardly be described as quiet after 16 h., but there was no large disturbance until the afternoon of the 28th. In the Antarctic there was no special disturbance until near the end of the quick run taken from 8 h. to 10 h. on July 28. As the quick runs have been dealt with separately, it is convenient to take for comparison at the different stations the 24 hours commencing at 10 h. on July 28. The disturbance had not wholly disappeared at most stations by 10 h. on the 29th, but it was at least much reduced.

TABLE CL.—10 h. July 28 to 10 h. July 29, 1911. Plate XLV.

Station.	Element.	Times of Maximum.	Times of Minimum.	Disturbance Range.	Inequality Range.
		h. m.	h. m.	γ	γ
Antarctic	N′	13 50 (28th)	0 2 (29th)	342	68
	E′	7 36 (29th)	19 58 (28th)	311	48
	V	22 39 (28th)	11 21 (28th)	271	33
Mauritius	H	18 50 (28th)	13 30 (28th)	48	20
	D	11 25 (28th)	16 25 (28th)	46	23
Buitenzorg	N	2 50 (29th)	11 10 (28th)	121	37
	E	10 30 (28th)	4 20 (29th)	32	26
	V	6 35 (29th)	11 20 (28th)	39	15
Alibag	H	18 50 (28th)	13 35 (28th)	65	34
Honolulu	H	13 28 (28th)	3 51 (29th)	65	11
	D	17 52 (28th)	21 46 (28th)	50	42
	V	4 8 (29th)	21 3 (28th)	18	18
Helwan	H	10 0 (28th)	16 10 (28th)	74	25
	D	5 30 (29th)	10 50 (28th)	88	46
	V	13 40 (28th)	9 0 (29th)	32	20
Agincourt	H	22 20 (28th)	3 45 (29th)	100	46
	D	23 40 (28th)	16 5 (28th)	127	65
Eskdalemuir... ...	N	18 11 (28th)	11 2 (28th)	237	44
	E	20 56 (28th)	13 45 (28th)	134	45
	V	16 30 (28th)	0 30 (29th)	100	22
Sitka	H	10 1 (28th)	13 23 (28th)	213	29
	D	11 23 (28th)	13 8 (28th)	174	50
	V	3 47 (29th)	13 25 (28th)	375	25

In the Antarctic the disturbance was of an irregular character, comparatively quiet and more disturbed intervals succeeding one another. Between 11 h. and 12 h. on the 28th, there were large movements in all the elements, and between 14 h. and 15 h. there was a large bay in N′. From 15 h. to 18 h. on the 28th and from 4 h. to 7 h. on the 29th it was comparatively quiet.

At Mauritius the H trace was more disturbed than the range might suggest, for though there was no large continued movement in one direction, there were a number of rather prominent oscillations. The principal of these occurred between 11 h. and 15 h., and between 18 h. and 20 h. on the 28th. After 1 h. on the 29th, there was little disturbance in H, except for a moderate oscillation between 7 h. and 9 h. While the ranges in H and D were practically equal, the D trace looks comparatively undisturbed. In the normal course, a westerly movement of about $2\frac{1}{2}'$ (16γ) was to be expected between 11 h. and 16 h. on the 28th, and what the corresponding part of the trace suggests is rather an enhancement of the normal diurnal change than an active disturbance. The D trace exhibited more signs of disturbance between 18 h. and 21 h., when several oscillations appeal to the eye.

At Buitenzorg N was much more disturbed than E or V. The chief changes in N occurred between 10 h. and 17 h. on the 28th, and between 0 h. and 2 h. and again between 6 h. and 8 h. on the 29th. The E and V traces showed no large departures from the normal, but contained a number of undulatory movements of sensible size, representing in the aggregate more disturbance than the range in Table CL might suggest.

At Alibag there had been a very considerable fall in H between 8 h. and 10 h. on the 28th, and this continued until after 11 h. From then up to 23 h. there was a great deal of irregular movement, more than the range would suggest, but no large departure from the mean. The largest movements occurred between 12 h. and 14 h. and between 18 h. and 20 h. on the 28th. After 24 h. on the 28th, there was little disturbance for a number of hours.

At Honolulu the D and V traces were only slightly disturbed, and even in H there was but little disturbance after 14 h. on the 28th.

At Helwan the H trace closely resembled that at Alibag. The D and V traces were on the whole smooth, but minor oscillations were visible, more especially between 18 h. and 20 h., and again near 24 h. on the 28th.

At Agincourt disturbance appeared in H a little before 18 h. on the 27th, and gradually increased, the largest movements occurring between 22 h. and 24 h. on the 28th. The D trace showed comparatively little disturbance until 10 h. on the 28th. After that it was pretty disturbed until 8 h. on the 29th.

At Eskdalemuir considerable disturbance prevailed during the whole afternoon of the 28th. The disturbance then gradually abated, and had nearly disappeared by 8 h. on the 29th. The most disturbed times in the N trace were from 12 h. to 15 h. and 18 h. to 20 h. on the 28th, and from 22 h. on the 28th to 1 h. on the 29th. There were also considerable E movements at the later times. The only considerable change in V occurred near 24 h. on the 28th.

At Sitka, the quick run trace showed considerable disturbance, especially near 10 h. on the 28th, and the disturbance continued very active without intermission until $4\frac{1}{2}$ h. on the 29th, when conditions became much quieter for a few hours. Active disturbance was, however, resumed after 7 h. and continued until 14 h., when the amplitude of the movements was much reduced. The H and D traces showed numerous small oscillations throughout the whole time. The largest movements occurred between 10 h. and 15 h. on the 28th, the V changes being particularly striking. A rapid fall in V between 10 h. and $10\frac{1}{2}$ h. was followed by a nearly equal but much slower rise between $10\frac{1}{2}$ h. and $12\frac{3}{4}$ h. There then ensued during the next two hours a very large rapid fall, followed by a somewhat larger but less rapid rise. During the later part of this double movement in V the H and D curves also exhibited large oscillations. The three traces also showed large movements between 7 h. and 14 h. on the 29th, but during most of this time minor oscillations were a good deal less in evidence than during the afternoon of the 28th.

On this occasion, if we judged by the horizontal components, we should regard Eskdalemuir and Sitka as similarly disturbed; but the vertical force disturbance at Sitka was out of all comparison greater than at Eskdalemuir, and was considerably in excess even of that recorded in the Antarctic. Again, while the horizontal components showed a considerably larger total range in the Antarctic than at Eskdalemuir and Sitka, the superposed minor oscillations were least prominent in the Antarctic as compared with average conditions at the respective stations.

Section 101.—The s.c. which preceded the disturbance of August 19–20 was a large and well-marked one, and if disturbances and their s.c's corresponded in magnitude we should have had a notable storm. But, as a matter of fact, the subsequent

TABLE CLI.—12 h. August 19 to 9 h. August 20, 1911. Plate XLV.

Station.	Element.	Times of Maximum.	Times of Minimum.	Disturbance Range.	Inequality Range.
		h. m.	h. m.	γ	γ
Antarctic	N′	17 5 (19th)	23 20 (19th)	181	59
	E′	7 12 (20th)	21 55 (19th)	236	60
	V	23 10 (19th)	14 50 (19th)	84	26
Mauritius	H	7 50 (20th)	21 10 (19th)	41	22
	D	12 35 (19th)	9 0 (20th)	34	33
Buitenzorg	N	3 10 (20th)	15 55 (19th)	67	42
	E	23 35 (19th)	3 10 (20th)	37	31
	V	5 15 (20th)	21 10 (19th)	23	16
Alibag	H	6 10 (20th)	21 10 (19th)	42	36
Helwan	H	12 15 (19th)	23 5 (19th)	61	31
	D	5 5 (20th)	12 20 (19th)	62	46
	V	20 50 (19th)	7 55 (20th)	19	18
Agincourt	H	20 20 (19th)	16 5 (19th)	69	51
	D	3 55 (20th)	17 25 (19th)	115	69
Eskdalemuir... ...	N	21 33 (19th)	12 17 (19th)	68	40
	E	23 40 (19th)	12 44 (19th)	88	49
	V	{17 23 (19th); 21 51 (19th)}	12 45 (19th)	28	22
Sitka	H	8 5 (20th)	21 38 (19th)	88	35
	D	7 31 (20th)	23 26 (19th)	117	49
	V	23 26 (19th)	17 18 (19th)	71	22

disturbance was everywhere of a commonplace character. It does not appear at all in the Honolulu and Sitka lists. The Buitenzorg, Agincourt and Eskdalemuir curves were those mainly relied on when fixing 9 h. on the 20th as the end of the disturbance.

In the Antarctic the s.c. and the subsequent disturbance were both largest in E′. Between 13 h. and 16 h. on the 19th the movements were trifling. The largest movements especially in E′ were between 16 h. and 18 h. and after 21 h. on the 19th, and between 1 h. and 4 h. on the 20th.

At Mauritius the H trace was generally quiet. Apart from the s.c. itself, the only time when the H trace showed appreciable disturbance was from 21 h. to 23 h. on the 19th, when a somewhat conspicuous hump or elevation presented itself. Between 21 h. 10 m. and 21 h. 35 m. H rose 22γ. The subsequent fall was much slower and was interrupted by small oscillations. The D trace showed little disturbance, the visible changes being apparently almost entirely due to the normal diurnal variation.

At Buitenzorg there was a large s.c. movement in N which subsided largely within half an hour. A quiet time followed until nearly 16 h. on the 19th. The largest N movements occurred between 21 h. and 23 h. Except between these hours there were few irregular movements in E or V. The N trace continued to show irregular minor movements until nearly 9 h. on the 20th.

At Alibag the chief disturbance in H was between 21 h. and 23 h. on the 19th and for half an hour subsequent to the s.c. D and V traces were available for only part of the time and showed little sign of disturbance.

The phenomena at Helwan were similar to those at Alibag. Even the H trace was mostly pretty smooth, and the D and V traces were almost entirely so. At the same time, the D range seems to have been sensibly above the normal.

At Agincourt the H trace showed minor oscillations throughout most of the time; the disturbance was most active from 20 h. to 24 h. on the 19th. The D trace showed less persistent oscillation than the H trace, but contained a considerable bay between 3 h. and 5 h. on the 20th.

At Eskdalemuir there were numerous minor irregularities in the N trace, especially between 16 h. and 18 h. and between 21 h. and 24 h. of the 19th. The V trace throughout was almost undisturbed.

The Sitka traces available stopped at 3 h. on the 20th, but information as to the maxima in H and D was derivable, as in many other cases, from the official publication. There were no really large movements, but the H and D curves showed numerous oscillations during most of the time they covered. The oscillations were least in evidence from one to three hours after the s.c. At Sitka, as at Agincourt, the D range considerably exceeded that of H.

Section 102.—During August 23–25 there was considerable disturbance at all the stations. Conditions had been generally quiet during the previous 12 hours, and the selection of 8 h. for the commencement of the disturbance is open to little doubt. There is more room for difference of opinion as to the end. The duration is given in the official Honolulu publication as 52 hours, while the Sitka estimate is 120 hours. In the Antarctic, noon on the 25th was followed by one or two hours free from large disturbance, so 12 h. has been accepted here for the end of the disturbed interval.

TABLE CLII.—8 h. August 23 to 12 h. August 25, 1911. Plate XLVI.

Station.	Element.	Times of Maximum.	Times of Minimum.	Disturbance Range.	Inequality Range.
		h. m.	h. m.	γ	γ
Antarctic	N′	15 5 (23rd)	23 15 (23rd)	454	59
	E′	3 42 (24th)	14 58 (23rd)	523	60
	V	2 5 (24th)	9 5 (24th)	338	28
Mauritius	H	8 20 (23rd)	14 35 (23rd)	125	22
	D	10 20 (24th)	15 0 (23rd)	68	33
Buitenzorg	N	8 25 (23rd)	14 0 (23rd)	140	42
	E	8 50 (23rd)	4 20 (25th)	52	31
	V	8 5 (23rd)	14 35 (23rd)	46	16
Alibag	H	8 25 (23rd)	15 30 (23rd)	117	37
Honolulu	H	19 20 (23rd)	23 28 (23rd)	86	11
	D	22 8 (23rd)	17 26 (23rd)	86	49
	V	15 4 (23rd)	21 32 (24th)	29	22
Helwan	H	8 24 (23rd)	6 20 (25th)	108	32
	D	5 15 (25th)	11 19 (23rd)	71	48
	V	14 38 (23rd)	7 24 (24th)	39	18
Agincourt	H	23 25 (23rd)	14 57 (23rd)	235	51
	D	23 30 (23rd)	15 15 (23rd)	299	69
Eskdalemuir... ...	N	14 59 (23rd)	23 28 (23rd)	270	42
	E	15 19 (23rd)	14 23 (23rd)	150	49
	V	15 19 (23rd)	23 36 (23rd)	240	22
Sitka	H	5 38 (24th)	14 56 (23rd)	573	35
	D	15 0 (23rd)	11 29 (24th)	287	49
	V	0 8 (24th)	15 2 (23rd)	559	22

In the Antarctic all three elements showed considerable disturbance. The largest movements occurred on the 23rd between 14 h. and 16 h., and between 20 h. and 24 h.; on the 24th between 3 h. and 6 h., and between 8 h. and 10 h. The movements between 8 h. and 10 h. on the 24th have been already discussed amongst the short-period disturbances. Throughout the whole 52 hours there was no sensible interlude to the disturbance, and numerous small oscillations were superposed on the larger movements in the curves of all the elements. The first movement of any size was a rise and fall in N′ between 8 h. 22 m. and 8 h. 32 m. on the 23rd. This was accompanied by a general rise in E′, but the movements did not suggest an ordinary s.c. Between 14 h. and $16\frac{1}{4}$ h. on the 23rd, N′ rose 252γ and fell 239γ, E′ fell 362γ and rose 336γ, while

V had fallen (algebraically) 190γ by 15 h. 25 m., when a long but comparatively slow recovery set in. At about 8 h. 25 m. on the 25th there was an oscillation in all the elements, lasting about six minutes, which was distinctly suggestive of an s.c.

At Mauritius the H trace shows numerous oscillations of moderate period, superposed on slower movements which resemble the regular diurnal variation, enhanced, however, especially on the 23rd. A noticeably sharp oscillation in H occurred shortly after 8 h. on the 23rd, a rise of 11γ occurring in about 10 minutes. Between 14 h. and 16 h. on the 23rd H fell 27γ, rose 16γ, fell 15γ, and rose 16γ. Considerable oscillatory disturbance followed until 24 h. on the 23rd, when a quieter time ensued until 8 h. on the 24th. From 8 h. to 20 h. on the 24th there was a succession of fairly slow oscillations. After 20 h. on the 24th the trace was considerably quieter, though still a little oscillatory. The movements in the Mauritius D trace represent in the main the regular diurnal variation. There was, however, one considerable oscillation, a westerly movement of $5\frac{1}{2}'$ in 33 minutes, leading to the minimum (of easterly declination) at 15 h. on the 23rd, being followed by an easterly movement of $5\frac{1}{2}'$ in 22 minutes. These movements may appear trifling, but either exceeds the normal diurnal range. A second somewhat rapid change was an easterly movement of $3\frac{1}{2}'$ between 23 h. 0 m. and 23 h. 25 m. on the 23rd.

At Buitenzorg N had been falling for some time prior to 8 h. on the 23rd. But about 8 h. 20 m. there was a sharp rise, leading to a horn-like peak at about 8 h. 25 m. After this the fall was resumed, and continued almost uninterruptedly for fully three hours. Between 14 h. 0 m. and 15 h. 20 m. on the 23rd there was a rise of 99γ and fall of 84γ in H ; corresponding fairly in time with the large oscillation in Antarctic E′. There was a comparatively quiet time from 18 h. to 23 h. on the 23rd, though even then there were numerous small oscillations in N. There was a rise of 77γ in N between 23 h. 30 m. on the 23rd and 2 h. on the 24th, and a fall of 96γ between 4 h. and 8 h. on the 25th. The E and V curves were much quieter, but both showed very appreciable oscillations during the large N oscillation between 14 h. and 16 h. on the 23rd.

Only the H Alibag trace was available. Shortly after 8 h. on the 23rd it showed a prominent horn, answering to that in the Buitenzorg N trace. Between 8 h. 25 m., when the top of the horn was reached, and 14 h. 10 m. there was a fall of 113γ. Between 14 h and 16 h. of the same day there was a prominent oscillation similar to that in N at Buitenzorg. The trace was comparatively quiet from 0 h. to 8 h. on the 24th. Subsequent to 20 h. on the 24th there was no movement worth mentioning, except a decided bay between 6 h. and $8\frac{1}{2}$ h. on the 25th.

At Honolulu shortly after 8 h. on the 23rd there was a prominent horn in the H curve, similar to those described at Buitenzorg and Alibag. Corresponding to this there were oscillations in D and V, the former, however, being very small. This was followed by a large fall in H. The largest subsequent H movements were on the 23rd, between 23 h. and 24 h., and on the 24th between 5 h. and 6 h., and again between 8 h. and 9 h. While the range in D considerably exceeded that in V, short-period oscillations were more prominent in the latter element.

The Helwan H trace shows the tooth-like movement between 8 h. and 9 h. on the 23rd, and there was a corresponding visible oscillation in V. The H trace was most disturbed between 13 h. and 22 h. on the 23rd, and between 18 h. and 21 h. on the 24th. During the afternoon of the 23rd there were some slow oscillations in D.

The Agincourt traces, both H and D, were considerably disturbed. The D movements were the larger, but short-period oscillations were more prominent in H. On the 23rd the oscillation having its turning point about 8 h. 25 m. was prominent; it was slightly larger in D than in H. No large movement occurred until 9 h. 5 m., when there began a swing of 24′ to the East, which ended at 10 h. 15 m. Between 14 h. 0 m. and 15 h. 17 m. H fell 133γ and rose 142γ. The other chief H changes occurred between 20 h. and 24 h. on the 23rd, and between 3 h. and 9 h. on the 24th. There was a very deep bay in the D curve between 23 h. and 24 h. on the 23rd. This was composed of uninterrupted movements of 45′ to the East and 39′ to the West. Other smaller but noteworthy D movements occurred on the 24th, between 2 h. and 3 h., between 4 h. and 6 h., and between 8 h. and 10 h. Neither H nor D showed any large change during the afternoon of the 24th.

At Eskdalemuir the tooth-like oscillation before 8½ h. on the 23rd was apparently represented, but it was preceded and followed by other oscillations of decided though smaller amplitude, and so makes less appeal to the eye than at Buitenzorg, Alibag, Honolulu or Helwan. At Eskdalemuir this movement in N was accompanied by a fully larger movement in E, and there was also a distinct dimple in the V curve. Throughout the greater part of the time at Eskdalemuir N was considerably more disturbed than E. The largest movements in all three elements occurred between 14 h. and 16 h. on the 23rd, and between 23 h. on the 23rd and 1 h. on the 24th. At the former time the V trace showed the pinnacle, and at the latter time the pit, which are respectively characteristic of afternoon and early morning disturbance in that element. The movement at Eskdalemuir between 23 h. on the 23rd and 1 h. on the 24th was of a rotating type, the vector in the horizontal plane rotating anti-clockwise.

At Sitka the tooth-like movement before 8½ h. on the 23rd is represented in H and to a minor extent in D and V, but it is preceded as at Eskdalemuir by minor oscillations, and so is comparatively insignificant. The largest movements occurred between 13 h. and 16 h. on the 23rd, when there were large bays in the traces of all three elements. The deepest points in the bays (minimum in H, maximum easterly declination, and minimum in V) all occurred within a few minutes of 15 h., when the D trace was for a short time beyond the limits of registration. During the three hours specified the range was 406γ in H, and 398γ in V, and exceeded 180γ in D. The V trace contained a bay of some size between 23 h. on the 23rd and 1 h. on the 24th, and there were simultaneously fair movements in H and D; but the disturbance near midnight on the 23rd was not outstanding as at some of the other stations, being only a little larger than in adjacent hours. There was a specially large rapid oscillation in the three elements about 5 h. 40 m. on the 24th, and several large but slower oscillations occurred later on the same day between 8 h. and 13 h. During most of the time, especially between 9 h. on the

23rd and 6 h. on the 24th, there were incessant short-period oscillations in H and D.

One of the most interesting features of this disturbance is a recognisable tooth-like disturbance at all the stations, preceding the larger movements. It was not of the ordinary s.c. type. It commenced indeed like the ordinary s.c. with a rise in H or N, but this was immediately followed by a similarly large and equally rapid fall. At some stations, including Buitenzorg, Alibag and Honolulu, the fall appealed more to the eye than the rise. The amplitudes of this oscillation, taking the mean of the rise and fall, were as follows :—Antarctic N′, 23γ ; Mauritius H, 10γ ; Buitenzorg N, 13γ ; Alibag H, 12γ ; Honolulu H, 9γ ; Helwan H, 16γ ; Agincourt H, 15γ ; Eskdalemuir N, 17γ ; and Sitka H, 19γ. The law of variation of the amplitude with latitude is thus fairly similar to that seen in s.c's.

The movements between 14 h. and 16 h. on the 23rd were especially prominent at Sitka and the Antarctic, and were amongst the largest at Buitenzorg, Alibag, Agincourt and Eskdalemuir ; but they were comparatively insignificant at Honolulu. The movement near midnight of the same day was, on the other hand, the most prominent recorded at Honolulu, but was comparatively insignificant at Sitka. At Eskdalemuir it was fully as prominent as the disturbance between 14 h. and 16 h. It was also exceedingly prominent at Agincourt, and was well represented at Buitenzorg and the Antarctic.

Section 103.—Between 7 h. and 10 h. on August 31, 1911, there was a large and distinctive movement in the Antarctic curves. Before 7 h. conditions were quiet, but after 10 h. conditions remained unquiet for some time. The movements in the Antarctic N′ and V traces were such as are not infrequently met with in the "special type." There was a fall in E′, which showed no signs of slackening when the N′ and V movements slackened, but continued, interrupted only by short-period oscillations, for about 1½ hours. During that time the general slope was nearly uniform.

At Mauritius the H trace showed a distinct bay, the fall to the minimum at 9 h. 5 m. somewhat exceeding the subsequent rise. The D trace showed little but the normal variation.

At Buitenzorg there was a bay in the N curve, followed after 10 h. by irregular movements. The E and V traces were comparatively undisturbed. At Alibag there was a distinct bay in H.

At Agincourt there was a decided bay in H ; but the disturbance in D, a westerly followed by an easterly movement, was at once much larger and more regular, being quite a conspicuous object on the curve.

At Eskdalemuir there were bays in the N and E curves, and to a minor extent in the V curve.

At Sitka the minor oscillations usually visible there increased in activity after 5 h., and remained active after 10 h. ; but between 7 h. and 10 h. the amplitude of the movements was greater than either before or after. These movements took the form of irregular oscillations in the H curve. The D movements were at once larger and more regular. A movement to the East was followed by a larger movement to

TABLE CLIII.—7 h. to 10 h. August 31, 1911. Plate XLVI.

Station.	Element.	Times of Maximum.		Times of Minimum.		Disturbance Range.	Inequality Range.
		h.	m.	h.	m	γ	γ
Antarctic	N′	8	26	7	18	172	23
	E′	8	26	9	57	174	15
	V	8	6	8	55	94	9
Mauritius	H	7	0	9	5	19	7
	D	10	0	7	45	30	25
Buitenzorg	N	7	0	8	52	43	22
	E	8	50	7	0	15	11
	V	7	0	9	20	16	11
Alibag	H	7	10	8	55	16	19
Agincourt	H	8	45	8	10	33	3
	D	10	0	8	30	109	12
Eskdalemuir... ...	N	7	20	8	35	43	25
	E	8	34	9	34	38	17
	V	7	0	10	0	11	6
Sitka	H	8	5	9	15	83	3
	D	8	40	9	15	127	5
	V	8	4	9	1	117	1

the West, this being followed by an easterly and then by a westerly swing. The V movement was still more regular. There was a marked hump (depression), of the type usually exhibited during the occurrence in the Antarctic of disturbances of the special type.

Section 104.—The earlier part of September 19, 1911, was generally quiet. Gradually unrestfulness began to be visible, both in the Antarctic and at Eskdalemuir, and by the time, 18 h., taken here as the beginning of the disturbance, minor oscillations were a good deal in evidence. The time accepted here as the end of the disturbance, 24 h. on the 21st, is somewhat arbitrary. There was appreciable abatement of disturbance for an hour or two at that time at Eskdalemuir, but disturbance prevailed again later in the 22nd. At both Honolulu and Sitka the duration of the storm was estimated at 67 hours, which would put the end at 13 h. on the 22nd, and if records covering the whole of that time had been available it might have had advantages over the choice made above.

In the Antarctic there were some comparatively quiet short interludes, including 22 h. to 23 h. on the 19th, and 3 h. to 5 h. on the 21st, but rapid oscillations were in progress practically the whole time. The larger movements recorded took place between 2 h. and 12 h. on the 20th, and between 6 h. and 12 h. and again between

21 h. and 23 h. on the 21st; but the minor short-period oscillations were equally if not more prominent at other times. On the forenoon of the 20th much the most prominent feature was a depression of N′, lasting from 2 h. to 7 h.

TABLE CLIV.—18 h. September 19 to 24 h. September 21, 1911. Plate XLVII.

Station.	Element.	Times of Maximum.	Times of Minimum.	Disturbance Range.	Inequality Range.
		h. m.	h. m.	γ	γ
Antarctic	N′	15 40 (21st)	3 18 (20th)	486	68
	E′	7 39 (20th)	22 25 (21st)	403	68
	V	2 33 (20th)	10 53 (20th)	257	38
Mauritius	H	19 25 (19th)	15 25 (21st)	75	20
	D	11 0 (20th)	7 45 (20th)	53	34
Buitenzorg	N	1 35 (20th)	10 30 (20th)	204	41
	E	7 40 (20th)	2 40 (20th)	58	31
	V	4 35 (21st)	9 35 (21st)	38	17
Alibag	H	19 30 (19th)	10 40 (20th)	112	29
Honolulu	H	19 26 (19th)	4 45 (20th)	115	7
	D	18 5 (19th)	22 21 (20th)	54	45
	V	17 53 (21st)	20 32 (19th)	36	24
Helwan	H	19 25 (19th)	15 25 (21st)	99	35
	D	14 55 (20th)	10 50 (21st)	63	54
	V	14 30 (21st)	17 45 (21st)	29	23
Agincourt	H	20 25 (19th)	7 20 (20th)	283	37
	D	3 5 (20th)	7 40 (20th)	326	49
Eskdalemuir... ...	N	17 42 (21st)	10 50 (20th)	215	39
	E	17 32 (21st)	3 4 (20th)	155	37
	V	16 30 (21st)	4 5 (20th)	161	15
Sitka	H	3 58 (20th)	9 12 (20th)	489	29
	D	9 40 (20th)	7 24 (20th)	330	37
	V	4 3 (20th)	10 46 (20th)	626	11

On the 21st from 6 h. to 12 h. there was a continual depression in the V curve (numerical increase). Between 21 h. and 23 h. on the 21st the principal movements took place in E′. Amongst them were a fall of 168γ and a rise of 174γ, both within 15 minutes. Synchronous with this there was a considerable oscillation in V, numerical rise, then fall.

The traces, more especially the H trace, received from Mauritius were in parts too faint for exact measurement, but the ranges in Table CLIV are at least approximately correct. D when approaching its extreme values was changing so slowly that the times of maximum and minimum could not be fixed with great precision. The H trace showed one or two small but sharp oscillations between 19 h.

and 20 h. on the 19th. It was practically quiet between 22 h. on the 19th and 2 h. on the 20th, when some moderate slow oscillations began. Later in the 20th there was a fall of 21γ between 6 h. 50 m. and 7 h. 40 m., and a rise of 21γ between 19 h. 0 m. and 19 h. 35 m. But the largest movements in H occurred on the 21st between 13 h. and 18 h. A deep bay, depression, lasted from 13 h. 0 m. to 17 h. 40 m. The fall, 37γ, was slightly interrupted and nowhere very rapid. The rise was at first slow, but between 17 h. 15 m. and 17 h. 40 m. it amounted to 41γ. There were bays in the D curve on the 20th between 2 h. and 6 h. and between 8 h. and 13 h., but they mainly represent the regular diurnal variation, though somewhat enhanced.

At Buitenzorg, as usual, N was much the most disturbed element. Throughout most of the time there were successive large bay-like movements, with a considerable number of short-period oscillations superposed. There were, however, two comparatively quiet interludes, the first between 21 h. on the 19th and 1 h. on the 20th, the second between 20 h. on the 20th and 5 h. on the 21st. The most disturbed time was from 2 h. to 16 h. on the 20th. Between $9\frac{1}{2}$ h. and 12 h. N fell 72γ and rose 111γ. There was also considerable disturbance on the 21st between 6 h. and 18 h. The E trace showed a fair number of short-period oscillations, and the V trace some wave-like movements of longer period, but neither element was much disturbed.

The disturbance in H at Alibag was a good deal less than that in N at Buitenzorg. It was pretty quiet at Alibag until 19 h. on the 19th. Some considerable oscillations and a decided bay occurred in the H curve between 19 h. and 21 h., after which it remained nearly quiet until 2 h. on the 20th. From 7 h. to 17 h. on the 20th there was a good deal of disturbance, the element being on the whole considerably depressed. Between 9 h. 35 m. and 12 h. 5 m. there were a fall and rise, each of about 45γ. It was practically quiet from 20 h. on the 20th to 6 h. on the 21st and again after 18 h. on the 21st. From 6 h. to 17 h. on the 21st the element was markedly depressed. Between 17 h. 20 m. and 17 h. 40 m. on the 21st there was a recovery of 44γ, which was the most rapid of the larger movements.

At Honolulu the D and V curves were not much disturbed, but showed a few minor wave-like movements. There was a brisk fall in H between 19 h. and $20\frac{1}{2}$ h. on the 19th. Thereafter it was but little disturbed until $2\frac{1}{2}$ h. on the 20th. Between 2 h. and 7 h. 20 m. on the 20th H fell 83γ and rose 73γ. The trace remained a good deal disturbed up to 13 h. on the 20th. Subsequently there were only minor oscillations, the principal between 6 h. and $10\frac{1}{2}$ h. and between 14 h. and 18 h. on the 21st.

The Helwan H trace in many respects closely resembled that at Alibag, outstanding movements in the two corresponding. But while at Alibag there was a rather prominent summit about 6 h. 40 m. on the 20th, H had been falling at Helwan since 4 h. Corresponding to a principal summit at one place there was only a stationary point at the other. At Helwan H rose 50γ between 17 h. 20 m. and 17 h. 40 m. on the 21st. The D and V traces at Helwan were but little disturbed on the whole, but contained rather conspicuous bay or wave-like movements between $14\frac{1}{2}$ h. and $15\frac{1}{2}$ h. on the 20th, and between 17 h. and 18 h. on the 21st.

At Agincourt the H and D traces were both highly disturbed. The principal movements in both occurred between 2 h. and 11 h. on the 20th. The only considerable D movements except at that time occurred between $21\frac{1}{2}$ h. on the 20th and 1 h. on the 21st, and between $6\frac{1}{2}$ h. and 10 h. on the 21st, and they were much smaller than those first mentioned. Minor oscillations were more in evidence in the H trace, where they prevailed most of the time except from 3 h. to 6 h. on the 21st.

At Eskdalemuir numerous small oscillations appeared in the N and E traces after 16 h. on the 19th. The larger movements in N occurred on the 20th between 2 h. and 8 h. and between 14 h. and 20 h., and on the 21st between 17 h. and 18 h. Between 17 h. 28 m. and 17 h. 45 m. on the 21st there was a rise of 143γ. The chief movements in the E trace were 64γ East between 20 h. 10 m. and 20 h. 40 m. on the 19th, 79γ West between 2 h. 40 m. and 3 h. 5 m. on the 20th, and an oscillation 97γ East and 93γ West between 17 h. 20 m. and 17 h. 50 m. on the 21st. The only prominent feature in the V trace was a bay from about 2 h. to 8 h. on the 20th. Between 2 h. 0 m. and 4 h. 10 m. the element fell 89γ. Between 2 h. and 6 h. on the 21st and from 11 h. to 14 h. on the 21st there was little disturbance in any of the elements.

At Sitka conditions were pretty quiet until after 17 h. on the 19th, and there were no very large movements until 3 h. on the 20th. The most highly disturbed times were between 6 h. and 16 h. on the 20th, and between 6 h. and 16 h. on the 21st. The movements in all three elements were large, especially in V where the trace was twice off the sheet on the 20th, though for less than 10 minutes on either occasion. Between 4 h. and 7 h. 20 m. on the 20th, when the trace went off the sheet, there was a nearly uninterrupted fall of V amounting in all to 625γ. Between 6 h. 40 m. and 7 h. 40 m. on the 20th H fell 379γ and rose an equal amount. Between 7 h. 15 m. and 7 h. 33 m. D moved 39′ (179γ) West and 61′ (280γ) East. There were numerous other large oscillations on the 20th between 6 h. and 16 h., and considerable intercrossing of the traces. On the 21st between 7 h. 5 m. and 9 h. 5 m. H fell 290γ. Between 6 h. 40 m. and 9 h. 10 m. V fell 302γ. Between 10 h. 5 m. and 12 h. 0 m. H rose 248γ. Between 10 h. 30 m. and 12 h. 20 m. V rose 321γ. There were also considerable D movements between 6 h. and 11 h. At Sitka it was comparatively quiet from 16 h. on the 20th to $6\frac{1}{2}$ h. on the 21st.

During the disturbance of September 19–21, 1911, the movements were numerous and none had any particularly outstanding feature, while the almost continuous succession of minor oscillations tended to distract the eye from such bold movements as there were. Thus it is difficult to gauge the greater or less parallelism of the disturbance at the different stations, or the degree of correspondence in individual movements. A general parallelism, however, obviously existed in the sequence of events at the different stations. In particular there was everywhere a markedly increased activity of disturbance after 2 h. on the 20th, and this activity continued until the early afternoon. It fell off decidedly later on the 20th, but showed a marked recrudescence after 6 h. on the 21st. As usual V showed little disturbance at the stations in lower latitudes. At Eskdalemuir the range in V was considerable, but the disturbance was inconsiderable except during a few hours. At Sitka disturbance in V was quite of a different order. Short-period oscillations, it is true, were not nearly so conspicuous as in H or D, but there were a number of bold movements and much more oscillation than is usually seen in a V trace. While there was no close resemblance between the V movements in the Antarctic and at Sitka, the larger movements occurred about the same time at the two stations. The storm in fact was active in the Antarctic and at Sitka at the same time, and was much more feebly developed in the intervening region.

Section 105.—The disturbance of October 10–11, 1911, had no very definite beginning or ending. At Honolulu it was regarded as commencing at $8\frac{1}{2}$ h. on October 10, and ending at $14\frac{1}{2}$ h. on October 11. At Sitka the accepted times were :—Beginning 11 h. on 10th, end 11 h. on 11th. Here it is regarded as comprised within the 24 hours commencing at 12 h. on the 10th. This includes all that would naturally be included in a magnetic storm in the Antarctic or at Eskdalemuir.

TABLE CLV.—12 h. October 10 to 12 h. October 11, 1911. Plate XLVIII.

Station.	Element.	Times of Maximum.	Times of Minimum.	Disturbance Range.	Inequality Range.
		h. m.	h. m.	γ	γ
Antarctic	N′	16 45 (10th)	5 38 (11th)	330	75
	E′	5 20 (11th)	19 35 (10th)	467	82
	V	23 28 (10th)	8 38 (11th)	143	46
Mauritius	H	12 0 (10th)	18 40 (10th)	70	21
	D	8 45 (11th)	19 0 (10th)	58	37
Buitenzorg	N	21 10 (10th)	5 55 (11th)	127	39
	E	5 35 (11th)	2 15 (11th)	41	48
	V	5 35 (11th)	1 40 (11th)	27	32
Alibag	H	23 15 (10th)	4 50 (11th)	55	44
Honolulu	H	12 52 (10th)	4 20 (11th)	148	18
	D	18 10 (10th)	23 12 (10th)	68	28
	V	5 28 (11th)	21 35 (10th)	35	17
Helwan	H	12 0 (10th)	18 55 (10th)	89	30
	D	23 10 (10th)	3 55 (11th)	95	32
	V	19 0 ? (10th)	23 5 (10th)	25	18
Agincourt	H	21 25 (10th)	5 25 (11th)	291	27
	D	4 10 (11th)	21 25 (10th)	245	35
Eskdalemuir... ...	N	2 24 (11th)	5 4 (11th)	183	28
	E	23 8 (10th)	5 50 (11th)	317	31
	V	19 16 (10th)	1 45 (11th)	233	16
Sitka	H	1 11 (11th)	4 58 (11th)	697	25
	D	5 26 (11th)	2 25 (11th)	299	24
	V	2 34 (11th)	5 0 (11th)	405	7

In the Antarctic short-period oscillations were hardly more prominent than on the average day; the outstanding feature was the long persistence of changes in one general direction. N′ began to show a decided fall after 17 h. on the 10th, and continued to fall with only slight interruptions until 4 h. on the 11th. A considerable oscillation ensued between 4 h. 0 m. and 5 h. 40 m., and then a nearly uninterrupted rise took place until 10 h. The E′ trace after 15 h. on the 10th, showed a general fall until 21 h. There was a general rise from 23 h. on the 10th to 5 h. 20 m. on the 11th, followed by a general fall until 11 h. Near 12 h. on the 11th, the elements were all very quiet. As Table CLV shows, the total ranges in N′ and E′ were very considerable.

There was also a considerable range in V, there being a slow but long continued (numerical) rise from 0 h. to 8 h. on the 11th, but there was no single striking movement.

At Mauritius there was a rather rapid, if small, fall in H about 8 h. 40 m. on the 10th, and after it an almost uninterrupted fall until after 17 h. This is much after the style of the ordinary diurnal change, but the amplitude was three or four times the normal. Several considerable slow oscillations ensued, followed by a general rise of H until 24 h. on the 10th. Subsequently, until 6 h. on the 11th, there were successive slow oscillations, accompanied on the whole by a slight fall in H. The D trace shows a few irregular movements, especially between 2 h. and 6 h. on the 11th. From 12 h. to 19 h. on the 10th, there was an almost uninterrupted swing of $7\frac{1}{2}'$ to the West, the normal change in the time being only about 2′. Also the value of D at 19 h. was about $5\frac{1}{2}'$ more westerly than the value next day at 6 h., whereas in the normal course it would have been fully 2′ more easterly. Still the general appearance of the D curve does not suggest active disturbance.

At Buitenzorg, as usual, the N movements were much the largest. On the whole there was a rise in N from 17 h. to 21 h. on the 10th, followed by a very considerable fall from 23 h. on the 10th to 6 h. on the 11th. Though the ranges in Table CLV would not suggest it, the E and V traces were both obviously disturbed, but the individual movements were of an irregular character and not large. The E trace at times exhibited a good many small short-period oscillations, while the V trace presented a succession of slow wave-like movements.

At Alibag, as at Mauritius, H had been falling on the whole for some hours before 12 h. on the 10th, and the fall continued until 17 h. Then followed a general rise, interrupted slightly by slow oscillations, until 23 h., and then a fall similarly interrupted until 4 h. on the 11th. After 6 h. a rise set in, which lasted with only trifling oscillations throughout most of the 11th. The principal phenomenon was perhaps the depression of H throughout the greater part of the time. No individual movement was at all striking.

At Honolulu H began to fall shortly after 12 h. on the 10th. From 15 h. to 17 h. the fall was interrupted by a slight rise, but after 17 h. it continued with only slight interruptions until after 4 h. on the 11th. A rise then began, which continued with minor interruptions until after 18 h. on the 11th, but the total rise after 14 h. on the 11th was not large. Here, as at Mauritius, the general appearance of the H trace is that of a large indented bay. The D and V ranges, as Table CLV shows, were decidedly enhanced, but the traces, especially that of D, were on the whole smooth. The largest short-period movements occurred between $4\frac{1}{2}$ h. and $6\frac{1}{2}$ h. on the 11th.

At Helwan, H had a general fall from 11 h. to 19 h. on the 10th, a rise from 19 h. on the 10th to 1 h. on the 11th, then a fall from 3 h. to 7 h. followed by a rise. The main feature is the depression throughout the greater part of the afternoon of the 10th. The D trace showed a slow easterly movement from 15 h. to 23 h. on the 10th, followed by a slow westerly movement until 4 h. on the 11th. The D range is considerable for Helwan, but irregular movements were small.

At Agincourt both H and D traces showed quite a brisk disturbance between 21 h. on the 10th and 9 h. on the 11th. There were numerous short-period oscillations, some of considerable size, but the general trend of the H trace was unmistakably downwards from 21 h. on the 10th to $5\frac{1}{2}$ h. on the 11th. A very rapid recovery then set in; but the element was markedly below its normal value from 0 h. to 9 h. on the 11th. The D trace exhibited a general tendency to easterly movement from 21 h. on the 10th to nearly 5 h. on the 11th, followed by a return towards the normal. But the oscillations in D were larger relative to the general drift than was the case in H. Thus while both curves suggest prolonged bays lasting from 21 h. on the 10th until 10 h. on the 11th, the D bay seems shallower and more indented than that in H. The largest of the comparatively short-period movements in both elements took place between 4 h. and 6 h. on the 11th.

At Eskdalemuir, the curves remained normally quiet until 12 h. on the 10th, and had reverted to a quiet condition by 10 h. on the 11th. There were minor oscillations in N from 12 h. to 18 h. on the 10th. Larger movements followed from 18 h. on the 10th to 6 h. on the 11th. On the whole, N was falling from 18 h. to 21 h. on the 10th, and from $2\frac{1}{2}$ h. to 6 h. on the 11th, but there was a considerable rise from 21 h. on the 10th to $2\frac{1}{2}$ h. on the 11th. The largest movements occurred between 0 h. and 6 h. on the 11th. At 6 h. on the 11th, when active disturbance seemed practically over, N was depressed some 80γ below its normal value. Thus the depression in N, like that in H at Alibag and Helwan, was in two stages, interrupted by a marked recovery.

There was a large E range at Eskdalemuir. There were some large comparatively slow oscillations, but the disturbing forces had a generally easterly trend from 15 h. to 23 h. on the 10th, followed by a more rapid westerly reaction until 4 h. In fact from 3 h. to 7 h. on the 11th, the W element was numerically above its normal value. The E trace has the general appearance of a bay from about 17 h. on the 10th to 4 h. or 6 h. on the 11th. The larger oscillations in the element occurred between 22 h. on the 10th, and 3 h. on the 11th. The V trace at Eskdalemuir showed a practically uninterrupted though not very large rise from 12 h. to 19 h. 20 m. on the 10th. Then followed a practically unbroken fall until nearly 2 h. on the 11th. From 2 h. to 4 h. the trace was nearly level, and then followed an almost continuous rise, restoring V to its normal value about 10 h. on the 11th. Thus the trace resembles a large bay with no striking indentations, extending from about 19 h. 20 m. on the 10th to 10 h. on the 11th.

At Sitka there seem three phases in the storm. From 12 h. to 24 h. on the 10th there were large bold movements in all the elements. From 0 h. to nearly 5 h. on the 11th there were no large movements but a rapid succession of very appreciable though minor oscillations, the H and D traces, which then happened to be close together, crossing and recrossing. From 5 h. to 11 h. on the 11th larger and longer period movements were again in evidence. By 12 h. on the 11th disturbance had practically ceased, though small oscillations—which seem a dominant feature at Sitka—continued for hours. One of the largest of the comparatively slow movements at Sitka occurred between 12 h. and 14 h. 5 m. on the 10th. In this time H fell 165γ and rose as much; declination changed 21′ to the West then 21′ to the East; V fell 129γ and rose 114γ. From 14 h. 5 m. to 19 h. 20 m. on the 10th H had a nearly uninterrupted fall of 198γ. A rapid rise interrupted only by small short-period oscillations followed until 23 h. 5 m., the total rise since 19 h. 20 m. amounting to 281γ. H remained oscillatory but high until nearly 5 h. on the 11th, when some large rapid oscillations occurred, not very clearly shown on the sheet. They left H reduced by some 232γ. The minor oscillations which followed on the whole tended to raise H, and by 11 h. on the 11th, it had returned to about its normal value. The D range at Sitka, so far as shown,* was considerably smaller than that in H. The needle was considerably to the West of its normal position from 18½ h. to 22 h. on the 10th. There were some very rapid oscillations, not very clearly shown in the trace, between 5 h. and 6 h. on the 11th. In the course of 45 minutes there were movements of 59′ + to East, 52′ + to West, and finally 38′ to East. As usual, the V movements at Sitka were less oscillatory throughout most of the time than those in the horizontal components, but some were large. The element was below its normal value from 12½ h. to 20½ h. on the 10th. A rise which began about 19½ h. continued almost uninterruptedly until 23 h. 50 m. on the 10th, during which time V had risen 287γ. The element remained high, showing only minor though somewhat rapid oscillations, until nearly 5 h. on the 11th, when some very rapid oscillations occurred, not clearly shown on the trace. In the course of 5 minutes V fell 315γ and rose 429γ. In the course of the next 10 minutes some similarly large oscillations occurred, the resultant effect being a fall of 383γ. After that V, while oscillating considerably, remained decidedly depressed until 10 h. 20 m. on the 11th. A recovery then set in, restoring the element to near its normal value before 12 h.

The prominent feature in the disturbance of October 10–11, 1911, was the tendency, especially in H or N, to a persistent change in one direction for hours at a time, interrupted only by minor oscillations not sufficient to affect the general trend. Details, however, vary at the different stations. At Honolulu, where the fall in H

* The trace was off the sheet for 5 minutes centring at 5 h. 26 m. on the 11th, which has been accepted as the time of the maximum.

was particularly regular, and in the Antarctic in the case of N′, the fall continued until about 4 h. on the 11th. At Mauritius, Alibag and Helwan it continued only until 17 h. or 18 h. on the 10th, but it had commenced at these stations before 12 h. on the 10th. At Agincourt it continued until 4 h. or 5 h. on the 11th, but did not become prominent until about 21 h. on the 10th. At Buitenzorg the fall in N was interrupted from 17 h. to 21 h. on the 10th, during which time there was a considerable rise. Similarly at Eskdalemuir there was a considerable recovery in N between 21 h. on the 10th and 2½ h. on the 11th ; while at Sitka a marked recovery in H continued from 19½ h. until 24 h. As usual the V disturbance was trifling at the stations in low latitudes, but it was considerably larger at Eskdalemuir than in the Antarctic, a very unusual feature, and at Sitka it was immensely larger than elsewhere. Further, while the V range at Eskdalemuir was considerable, the movements there were all slow ; but at Sitka there were movements of all kinds, including several oscillations of a suddenness most unusual in the element.

Section 106.—The disturbance of November 8–9, 1911, had an s.c., generally of considerable amplitude, at about 13 h. 43 m. This had, however, been preceded at Sitka by some short-period oscillations, which commenced shortly after 12 h. on the 8th. Thus 12 h. has been taken as the beginning of the interval to which Table CLVI refers.

In the Antarctic conditions were very quiet for 10 or 11 hours preceding the s.c. The s.c. movement was followed by others of similar amplitude, and though conditions were quieter between 16 h. and 20 h. on the 8th than they had been during the previous two hours, there was no conspicuous reduction of disturbance until after 6 h. on the 9th. The largest movements which, as Table CLVI shows, were very considerable, occurred between 21 h. on the 8th and 4 h. on the 9th.

At Mauritius the H trace shows no disturbance worth mentioning except between 21 h. and 24 h. on the 8th. Between 21 h. 30 m. and 23 h. 25 m. there was a fall of 34γ. The D trace was extremely regular until 22 h. on the 8th. After that, small irregularities appeared, but the main changes arose apparently from the regular diurnal variation somewhat enhanced.

At Buitenzorg, considering the size of the s.c. movement, the total range in N was comparatively trifling. The largest movements appeared between 21 h. on the 8th and 5 h. on the 9th. The E and V curves showed only trifling irregularities, but both elements, especially V, had a range markedly in excess of the normal.

At Alibag, except at the time of the s.c. and again between 21 h. and 24 h. on the 8th, the H trace showed only trifling irregularities. The D and V traces were nearly smooth throughout.

The trace received from Honolulu stopped a little after 3½ h. on the 9th ; thus the ranges given in Table CLVI may have been slightly exceeded. The s.c. movement itself was of fair size in H. But subsequently with the exception of some not very large oscillations, especially between 21 h. and 24 h. on the 8th, the curves showed little trace of disturbance.

At Helwan there was a very appreciable bay in H from 21 h. to 24 h. The phenomena resembled those at Alibag.

At Agincourt the s.c., which was rather insignificant, was followed by numerous but small oscillations in H. Some larger movements occurred later between 21 h. on the 8th and 3 h. on the 9th. The D trace showed some oscillations following the s.c., up to 15 h. on the 8th. Between 15 h. and 22 h. it was of normal quietness. Between 22 h. on the 8th and 5 h. on the 9th there was appreciable disturbance, the most notable movement occurring near 3 h. on the 9th. After 6 h. on the 9th, the D and H traces were both practically quiet.

TABLE CLVI.—12 h. November 8 to 8 h. November 9, 1911. Plate XLVIII.

Station.	Element.	Times of Maximum.	Times of Minimum.	Disturbance Range.	Inequality Range.
		h. m.	h. m.	γ	γ
Antarctic	N′	15 32 (8th)	3 19 (9th)	324	94
	E′	4 54 (9th)	22 47 (8th)	308	102
	V	1 37 (9th)	15 48 (8th)	210	66
Mauritius	H	21 30 (8th)	23 30 (8th)	34	21
	D	12 0 (8th)	4 45 (9th)	58	31
Buitenzorg	N	2 15 (9th)	7 55 (9th)	56	30
	E	6 10 (9th)	2 5 (9th)	73	45
	V	4 55 (9th)	23 50 (8th)	60	23
Alibag	H	4 25 (9th)	23 25 (8th)	53	35
	D	23 0 (8th)	1 15 (9th)	22	13
	V	17 35 (8th)	1 0 (9th)	12	13
Honolulu	H	21 1 (8th)	3 35 (9th)	46	14
	D	16 47 (8th)	22 37 (8th)	36	20
	V	13 45 (8th)	21 19 (8th)	20	14
Helwan	H	13 45 (8th)	22 55 (8th)	61	18
	D	22 35 (8th)	15 5 (8th)	40	12
	V	22 50 (8th)	8 0 (9th)	20	12
Agincourt	H	21 20 (8th)	5 10 (9th)	49	28
	D	2 55 (9th)	22 50 (8th)	109	28
Eskdalemuir... ...	N	13 50 (8th)	23 0 (8th)	62	19
	E	22 14 (8th)	13 50 (8th)	92	24
	V	23 10 (8th)	13 0 (8th)	26	9
Sitka	H	15 3 (8th)	22 42 (8th)	57	15
	D	3 39 (9th)	23 15 (8th)	69	14
	V	3 43 (9th)	14 15 (8th)	76	8

At Eskdalemuir some slight disturbance occurred from the time of the s.c. until 15 h. on the 8th. From then until 21 h. ordinarily quiet conditions prevailed. After 21 h. the N and E traces were evidently disturbed, especially from 21 h. to 24 h., and V was visibly enhanced for a few hours. The disturbance diminished after the early hours of the 9th, but it is difficult to assign a definite hour for its conclusion, as distinct unrestfulness persisted throughout the forenoon, and was followed by considerable disturbance later in the day.

The traces received from Sitka stopped at 2 h. on the 9th, but the information derived from the traces was supplemented by that given in the official publication, so that the disturbance ranges in Table CLVI do not suffer by the curtailment. Conditions at Sitka were exceptionally quiet for some hours prior to 12 h. on the 8th. But shortly after 12 h., as already explained, short-period oscillations appeared in both the H and D curves, and the s.c. movements when they appeared were somewhat inconspicuous. The short-period oscillations were less in evidence from 15 h. to 21 h. than from 21 h. to 24 h. on the 8th. As compared with ordinary disturbances at Sitka, the movements recorded on November 8 and 9 were quite trifling.

It is clear that outside the Antarctic the disturbance was comparatively trifling, not merely at the tropical but also at the northern stations. In this case presumably the Arctic was much less disturbed than the Antarctic.

Section 107.—The disturbance of November 12–14, 1911, had an s.c. at about 15 h. 5 m. on the 12th, of which an account has already been given. The s.c. was somewhat insignificant, and it might be questioned whether it was the real commencement of the disturbance.

The time assigned for the end of the disturbance is somewhat arbitrary. There was considerable disturbance on the afternoon of the 14th, but it was preceded at most stations by six or seven hours of decided quietness, and may thus be regarded as a separate disturbance.

In the Antarctic conditions had been pretty quiet since 6 h. on the 12th; but they were less quiet from $13\frac{1}{2}$ h. to 15 h. than they had been for the three previous hours. There was in particular a rather sharp rise of 27γ in E′, commencing at about 13 h. 35 m., which seems fairly synchronous with movements at other stations presently to be discussed.

There were no very striking movements, and the largest movements in the different elements were at different times, thus it is difficult to say exactly when the activity was greatest. Also the disturbance cannot be said to have altogether subsided by 6 h. on the 14th, but from 6 h. to 11 h. on that day was at least a considerably quieter time than either earlier or later. The largest N′ movements occurred from 18 h. to 24 h. on the 12th, 10 h. to 14 h. on the 13th, and 2 h. to 5 h. on the 14th. In E′ there were some specially large oscillations between 21 h. and 23 h. on the 12th, and between 11 h. and 13 h. on the 13th. In V there was a fairly deep bay from 18 h. to 23 h. on the 12th, and during its occurrence there were successive considerable oscillations.

At Mauritius conditions were quiet for some hours before the s.c. After the subsidence of the crest described in Section 72, the H trace was quiet until nearly 18 h. From then until 20 h. there were some small but smart oscillations. There was also some disturbance between 23 h. on the 12th and 1 h. on the 13th, but the most disturbed time in H was from 9 h. to 22 h. on the 13th, when there was a succession of slow oscillations. Between 10 h. 0 m. and 12 h. 20 m. H rose 16γ and fell 40γ; while between 15 h. 50 m. and 16 h. 20 m. it rose 31γ. The only part of the D trace in which disturbance appealed to the eye was included between 14 h. and 17 h. on the 13th. Between 14 h. 0 m. and 14 h. 40 m. there was a swing of $3\frac{1}{2}'$ to the West; while between 15 h. 30 m. and 16 h. 30 m. there were swings of $3\frac{1}{2}'$ to the West and $3'$ to the East.

TABLE CLVII.—15 h. November 12 to 6 h. November 14, 1911. Plate XLIX.

Station.	Element.	Times of Maximum.	Times of Minimum.	Disturbance Range.	Inequality Range.
		h. m.	h. m.	γ	γ
Antarctic	N′	12 50 (13th)	2 58 (14th)	424	94
	E′	11 26 (13th)	22 3 (13th)	456	102
	V	23 0 (12th)	13 24 (13th)	229	66
Mauritius	H	23 35 (12th)	13 5 (13th)	69	21
	D	12 0 (13th)	3 45 (13th)	53	38
Buitenzorg	N	1 25 (14th)	13 5 (13th)	109	30
	E	7 0 (13th)	1 25 (14th)	39	45
	V	6 0 (14th)	12 25 (13th)	39	26
Alibag	H	16 15 (12th)	12 20 (13th)	70	35
Honolulu	H	18 18 (12th)	3 22 (14th)	55	14
	D	18 10 (12th)	21 40 (13th)	24	20
	V	19 1 (13th)	23 49 (12th)	20	16
Helwan	H	23 35 (12th)	15 35 (13th)	74	21
	D	19 20 (13th)	11 30 (13th)	49	19
	V	14 40 (13th)	7 55 (13th)	20	15
Agincourt	H	11 35 (13th)	16 35 (13th)	71	28
	D	2 22 (14th)	19 20 (13th)	109	28
Eskdalemuir... ...	N	23 33 (12th)	12 24 (13th)	130	19
	E	16 22 (13th)	14 33 (13th)	131	24
	V	16 22 (13th)	3 13 (14th)	109	9
Sitka	H	12 10 (13th)	11 49 (13th)	181	15
	D	6 33 (13th)	12 10 (13th)	194	14
	V	3 48 (14th)	12 59 (13th)	240	8

At Buitenzorg conditions were pretty quiet from 10 h. 0 m. to 13 h. 35 m. on the 12th. At 13 h. 35 m. there began an oscillation in N of total range about 5γ, and between the end of this and the occurrence of the s.c. there was a rise of some 9γ in N, and some small oscillations in both N and E. As usual at Buitenzorg, during the disturbance the movements in N were much the most conspicuous, but wave-like movements occurred in both the E and the V curves. There were a number of short-period oscillations in N, but all were small. The larger of the slower oscillations in N occurred between 10 h. and 20 h. on the 13th. On the 14th there were no large movements after 4 h., but the N trace remained unrestful until after 6 h.

At Alibag the H trace was very quiet until about 13 h. 35 m. on the 12th. An oscillation occurred then, which though a good deal smaller than the subsequent s.c. is easily recognisable. From 17½ h. to 20 h. on the 12th the trace was of a decidedly oscillatory type but the oscillations were small. The largest H movements occurred between 11 h. and 16 h. on the 13th. Between 22 h. on the 13th and 9 h. on the 14th there was little further movement. The D and V traces received from Alibag stopped about 5 h. on the 13th, so it seemed inexpedient to include ranges from them in Table CLVII. They showed none but the most trifling movements.

At Honolulu H fell 22γ between 23 h. and 24 h. on the 12th, and between 16 h. 50 m. and 19 h. 20 m. on the 13th it rose 16γ and fell 20γ. There were various other slow oscillations of lesser amplitude, and at times small shorter-period oscillations. The D and V curves, though not wholly regular, showed only small movements. The times assigned in the Honolulu publication for the beginning and end of the disturbance were respectively 14½ h. on the 12th and 14½ h. on the 15th.

At Helwan all the curves showed some oscillations between 14 h. and 22 h. on the 13th. Some oscillations commencing about 13 h. 35 m. on the 12th appeared in the H trace, but they are a good deal smaller than the subsequent s.c. There were some rather striking short-period oscillations between 17½ h. and 20 h. on the 12th, which closely resembled synchronous movements at Alibag. There was also rather a rapid fall in H between 11 h. and 12 h. on the 13th.

At Agincourt the s.c. was of a very insignificant character, and there was a previous oscillation (—, + in H; E. W. in D) of about the same amplitude, commencing about 13 h. 35 m. There was little sign of disturbance, practically none in D, until 21 h. on the 12th, and it was also nearly quiet from 22½ h. on the 13th to 1½ h. on the 14th, and from 4 h. to 9 h. on the 14th. H was considerably disturbed from 23 h. on the 12th to 7 h. on the 13th, from 11 h. to 15 h. on the 13th, and from 1 h. to 3 h. on the 14th. The largest D movements occurred on the 13th between 2 h. and 14 h. and between 21 h. and 23 h., and on the 14th between 1 h. and 4 h. Between 5 h. and 8 h. on the 13th D moved 20′ to the West, and then 18½′ to the East. The D movements were more intermittent than those in H but were larger.

At Eskdalemuir the s.c. movement was small, even in N, and was preceded by a somewhat larger movement between 13 h. 35 m. and 14 h. 10 m. This earlier movement was largest in N, where it took the form of a comparatively slow double oscillation; in V only a small rise is clearly visible. The largest movements in N occurred between 23 h. on the 12th and 1 h. on the 13th, and between 16 h. and 22 h. on the 13th. Between 1 h. and 10 h. on the 13th, and after 22 h. on the 13th, there was no large movement but numerous minor short-period oscillations. The principal E movements occurred between 14 h. and 22 h. on the 13th. The V curve contained a perceptible bay between 23 h. on the 12th, and 1 h. on the 13th, rather a sharp rise and fall between 16 h. and 17 h. on the 13th, and shallow bays between 21 h. and 23 h. on the 13th, and between 2 h. and 5 h. on the 14th.

The Sitka trace available commenced about $2\frac{1}{2}$ h. on the 13th, and there was no record from 18 h. on the 13th to $2\frac{1}{2}$ h. on the 14th. The chief movements shown occurred between 6 h. and 17 h. on the 13th, when all the elements, especially V, were considerably disturbed. From 4 h. to 9 h. on the 14th disturbance was represented only by numerous small short-period oscillations. In the Sitka publication the commencement of the storm is put as late as 6 h. on the 13th, and its conclusion is given as 17 h. on the 15th, so the comparatively quiet time during the forenoon of the 14th was regarded as only an interlude.

Perhaps the most unusual feature in connection with this disturbance is the existence prior to the s.c. of movements of a different type clearly represented at most if not all the stations. The s.c. movement was but poorly represented in the northern hemisphere, and the subsequent disturbance in the horizontal plane at Agincourt and Sitka was not so large compared with that elsewhere as was usually the case. On the other hand, while short-period oscillations in V were much more in evidence in the Antarctic than at Sitka, the latter station showed the larger range of disturbance.

Section 108.—Later in the 14th, between 11 h. and 16 h., there were rather conspicuous movements at all the stations from which curves had been received. The usual particulars appear in Table CLVIII.

In the Antarctic the E′ trace during the five hours showed several slow oscillations which differed from those preceding them only in being larger. The N′ and V movements were relatively more conspicuous. The principal N′ movements were a rapid rise and slower fall between 11 h. 10 m., and 13 h. 20 m. The V curve contained a large bay (numerical increase) extending from 11 h. to 15 h.

At Alibag the H trace showed a large bay from 11 h. 20 m. to 14 h. 40 m., followed by a smaller but considerable oscillation between 14 h. 40 m. and 16 h. 0 m.

At Honolulu the principal feature was a rise and fall of H, the rise being the larger and more rapid movement, between 11 h. 10 m. and 13 h. 10 m.

At Helwan the H trace was too faint to show details. In the D and V curves the most noteworthy incident was an oscillation lasting about an hour which began about 14 h. 20 m. The first movement—easterly swing in D, fall in V—was considerably the more rapid. This oscillation was followed by a second but considerably smaller one.

At Agincourt two bays appeared in succession in the H curve. The D curve showed a large westerly swing from 11 h. 10 m. to 12 h. 10 m., followed by a slower and somewhat smaller easterly swing.

At Eskdalemuir, a fall in N between 11 h. and 12 h. was followed by a slower rise. This was interrupted by two considerable oscillations between 14 h. 10 m. and 16 h. 0 m. The E trace showed several oscillations, the most conspicuous occurring between 14 h. 15 m. and 15 h. 5 m. There was a decided rise in V above the normal value, commencing about 11 h. 15 m. and culminating about 14 h. 45m. The rise was most rapid between 14 h. 20 m. and 14 h. 40 m.

TABLE CLVIII.—11 h. to 16 h. November 14, 1911. Plate XLIX.

Station.	Element.	Times of Maximum.		Times of Minimum.		Disturbance Range.	Inequality Range.
		h.	m.	h.	m.	γ	γ
Antarctic	N′	11	45	15	50	211	14
	E′	12	15	14	40	267	35
	V	15	30	12	30	180	18
Alibag	H	14	40	12	30	75	6
Honolulu	H	12	5	11	5	36	3
	D	12	50	11	20	14	5
	V	13	10	13	45	5	1
Helwan	D	14	35	11	0	44	9
	V	11	50	14	35	20	4
Agincourt	H	11	0	14	40	53	26
	D	14	50	12	5	127	17
Eskdalemuir... ...	N	14	52	11	58	95	9
	E	14	36	12	50	86	9
	V	14	45	11	5	47	8
Sitka	H	11	25	13	53	200	1
	D	12	52	11	53	236	6
	V	16	0	12	54	295	4

At Sitka there was a prominent double bay in H (–, + , –, +) between 11 h. 20 m. and 15 h. 20 m., and a large oscillation (East, West) in D. There was a fall of 264γ in V between 11 h. 20 m., and 12 h. 53 m. The recovery from this depression was at first very rapid, but was interrupted about 13 h. 35 m. by a reverse movement lasting about 20 minutes. Subsequently a rise continued almost without interruption until after 16 h. The hump thus formed on the V trace from 11 h. 20 m. to 16 h. is of the same general character, though of longer duration, than that usually observed at Sitka on occasions of Antarctic disturbances of the "special type." The disturbance between 11 h. and 16 h. at Sitka, was followed as well as preceded by a much quieter time. It had much more the appearance of an isolated event than the simultaneous disturbance in the Antarctic. The disturbance occurred during a part of the day when the regular diurnal changes at Sitka are very trifling.

It will be observed that at Alibag, Agincourt, Eskdalemuir and Sitka, the first of the large movements in H or N was a fall, whereas at Honolulu it was a rise.

Section 109.—In the Antarctic, considering the time of year, conditions were exceedingly quiet on December 6, 1911, until 11 h. Shortly after 11 h., there commenced one of a series of large oscillations in E′. The disturbance was at first a good deal smaller in N′ and V; but from 15 h. on the 6th, until 2 h. on the 7th, all three elements showed a succession of large oscillations. The most disturbed time was from 16 h. to 24 h. on the 6th. The disturbance subsided almost as rapidly as it commenced, and after 3 h. on the 7th, the curves were quieter than was usual in December.

TABLE CLIX.—11 h. December 6 to 2 h. December 7, 1911. Plate L.

Station.	Element.	Times of		Disturbance Range.	Inequality Range.
		Maximum.	Minimum.		
		h. m.	h. m.	γ	γ
Antarctic	N′	18 40 (6th)	23 14 (6th)	341	92
	E′	11 59 (6th)	18 30 (6th)	474	67
	V	21 10 (6th)	21 52 (6th)	317	82
Mauritius	H	11 50 (6th)	18 55 (6th)	89	12
Buitenzorg	N	11 40 (6th)	19 0 (6th)	61	25
	E	12 5 (6th)	18 10 (6th)	36	31
	V	11 45 (6th)	17 20 (6th)	22	6
Alibag	H	11 40 (6th)	18 55 (6th)	89	11
	D	18 40 (6th)	16 40 (6th)	20	13
	V	11 15 (6th)	19 20 (6th)	11	7
Honolulu	H	11 31 (6th)	18 52 (6th)	124	14
	D	18 17 (6th)	11 55 (6th)	79	14
	V	17 50 (6th)	11 0 (6th)	28	9
Agincourt	H	11 30 (6th)	18 30 (6th)	84	20
	D	22 50 (6th)	18 30 (6th)	103	24
Eskdalemuir... ...	N	14 23 (6th)	18 11 (6th)	110	9
	E	18 32 (6th)	17 13 (6th)	142	20
	V	18 31 (6th)	12 0 (6th)	116	9
Sitka	H	16 30 (6th)	18 20 (6th)	191	13
	D	16 29 (6th)	18 36 (6th)	183	16
	V	0 58 (7th)	18 58 (6th)	113	5

At Mauritius there was decided disturbance in H between 10 h. and 11 h. on December 6, a rise of 20γ occurring in the course of the hour. After 11 h. there was a nearly continuous but slow fall in H until 16 h., when the rate of fall accelerated. The decrease between 16 h. and 17 h. 55 m. amounted to 47γ. The fall was interrupted by a slight rise between 17 h. 55 m. and 18 h. 10 m. Between 18 h. 10 m. and 20 h. 0 m., there was a fall of 25γ and rise of 29γ. There was a continuous rise, in all about 25γ, from 20 h. to 23 h. 20 m., and a continuous fall thereafter, until 2 h. on the 7th, which amounted to about 20γ. After this the trace appeared undisturbed. The D trace available covered only the last seven hours of the period; it showed only slight disturbance.

The traces received from Buitenzorg did not commence until about 11 h. 40 m. on the 6th, and it is probable that the ranges appearing in Table CLIX were slightly exceeded, at least in the case of N and V. As usual disturbance was most active in N, but even in that element it was but trifling after 19 h. on the 6th. Much the largest movements occurred between 16 h. and 19 h. During that time N fell 43γ, rose 56γ and fell 61γ. During the same interval E fell 25γ and rose 19γ, while V algebraically considered fell 13γ, rose 14γ and fell 12γ.

At Alibag the movements in D and V were very trifling, but some small oscillations were visible, especially on the 6th between 18 h. and 22 h. The H trace resembled that at Mauritius in showing a considerable but very regular rise between 10 h. and 11 h. on the 6th. This was followed up to 16 h. by a gradual fall, superposed on which were numerous small oscillations of short period. Between 16 h. and 20 h. there was a fall of 46γ, a rise of 23γ, a rapid fall of 46γ and finally a less rapid rise of 23γ. During the next three hours a gradual rise took place. All trace of disturbance has ceased before 2 h. on the 7th.

At Honolulu the H and V curves showed a good many short-period oscillations, and there were a few in D, but the only movements that were not of trifling size occurred between 16 h. and 20 h. on the 6th. During that time H fell 24γ, rose 22γ and fell 24γ.

At Helwan there was a very regular rise in H between 10 h. and 11 h. on the 6th. From 11 h. to 16 h. there was a gradual fall in H, having superposed on it a good many very small oscillations of short period. From 16 h. to 19 h. there was a considerable fall, interrupted for a short time near 18 h. by a very slight rise. The total fall in the three hours amounted to 101γ. A recovery, which set in a few minutes before 19 h., raised H by 47γ in the course of the next hour, and continued at a much slower rate until 23 h. The Helwan D trace showed a considerable oscillation between 17 h. and 19 h., an easterly swing of 9′ being followed by a westerly swing of 6′. During the rest of the time, the D movements were very small. V was slightly enhanced above its normal value from 16 h. to 20 h. on the 6th, otherwise it showed little trace of disturbance.

At Agincourt the disturbance was mainly confined to the hours 16 h. to 21 h. on the 6th. After 2 h. on the 7th, conditions were very quiet. H fell 58γ between 17 h. and 18½ h. on the 6th, and rose 45γ between 18½ h. and 19 h. Between 17½ h. and 19 h. 40 m. on the 6th D moved 16½′ to the West, and then 15½′ to the East. Some minor oscillations followed between 21 h. on the 6th and 2 h. on the 7th, after which normal quietness prevailed.

At Eskdalemuir N was unquiet throughout the afternoon of the 6th. Between 17 h. and 18 h. N fell 66γ; between 18 h. and 19 h. it showed a considerable oscillation; between 19 h. and 20 h. it rose 59γ. There were some moderate oscillations between 22 h. on the 6th and 1 h. on the 7th. Between 20 h. and 22 h. on the 6th, and after 2 h. on the 7th, conditions were almost normal. E rose 138γ between 17 h. 15 m. and 18 h. 15 m. on the 6th and fell 112γ between 18 h. 30 m.

and 18 h. 58 m. Between 22 h. 25 m. on the 6th and 0 h. 15 m. on the 7th there was a fall of 33γ, a rise of 56γ, and a fall of 39γ. Between 20 h. and 22 h. on the 6th, and after 2 h. on the 7th, conditions were quiet, as with N. V was not sensibly disturbed until 17 h. on the 6th. Between 17 h. and 21 h., the curve had the pyramidal shape customary during afternoon disturbances. The rise from 17 h. to the maximum at 18 h. 31 m. was 109γ, and the fall between 18 h. 31 m. and 21 h. 0 m. was 89γ. After 21 h., except for a shallow bay between 22 h. and 24 h., there was hardly any sign of disturbance.

At Sitka, minor short-period oscillations were considerably in evidence from 11 h. on the 6th to 2 h. on the 7th, but the only large movements occurred between 17 h. and 20 h. on the 6th. H fell 177γ between 17 h. and 18 h. 20 m., and rose 158γ between 18 h. 20 m. and 19 h. D moved $35\frac{1}{2}'$ to the West between 17 h. and 18 h. 36 m., and $36'$ to the East, between 18 h. 36 m. and 20 h. V fell 90γ between 17 h. 30 m. and 18 h. 58 m., and rose 82γ between 18 h. 58 m. and 20 h. 30 m. The fall between $17\frac{1}{2}$ h. and 18 h. 58 m. was interrupted by a short rise commencing about $18\frac{1}{4}$ h. The disturbance at Sitka in the horizontal plane was for a time of a rotating character, the vector rotating from South to North through West.

The more northern stations agreed with Mauritius, Buitenzorg and Alibag in having the chief disturbance in H or N limited to the interval 16 h. to 20 h. on the 6th. There was, however, a good deal of difference in the nature of the movements. At Eskdalemuir there were in N, as in H at Alibag, four distinct considerable movements. These consisted of a fall, a short rapid rise, a second fall and a second rise. The second and third of the movements seemed of a more secondary character than the other two. At Honolulu, as in N at Buitenzorg, there were three movements in H, not widely different in size, viz., a fall, a rise and a second fall. At Helwan, Agincourt and Sitka the movements were practically confined to a fall and a rise.

The disturbance in the Antarctic was much larger than anywhere else, being of quite a different order except between 16 h. and 20 h. on the 6th. While, however, there were no large disturbances at Eskdalemuir and Sitka except for a few hours, there were almost incessant short-period oscillations during the whole time, almost as much so in fact as in the Antarctic. Thus the conditions, whatever they are, which lead to short-period oscillations were shared by the northern and southern hemispheres.

Section 110.—The disturbance of December 10–12, 1911, began with an s.c., which has been already described. The s.c. was by no means large at the more northern stations, but was well developed in the Antarctic and at Buitenzorg.

In the Antarctic, conditions had been quiet, for the season, for a number of hours prior to the s.c. Apart from the s.c. there was no very well-marked development of disturbance until nearly an hour had elapsed. A continual succession of oscillations of considerable size then appeared in all the traces. There were some specially large movements between 23 h. on the 10th and 3 h. on the 11th. E′ fell 472γ between 22 h. 55 m. and 23 h. 35 m., while N′ fell 355γ between 2 h. 18 m. and 2 h. 42 m.

Between 3 h. and 9 h. on the 11th oscillatory movements were much less in evidence, but there was a comparatively uninterrupted rise in N′ and E′ and a numerical rise in V. After this, oscillations again became more prominent, especially between 18 h. and 22 h. Conditions had become fairly quiet before 24 h. on the 11th.

TABLE CLX.—15 h. December 10 to 2 h. December 12, 1911. Plate L.

Station.	Element.	Times of Maximum.	Times of Minimum.	Disturbance Range.	Inequality Range.
		h. m.	h. m.	γ	γ
Antarctic	N′	15 22 (11th)	3 42 (11th)	444	99
	E′	8 27 (11th)	1 30 (11th)	727	95
	V	22 48 (10th)	13 48 (11th)	382	82
Mauritius	H	1 50 (11th)	15 30 (11th)	162	12
	D	9 30 (11th)	16 40 (11th)	81	35
Buitenzorg	N	1 55 (11th)	9 40 (11th)	290	33
	E	8 35 (11th)	2 45 (11th)	104	39
	V	4 50 (11th)	9 50 (11th)	58	24
Alibag	H	1 30 (11th)	9 45 (11th)	178	11
	D	9 20 (11th)	1 0 (11th)	58	7
	V	12 50 (11th)	4 50 (11th)	29	4
Honolulu	H	23 12 (10th)	10 12 (11th)	167	12
	D	19 9 (10th)	22 53 (10th)	42	25
	V	15 48 (10th)	21 46 (10th)	29	15
Helwan	H	{1 21 (11th) 3 55 (11th)}	15 52 (11th)	156	14
	D	17 24 (11th)	3 36 (11th)	75	33
	V	15 50 (11th)	{1 21 (11th) 17 37 (11th)}	27	16
Agincourt	H	21 25 (10th)	8 15 (11th)	235	24
	D	3 40 (11th)	12 55 (11th)	326	23
Eskdalemuir... ...	N	21 3 (11th)	8 13 (11th)	191	9
	E	17 36 (11th)	5 25 (11th)	178	20
	V	16 53 (11th)	5 33 (11th)	174	11
Sitka	H	5 49 (11th)	12 59 (11th)	729	13
	D	8 15 (11th)	9 19 (11th)	379	16
	V	5 49 (11th)	8 31 (11th)	689	5

At Mauritius, conditions were very quiet for some hours prior to the s.c. After it there was a slow gradual rise in H, very slightly interrupted, and hardly suggestive of disturbance until after 23 h. on the 10th. During the next five hours there were two or three slow oscillations of moderate size. At 4 h. on the 11th a fall set in, which continued until 9 h. 45 m. During the last two hours of this period there were 5 or 6 rather sharp minor oscillations, but the general trend of the trace is a downward slope at a roughly constant angle, the total fall being about 143γ. Slow oscillations followed until after 20 h. on the 11th. Superposed on these were a few shorter period oscillations, the most noteworthy occurring near 13 h. The D trace showed very little sign of disturbance until after 2 h. on the 11th. Between 2 h. and 4 h. there were some sensible movements. Between 6 h. 40 m. and 9 h. 30 m. there was an easterly movement of $10\frac{1}{2}'$, and between 10 h. and 16 h. a westerly movement of 11$'$. These movements, which were interrupted by minor oscillations, suggest the regular diurnal variation enhanced some 3 or 4 times. Minor oscillations occurred at intervals until 24 h. on the 11th.

At Buitenzorg N was raised very considerably by the s.c., and remained above the normal value for several hours. But beyond small oscillations there was little further sign of disturbance in any of the elements until the early hours of the 11th. Between 0 h. and 3 h. on the 11th there were considerable oscillations in N and minor oscillations in E and V. Shortly before 3 h. a fall began in N which continued, with interruptions due to short-period oscillations, until about 9 h. 40 m. The total fall during this time was 285γ. A rapid recovery ensued for some time, the rise between 9 h. 40 m. and 11 h. 20 m. amounting to 133γ. Oscillations followed, succeeded by a second decided rise after 16 h. E had a nearly uninterrupted rise of 104γ between 2 h. 45 m. and 8 h. 35 m. During this time the minor oscillations were all small. Between 8 h. 35 m. and 17 h. 15 m. E fell 91γ, but this fall was more interrupted by minor oscillations than the previous one. There were some oscillations in V, but none of any great size. After 19 h. on the 11th the V trace was nearly level, and the other traces contained only minor movements.

At Alibag the elevation of H following the s.c. continued for a number of hours. Apart from the s.c. there were only some trifling movements in any of the traces up to 24 h. on the 10th. About 2 h. on the 11th a fall began in H, which continued with only minor interruptions until about 9 h. 45 m., the total fall being 177γ. From 9 h. 45 m. to 18 h. on the 11th the Alibag H curve closely resembled that at Mauritius, H at Alibag rising on the whole from 9 h. 45 m. until nearly 12 h., then falling—with a sharp interruption near 13 h.—until after 15 h., and then rising rather smartly until $17\frac{1}{2}$ h. The Alibag D and V curves showed only some minor oscillations, the largest between 12 h. and 14 h. on the 11th.

At Honolulu there was no large movement throughout the 10th. Near 2 h. on the 11th a marked fall began in H. At 10 h. 12 m., when the minimum was reached, the fall since 1 h. 50 m. had amounted to 164γ, the major part of this occurring prior to 7 h. Between 8 h. and 10 h. short-period oscillations were considerably in evidence in H. Between 10 h. 12 m. and 13 h. H rose 103γ. Neither the D nor the V trace showed any conspicuous movement, but the V trace showed a good many short-period oscillations, especially between 8 h. and 10 h. 15 m. and between 11 h. and 14 h. on the 11th. Conditions had apparently become pretty quiet before 20 h. on the 11th, when the record received ended.

At Helwan there was little disturbance on the 10th after the s.c. The H trace showed moderate slow oscillations on the 11th from 0 h. to 4 h. About 4 h. a pronounced fall began in H, which continued almost without interruption until about 9 h. 45 m., the total fall being about 115γ. There were a good many minor oscillations from 8 h. until after 10 h. From 10 h. on the 11th to 1 h. on the 12th there was a series of slow oscillations, H falling on the whole until near 16 h. on the 11th, and then showing a general rise. The Helwan H trace resembles the Alibag H trace fairly closely, but the later oscillations with apices about 21 h. and 24 h. on the 11th are more accentuated at Helwan. The D and V traces at Helwan showed almost no disturbance on the 10th. Throughout the 11th the D trace showed a good many minor oscillations, the largest between 3 h. and 4 h. and between 16 h. and 18 h. The V trace was decidedly undulatory throughout the 11th. The largest movements—which were however quite trifling—occurred between 16 h. and 18 h. on the 11th.

At Agincourt the s.c. itself was almost insignificant, and except for small short-period oscillations, mostly in H, there was no sign of serious disturbance during the 10th. After 0 h. on the 11th a fall began in H, which continued with interruptions until the minimum was reached at 8 h. 15 m. The total fall during the $8\frac{1}{4}$ hours, the greater part occurring after $2\frac{1}{2}$ h., amounted to 210γ. Between 8 h. 15 m. and 9 h. 40 m. there were some rapid oscillations, with a resultant rise in H of 188γ. Oscillations of less magnitude followed until 1 h. on the 12th, after which the H trace was practically quiet. The D trace showed only minor disturbance until 3 h. on the 11th. Between 3 h. 17 m. and 4 h. 25 m. there was a very large oscillation, an easterly swing of 46′ being followed by a westerly swing of 45′. Other considerable though smaller oscillations followed, especially between 6 h. and 14 h. on the 11th. The chief movements after 14 h. occurred near 21h. and 24 h. After 1 h. on the 12th the trace was practically quiet.

At Eskdalemuir after the s.c., which was comparatively small, none of the traces showed anything beyond trifling oscillations until subsequent to 23 h. on the 10th. N rose 63γ and fell 64γ between 0h. 30 m. and 1 h. 45 m. on the 11th. Between 3 h. 30 m. and 4 h. 0 m. it rose 74γ. From 4 h. to 8 h. on the 11th the general trend of N was downwards, the total fall amounting to 122γ, but the fall was interrupted between 5 h. 5 m. and 5 h. 30 m. by a sharp rise of 61γ. The largest N movements occurred between 20 h. and 22 h. on the 11th, when there were several sharp oscillations with a total range of 166γ. After 22 h. the disturbance fell off, and by 1 h. on the 12th it had nearly disappeared. After 2 h. conditions were very quiet for several hours. Disturbance in E was trifling until 0 h. on the 11th. Between 3 h. and 5 h. 55 m. two prominent wave-like disturbances succeeded one another. Minor disturbances followed until 16 h. on the 11th. Between 16 h. and 18 h. conditions were much more disturbed, several considerable oscillations following one another, with a total range of 162γ in the two hours. There were also some smart oscillations between 20 h. and 21 h. 40 m. After that, except for a sharp fall in E between 23 h. 20 m. and 23 h. 40 m., there was little further disturbance, and by 2 h. on the 12th conditions had become very quiet. The V trace was almost a straight line throughout the 10th. The first movement of any size was a fall of 44γ between 3 h. 30 m. and 4 h. 15 m. on the 11th. During the afternoon of the 11th V rose in the way customary during magnetic storms. After the maximum was reached at 16 h. 53 m. the general trend was downward until $21\frac{1}{2}$ h., the fall in that time amounting to 139γ. Subsequently, with the exception of a shallow cup-shaped depression about midnight, the V trace was but little disturbed. After 2 h. on the 12th it was very quiet.

At Sitka the s.c. was very small. Subsequently throughout the 10th the disturbance was represented solely by incessant small oscillations, which were visible even in the V trace. After 0 h. on the 11th disturbance gradually increased, but there was no movement of any size until after 3 h. on the 11th. After 3 h. 15 m. H became decidedly more disturbed, but exhibited no really striking movement prior to a sharp rise, which led up to the maximum at 5 h. 49 m. Between the time of the maximum and 9 h. on the 11th the general trend of H was downwards, but during this interval several large oscillations occurred, having superposed on them numerous short-period oscillations, also of considerable size. The total range between 5 h. 49 m. and 9 h. was 615γ, the largest individual movement being a fall of 339γ between 8 h. 2 m. and 8 h. 12 m. From 9 h. to 10 h. there was a succession of short-period oscillations, the element remaining low. Between 10 h. 2 m. and 10 h. 12 m. H rose 294γ. From 10 h. 40 m. until 12 h. 18 m. there was one considerable and numerous small oscillations, tending on the whole to reduce H. Then followed from 12 h. 18 m. to 13 h. 14 m. a very rapid fall, interrupted by some short-period oscillations, and a practically uninterrupted rise. The fall amounted to about 687γ, the rise to about 624γ. For some hours after this considerable though much smaller oscillations presented themselves in H, the general trend of the element being upwards. After 18 h. the oscillations fell off much in amplitude, but small short-period oscillations were still in progress at 1 h. on the 12th. The disturbance in D at Sitka began to increase after 3 h. on the 11th. The most notable movements were a fall of $82\frac{1}{2}'$ between 8 h. 15 m. and 9 h. 19 m., and a rise of $68'$ between 9 h. 19 m. and 9 h. 50 m. Large oscillations, with short-period oscillations superposed, followed until 16 h., when the larger waves of longer period became decidedly less prominent. Short-period oscillations continued until at least 2 h. on the 12th, but they had decidedly diminished during the previous three hours.

The disturbance in V at Sitka was of a bold character. There were many short-period oscillations, but they interfered much less with the general trend of the curve than was the case with H or D. The trace was but little disturbed until nearly 3 h. 30 m. on the 11th, when a conspicuous rise began in V. This continued with minor interruptions until the maximum was reached at 5 h. 49 m., the total rise amounting to 168γ. After 5 h. 49 m. a rapid fall set in, continuing with only minor interruptions until 8 h. 31 m., the total fall amounting to no less than 689γ. From 8 h. 31 m. until 11 h. 20 m. the general trend was upwards, the total rise being 481γ. Between 11 h. 20 m. and 12 h. 50 m. there was a fall of 372γ, and between 12 h. 50 m. and 17 h. 30 m. there was a rise of 393γ, but both these movements were considerably interrupted by oscillations. After $17\frac{1}{2}$ h. conditions were much quieter, and after 1 h. on the 12th the trace was almost quiet.

The disturbance of December 10–12 was large at all the stations. In the Antarctic the s.c. was shortly followed by persistent oscillations of considerable size, but elsewhere there was little trace of disturbance during the first 8 or 9 hours after the s.c., beyond persistent short-period oscillations of small size. A feature common to all the stations except the Antarctic was a large fall in H or N during part of the forenoon of the 11th. But the hour when the fall commenced varied a good deal. It was clearly recognisable at several of the stations by 3 h. or earlier. But at Mauritius, Helwan and Eskdalemuir it was one hour later, and at Sitka nearly three hours later in commencing. The fall was interrupted by oscillations, but the general trend was clearly downwards at almost all the stations until nearly 10 h. on the 11th. In the Antarctic the largest oscillations occurred earlier than elsewhere. At Sitka the disturbance showed a concentration between 6 h. and 16 h. on the 11th, to which there was no parallel in the Antarctic. At Agincourt the principal part of the storm also occupied only about 10 hours, but it began shortly after 3 h. The oscillation in H recorded near 13 h. on the 11th at Sitka was enormously larger than the synchronous movements recorded elsewhere. From Buitenzorg to Helwan the movements in V were quite trifling. At Eskdalemuir, while the general aspect of the V trace was much quieter than that of the horizontal components, the range was not much less than that of N or E. The V movements at Sitka were quite of a higher order than those at the other co-operating stations, and they were decidedly more prominent than the V movements in the Antarctic throughout the greater part of the storm.

CHAPTER XIII.

DISTURBANCES OF LONGER PERIOD DURING 1912.

Section 111.—The disturbance of January 13, 1912, has been included in Table CXL, as being at least closely similar to the "special type." But it occurred at an hour of the day and a season of the year when that type of disturbance is unusual. Also it was of unusually large size, and copies of the corresponding disturbance had been received from most of the stations. It has accordingly been dealt with in the same way as the longer disturbances.

TABLE CLXI.—5 h. to 9 h. January 13, 1912. Plate LI.

Station.	Element.	Times of Maximum.	Times of Minimum.	Disturbance Range.	Inequality Range.
		h. m.	h. m.	γ	γ
Antarctic	N′	6 50	6 0	201	33
	E′	7 0	8 20	426	17
	V	5 50	7 20	132	25
Buitenzorg	N	5 25	7 10	56	24
	E	7 10	5 25	22	14
	V	5 55	9 0	21	16
Alibag	H	5 50	7 5	31	10
	D	8 15	6 0	10	15
	V	9 0	5 30	17	21
Honolulu	H	5 15	6 35	25	3
	D	7 0	6 20	20	2
	V	6 55	6 25	10	3
Agincourt	H	5 0	6 40	42	2
	D	8 0	6 50	117	7
Eskdalemuir... ...	N	6 25	7 5	53	5
	E	6 55	7 35	33	6
	V	5 10	6 40	8	3
Sitka	H	6 35	7 40	120	4
	D	7 5	7 55	168	2
	V	6 50	7 20	99	2

In the Antarctic the disturbance was neither preceded nor followed by a quiet time, and its limitation to four hours is admittedly arbitrary. The really outstanding feature was the rise in E′ culminating about 7 h. 0 m. Within $1\frac{1}{4}$ hours the element rose 301γ and fell 337γ. The movements in N′ and V were not conspicuously larger or more rapid than some others recorded during the previous 24 hours.

At Buitenzorg the main feature was a bay in the N curve, superposed on the normal fall.

Alibag also showed a well marked bay in H between 6 h. and 8 h., and the normal course of the variation in D was interrupted.

The Honolulu H trace showed a bay, depression, from 5 h. 20 m. to 7 h. V was enhanced from 6 h. 20 m. to 7 h. 30 m. The D trace contained a bay (easterly deflection) synchronous with the enhancement of V.

At Agincourt there was a pretty deep bay in H between 5 h. and 7½ h., but a more prominent feature was a hump on the D curve. Between 6 h. 20 m. and 8 h. 0 m. there was a movement of 22½′ to the West, and then of 24½′ to the East.

At Eskdalemuir there was a prominent bay in N between 6 h. and 8 h., and a less prominent one (enhancement of easterly force) synchronously in E. The V trace was undulatory, but the amplitude of disturbance was small.

At Sitka there were considerable but rather irregular movements in all the traces between 6 h. and 8½ h. The range was largest in D, rather an unusual feature. The chief feature in the H trace was a hump (enhancement of H), while D was deflected to the east of its mean position. The simultaneous H and D movements at Sitka and Agincourt were thus diametrically opposite. Sitka was in fact the only one of the co-operating stations at which the first large movement in H was a rise. The Sitka V movements between 6 h. and 8 h. consisted of a sharp rise, an equally sharp and larger fall, and a more gradual return towards the normal.

For some hours prior to 6 h. and again for some hours after 8 h. the Sitka curves were much quieter than the Antarctic curves. But later in the day between 12 h. and 15 h. there was a prominent and pretty regular movement at Sitka (H and V reduced, D deflected to West) which was considerably larger than the synchronous Antarctic disturbance. This later movement seems clearly represented at Alibag, Honolulu, Agincourt and Eskdalemuir. The following comparison of these later movements and those occurring between 6 h. and 8 h. seems of interest. The movement in either case was oscillatory, but during the whole or greater part of it the element diverged from its normal value in the direction indicated.

—	Antarctic.		Alibag.	Honolulu.	Agincourt.		Eskdalemuir.	Sitka.	
	N′	E′	H	H	H	D	N	H	D
Deflection, 6 h.–8 h.	+	+	−	−	−	W	−	+	E
„ 12 h.–15 h. ...	+	−	−	+	−	W	−	−	W

Declination changes between 12 h. and 15 h. at Alibag and Honolulu and changes in E at Eskdalemuir were small and rather irregular. In the Antarctic the E′ deflection on the second occasion was relatively trifling. At Alibag, Honolulu and Agincourt the movements between 12 h. and 15 h. were comparatively small, but their direction was not doubtful. At Eskdalemuir the amplitude of the later movement was about three-fourths that of the first. We have thus the interesting result that two elementary disturbances separated only by a few hours resembled one another at some stations, while at others they were more or less directly opposed.

Section 112.—The disturbance of January 17, 1912, had an s.c. about 4 h. 42 m., which has been already described. The subsequent disturbance was generally of a comparatively trifling character. At most stations it seemed to have practically died out by 18 h. on the 17th, and several of the traces received stopped shortly after that hour. This partly led to the limitation here of the disturbance to the interval 4 h. to 18 h.

TABLE CLXII.—4 h. to 18 h. January 17, 1912. Plate LI.

Station.	Element.	Times of Maximum.		Times of Minimum.		Disturbance Range.	Inequality Range.
		h.	m.	h.	m.	γ	γ
Antarctic	N′	10	25	9	20	147	80
	E′	11	33	16	30	315	71
	V	17	5	10	50	153	57
Mauritius	H	8	20	15	50	50	21
	D	10	35	4	50	51	33
Buitenzorg	N	4	55	14	50	74	34
	E	10	5	4	50	29	27
	V	6	10	11	55	30	22
Alibag	H	6	55	15	55	74	25
	D	10	20	7	20	26	23
	V	10	5	6	5	18	22
Honolulu	H	10	12	15	13	30	12
	D	15	40	17	50	14	3
	V	4	50	17	45	12	3
Helwan	H	7	25	15	55	48	16
	D	7	50	11	15	29	25
	V	12	35	9	25	30	14
Agincourt	H	10	50	10	10	36	10
	D	12	35	10	10	63	20
Eskdalemuir... ...	N	7	20	10	35	36	9
	E	5	35	11	25	29	16
	V	15	40	9	10	11	21
Sitka	H	9	47	10	31	49	4
	D	10	39	9	43	70	6
	V	16	20	10	33	109	4

In the Antarctic, taking into account the season of the year, the disturbance was by no means large. Except for a considerable movement in N′ between 9 h. and 11 h., the disturbance was mainly confined to the hours $15\frac{1}{2}$ h. to 18 h. The disturbance did not subside in the Antarctic at 18 h., but what happened later in the day can best be treated separately.

At Mauritius in the H trace a crest followed the s.c., the shortest estimate of its duration being 1 h. 50 m. There was a distinct hump (elevation in H) until about 11 h. 40 m. The trace, in short, resembled the arch of a wide but rather low bridge. There were a few minor oscillations between 6 h. and 10 h. The maximum in H was reached somewhat later than the usual hour, but the changes were generally similar to those occurring in the ordinary day, except that the range was fully double the normal. The changes in D were also of a fairly normal type. The extreme westerly position came somewhat late, and the subsequent swing to the East was a little larger than usual, but there was little in the appearance of the curve suggestive of disturbance.

At Buitenzorg N had a large rise during the s.c. After that the general trend was downwards—the normal direction for that time of day—until the minimum was reached about 14 h. 50 m. The fall was broken only by minor oscillations. There was a rise in N from 15 h. to 18 h., as was normal for the time of day, again interrupted by minor oscillations. For at least 5 hours after 18 h. there were only trifling oscillations. The E trace showed only a few trifling oscillations. The V trace showed a sensible rise at the time of the s.c. and a few subsequent small oscillations.

At Alibag the curves showed on the whole the changes natural to the time of day, with some minor oscillations superposed in the case of H. The rise in H continued for 2 hours after the s.c., and the subsequent fall went on to nearly 16 h., the ordinary time of the minimum. The range, however, was considerably enhanced. Neither the D nor the V trace showed any disturbance worth mentioning.

At Honolulu after the s.c. there were some minor oscillations in H and V. But the chief movements in these elements, and they were not large, occurred between $9\frac{1}{2}$ h. and $11\frac{1}{2}$ h. They included a pretty smart rise in H and a slower fall, with a sensible oscillation in V. After the minimum at 15 h. 13 m. there was a moderate rise in H, as was normal at that time of day. Conditions were very quiet for some hours at least after 17 h.

At Helwan all the traces showed minor irregularities for a few hours after the s.c. But after 12 h. they might be regarded as quiet, and they continued so throughout the rest of the 17th, and the early hours of the 18th.

At Agincourt the s.c. was small, and during the next 4 hours there were only trifling oscillations. The only subsequent disturbance worth mentioning occurred between 9 h. 40 m., and 11 h. 30 m. After a slight fall H rose 36γ between 10 h. 10 m. and 10 h. 50 m., the rise being followed by a more gradual fall. D moved $11\frac{1}{2}'$ to West between 9 h. 40 m. and 10 h. 10 m., and then 13′ to East. After 12 h. there was no disturbance worth mentioning during the 17th.

At Eskdalemuir the s.c. itself was not large, and it was followed only by small oscillations. The chief signs of unrest were short-period oscillations in N, and to a less extent in E. They were most in evidence between 9 h. and 16 h. After 18 h. conditions were at least as quiet as usual. The V trace was quiet throughout.

At Sitka the s.c. was followed only by minor oscillations, chiefly of short period, until 9 h. 30 m. Between that hour and 12 h. there were considerably larger oscillations in H and D, the range in the latter element being considerably the larger. In H a sharp rise was followed by a larger but interrupted fall. In D between 9 h. 30 m. and 10 h. 40 m. there was the following double oscillation : 7′ W, 9′ E, 5′ W and 12′ E. The largest movement occurred in V. Between 9 h. 45 m. and 10 h. 20 m. the element fell 97γ, the greater part of the fall occurring in the first 15 minutes. After the minimum at 10 h. 33 m. V rose rapidly at first, and continued to rise at a diminishing rate during the next $2\frac{1}{2}$ hours. The V disturbance at Sitka appeared to be of the type customary at that station during the short-period disturbances already discussed. From 12 h. to 18 h., when the record ceased, there were only minor oscillations.

January 17, 1912, was an example of an s.c., everywhere recognisable though not large, which was not followed during the next 12 hours by anything worth calling a magnetic storm. There was only a short-period disturbance, commencing about 5 hours after the s.c., and lasting only about 2 hours. The short-period disturbance, moreover, while fairly prominent in the Antarctic and at Honolulu, Agincourt and especially at Sitka, was but slightly represented at Buitenzorg and Eskdalemuir. At some stations, including Buitenzorg, Alibag and Helwan, the principal phenomenon was an increased amplitude in the normal diurnal changes.

The Antarctic differed from all the other stations which contributed records in having a large disturbance which commenced after 15 h. on the 17th and continued until 2 h. or 3 h. on the 18th. Between 18 h. on the 17th and 3 h. on the 18th, the ranges were 194γ in N′, 282γ in E′ and 165γ in V. All the Antarctic traces showed a large oscillation between 22 h. on the 17th and 1 h. on the 18th and numerous considerable but smaller oscillations, extending from 16 h. to 21 h. on the 17th.

At Mauritius and Honolulu information subsequent to 18 h. on the 17th was limited to the two hours, 18 h. to 20 h., the traces for which were normally quiet. At Buitenzorg, Alibag (H), Helwan, Agincourt and Eskdalemuir between 18 h. on the 17th and 2 h. on the 18th conditions were at least as quiet as usual. Some of the curves, in fact, were unusually quiet. Thus we have on this occasion a large Antarctic disturbance accompanied by ordinarily quiet conditions over at least a large portion of the earth.

Section 113.—The disturbance of March 21–22, 1912, was not a very large one, and the records obtained of it were somewhat scanty. Curves were not received from Honolulu or Sitka, but the official publications supplied a certain amount of information which has been included in Table CLXIII, as it suffices to show that appreciable disturbance prevailed.

In the Antarctic between 23 h. 15 m. on the 21st and 3 h. 15 m. on the 22nd there was a large fall and rise in N′. During these movements there were smaller oscillations in E′. The largest movements in V occurred earlier, between 21¼ h. and 23½ h. on the 21st.

TABLE CLXIII.—20 h. March 21 to 5 h. March 22, 1912. Plate LI.

Station.	Element.	Times of Maximum.	Times of Minimum.	Disturbance Range.	Inequality Range.
		h. m.	h. m.	γ	γ
Antarctic	N′	20 0 (21st)	1 40 (22nd)	307	35
	E′	4 30 (22nd)	23 4 (21st)	176	57
	V	23 15 (21st)	22 5 (21st)	81	22
Mauritius	H	2 10 (22nd)	21 25 (21st)	21	10
	D	1 45 (22nd)	4 25 (22nd)	25	21
Buitenzorg	N	21 5 (21st)	1 35 (22nd)	26	28
	E	20 40 (21st)	1 5 (22nd)	22	30
Alibag	H	20 55 (21st)	1 30 (22nd)	22	40
Honolulu	H	22 28 (21st)	1 58 (22nd)	58	12
	D	19 59 (21st)	0 32 (22nd)	66	38
Agincourt	H	20 20 (21st)	1 55 (22nd)	55	7
	D	1 30 (22nd)	20 0 (21st)	115	22
Eskdalemuir... ...	N	0 7 (22nd)	1 30 (22nd)	54	4
	E	0 52 (22nd)	20 20 (21st)	93	5
	V	21 30 (21st)	2 0 (22nd)	59	20
Sitka	H	?	?	<59 >41	22
	D	?	1 20 (22nd)	> 83	23
	V	1 50 (22nd)	?	<87 >74	9

At Mauritius between 20 h. 20 m. and 21 h. 25 m. there was a symmetrical rise and fall of H, each about 10γ. Between 0 h. and 3 h. on the 22nd there were slow oscillations in H, and between 1 h. 25 m. and 2 h. 30 m. the element rose 15γ and fell 8γ. The D trace exhibited little disturbance. The swing to the West after 2 h. was practically that normal to the time of day.

At Buitenzorg there was considerably more disturbance in N than the range suggests. It was, however, of an irregular character. The E trace also was decidedly not regular, and showed a good many small oscillations.

At Alibag, H showed a small rise and fall between 20 h. and 21½ h. on the 21st, and a small fall and rise between 0 h. 30 m., and 2 h. on the 22nd.

The maximum and minimum and the hourly values in the Honolulu official publication showed that the disturbing forces there in the horizontal plane were considerably in excess of those at Buitenzorg and Alibag.

The Agincourt H trace showed a persistent disturbance, commencing with a rise about 19 h. 25 m., and continuing until 5 h. on the 22nd. Between 0 h. and 3 h. on the 22nd, H was sensibly depressed. The Agincourt D trace was practically quiet until the end of the 21st, but there were sharp movements between 1 h. and 2 h. 20 m. on the 22nd, consisting of a westerly movement of 6′, an easterly movement of 18′, and a slower westerly movement of $14\frac{1}{2}'$. There were subsequent smaller movements until nearly 6 h. on the 22nd.

At Eskdalemuir N was decidedly disturbed between 21 h. on the 21st, and 3 h. on the 22nd. There was a bay (depression) between 21 h. and 22 h. on the 21st, and considerable oscillations between 1 h. and 2 h. 30 m. on the 22nd. The disturbance in E was larger than in N. There was a pretty deep bay (algebraic rise in E) between 20 h. 20 m. and 21 h. 30 m. The largest movements occurred between 23 h. 50 m. on the 21st, and 2 h. 20 m. on the 22nd. During this time the numerical value of the element fell 86γ, rose 86γ, and fell 44γ. V at Eskdalemuir was slightly elevated at 21 h. on the 21st. But a decided fall set in after 23 h. and continued until 2 h. on the 22nd, when recovery commenced. The early morning depression was very considerable, having regard to the comparatively small amplitude of the horizontal disturbing forces.

The data in the Sitka official publication show that the disturbance there was considerable in D and V.

The phenomena observed on March 21–22, show a marked contrast to those described on January 17. On the earlier occasion there was considerable disturbance in the Antarctic near 24 h. G.M.T., which was practically not represented elsewhere. On the later occasion there was again considerable disturbance in the Antarctic near 24 h., but there was also very appreciable disturbance all over the world, especially at the more northern stations. Moreover V, which is usually a quiet element, was decidedly disturbed at Eskdalemuir and Sitka.

Section 114.—In the Antarctic the earlier part of April 5 showed an average amount of disturbance. The N′ trace showed a nearly uninterrupted fall (numerical increase) for the $3\frac{1}{2}$ hours ending at 0 h. 45 m. on the 6th, and a corresponding nearly steady rise during the next $2\frac{1}{2}$ hours.

About 18 h. on the 5th, a fall commenced in E′ which continued almost without interruption until $20\frac{1}{2}$ h. From 0 h. to 2 h. 45 m. on the 6th, there was a corresponding almost uninterrupted rise. A considerable oscillation intervened between the two movements. The disturbance in V was considerably less than in the other elements. The general tendency was up the sheet (numerical fall) until $21\frac{1}{2}$ h. on the 5th, the subsequent movement down the sheet being slow. The subsidence of the disturbance in the Antarctic was rapid, and its conclusion unusually well marked, the traces being exceptionally quiet from 5 h. to 11 h. on the 6th.

At Mauritius the H trace shows an uninterrupted but slow rise to a crest at about 20 h. 20 m. on April 5, followed by a sharp fall to the minimum at about 21 h. 35 m. There then ensued another uninterrupted rise to the maximum at 24 h. 0 m., followed by a fall of 16γ in 40 minutes, and subsequent slight fall until about 3 h. on the 6th. The general appearance of the curve is that of two long waves, with crests at about 20 h. 20 m. and 24 h. 0 m. on the 5th. The D trace is also undulatory, the turning points corresponding to extreme westerly positions falling at about 20 h. 25 m. and 23 h. 0 m. on the 5th, and 2 h. 0 m. on the 6th, while those corresponding to extreme easterly positions fell about 22 h. 20 m. on the 5th, and 0 h. 50 m. and 3 h. 30 m. on the 6th. On the normal April day, declination is practically constant from 22 h. to 3 h., so the above undulations, though not large, clearly represent disturbance.

TABLE CLXIV.—18 h. April 5 to 5 h. April 6, 1912. Plate LI.

Station.	Element.	Times of		Disturbance Range.	Inequality Range.
		Maximum.	Minimum.		
		h. m.	h. m.	γ	γ
Antarctic	N′	18 45 (5th)	0 45 (6th)	208	39
	E′	2 40 (6th)	20 38 (5th)	311	48
	V	21 29 (5th)	5 0 (6th)	101	18
Mauritius	H	0 0 (6th)	21 35 (5th)	34	17
	D	3 30 (6th)	20 25 (5th)	28	18
Buitenzorg	N	20 30 (5th)	22 25 (5th)	43	31
	E	23 50 (5th)	2 35 (6th)	40	13
	V	5 0 (6th)	1 0 (6th)	28	17
Alibag	H	20 30 (5th)	3 0 (6th)	42	41
Honolulu	H	?	0 47 (6th)	> 42 < 57	18
	D	18 56 (5th)	0 36 (6th)	57	42
	V	18 55 (5th)	21 26 (5th)	24	23
Agincourt	H	22 50 (5th)	1 20 (6th)	67	14
	D	0 20 (6th)	20 35 (5th)	106	33
Eskdalemuir... ...	N	19 45 (5th)	0 29 (6th)	74	8
	E	0 2 (6th)	18 0 (5th)	125	12
	V	20 15 (5th)	0 41 (6th)	63	26
Sitka	H	0 57 (6th)	20 31 (5th)	119	22
	D	?	1 45 (6th)	>111<119	45
	V	1 42 (6th)	?	>134<184	12

At Buitenzorg the largest movements in N were a rise of 37γ between 19 h. 5 m. and 20 h. 30 m., and fall of 43γ during the next two hours. A considerable fall in E occurred between 0 h. and 2 h. on the 6th, and synchronous with it was a well marked bay in the V trace.

At Alibag the H trace showed two considerable wave-like oscillations, the rise coming first in both. The crests appeared at about 20 h. 30 m. and 24 h. 0 m. on the 5th, hours at which the element is normally below its mean. In this case, any comparison limited to the amplitudes of the disturbance and normal ranges would be quite misleading.

No trace was received from Honolulu, the data in Table CLXIV being derived exclusively from the official publication. Clearly the disturbance there was similar in size to that at Buitenzorg and Alibag.

The Agincourt H and D traces both show very considerable but irregular disturbance. In H it persisted without cessation from about 18½ h. on the 5th until nearly 4 h. on the 6th. H was decidedly depressed for three hours after 23 h. on the 5th. In D disturbance was hardly apparent until 22 h. on the 5th, and it ceased almost abruptly at 4 h. on the 6th. As in the Antarctic, the disturbance was followed by a conspicuously quiet time, which lasted for a good many hours.

At Eskdalemuir N was very sensibly disturbed on the 5th during the earlier part of the afternoon; and whilst it was nearly quiet for a short time near 18 h., the Eskdalemuir curves alone would not have suggested making a separation between the disturbance before and after that hour. The largest N movements were a nearly uninterrupted fall of 57γ between 19 h. 46 m. and 20 h. 46 m. on the 5th, and an oscillation between 23 h. 10 m. on the 5th, and 0 h. 30 m. on the 6th. The E trace showed only small movements until 18 h. 55 m., when a numerical fall began which continued almost without interruption until 20 h. 40 m., the total fall amounting to 108γ. A numerical rise of 79γ ensued in the course of the next 45 minutes. Between 22 h. 55 m. on the 5th and 0 h. 5 m. on the 6th, there was a second large, numerical fall of 95γ. The value of V was slightly enhanced prior to 18 h. on the 5th. The principal movement was a sharp fall between 23 h. 40 m. on the 5th, and 0 h. 41 m. on the 6th, followed by a gradual recovery. The traces were all very quiet for several hours after 4 h. on the 6th.

No traces were received from Sitka. The data in Table CLXIV were derived entirely from the official publication. Obviously the disturbance was larger in V than in H or D, and the range in V considerably exceeded that in the Antarctic. The disturbance in the horizontal plane would seem to have been much less than in the Antarctic, but fairly similar to the disturbance in D at Agincourt and in E at Eskdalemuir.

The disturbance of April 5–6 was unusually sharply defined as regards its termination, a markedly quiet time setting in somewhat suddenly at all the stations, the Antarctic included. The disturbance was characterised rather by the persistence in direction of moderately rapid movements than by the presence of any conspicuous short-period oscillations. It was clearly of general incidence, and the times of the largest movements were roughly the same at the different stations. The East–West component was on the whole considerably more disturbed than the North–South. The disturbance in V increased relative to the disturbance in the horizontal plane in passing from South to North.

Section 115.—The disturbance of April 10, 1912, was of short duration.

In the Antarctic the earlier part of the day contained many comparatively short-period oscillations in all three elements. The largest movement shown was in N′. It consisted of a rise (numerical fall) from 8 h. 10 m. to the maximum at 9 h. 24 m., and a subsequent nearly equal fall until 11 h. After this the element became as quiet as usual. In E′ there was a considerable rise and fall, corresponding roughly in time with the rise and fall in N′, but not so large either absolutely or by comparison with the previous movements. The chief movements in V were a fall between 8 h. and 10 h., and a subsequent rise.

TABLE CLXV.—6 h. to 12 h. April 10, 1912. Plate LII.

Station.	Element.	Times of Maximum.	Times of Minimum.	Disturbance Range.	Inequality Range.
		h. m.	h. m.	γ	γ
Antarctic	N′	9 24	6 0	228	34
	E′	9 50	11 10	162	29
	V	6 15	10 3	131	19
Mauritius	H	8 10	9 55	65	19
	D	9 40	6 0	55	32
Buitenzorg	N	6 0	9 55	88	29
	E	6 0	11 30	28	10
	V	6 0	10 0	36	18
Alibag	H	8 5	9 55	64	39
	D	6 0	8 10	22	25
	V	11 50	6 30	35	29
Honolulu	H	9 25	6 53	30	2
	D	9 10	6 15	17	3
	V	9 0	4 50	9	1
Agincourt	H	10 40	9 0	49	3
	D	6 0	9 25	122	16
Eskdalemuir... ...	N	8 15	9 36	80	33
	E	7 57	10 0	38	29
	V	11 20	8 15	8	5
Sitka	H	8 59	9 51	161	8
	D	9 58	6 10	108	5
	V	7 0	9 46	245	6

The Mauritius H trace shows a deep bay (depression) between 8 h. 10 m. and 12 h. The decline after 8 h. 10 m. was at first extremely rapid, a fall of 18γ appearing to be nearly instantaneous. The rise after the minimum at 9 h. 55 m. until 12 h. amounted to 26γ, the recovery being by no means complete. In D there was a gradual easterly movement, 8′ in all, between 6 h. 0 m. and 9 h. 40 m., followed between 9 h. 40 m. and 12 h. 0 m. by a gradual westerly movement of 2½′. These changes are both in the direction to be expected at the hour, but the former is considerably larger than the normal diurnal change.

At Buitenzorg there was a conspicuous bay in the N curve, there being an almost uninterrupted fall from 7 h. 30 m. until the minimum at 9 h. 55 m., but the fall ceased to be rapid after 9 h. The recovery was at first very rapid, but soon became slower. Disturbance was visible in E, but it was not large. The V trace showed a bay, corresponding fairly in time with that in N, but much shallower.

At Alibag there was a considerable fall in H between 8 h. and 9 h. 55 m., when the minimum occurred; it was most rapid between 8 h. 20 m. and 9 h. 10 m. The recovery was fairly rapid for the first 15 minutes, but then became very slow. There was little apparent disturbance in D or V.

At Honolulu the only conspicuously disturbed feature was a hump in H between $7\frac{1}{2}$ h. and $9\frac{1}{2}$ h. During its occurrence H was enhanced, not depressed like H at Alibag or N at Buitenzorg. The D trace was generally smooth, but showed decided dimples between $8\frac{1}{2}$ h. and $10\frac{1}{2}$ h. During their occurrence the needle was to the East of its normal position. The V trace showed a decided bay (element numerically enhanced) between $8\frac{1}{2}$ h. and $9\frac{1}{2}$ h.

At Agincourt there were a good many minor oscillations in the H trace between 6 h. and 12 h., just as there had been earlier in the day. The most noteworthy feature was a considerable bay (depression) between 8 h. and 10 h. In D the disturbance was much larger. The trace, which had been very quiet during the early morning of the 10th, became slightly oscillatory shortly after 4 h., and remained so until 8 h. 15 m., when a decided westerly movement began which continued until 9 h. 25 m. The time of most rapid movement was from 8 h. 35 m. to 9 h. 10 m. The total amplitude of the westerly movement was 24′. After 9 h. 25 m. an easterly movement began which continued until 12 h.; it amounted to 21′.

At Eskdalemuir the N trace was unquiet throughout the earlier part of April 10. From 6 h. to 8 h. there were numerous very short-period oscillations. Between 8 h. 15 m. and 9 h. 5 m. there was a nearly uniform downward slope on the trace, the fall amounting to 52γ. Subsequently until nearly 12 h. there were numerous short-period oscillations. The disturbance in E was a good deal smaller. The largest movement was an algebraic fall of 29γ between 9 h. 30 m. and 10 h. The V trace, except for a slight dip just after 8 h., was practically quiet.

At Sitka the traces showed some minor oscillations, but no movement of any size until after 8 h. The first considerable movement in H was a rise of 59γ commencing about 8 h. 30 m. After some minor oscillations there occurred a fall of 87γ in 15 minutes, commencing about 8 h. 55 m. In the course of 36 minutes there was a fall of 98γ and rise of 102γ, the turning point occurring at 9 h. 51 m. After 12 h. there were only small oscillations. The D movements, though smaller, were also considerable, but somewhat irregular. The needle was on the whole displaced to the East of its normal position. The largest movements occurred between 8 h. 20 m. and 11 h. 15 m. The most prominent was an oscillation between 9 h. 50 m. and 10 h. 30 m., which included an easterly swing of 20′ followed by a westerly swing of 15′. The V movements were larger, and much more symmetrical than those in the horizontal components. There was a large hump on the trace (depression of V) extending from about $7\frac{1}{2}$ h. to 13 h.; but the rate of change was slow until after 8 h. and again after 12 h., and comparatively slow after 11 h. The hump was not perfectly symmetrical, there being two summits, the second the higher. The rise to the first summit was on the whole faster than the final fall. The rise in the trace (fall in V) was most rapid between 8 h. 50 m. and 9 h. 20 m. The hump was very similar in appearance to that described at Sitka on several previous occasions. After 12 h. for several hours the curves showed only small oscillations, mostly of short period, being almost normally quiet for Sitka.

The disturbance on April 10, 1912, was of comparatively short duration, and at most stations it was preceded and followed by much quieter times. It was only of moderate amplitude, but some rather noteworthy differences presented themselves between the different stations. At most, including the Antarctic, the disturbance was greater in H (or N) than in D (or E), but to this Agincourt was a remarkable exception. At most stations (including Mauritius, Buitenzorg, Alibag, Agincourt, Eskdalemuir and on the whole Sitka) H (or N) was depressed, but at Honolulu it was elevated. At most stations, including the Antarctic, the range in V was less—usually much less—than the range in H (or N), but at Sitka it was considerably larger.

Section 116.—In the Antarctic conditions had been normally quiet for some hours prior to 1 h. on April 15, 1912. The first indication of disturbance was a fall in N′ commencing about 1 h. 40 m. It was interrupted by short-period oscillations but continued until nearly 5 h., the natural time of the daily minimum (maximum in S′). A reverse movement then set in and continued with minor interruptions until after 11 h., or about the natural time of the daily maximum. Between 11 h. 16 m. and 14 h. there was a considerable fall in N′, which brought the trace back to about its normal level. The general trend in the E′ trace was a rise to about 7 h., the time of the ordinary maximum, followed by a fall to about 12 h. There were numerous short-period oscillations, and after 10 h. there were two or three larger oscillations of longer period. The V trace exhibited numerous short-period oscillations. The largest single movement was comparatively trifling, being a fall of about 35γ between 12 h. 45 min. and 13 h. The general trend of the V trace was downwards (*i.e.*, numerical rise) from 2 h. 40 m. to 8 h. What the Antarctic curves as a whole suggested was not so much a disturbance as an amplification of the ordinary regular diurnal variation throughout the time considered.

At Mauritius the H trace showed some slow oscillations after 2 h. The fall from the maximum to the minimum was considerable, but at no time rapid; it was interrupted by some minor oscillations. Between 11 h. 20 m. and 14 h. there was a rise of 27γ, leaving the element still considerably depressed. The D trace was slightly undulatory. Between 2 h. and 3 h. there was an easterly movement of about $2\frac{1}{4}'$, and again between $10\frac{1}{4}$ h. and 11 h. an easterly movement of about $1\frac{1}{2}'$, while the natural direction of movement at both hours is westerly. On the other hand, between 7 h. and $8\frac{1}{2}$ h. there was an easterly movement of about $2\frac{1}{4}'$, agreeing this time with the normal direction of change. Thus at Mauritius the natural diurnal variation sometimes assisted and sometimes opposed the influence of disturbance on the declination.

At Buitenzorg the N trace showed a fall between 3 h. 40 m. and 8 h. 40 m., interrupted only by numerous small short-period oscillations. Leaving these out of account, the slope downwards of the trace during these five hours was not far from uniform. After 9 h. 20 m. the general trend of the trace was upwards, but the rise was interrupted by a fall of 27γ between 10 h. 40 m. and 11 h. 10 m. The E trace showed a nearly continuous rise, interrupted only by some small oscillations, from a little after 2 h. (the ordinary time of minimum) until after 8 h. (near the ordinary time of maximum). The rise was followed by a nearly uninterrupted fall. It was hardly a case of disturbance, but rather of amplification of the natural diurnal changes. The V trace showed a gradual rise (numerical fall) from 1 h. to 4 h., with subsequent reverse movement from 4 h. to 10 h. The change in V, like that in E, represented enhancement of the natural diurnal changes.

TABLE CLXVI.—1 h. to 14 h. April 15, 1912. Plate LII.

Station.	Element.	Times of Maximum.	Times of Minimum.	Disturbance Range.	Inequality Range.
		h. m.	h. m.	γ	γ
Antarctic	N′	11 16	4 25	207	48
	E′	7 24	11 40	248	31
	V	2 40	8 0	139	33
Mauritius	H	5 30	11 20	70	21
	D	8 30	1 0	24	32
Buitenzorg	N	2 50	9 20	156	41
	E	8 20	2 5	46	25
	V	3 50	9 35	42	22
Alibag	H	5 35	11 20	94	47
Honolulu	H	?	8 21	>102	15
	D	9 20	?	> 25	19
	V	9 5	?	> 26	9
Helwan	H	3 35	11 10	56	30
	D	6 10	10 0	53	45
Agincourt	H	1 55	8 35	147	19
	D	3 0	9 10	134	21
Eskdalemuir... ...	N	5 19	11 23	123	34
	E	4 0	12 50	69	41
	V	14 0	5 19	45	9
Sitka	H	6 52	11 22	599	13
	D	9 10	7 13	291	28
	V	6 46	11 24	510	9

At Alibag the natural change in H is a fall from a little before 6 h. until 16 h. On the present occasion the fall set in about the usual time but proceeded at a considerably greater rate than usual, reaching a minimum considerably lower than usual about 11 h. 20 m. It was roughly a case of doing double the normal fall in half the ordinary time. After 11 h. 20 m. a recovery set in which, though fairly rapid for the first 20 minutes, was on the whole a good deal more gradual than the fall, the element remaining sensibly depressed until at least 20 h.

The trace received from Honolulu commenced about 3 h. 40 m., but apparently did not show the full range in any of the elements, the maximum in H and the minima in D and V occurring earlier. Thus Table CLXVI contains only an approximation to the ranges, derived from the data in the official publication. During the time covered by the trace received, the principal movements were a slightly interrupted fall and rise in H, the minimum appearing at 8 h. 21 m., and the rise ending about 11 h. 20 m. After this hour the H trace showed only some small oscillations. The daily minimum in H is but poorly marked at Honolulu, so that all that can be said is that on April 15 the minimum occurred at an hour when values near the minimum are normally recorded. The D and V traces at Honolulu contained some undulatory movements of no great size.

At Helwan H rose about 20γ between 2 h. 35 m. and 3 h. 35 m. After that the general trend was a fall to the minimum at 11 h. 10 m., but the slope of the curve was never steep, and there were temporary recoveries. The minimum occurred about the ordinary hour of the maximum. Thus the disturbance was opposed by the natural diurnal change, which presumably explains the comparatively small amplitude of the range. The D trace appeared almost normal. The V trace was too faint for satisfactory measurement, but apparently was but little disturbed.

At Agincourt conditions were quiet from 23 h. on the 14th until 2 h. on the 15th. At 2 h. H began to fall pretty rapidly, and the fall continued until nearly 4 h. There then ensued a series of undulations with shorter period oscillations superposed, the general trend continuing downwards until the minimum was reached at 8 h. 35 m. A rapid recovery then set in. Between 8 h. 5 m. and 9 h. 0 m. there was a fall of 70γ and rise of 89γ. After the minimum at 8 h. 35 m. the general trend of the curve was upwards until 13 h., but there were no large movements after 11 h. The D trace was quiet until 2 h. Between 2 h. 40 m. and 9 h. 15 m. there was a succession of slow undulatory movements $16\frac{1}{2}'$ E., $21\frac{3}{4}'$ W., $21'$ E., $20'$ W., $20\frac{1}{2}'$ E., $28\frac{1}{2}'$ W. and $16\frac{1}{2}'$ E., with shorter period oscillations superposed on them. Subsequently there were no large movements, but shorter period oscillations continued until 15 h.

At Eskdalemuir conditions were normally quiet from 23 h. on the 14th until nearly 3 h. on the 15th. Between 3 h. 10 m. and 4 h. 25 m. N. rose 26γ and fell 35γ. Between 4 h. 25 m. and 5 h. 19 m. it rose 49γ. From 5 h. 19 m. to 6 h. 30 m. there was a fall, interrupted by minor oscillations, which amounted in all to 106γ. Subsequently there were very numerous and not inconsiderable short-period oscillations, which continued until the early hours of the 16th. They showed, in fact, no marked tendency to diminish until 18 h. on the 15th. The E trace was practically quiet until 2 h. 45 m. From then to 4 h. 50 m. it executed three considerable movements, a fall of 26γ (numerical rise), a rise of 67γ and a fall of 67γ. No subsequent movement approached the last oscillation in size, but oscillations of short period continued until 18 h. A distinct fall began in V after 2 h. 30 m., but it was interrupted by a slight rise between 3 h. 50 m. and 4 h. 30 m. Thereafter the fall was resumed until 5 h. 19 m. From 6 h. to 14 h. there was a very gradual rise.

At Sitka the disturbance was a very lively one. The trace received did not begin until 2 h. 20 m., but conditions then and for the next half-hour were quiet, except for small short-period oscillations. Conditions had become decidedly more disturbed by 3 h. Larger movements set in about 6 h. 40 m., and conditions from then until 12 h. were very highly disturbed, there being numerous large oscillatory changes in all the elements. After 12 h. there was a rapid decline in disturbance, but minor short-period oscillations continued for some hours after 14 h. The general trend of the H trace was downwards from the maximum at 6 h. 52 m. to the minimum at 11 h. 22 m., but the fall was interrupted by many large oscillations. The recovery after the minimum was at first very rapid. In the first 20 minutes there was a rise of 231γ. The depression remaining after 14 h. was comparatively small. The disturbance in D was smaller than in the other elements, and its general trend less decided. Between 7 h. 0 m. and 7 h. 30 m. there was an oscillatory movement 33′ West followed by 39′ East. Between 10 h. 35 m. and 11 h. 25 m. there was another large pair of movements 37′ to West and 45′ to East, a quiet interval of some eight minutes separating them. In V the general trend was a rise, in all about 227γ, between 3 h. and the maximum at 6 h. 46 m., and then a fall. At 9 h. 35 m. the fall since the maximum amounted to 446γ. Both the rise and the fall were interrupted by oscillations, but these were neither so large nor so numerous as in the case of H. From 9 h. 35 m. until 10 h. 45 m., V on the whole rose decidedly; but between 10 h. 45 m. and 11 h. 24 m. there was a further fall of 154γ. After the minimum at 11 h. 24 m. V rose almost uninterruptedly until 14 h., the rise amounting to 254γ. There was a further rise between 14 h. and 17 h. but only about 25γ in all. The disturbance at Sitka centred about local midnight, an hour when the normal diurnal changes are very small.

In the storm of April 15 there was a marked contrast between the phenomena at the southern stations, including the Antarctic, and at the northern. In the southern stations the range was considerable, but the movements were on the whole comparatively slow and regular, more like an enhancement of the normal diurnal changes than anything else. At Agincourt and Eskdalemuir, however, and still more at Sitka, the changes were abrupt and irregular, and in every way indicative of disturbance. Except at Sitka the range of the vertical force was trifling, but there it was very large, being nearly four times as large as in the Antarctic. The contrast between the V changes at Eskdalemuir and Sitka, stations differing only $1\frac{3}{4}$° in latitude, is truly remarkable.

Section 117.—On May 12–13, 1912, there was a disturbed time during which there were considerably quieter interludes of some duration. It has seemed best to discuss three separate parts of the disturbance separately, the first including 0 h.–14 h. on the 12th.

TABLE CLXVII.—0 h. to 14 h. May 12, 1912. Plate LII.

Station.	Element.	Times of Maximum.	Times of Minimum.	Disturbance Range.	Inequality Range.
		h. m.	h. m.	γ	γ
Antarctic	N′	11 25	3 33	300	47
	E′	7 37	11 12	226	34
	V	2 10	8 5	116	32
Mauritius	H	2 45	11 40	60	20
	D	3 15	8 15	26	28
Buitenzorg	N	2 5	11 5	106	42
	E	7 50	4 20	28	22
	V	3 50	11 25	22	19
Alibag	H	3 40	13 10	69	39
Honolulu	H	1 32 ?	5 58	$\nless 83 < 92$	11
	D	?	?	> 25	20
	V	7 34	0 32 ?	$\nless 22 < 34$	8
Agincourt	H	1 35	3 40	67	16
	D	5 50	7 35	202	23
Eskdalemuir... ...	N	3 40	11 22	109	35
	E	4 15	13 50	98	40
	V	14 0	3 57	34	9
Sitka	H	5 40	7 42	144	20
	D	7 32	3 59	197	37
	V	5 54	11 40	266	12

In the Antarctic the disturbance bore a considerable resemblance to that on April 15, 1912, during the same part of the day. On comparing Tables CLXVI and CLXVII it will be seen that corresponding maxima and minima appear at hours which do not differ much. On May 12, as on April 15, the disturbance was largely represented by an enhancement of the normal diurnal variation. The N′ trace was more disturbed than the others. Its trend was on the whole downwards from 0 h. to the minimum at 3 h. 33 m., but the fall was interrupted by considerable oscillations. After the minimum the general tendency was a rise until $7\frac{1}{2}$ h., a fall until $8\frac{1}{2}$ h., a nearly level portion, a rise to the maximum at 11 h. 25 m., and a considerable subsequent fall. After 14 h. the trace was much quieter for some hours. The E′ trace showed a gradual rise, interrupted by numerous minor oscillations, until the maximum at 7 h. 37 m. This was followed during the next 45 minutes by a fall of 139γ. Between 10 h. 5 m.

and 12 h. there was a fall of 113γ and a rise of 84γ, the latter occurring after the minimum was reached. V was hardly disturbed until after 2 h. From the maximum at 2 h. 10 m. to the minimum at 8 h. 5 m. there was a gradual fall, interrupted only by small oscillations. A sensible rise ensued during the first hour after the minimum. The subsequent changes were not striking.

At Mauritius after 0 h. H increased, with one slight interruption, to the maximum at 2 h. 45 m., and then fell with one or two slight interruptions until after 8 h. After a slight rise between 8 h. 15 m. and 9 h. 20 m., the fall was resumed until the minimum was reached at 11 h. 40 m. The time of maximum somewhat precedes that of the normal diurnal variation, but the changes agree generally in direction with those customary at the hour, only the range is about thrice the normal. The D trace gave but slight indication of disturbance, and the range did not exceed that of the average day.

At Buitenzorg the disturbance was mainly confined to N. The N trace showed a large number of short-period oscillations, and some longer period oscillations of no great size. On the whole the movements represented merely an enhancement of the regular diurnal variation.

At Alibag the H trace showed a few small oscillations after 2 h. Its main feature was a nearly unbroken fall from 6½ h. to the minimum at 13 h. 10 m. There was a pretty smart recovery during the first half-hour after the minimum. The curve was practically quiet from 12 h. to 16 h.

No trace was received from Honolulu, but the data in the official publication supplied information which has been included in Table CLXVII. There was obviously a fair disturbance there in H, the range exceeding that at Mauritius or Alibag. The V trace must have been sensibly disturbed as well.

At Agincourt the H trace had shown minor oscillations since 19 h. on the 11th, but became more disturbed after 1 h. on the 12th. The largest movements occurred between 3 h. and 8 h. They included a fall of 60γ and rise of 40γ between 3 h. 5 m. and 4 h. 10 m., a rise of 40γ and fall of 45γ between 5 h. 40 m. and 6 h. 20 m., and a rise of 45γ between 6 h. 55 m. and 7 h. 40 m. Shorter period oscillations continued after 8 h., but there were no large movements. H was normally quiet for several hours after 12 h. The D trace was very quiet during the afternoon of the 11th, and showed no considerable movement until after 2 h. on the 12th. Between 3 h. and 9 h. there were some considerable movements, larger decidedly than the movements then proceeding in H. Between 4 h. 10 m. and 4 h. 50 m. there were movements of 13′ to the West and 9′ to the East; between 5 h. 20 m. and 6 h. 15 m., 20′ to the East and 17′ to the West; and between 6 h. 25 m. and 8 h. 15 m., 29½′ to the West and 16′ to the East. After 11 h. D was normally quiet for a number of hours.

At Eskdalemuir the N trace on the afternoon of May 11 showed a considerable amount of minor disturbance, which would not naturally be separated from the larger disturbance on the 12th, though the first two hours of that day were comparatively quiet. The disturbance in N on the 12th increased decidedly after 3 h., and remained more active until 12 h., when a decidedly quieter though still slightly disturbed time ensued. There were no individual movements in any way striking. E was most disturbed between 2 h. and 6 h., when some considerable movements occurred. Short-period oscillations were a good deal in evidence then and until 10 h. Between 12 h. and 16 h. the E trace was as quiet as usual. The V trace showed two or three small dimples, the largest about 4 h., but the disturbance in that element was trifling.

At Sitka the H and D traces during the afternoon of the 11th contained many short-period oscillations, and after 0 h. on the 12th these increased in size. Longer period oscillations gradually developed, and after 4 h. they also appeared in the V trace. The largest movements occurred between 7 h. and $8\frac{1}{2}$ h., and again between 11 h. and 13 h. A somewhat unusual feature was that the range was larger in D than in H. There were several rapid oscillations in D between 7 h. and $8\frac{1}{2}$ h. The most noteworthy was a westerly movement of 26′ and easterly movement of 22′ between 7 h. 35 m. and 7 h. 50 m. The V trace was a good deal less oscillatory than the D and H traces, but showed a good deal larger range. There was a general fall in V, interrupted by oscillations, from the maximum at 5 h. 54 m. to a conspicuous turning point about 8 h. The fall during this time amounted to 195γ, of which 157γ occurred between 7 h. 10 m. and 8 h. After 8 h. V showed no large oscillation, but a gradual rise until 9 h. 40 m. There then ensued a gradual fall, interrupted for about 10 minutes shortly after 11 h., to the minimum at 11 h. 40 m. During the first 40 minutes after the minimum the rise amounted to 66γ. Subsequently it took place at a diminished rate until about 15 h. All the traces were practically quiet for some hours after 14 h.

On this occasion the disturbance in the horizontal plane was decidedly larger in the Antarctic than at Sitka, but the disturbance in vertical force at Sitka had a range more than double that in the Antarctic. The disturbance in declination was larger than that in H both at Sitka and Agincourt, and it was fully larger at Agincourt than at Sitka.

Section 118.—The Antarctic traces after 14 h. on May 12 were by no means specially quiet, but showed no outstanding movement until after 21 h. Between 21 h. and 24 h. there was a conspicuous bay in the E′ trace, and also considerable though smaller movements in N′. Ten minutes' trace was lost immediately before 23 h., so the range in Table CLXVIII may have been exceeded. The V trace showed many short-period oscillations, but no large movement. After 23 h. 20 m. the traces were all normally quiet.

At Mauritius the H trace, which had been very quiet for 2 hours previously, contained a well-marked hump (elevation of H) between 21 h. and 23 h., a rise of 24γ being followed by a fall of 16γ. The D trace showed a bay (easterly deflection). A swing to the East of 2′ occurred in about 20 minutes. The subsequent swing to the west was slower, but details could not be made out in the trace, and the range in Table CLXVIII may have been slightly exceeded.

At Buitenzorg the movement in N was pretty similar to that in H at Mauritius. The D trace was sensibly undulatory. The V trace seemed also slightly disturbed, but was too faint to measure.

At Alibag the H trace showed a decided hump (elevation) between 21 h. and 23 h. The fall in H was less than the previous rise, but not so decidedly so as in the case of H at Mauritius or N at Buitenzorg.

At Agincourt the H trace showed a succession of waves between 20 h. and 24 h., of which the disturbance between 21 h. and 23 h. seemed to form part. The D trace, however, was practically quiet, except between 21 h. and 23 h., when there was a bay, during which D was East of its normal position.

TABLE CLXVIII.—21 h. to 24 h. May 12, 1912. Plate LII.

Station.	Element.	Times of Maximum.	Times of Minimum.	Disturbance Range.	Inequality Range.
		h. m.	h. m.	γ	γ
Antarctic	N′	22 45	23 20	106	14
	E′	23 15	21 55	180	6
	V	21 20	21 55	36	5
Mauritius	H	22 10	21 15	24	5
	D	21 40	21 0	14	1
Buitenzorg	N	22 40	21 35	28	9
	E	21 40	22 35	10	6
Alibag	H	22 15	21 20	25	2
Agincourt	H	21 20	22 50	43	11
	D	21 50	21 0	33	17
Eskdalemuir... ...	N	21 55	22 55	50	4
	E	22 55	21 33	70	3
	V	21 20	22 35	17	14
Sitka	H	23 25	21 45	66	8
	D	21 0	23 50	34	16
	V	23 46	21 0	27	11

At Eskdalemuir the N trace showed an irregular hump (elevation) from about 21 h. to 23 h. The E trace contained a rather rapid oscillation between 21 h. 25 m. and 21 h. 50 m., a numerical rise of 28γ being followed by a numerical fall of 60γ. The V trace was more disturbed than the range might suggest. The value was naturally falling at the time, but the fall from $21\frac{1}{2}$ h. to 22 h. was so much faster than usual that a decided bay (depression) was formed, the element reversing its normal direction of change and rising between $22\frac{1}{2}$ h. and 23 h.

At Sitka the disturbance was somewhat irregular. If anything, H was *depressed* between 21 h. and $22\frac{1}{2}$ h. Between 22 h. 25 m. and 22 h. 35 m. there was a rise of 58γ. The D trace resembled the H in showing numerous short-period oscillations between 21 h. and 24 h., but was not more disturbed then than earlier. The V trace showed a shallow bay between $21\frac{1}{2}$ h. and $23\frac{1}{4}$ h., the element being slightly enhanced in value.

The appearance of the curves suggests a common source for the disturbances in the Antarctic and at Mauritius, Buitenzorg and Alibag, especially at the three latter stations, where the prominent movements were a rise and subsequent fall in H or N. The principal movements in the Antarctic corresponded fairly in time with those at Mauritius, Buitenzorg and Alibag, but the most conspicuous change was a fall and rise in E′. The N movement at Eskdalemuir and the D movement at Agincourt suggested a common source of disturbance for these and the more southern stations, but this is not what would have been suggested by the E trace at Eskdalemuir, the H trace at Agincourt, or any of the traces at Sitka.

Section 119.—The disturbance between 0 h. and 3 h. on May 13, 1912, has already been dealt with amongst the short period disturbances, see Section 83 and Plate XXXVIII, but it has been included in the disturbance between 0 h. and 14 h. to facilitate comparison with the previous day.

TABLE CLXIX.—0 h. to 14 h. May 13, 1912. Plate LIII.

Station.	Element.	Times of Maximum.		Times of Minimum.		Disturbance Range.	Inequality Range.
		h.	m.	h.	m.	γ	γ
Antarctic	N′	7	50	1	23	382	47
	E′	8	15	0	5	247	34
	V	0	20	9	10	306	32
Mauritius	H	0	50	10	30	58	20
	D	12	0	8	15	27	28
Buitenzorg	N	3	55	10	15	123	42
	E	9	10	3	10	24	22
	V	4	50	10	25	38	19
Alibag	H	6	40	10	30	73	39
Agincourt	H	1	35	1	45	93	16
	D	1	15	1	40	251	23
Eskdalemuir... ...	N	0	0	8	58	98	35
	E	0	33	11	42	85	40
	V	10	20	1	48	80	9
Sitka	H	1	27	9	44	305	20
	D	10	12	1	8	216	37
	V	1	20	10	13	431	12

In the Antarctic the regular diurnal changes showed evident expansion on the 13th as on the 12th, but on the 13th irregular variations were considerably more in evidence. In addition to the large bay-like movements in N′ and E′ between 0 h. and 3 h., there was a disturbance between 5 h. and 7 h. which presented some resemblance to the "special type." Between 3 h. and 5 h. conditions were quieter in all the elements than they were again until after 14 h. In N′ the most prominent movements were the fall and rise (numerical rise and fall in S′) constituting the bay between 0 h. and 3 h., a series of rapid oscillations between $5\frac{1}{2}$ h. and $6\frac{1}{2}$ h., and a rise of 191γ between 6 h. 55 m. and 7 h. 50 m. In E′ the most prominent movements were the rise and fall between 0 h. and 3 h., some sharp oscillations near 6 h. (between 5 h. 56 m. and 6 h. 11 m. there was a fall of 129γ and a rise of 103γ), a rise of 149γ between 7 h. 10 m. and 7 h. 55 m., and a fall of 132γ between 10 h. 25 m. and 10 h. 55 m. In V the movement between 0 h. and 3 h. was not large compared with the later movements. Between 5 h. 48 m. and 6 h. 40 m. there was a fall (numerical rise) of 210γ and rise of 170γ. Between 7 h. 50 m. and 9 h. 10 m. there was a fall (numerical rise) of 238γ, and between 10 h. 35 m. and 11 h. 35 m. a rise of 150γ. V was very decidedly depressed (numerically enlarged) between 6 h. and 13 h.

At Mauritius H had a smart fall of 16γ between 0 h. 50 m. and 1 h. 25 m., followed by a gradual rise until 4 h. The curve between 7 h. and 14 h. was of a bay shape, the fall to the minimum at 10 h. 30 m. being about 48γ, and the subsequent rise about 40γ. The minimum occurred somewhat earlier in the day than usual, and the range was about thrice the normal, but the changes were of similar type to those of the average day. The D trace was too faint to measure until after 2 h. But it was very quiet for an hour after it was clearly visible, so it is unlikely that the range given in Table CLXIX was exceeded. The trace was on the whole smooth, a westerly movement prevailing from $3\frac{1}{2}$ h. to $6\frac{1}{2}$ h. and from 12 h. to 14 h., and an easterly movement from $8\frac{1}{2}$ h. to 11 h. These movements fairly represented the normal diurnal changes. Thus D was practically unaffected by the disturbance.

At Buitenzorg, after recovering from the depression between 0 h. and 3 h., N began to fall about 4 h., and the fall continued with minor interruptions to the minimum at 10 h. 15 m. The ordinary diurnal fall appeared to be more than doubled in size, and shortened in time by from 3 to 4 hours. During the first hour after the minimum was reached there was a rise of 48γ. The subsequent recovery was slower. The E trace showed some minor oscillations, but the range was about normal. The V trace had a pretty regular course, but the amplitude of the regular diurnal change was doubled, and the turning point was advanced. After the minimum (numerical maximum) there was a pretty smart rise for 40 minutes, the rate then markedly declining.

At Alibag the bay in the H trace shortly after 0 h. was fairly prominent, and there were small irregular movements between $4\frac{1}{2}$ h. and 6 h., but the largest movement consisted of a nearly uninterrupted fall from the maximum at 6 h. 40 m. to the minimum at 10 h. 30 m. The maximum occurred about the normal hour, but the minimum anticipated the usual time by about $4\frac{1}{2}$ hours, and the amplitude was quite double the normal. Between 10 h. 30 m. and 11 h. 30 m. there was a pretty smart rise of 25γ. After 12 h. conditions were practically quiet.

At Agincourt H was continuously disturbed from 20 h. on the 12th to 12 h. or 13 h. on the 13th, with the exception of a pretty quiet time between 2 h. 40 m. and 4 h. 20 m. on the 13th. The largest movements on the 13th occurred between

1 h. and 3 h. Between 4 h. 20 m. and 6 h. there was a rise of 40γ and fall of 35γ. Between $6\frac{1}{2}$ h. and $10\frac{1}{2}$ h. there was a bay (depression of H) of no very great depth, but accompanied by numerous minor oscillations. These oscillations continued until 13 h. The D trace at Agincourt showed large oscillations between 0 h. and 3 h. on the 13th. From 3 h. to 4 h. there was normal quietness. Between $4\frac{1}{2}$ h. and 6 h. there were some moderate oscillations. Between 7 h. 20 m. and 8 h. 10 m. there was a westerly movement of 18′, and between 8 h. 50 m. and 9 h. 35 m. an easterly movement of 15′. Subsequently there were only minor oscillations.

At Eskdalemuir the bay movement in N, which ended about 2 h., was prominent. From 2 h. to 5 h. there were only small oscillations. Between 5 h. and 7 h. there was a bay (depression of N), the element being about 30γ lower at 6 h. than at 5 h. or 7 h. From 7 h. to the minimum at 8 h. 58 m. there was a fall of 77γ, and between 10 h. 18 m. and 11 h. 38 m. a rise of 70γ. For some hours after 12 h. there were only small short-period oscillations. The E trace showed a double bay (numerical depression) between 0 h. and 3 h. The subsequent movements were smaller. Between 7 h. and 9 h. there was a bay, the element being numerically lower at 8 h. 2 m. by 43γ than at 7 h. From 12 h. to 16 h. there were only trifling short-period oscillations. In V the depression between 0 h. and 3 h. was the only conspicuous feature.

At Sitka* the disturbance between 0 h. and 3 h. was well marked. During the next 2 hours conditions were much quieter, though short-period oscillations still prevailed, especially in H. After 6 h. the curves, especially at first the D curve, became considerably more disturbed and the disturbance gradually increased. Between 7 h. 40 m. and 9 h. 44 m. H fell in all 147γ, and between 9 h. 44 m. and 11 h. 30 m. it rose 118γ, the fall and the earlier part of the rise being interrupted by numerous oscillations. Between 5 h. 5 m. and 5 h. 25 m. D moved 19′ to the East. Between 6 h. 5 m. and 7 h. 55 m. there was in the aggregate a westerly movement of 38′, and between 7 h. 55 m. and 10 h. 12 m. on the aggregate an easterly movement of 47′. These two movements were much interrupted by shorter period oscillations. Between 10 h. 12 m. and 11 h. 20 m. there was an almost uninterrupted westerly movement of 33′. The V trace was much quieter than the H and D traces until after 7 h., but about 7 h. 20 m. there began a drop in V, which continued with only minor interruptions until the minimum at 10 h. 13 m. The total fall in this time was 289γ. A rapid rise then set in, the increase measured up to 11 h. 30 m. amounting to 234γ. V continued to rise from 12 h. to 13 h., but at a much gentler rate. In fact after 12 h. the conditions might be described as very quiet compared with those prevailing during the previous 5 hours. H continued to fall, and D to move to the East after 14 h., but at a comparatively slow rate, and short-period oscillations though present were of a small size.

Disturbance was everywhere prevalent on May 13, but the time when it was most active differed at the different stations. This aspect of the case will be best brought out by a short survey of the two days May 12 and 13.

* Sitka trace was overlooked when preparing Plate XXXVIII. There was a short gap after 2 h.

The Antarctic curves suggest practically continuous disturbance, with periods of special activity centring about 3 h., $7\frac{1}{2}$ h., $11\frac{1}{2}$ h. and 22 h. on the 12th, and about $1\frac{1}{2}$ h., $6\frac{1}{2}$ h., and 10 h. on the 13th, with a distinctly quieter interval from 14 h. to 18 h. on the 12th. Which of the disturbed periods was the most disturbed it is difficult to say, but the 13th was decidedly the more disturbed day of the two.

At Mauritius the most disturbed time was from 21 h. to 23 h. on the 12th.

At Buitenzorg the most disturbed times seemed to be from 0 h. to 3 h. and 7 h. to 12 h. on the 13th. But the movements as a whole seemed not so much disturbances as enhancements of the ordinary diurnal change in N.

At Alibag the phenomena were similar to those at Buitenzorg, but the disturbance from 0 h. to 3 h. on the 13th was little if at all greater than that centring at 22 h. on the 12th.

At Agincourt the D trace is the most instructive, as it consisted of several more or less isolated patches of disturbance, separated by much quieter intervals. The first highly disturbed time included 3 h. to $8\frac{1}{2}$ h. on the 12th, more especially 5 h. to 8 h. The second highly disturbed time, $0\frac{1}{2}$ h. to $2\frac{1}{2}$ h. on the 13th, exhibited a smaller range of oscillation than the first, but the oscillations were more rapid. The third period, 7 h. to 10 h. on the 13th, was decidedly the least disturbed of the three. The H curve at Agincourt showed much more persistent disturbance than the D. Its most disturbed times were 3 h. to 8 h. on the 12th, and $0\frac{1}{2}$ h. to $2\frac{1}{2}$ h. on the 13th, but they did not throw the disturbance at other times into the shade.

At Eskdalemuir the only considerable disturbance in V occurred between 0 h. and 3 h. on the 13th. The most prominent movement in the N trace occurred at the same time, and the corresponding disturbance in E was amongst the largest in that element.

At Sitka the V trace, like the D trace at Agincourt, showed a succession of comparatively isolated periods of high disturbance, including 4 h. to 9 h. and 10 h. to 14 h. on the 12th, and 1 h. to 3 h. and $7\frac{1}{2}$ h. to $11\frac{1}{2}$ h. on the 13th. The H and D disturbances were more persistent, but they undoubtedly culminated about the same time as those in V. The most disturbed time unquestionably was from $7\frac{1}{2}$ h. to $11\frac{1}{2}$ h. on the 13th.

Section 120.—On June 8–9, 1912, there was a somewhat disconnected series of disturbances, quiet intervals intervening. Of the traces received, some covered only the earlier and others only the later of the more disturbed periods. This led to separate consideration of the following times: on June 8, 2 h. to 5 h., 6 h. to 8 h., 10 h. to 16 h. and 19 h. to 22 h.; and on June 9, 0 h. to 5 h. Particulars for these intervals are given separately in Table CLXX.

In the Antarctic the chief movements between 2 h. and 5 h. on the 8th were bays in the N′ and E′ curves. During this time there was a fall (numerical rise) in V, interrupted by short-period oscillations.

Between 6 h. and 8 h. there was a disturbance of the special type, the phases of which are given in Table CXL. The movement in E′ between 6 h. and 8 h. was considerably greater than the movement between 2 h. and 5 h., but in N′ the reverse was the case. Disturbance was not wholly suspended between 5 h. and 6 h., or between 8 h. and 10 h., there being numerous short-period oscillations, but slower oscillations were less in evidence. In N′ the shorter period movements tended to give place to bolder more gradual movements before 11 h. The chief was a rise (numerical fall of S′) of 184γ between 12 h. and 13 h. 57 m., followed by a fall of 191γ in the course of the next 25 minutes. The movements in E′ were less prominent. In V there was a considerable fall (numerical rise) between 13 h. and the minimum at 14 h. 12 m., followed by a rapid rise until nearly 15 h. The rapid short-period oscillations seemed practically suspended in all the traces between 11 h. and 12 h. Between 16 h. and 19 h. conditions were about normal. Between 19 h. and 22 h. there was a deep bay in E′ (depression), and a considerably shallower bay in N′ (numerical rise), the V trace being less disturbed. Finally between 0 h. and 5 h. on the 9th there were some considerable oscillations in N′, especially between 2 h. and 3 h., when there was a deep bay. Between 1 h. 57 m. and 2 h. 17 m. N′ fell 153γ, and between 2 h. 17 m. and 4 h. it rose 198γ. Synchronously with the bay in N′ there was a shallower bay in E′, and also a bay in V (numerical rise). The turning points appeared later in E′ and in V

TABLE CLXX.—June 8-9, 1912. Plate LIII.

Station.	Element.	2 h. to 5 h. June 8.						6 h. to 8 h. June 8.					
		Time of				Disturbance Range.	Inequality Range.	Time of				Disturbance Range.	Inequality Range.
		Maximum.		Minimum.				Maximum.		Minimum.			
		h.	m.	h.	m.	γ	γ	h.	m.	h.	m.	γ	γ
Antarctic	N′	2	5	4	13	116	5	7	3	7	40	78	11
	E′	4	20	2	45	101	16	7	14	6	35	163	3
	V	2	30	4	30	55	11	7	5	7	30	86	7
Mauritius	H	4	20	3	5	12	8	6	0	7	15	16	4
	D	4	30	2	40	15	9	7	30	6	0	5	3
Alibag	H	2	15	3	25	25	19	6	0	7	20	20	4
Helwan	H	2	5	3	0	22	4	8	0	7	5	21	8
	D	4	5	2	15	16	22	6	0	8	0	19	20
	V	3	5	4	20	11	3	6	0	8	0	22	13
Agincourt	H	2	10	4	35	49	1	7	35	6	55	48	1
	D	4	10	2	2	67	2	8	0	7	5	97	2
Eskdalemuir ...	N	4	32	3	24	35	1	6	20	7	55	45	11
	E	5	0	4	12	44	10	6	43	7	48	31	3
	V	3	10	4	35	17	5	7	15	6	30	4	1
Sitka	H	3	20	3	30	77	6	7	10	7	43	86	3
	D	4	30	3	14	62	18	7	15	6	15	159	2
	V	4	20	3	35	49	4	7	8	7	35	109	0

TABLE CLXX—*continued.*

Station.	Element.	10 h. to 16 h. June 8.				19 h. to 22 h. June 8.				0 h. to 5 h. June 9.			
		Time of Maximum.	Time of Minimum.	Disturbance Range.	Inequality Range.	Time of Maximum.	Time of Minimum.	Disturbance Range.	Inequality Range.	Time of Maximum.	Time of Minimum.	Disturbance Range.	Inequality Range.
		h. m.	h. m.	γ	γ	h. m.	h. m.	γ	γ	h. m.	h. m.	γ	γ
Antarctic ...	N′	13 57	14 30	197	9	19 30	20 31	59	9	0 40	2 17	215	5
	E′	11 15	13 40	151	14	19 0	20 30	152	4	4 35	2 35	164	28
	V	12 35	14 12	124	11	21 40	19 15	38	6	0 25	2 28	150	14
Mauritius ...	H	10 10	13 40	34	9	20 30	19 45	24	4	3 40	0 0	18	12
	D	11 20	15 15	19	15	22 0	20 0	10	3	2 30?	5 0	23	9
Buitenzorg	N	15 10	13 15	21	2	20 35	19 45	21	3	3 20	2 15	28	16
	E	11 20	13 35	18	12	20 20	19 25	13	3	0 0	4 50	29	17
	V	15 15	13 25	10	2	20 30	21 55	9	1	3 45	2 30	9	9
Alibag ...	H	10 40	13 45	32	14	20 30	19 45	24	2	3 40	2 20	23	25
Honolulu ...	H	13 40	11 35	23	4	19 30	20 30	15	3	0 0	2 25	38	14
	D	16 0	11 15	19	11	19 0	22 0	30	26	3 30	1 35	9	14
	V	16 0	13 40	6	3	19 25	20 50	7	12	2 55	2 15	7	8
Helwan ...	H	10 35	13 40	49	24	20 10	19 55	25	1	2 0	4 55	8	5
	D	15 55	11 15	29	16	20 5	19 0	18	4	4 40	1 15	22	23
	V	13 40	10 0	19	18	19 55	20 20	9	0	4 0	1 10	5	3
Agincourt ...	H	10 5	13 55	30	20	20 55	21 50	35	6	0 5	2 10	42	4
	D	10 45	14 10	60	35	21 40	19 15	31	15	2 20	0 35	110	2
Eskdalemuir	N	15 45	13 45	74	27	20 20	20 0	63	6	1 40	4 56	21	4
	E	10 8	13 55	44	31	20 15	19 35	52	7	4 45	2 15	43	10
	V	16 0	10 43	32	13	20 10	22 0	8	6	0 30	2 40	17	6
Sitka ...	H	12 15	13 55	75	4	—	—	>42	4	—	—	>44	14
	D	15 35	13 0	81	31	—	—	>48	32	—	—	>35	24
	V	10 25	14 2	109	9	—	—	>23	3	—	—	>34	4

than in N′. The principal fall in V (numerical rise), amounting to 135γ, occurred between 2 h. 10 m. and 2 h. 28 m. The recovery from this fall soon diminished in rapidity, but continued until 4 h. So far as the Antarctic is concerned, the disturbance ceased to have special features after 4 h. on the 9th.

At Mauritius the H trace showed a shallow bay (depression) between 2 h. and $4\frac{1}{2}$ h. on the 8th. Between 6 h. 45 m. and 7 h. 10 m. H fell 14γ. There was a gradual fall of 34γ between 10 h. 10 m. and 13 h. 40 m., followed by a rise of 20γ between 13 h. 40 m. and 14 h. 50 m., and a subsequent fall of 12γ before 16 h. Between 19 h. and 22 h. there were two oscillations. In the second, which was considerably the larger, there was a rise of 24γ followed by a slightly interrupted fall of 19γ. Between 0 h. and 5 h. on the 9th the general trend of the H curve was upwards, the normal direction for the hour, but the rise was interrupted from 2 h. 0 m. to

2 h. 25 m., and again from 3 h. 40 m. to 4 h. 0 m., by oscillations. The D trace contained a bay (easterly deflection) between 2 h. and 6 h. on the 8th, the normal phenomenon for the hour. Between 6 h. and 8 h. on the 8th the D trace showed only two trifling oscillations. There was another slight bay (easterly deflection) between 10 h. and 14 h., but this showed no essential difference from the normal, except that a westerly movement of 1′ took place in about five minutes near 13 h. 20 m. Between 19 h. and 22 h., the only special feature was a rather sharp oscillation, 1′ to West then 1′ to East, the turning point coming at 20 h. Between 0 h. and 5 h. on the 9th there was a slow easterly movement, followed by a slow westerly movement, just as on the average day, only considerably larger.

The trace received from Buitenzorg commenced after 9 h. on the 8th. Between 10 h. and 16 h. there were several moderate oscillations in N, with smaller oscillations in E and V. Between 19 h. and 22 h. there were two oscillations in N, the second the larger. There were corresponding but smaller oscillations in V. The E trace showed one decided oscillation, corresponding roughly in time with the second oscillations in N and V, but somewhat in advance of them. There was a fairly deep bay (depression) in the N curve between 1 h. 20 m. and 3 h. 20 m. on the 9th, and disturbance was also visible at the time in the E and V traces.

At Alibag on the 8th the H curve contained a decided bay (depression) between 2 h. and 4 h. 20 m. There was another but shallower bay between 6 h. and 8 h. A third bay followed between 10 h. 40 m. and 15 h. From 16 h. to 19 h. the trace was almost quiet. Between 19 h. and 21½ h. there were two oscillations, as in N at Buitenzorg, the second the larger. On the 9th between 1 h. 45 m. and 3 h. 30 m. there was a decided bay, interrupting the rise of H natural at that hour.

The trace received from Honolulu commenced about 10½ h. on the 8th and ended about 3 h. 45 m. on the 9th. There was a bay (elevation) on the H trace between 12½ h. and 14½ h. The D and V traces showed some minor oscillations during the same time. Between 19½ h. and 20½ h. there was a fall of 15γ in H. The declination during this time accelerated a movement to the West which commenced about 17 h. The H movements in the early morning of the 9th were larger than those occurring on the 8th. Between 1 h. 0 m. and 2 h. 25 m. there was a fall of 36γ. Simultaneously there were movements in E and V, but they were small.

At Helwan there was a shallow bay (depression) in the H trace between 2 h. and 4½ h. on the 8th, while the D trace exhibited some small oscillations. Shallow bays were also visible in the H trace between 6 h. and 8 h., and between 13 h. and 15 h. Between 15 h. and 19 h. the curves were practically quiet. Between 19 h. and 22 h. there was a smaller followed by a larger oscillation in H, similar to what occurred at Mauritius and Alibag. Small movements were also visible in the D and V traces about 20 h. The H movements in the early hours of the 9th were inconspicuous; the element was, however, slightly elevated. The change in D during this time was larger, but appeared of almost normal character.

At Agincourt between 2 h. and 5 h. on the 8th there was a bay or rather double bay in the H and D curves, H being depressed and D to the East of its normal position. Between 6 h. and 8 h. H was again depressed, but D was to the West of its normal position. In the course of an hour D swung $17\frac{1}{2}'$ to the West and $19'$ to the East. During this oscillation the trace had a tooth-like appearance. There was some minor disturbance between 13 h. and 15 h. in both the H and D traces. After 19 h. the H trace became more disturbed, exhibiting a succession of undulatory movements until about 4 h. on the 9th. The D trace showed only trifling movements during the whole evening of the 8th. It exhibited, however, a considerable oscillation, $21'\cdot5$ E then $20'\cdot5$ W, between $1\frac{3}{4}$ h. and $2\frac{3}{4}$ h. on the 9th.

At Eskdalemuir the N and E traces showed a good deal of irregular disturbance after 23 h. on the 7th. On the 8th there were bays (depressions) in the N curve between 2 h. and 5 h., and between $6\frac{1}{2}$ h. and $8\frac{1}{2}$ h. There were simultaneous disturbances of similar size but more irregular character in the E curve. Between 10 h. and 16 h. there were considerable oscillations in N, the element being on the whole depressed. During this time E was less disturbed. It was comparatively quiet from 16 h. to 19 h. Between 19 h. and 22 h. there were two considerable oscillations in N and a bay (numerical depression) in E. Between 0 h. 50 m. and 2 h. 30 m. on the 9th there were two smallish oscillations in E, but on the whole the N and E curves were quiet after 22 h. on the 8th. During the whole time there were only a few gentle undulations in V. The largest led to shallow bays (depressions) centring about 4 h. 35 m. on the 8th and 2 h. 40 m. on the 9th.

The trace received from Sitka began a little after 2 h. and stopped a little before 18 h. on the 8th. From 3 h. to 4 h. 40 m. all the traces were a good deal more disturbed than during the next two hours, but the movements were of a somewhat irregular character. On the whole H was depressed and V elevated. Between 6 h. and 8 h., during the disturbance of the "special type" in the Antarctic, there were large comparatively regular movements. Between 6 h. 55 m. and 7 h. 43 m., H rose 47γ and fell 86γ. Between 6 h. 55 m. and 8 h. 0 m., D moved $31'$ to the East and then as much to the West. Between 6 h. 0 m. and 7 h. 35 m. V rose 69γ and fell 109γ, the turning point being at 7 h. 15 m. Half the rise occurred during the last 10 minutes it was in progress. Conditions were much quieter from 8 h. to 13 h., especially from 9 h. to 11 h. Between 12 h. 15 m. and 14 h. 40 m. there was a well developed bay (depression) in the H trace, and from 12 h. 40 m. to 14 h. 20 m. there was a hump (westerly deflection) in the D trace. From 12 h. 45 m. to 15 h. 10 m. there was a well developed hump on the V trace. The movements between 12 h. and 15 h. were on the whole the opposites of those recorded between 6 h. and 8 h. From 15 h. until the record ceased near 18 h. conditions were much quieter, being similar to what they were between 5 h. and 6 h. and between 9 h. and 11 h. Though the record received stopped before 19 h. on the 8th, the figures as to hourly and extreme values in the Sitka publication showed that conditions were decidedly disturbed from 19 h. to 22 h. on the 8th, and from 0 h. to 5 h. on the 9th, but apparently not to nearly the same extent as in the Antarctic.

Perhaps the chief feature of the disturbance of June 8–9 is the marked approach to synchronism in the more disturbed periods all the way from the Antarctic to Sitka. In general the disturbances were considerably larger in the Antarctic than elsewhere. Between 6 h. and 8 h. on the 8th, however, the disturbance was on the whole less in the Antarctic than at Sitka. The excess of the Antarctic movements was especially prominent between 0 h. and 5 h. on the 9th. Outside the Antarctic the only traces for those hours which would by themselves have attracted attention were the H trace at Honolulu and the D trace at Agincourt.

Section 121.—In the Antarctic the disturbance on June 27, 1912, occurred in the middle of a quiet time. The N′ disturbance consisted in the main of two slow oscillations. The first consisted of a small rise (numerical fall) and larger fall between 8 h. 25 m. and 9 h. 15 m., the second of a larger but comparatively slow rise of 153γ between 9 h. 15 m. and 10 h. 55 m., followed by a fall of about half the size. E′ exhibited a marked rise, commencing about 7 h. 15 m. The rise to the maximum at 8 h. 45 m. was interrupted from 7 h. 30 m. to 7 h. 40 m., and again from 8 h. to 8½ h. It amounted in all to 123γ. Between 8 h. 55 m. and 9 h. 25 m. there was a fall of 116γ, bringing E′ back to near its original value. Minor oscillatory movements continued until after 12 h. A decided fall (numerical rise) began in V about 7 h. 30 m. There were several nearly level portions of curve, especially from 8 h. 10 m. to 8 h. 40 m., but the general trend was downwards until 9 h. 15 m. A rise ensued which continued but at a reduced rate, until 10 h. 45 m. A much smaller fall and rise followed, which were accompanied by minor oscillations. The traces were not as quiet as they were

TABLE CLXXI.—6 h. to 12 h. June 27, 1912. Plate LIV.

Station.	Element.	Times of Maximum.	Times of Minimum.	Disturbance Range.	Inequality Range.
		h. m.	h. m.	γ	γ
Antarctic	N′	10 55	9 15	153	26
	E′	8 45	11 55	140	23
	V	6 0	9 15	95	12
Mauritius	H	10 25	10 45	43	15
	D	9 50	7 15	21	20
Buitenzorg	N	6 5	9 15	70	21
	E	9 15	6 5	18	13
	V	7 20	10 40	20	14
Alibag	H	6 25	10 40	56	32
Agincourt	H	8 0	9 35	28	5
	D	10 0	7 30	79	24
Eskdalemuir... ...	N	6 0	8 45	59	24
	E	7 6	12 0	43	35
	V	8 40	11 15	12	15

at 6 h. until after 13 h. The principal movement in V, and the first oscillation in N′, appeared to be decidedly of the "special type," and the disturbance appears as such in Table CXL. But whilst the corresponding E′ movement was also suggestive of the special type, there was very decided disturbance for the previous 70 minutes, and the fall in E′ representing the second phase of the special type continued after the corresponding movements in N′ and V had been reversed.

At Mauritius the H trace showed some small oscillations, but its main feature was the fall between $6\frac{1}{2}$ h. and $10\frac{3}{4}$ h. This differed little in type from the normal diurnal change, but was fully twice as large. The D trace exhibited a continuous easterly movement between 7 h. 15 m. and 9 h. 50 m., in no way abnormal. The curve in fact presented little if any trace of disturbance.

At Buitenzorg the N curve showed a rapid nearly smooth fall resembling the normal diurnal fall, but three times as large, the minimum being reached an hour or so in advance of the usual time. Short-period oscillations were superposed, but they were of small amplitude. The changes in E differed little from the normal. The V trace showed between 6 h. and $7\frac{1}{2}$ h. a decided arrest and slight reversal of the normal fall, and the fall on setting in again continued for several hours after the usual time.

At Alibag the H movement, except for its enhanced size, showed little abnormality. The fall was especially rapid between 7 h. and $8\frac{3}{4}$ h.

At Agincourt the H trace showed several slow oscillations between 6 h. and $11\frac{1}{4}$ h., but none of any great size. D was much more disturbed. The trace was practically quiet until 7 h. 20 m. Between 7 h. 20 m. and 7 h. 35 m. there was a westerly movement of $7\frac{1}{2}'$, and between 7 h. 35 m. and 8 h. 35 m. an easterly movement of 10′. Between 8 h. 35 m. and 9 h. 40 m. there was a westerly movement of $3\frac{1}{2}'$, and an easterly movement of 10′. The trace remained distinctly disturbed until 12 h. or 13 h.

At Eskdalemuir there was a well marked bay (depression) in the N trace between 7 h. and 9 h. 40 m. During this time there were many small short-period oscillations in E, but the general trend of the curve followed its normal course. The V trace was practically quiet.

In the Antarctic the disturbance seemed a thing quite apart and remote from the regular diurnal changes, and the same is true of the D trace at Agincourt and the N trace at Eskdalemuir. But at Mauritius, Buitenzorg and Alibag the changes in H or N seemed to represent in the main a simple enhancement of the normal daily changes.

Section 122.—After the disturbance last considered normal quietness prevailed in the Antarctic until 22 h. on June 27. A short disturbance then ensued, which continued until after 2 h. on the 28th, when conditions again became as quiet as usual. The N′ and E′ curves contained well marked bays between 23 h. on the 27th and 1 h. on the 28th. The V trace for three hours after 22 h. 30 m. contained a small plateau (numerical depression). The short-period oscillations on the several traces were similar to those in neighbouring hours.

At Mauritius there was a decided hump (elevation) in the H trace. The rise

TABLE CLXXII.—22 h. June 27 to 2 h. June 28, 1912. Plate LIV.

Station.	Element.	Times of Maximum.	Times of Minimum.	Disturbance Range.	Inequality Range.
		h. m.	h. m.	γ	γ
Antarctic	N′	1 35 (28th)	23 52 (27th)	93	15
	E′	1 50 (28th)	23 52 (27th)	101	13
	V	1 5 (28th)	22 10 (27th)	23	3
Mauritius	H	23 40 (27th)	23 5 (27th)	21	8
	D	23 40 (27th)	22 30 (27th)	11	1
Buitenzorg	N	2 0 (28th)	22 0 (27th)	31	20
	E	23 50 (27th)	22 20 (27th)	13	11
	V	0 35 (28th)	22 20 (27th)	10	4
Alibag	H	23 50 (27th)	23 10 (27th)	19	8
Agincourt	H	22 20 (27th)	18 40 (27th)	36	11
	D	23 50 (27th)	1 45 (28th)	36	5
Eskdalemuir... ...	N	23 30 (27th)	0 20 (28th)	61	6
	E	23 25 (27th)	22 20 (27th)	35	8
	V	22 0 (27th)	0 5 (28th)	19	11

between 23 h. 5 m. and 23 h. 40 m. on the 27th was much more prominent than the subsequent fall. The D trace showed a small but sharp easterly movement about $23\frac{1}{2}$ h. and a smaller westerly movement near 24 h.

At Buitenzorg between 23 h. on the 27th and 0 h. 20 m. on the 28th both N and E showed more than the normal rate of change. There was very perceptible movement also in V. In the case of N some short-period oscillations appeared, but their amplitude was small.

At Alibag there was rather a smart rise in H between 23 h. and 23 h. 30 m.; otherwise conditions were quiet.

At Agincourt H was distinctly disturbed between 22 h. and 24 h., a bay appearing on the trace between 23 h. 10 m. on the 27th and 0 h. 10 m. on the 28th. The D trace also contained a bay (easterly deflection) between 23 h. 25 m. on the 27th and 0 h. 35 m. on the 28th.

At Eskdalemuir N rose 49γ and fell 60γ between 23 h. 10 m. on the 27th and 0 h. 10 m. on the 28th; otherwise there was little disturbance. During the disturbance in N there were minor oscillations in E. There was a decided bay (depression) in the V curve commencing about 23 h. 10 m. on the 27th. The recovery after the minimum at 0 h. 5 m. on the 28th was very slow.

Though the disturbance was nowhere large, the traces everywhere departed decidedly from the normal. The nature and duration of the disturbance, however, varied. In the Antarctic the principal feature was a depression in N′ and E′. At Buitenzorg and Eskdalemuir N and E were both enhanced. At Alibag H was enhanced. At Agincourt H was on the whole depressed, while the main D deflection was easterly. In the Antarctic disturbance was only slightly greater before than after midnight. Elsewhere except for the D trace at Agincourt disturbance after midnight was relatively very small.

Section 123.—In the Antarctic conditions were normally quiet until 15 h. on July 31, and but for a recovery in progress in V the end of the disturbance would naturally be put at 7 h. on August 1. The interval 3 h. to 6 h. on August 1, already dealt with in Table CXXXIX, was considerably the most disturbed time, but there were numerous considerable oscillations in all the curves after 20 h. on July 31.

TABLE CLXXIII.—14 h. July 31 to 8 h. August 1, 1912. Plate LIV.

Station.	Element.	Times of		Disturbance Range.	Inequality Range.
		Maximum.	Minimum.		
		h. m.	h. m.	γ	γ
Antarctic	N′	17 15 (31st)	4 51 (1st)	196	43
	E′	4 19 (1st)	20 33 (31st)	323	53
	V	20 47 (31st)	4 56 (1st)	324	21
Mauritius	H	22 20 (31st)	18 25 (31st)	41	20
	D	2 40 (1st)	7 0 (1st)	32	19
Buitenzorg	N	3 45 (1st)	7 55 (1st)	59	42
	E	22 20 (31st)	3 5 (1st)	49	28
	V	3 50 (1st)	15 25 (31st)	30	15
Alibag	H	3 40 (1st)	21 50 (31st)	38	34
Helwan	H	22 15 (31st)	4 30 (1st)	49	23
	D	3 45 (1st)	14 0 (31st)	55	30
	V	4 30 (1st)	8 0 (1st)	22	20
Agincourt	H	21 20 (31st)	22 15 (31st)	91	32
	D	2 5 (1st)	4 20 (1st)	71	46
Eskdalemuir... ...	N	19 3 (31st)	4 31 (1st)	98	24
	E	22 18 (31st)	18 13 (31st)	125	44
	V	19 55 (31st)	5 30 (1st)	53	15
Sitka	H	4 8 (1st)	21 13 (31st)	135	33
	D	4 18 (1st)	1 36 (1st)	176	45
	V	4 13 (1st)	18 47 (31st)	217	16

At Mauritius there was a moderate hump (elevation) in the H trace between 18 h. 50 m. and 21 h. 30 m. on July 31, but there was a much more prominent hump between 21 h. 50 m. and 22 h. 55 m., consisting of a rise of 36γ and fall of 23γ. The D trace between 18 h. 40 m. and 19 h. 30 m. of July 31 showed a small but rather sharp oscillation, 2′ to East followed by 1½′ to West. Between 5 h. 20 m. and 6 h. 0 m. on August 1, there was a movement of about 2½′ to the West but there was little sign of disturbance.

At Buitenzorg the N curve began to show distinct signs of disturbance shortly after 14 h. on July 31, and quiet conditions were not restored until between 7 h. and 8 h. on August 1. The bay on the N curve between 3 h. and 6 h. on August 1 represented decidedly the largest movement. But some of the earlier movements, especially a rise commencing about 22 h. on July 31, were by no means relatively negligible. The E and V curves had their largest movements between 2 h. and 5 h. on August 1 but also showed smart movements near 22 h. on July 31. In the course of 45 minutes E had a rise and fall, each about 14γ.

At Alibag there was a certain amount of oscillation in the H trace after 14 h. on July 31. Between 21 h. 55 m. and 23 h. H rose 34γ and fell 22γ. The trace stopped about 4 h. 30 m. on August 1, when a considerable movement seemed to be in progress.

The Helwan H trace resembled that at Alibag. Between 21 h. 55 m. and 23 h. on July 31 H rose 34γ and fell 28γ. After 6 h. on August 1 the curve appeared quite quiet, except that H was rising rather faster than usual. The Helwan D trace showed a slight bay (easterly deflection), centring about 4 h. on August 1, and a few slight undulations hardly amounting to disturbance. The V trace had also a slight hump (elevation) about 4 h. on August 1, but more appeal is made to the eye by a bay between 22 h. and 23 h. on July 31, representing an extreme depression of about 12γ. After 6 h. on August 1 the D and V traces both appear quiet.

At Agincourt there was practically no disturbance prior to $16\frac{1}{2}$ h. on July 31. Oscillations then began in the H trace, which continued uninterruptedly until 6 h. on August 1. Disturbance in H was on the whole largest between 21 h. and $22\frac{1}{2}$ h. of July 31. Between 21 h. 30 m. and 22 h. 15 m. H fell 89γ. The disturbance was considerably greater during this time than between 3 h. and 6 h. on August 1. In D, on the other hand, while the disturbance on July 31 after 17 h. was decidedly greater than it was earlier in the day, it was small compared with that occurring between 3 h. and 6 h. on August 1.

At Eskdalemuir conditions were distinctly unquiet before 14 h. on July 31, but the intensity of disturbance then began to show a marked increase. Prior to the well developed bay between 3 h. and 6 h. on August 1, the N curve contained some oscillations only slightly smaller but of a less regular character. These included a rise of 54γ and fall of 44γ between 22 h. 5 m. and 22 h. 55 m. Considerably the largest movement in the E curve centred about 22 h. 20 m. Between 21 h. 30 m. and 23 h. 35 m. there was a rise (numerical fall) of 87γ, and fall of about the same size. The V trace contained some small undulations, the largest constituting a shallow bay (depression) centring about $5\frac{1}{2}$ h. on August 1. The influence of the depression on V is visible until about 8 h. After that all the traces appear fairly normal.

At Sitka there had been some disturbance on July 31 between 9 h. and 11 h., a time when the Antarctic N′ trace showed an appreciable bay. A quieter time followed, but oscillations gradually developed in the H and D curves, and to a minor extent in the V curve. The movements between 3 h. and 6 h. on August 1 were decidedly the largest in the case of D and V. But the movements then occurring in H were rivalled by movements occurring between 21 h. on July 31 and 2 h. on August 1. After 6 h. on August 1 the curves might fairly be described as quiet, except that a decided recovery continued for an hour or two in V.

During this disturbance there was a close parallelism between the fluctuations of the intensity in the Antarctic and at Sitka. The gradual waxing and rapid waning of the disturbance are characteristic features at both stations.

The relative development of the disturbance between 21 h. and 23 h. on July 31 varied a good deal at the different stations. In the Antarctic there was no special intensity of disturbance near 22 h., and the same was true of D at Agincourt. But there was a marked development of activity at that hour in the H curves at Mauritius, Alibag, Helwan and Agincourt, and in the E curve at Eskdalemuir. The Buitenzorg traces and the Eskdalemuir N trace showed also some increase of activity at that hour. As proved to be so frequently the case, the vertical force disturbance was especially prominent at Sitka, as compared with all the other stations except the Antarctic.

Section 124.—Conditions generally had been quiet throughout the earlier part of August 18. The incidence of disturbance was gradual, and the taking the hour of commencement as 14 h. rather than 15 h. or 16 h. was somewhat arbitrary.

In the Antarctic the traces were exceptionally quiet from 10 h. to 11 h. on the 18th. Between 14 h. and 15 h. the curves showed perhaps only an average amount of disturbance for the season, but by that time the disturbance was clearly on the increase. The most disturbed time was from 20 h. on the 18th to 3 h. on the 19th. There was, unfortunately, a loss of trace between 20 h. 25 m. and 22 h. 10 m. The ranges shown in Table CLXXIV may thus be underestimates. In the case of V this is almost certainly the case, as the trace was moving up the sheet when registration was resumed, and one of the extreme values was recorded then. In N′ two rather deep bays representing depressions (numerical enhancement) succeeded one another between 23 h. 20 m. on the 18th, and 3 h. 10 m. on the 19th. The rises and falls were practically equal in each case, amounting to about 109γ in the first bay and 99γ in the second. The most striking movement in E′ was a fall of 152γ between 20 h. 0 m. and 20 h. 20 m. on the 18th. There was also a deep bay in E′ approximately synchronous with the first of the two bays in N′ mentioned above. In the course of this E′ fell 132γ and rose 155γ. The V trace showed only minor movements, except between 20 h. and 22½ h. Between 22 h. 10 m. and 22 h. 25 m. there was a sharp rise of 70γ, presumably only part of a larger movement unrecorded through absence of trace. The curve was quieter between 5 h. and 7 h. on the 19th than during the previous or succeeding hours.

At Mauritius there was little sign of disturbance in the H trace until after 18 h. on the 18th. Some minor oscillations appeared after 18 h. 40 m. The most conspicuous phenomenon was a sharp rise of 32γ between 20 h. 5 m. and 20 h. 20 m. and fall of 24γ during the next hour. Another prominent oscillation consisted of a rise of 33γ and fall of 16γ between 23 h. 20 m. on the 18th and 1 h. 40 m. on the 19th. The D trace received stopped at 3 h. on the 19th, so the range given in Table CLXXIV may have been slightly exceeded. The curve seemed practically quiet.

TABLE CLXXIV.—14 h. August 18 to 6 h. August 19, 1912. Plate LV.

Station.	Element.	Times of Maximum.	Times of Minimum.	Disturbance Range.	Inequality Range.
		h. m.	h. m.	γ	γ
Antarctic	N′	16 0 (18th)	0 21 (19th)	188	44
	E′	3 45 (19th)	20 20 (18th)	302	48
	V	22 48 (18th)	22 10 (18th)	82	21
Mauritius	H	20 20 (18th)	23 25 (18th)	34	21
	D	3 0 (19th)	16 0 (18th)	14	13
Buitenzorg	N	20 40 (18th)	23 30 (18th)	42	42
	E	0 5 (19th)	3 45 (19th)	50	29
	V	6 0 (19th)	1 50 (19th)	41	15
Alibag	H	20 30 (18th)	2 30 (19th)	50	35
Honolulu	H	18 57 (18th)	0 19 (19th)	55	10
... ...	D	17 32 (18th)	0 32 (19th)	56	52
	V	17 16 (18th)	23 41 (18th)	28	19
Helwan	H	20 15 (18th)	6 0 (19th)	61	22
	D	23 50 (18th)	17 30 (18th)	39	30
	V	4 50 (19th)	20 20 (18th)	17	6
Agincourt	H	20 25 (18th)	0 25 (19th)	99	46
	D	0 25 (19th)	2 40 (19th)	97	51
Eskdalemuir... ...	N	20 11 (18th)	23 47 (18th)	93	19
	E	23 58 (18th)	14 50 (18th)	93	39
	V	15 58 (18th)	0 40 (19th)	58	15

At Buitenzorg about 14 h. 25 m. on the 18th the N curve, which had been nearly level during the previous hour, showed a small but rapid rise, rather suggestive of an s.c. After this oscillations gradually developed. Between 20 h. 5 m. and 21 h. 25 m. N rose 27γ and fell 21γ. Between 23 h. 0 m. and 23 h. 45 m. there was a fall of 14γ and rise of 29γ. From $2\frac{1}{2}$ h. to $4\frac{1}{2}$ h. on the 19th there was a moderate hump (elevation of N); subsequently the curve was practically undisturbed. Between 20 h. 0 m. and 20 h. 45 m. E rose 9γ and fell 15γ. From 20 h. 45 m. until the maximum of E at 0 h. 5 m. on the 19th, there was a nearly unbroken gradual rise, amounting in all to 33γ. This is in the same direction as the normal change at that time of day, but about four times as large. In the course of the next 3 hours E fell about 49γ, or about twice the normal. The V curve contained minor oscillations about 20 h. and between 23 h. and 24 h. on the 18th, and the normal movements seemed considerably enhanced.

The Alibag H trace, which had previously been very quiet, showed a rather rapid but small rise about 14 h. 25 m. on the 18th, which corresponded apparently with the movement in N described at Buitenzorg. But it was followed only by minor movements until 20 h. Between 20 h. 5 m. and 21 h. 30 m. H rose 32γ and fell 27γ. Between 23 h. 5 m. on the 18th and 0 h. 15 m. on the 19th H fell 12γ and rose 32γ. There was also a slight bay (depression) centring about 3 h. on the 19th. Altogether the changes in H at Alibag and in N at Buitenzorg followed a similar course.

At Honolulu prior to 19 h. on the 18th there was little to merit mention in the H trace, beyond the fact that the rise shown was much above the normal. The fall set in before the usual hour, but was interrupted between 20 h. 15 m. and 21 h. 40 m., and when resumed it was much more rapid than usual. The D and V traces showed occasional small oscillations, especially near 19 h., but nothing of note. The rise to the maximum in V and the subsequent fall were somewhat above the normal.

At Helwan the H trace showed movements very similar to those described at Alibag. Between 20 h. 5 m. and 21 h. 25 m. on the 18th, there was a rise of 40γ and fall of 39γ. Between 23 h. 20 m. on the 18th and 0 h. 5 m. on the 19th H rose 29γ. After 1 h. on the 19th the only noteworthy feature was a fall of 14γ between 4 h. and 5 h. The D trace showed some small oscillations between 20 h. and 24 h. on the 18th. The V trace contained a decided bay (depression) between 20 h. and 21 h. on the 18th. It began with a fall of 14γ in the course of 10 minutes. There was a second but shallower bay between 23 h. on the 18th and 1 h. on the 19th.

At Agincourt the H trace, which had been very quiet for some hours previously, showed minor oscillations after 14 h. on the 18th, but no movement of any size until about 18$\frac{3}{4}$ h. From then, with the exception of a quiet interlude between 20$\frac{1}{2}$ h. and 21$\frac{1}{2}$ h. on the 18th, there was practically continuous disturbance until 5 h. on the 19th. The disturbance after 3 h. was, however, comparatively trifling. The largest of the rapid movements in H on the 18th were an oscillation between 18 h. 55 m. and 19 h. 30 m. (a fall of 36γ and rise of 40γ), another oscillation between 20 h. 10 m. and 20 h. 35 m. (a rise of 31γ and fall of 42γ), and a rise of 58γ between 22 h. 5 m. and 22 h. 25 m. Between 22 h. 25 m. on the 18th and 0 h. 25 m. on the 19th there was a total fall of 87γ, interrupted by minor oscillations. The D trace at Agincourt was practically quiet until 19 h. on the 18th. During the next 5 hours and again from 3 h. to 7 h. on the 19th, there were only minor oscillations. The only time of considerable disturbance was between 0 h. and 3 h. on the 19th. Between 0 h. 12 m. and 1 h. 12 m. D moved 14′ to the East and 16$\frac{1}{2}$′ to the West. Between 1 h. 40 m. and 2 h. 20 m. it moved 10′ to the East, and between 2 h. 20 m. and 3 h. 0 m. executed an oscillation of 14′ to the West and 9$\frac{1}{2}$′ to the East.

At Eskdalemuir the N trace was very quiet in the early hours of the 18th, but began gradually to show a development of very small short-period oscillations. After 12 h. and still more after 14 h. the size of these increased. The largest of the recorded movements, which were only of moderate size, took place on the 18th between 19 h. and 22 h. and between 23 h. 20 m. and 24 h. After 1 h. on the 19th the disturbance was of small intensity and gradually diminishing. By 5 h. or 6 h. conditions were fairly normal. The E trace showed only trifling though numerous short-period oscillations until after 19 h. on the 18th. There then ensued a fair amount of disturbance, representing on the whole an enhancement of E (numerical depression), until 2 h. on the 19th. No individual movement was at all impressive. Minor movements appeared after 2 h., but by 5 h. conditions were fairly normal. The V curve contained two decided bays (depressions), the first between 20 h. and 22 h. on the 18th, the second and deeper between $23\frac{1}{2}$ h. on the 18th and 2 h. on the 19th. The recovery after the second of these bays was not completed until nearly 6 h., but the trace was practically quiet after 5 h.

The disturbance of August 18–19, 1912, though not very large, was well marked at all the stations, and the hours at which the largest movements occurred were roughly identical. At the stations in lower latitudes the movements of any size were confined to the interval 19 h. on the 18th to 1 h. on the 19th. There was a close similarity between the rapid movements near 20 h. of the 18th in the H or N curves at Mauritius, Buitenzorg, Agincourt and Helwan, and there was also considerable resemblance between the H or N movements between 23 h. on the 18th and 1 h. on the 19th at Buitenzorg, Alibag, and Helwan. This resemblance is hardly, however, recognisable at Honolulu. Both N and E at Eskdalemuir and H at Agincourt showed a more continuous and diffuse disturbance than that prevailing in lower latitudes, no particular movements making a special appeal to the eye. The D trace at Agincourt and the V trace at Eskdalemuir showed more concentration of disturbance at particular hours. A rather unusual feature, occurring in Table CLXXIV, is the close approach to equality between the ranges in H and D at Agincourt, and the ranges in N and E at Eskdalemuir. Also, as it so happens, the ranges at the two stations are nearly equal.

On August 19, 1912, between 9 h. and 10 h. there was rather a good example of the "special type" of Antarctic disturbance, particulars of the phases of which are given in Table CXL. The hour at which this appeared was included in the Alibag H trace and the Agincourt H and D traces. The Eskdalemuir clock stopped at the time, so the Kew traces were consulted. The following were the ranges of the movements between 9 h. and 10 h. :—

Antarctic.			Alibag.	Agincourt.		Kew.
N′	E′	V	H	H	D	H
102γ	87γ	63γ	11γ	17γ	59γ	16γ

At Alibag there was a bay (depression) in H from about 9 h. 5 m. to 9 h. 45 m. The Agincourt curves also contained bays (H depressed, D to west of normal) from a little after 9 h. to 10 h. The westerly swing was considerably the more rapid. At Kew there was a bay (depression) in the H curve from about 9 h. 10 m. to 9 h. 50 m. The Kew D curve contained a small dimple (easterly deflection of about $0'\cdot5$) between 9 h. 10 m. and 9 h. 20 m., but no further movement until 9 h. 35 m. The movement which occurred then, about 3′ to the East, if natural—which is not certain—was doubtfully connected with the disturbance elsewhere. The large size of the D movement at Agincourt seems thus very remarkable.

Section 125.—In the Antarctic on September 17, 1912, conditions had been very quiet from 5 h. to 11 h., and the commencement of the disturbance was gradual. Oscillatory movements did not become conspicuous until nearly 14 h. Between about 13 h. 50 m. and 15 h. 50 m. there were three rather conspicuous oscillations, in which the N′, E′ and V traces showed a close similarity of phase. These oscillations were considerably smaller in V than in N′ or E′, and they were more conspicuous in N′ than

TABLE CLXXV.—11 h. to 23 h. September 17, 1912. Plate LV.

Station.	Element.	Times of Maximum.	Times of Minimum.	Disturbance Range.	Inequality Range.
		h. m.	h. m.	γ	γ
Antarctic	N′	15 43	20 30	256	40
	E′	13 55	20 35	302	47
	V	21 43	14 18	119	29
Mauritius	H	20 20	18 0	85	11
	D	11 25	20 5	46	16
Buitenzorg	N	20 20	15 0	65	10
	E	12 5	17 25	28	5
	V	20 35	15 0	26	4
Alibag	H	20 30	16 35	79	9
	D	11 40	20 30	25	15
	V	11 20	20 10	21	12
Honolulu	H	17 55	20 40	55	14
	D	17 18	21 7	29	50
	V	14 35	20 18	18	32
Helwan	H	20 15	17 50	110	21
	D	20 15	11 20	82	30
	V	21 10	20 20	42	10
Agincourt	H	19 55	15 45	95	36
	D	15 45	20 10	94	48
Eskdalemuir... ...	N	20 23	14 25	245	37
	E	20 16	14 53	172	26
	V	18 10	11 25	77	15
Sitka	H	12 10	20 32	120	27
	D	20 0	19 30	90	41
	V	21 40	18 9	63	10

in E′. The successive crests appeared in the N′ curve at about 13 h. 55 m., 14 h. 50 m., and 15 h. 45 m., the amplitudes of the successive (algebraic) rises and falls being $+ 68\gamma$, $- 106\gamma$, $+ 119\gamma$, $- 140\gamma$, $+ 150\gamma$ and $- 89\gamma$. The vertical force trace contained a good many minor oscillations, but no really large or striking movements. The disturbance in the Antarctic moderated but by no means ceased by 23 h. It is convenient, however, to treat the subsequent movements independently. A separate and more detailed discussion is also given of the movements occurring between $19\frac{1}{2}$ h. and 22 h.

At Mauritius there was little sign of disturbance in H until after 12 h. Up to 18 h. there was a general tendency to fall, the subsequent tendency being to rise. But superposed on the slow changes was a series of well-marked oscillations, the crests (maxima of H) occurring at about 13 h. 50 m., 14 h. 45 m., 15 h. 40 m., 17 h. 5 m., 18 h. 50 m. and 20 h. 20 m. Of these oscillations the last was much the biggest, H rising 80γ between 19 h. 20 m. and 20 h. 20 m., and falling 58γ between 20 h. 20 m. and 22 h. The D trace showed no appearance of disturbance until after 14 h. But between 7 h. and 11 h. 20 m., the ordinary times of the westerly and easterly maxima, there was a range of fully $12'$. While the movements seemed quite of the normal type, the range was double the normal. Between 11 h. 20 m. and 15 h. 40 m. there was a nearly uniform westerly movement of $4\frac{1}{2}'$, again about double the normal change. From 16 h. 40 m. to 18 h. 20 m. there was a decided westerly deflection, the movement to the west $2\frac{1}{4}'$ being about twice the return movement to the east. Between 20 h. 5 m. and 22 h. there was a much more prominent deflection to the East, the easterly movement being about $4\frac{1}{2}'$, and the return movement a shade less.

At Buitenzorg there were only small oscillations prior to 12 h. Shortly after 12 h. N began to fall somewhat rapidly, the fall between 12 h. and 13 h. amounting to 29γ. A succession of large oscillations followed, with crests (maxima in N) at about 13 h. 55 m., 14 h. 40 m., 15 h. 45 m., 17 h. 15 m., 18 h. 55 m. (poorly developed) and 20 h. 25 m. Superposed on these were small short-period oscillations. The amplitudes of the successive larger movements were $+12\gamma$, -22γ, $+32\gamma$, $-3\ \gamma$, $+36\gamma$, -34γ, $+45\gamma$, -33γ, $+14\gamma$, -9γ, $+43\gamma$ and -38γ. These oscillations gave the N trace a somewhat jagged appearance. The V trace showed also a succession of oscillations, much smaller than those in N, but still corresponding roughly to them. The crests (numerical minima) were, however, somewhat later in time than those in N. The E trace also showed oscillations, but these did not remain even approximately in phase with those in N.

At Alibag conditions were practically quiet up to 12 h. Between 12 h. 10 m. and 13 h. 10 m. H fell 30γ. There were successive oscillations with crests (maxima of H) at about 13 h. 55 m., 14 h. 40 m., 15 h. 50 m., 17 h. 15 m., 18 h. 50 m. (poorly developed) and 20 h. 25 m. The amplitudes of the successive movements—which were only slightly interfered with by short-period movements—were $+3\gamma$, -9γ, $+11\gamma$, -12γ, $+10\gamma$, -17γ, $+13\gamma$, -12γ, $+7\gamma$, -4γ, $+38\gamma$ and -33γ. The D trace at Alibag gave little indication of disturbance. It was very quiet until 13 h., and again after 22 h. A few small bays (westerly deflections) were visible. The largest, between 19 h. 30 m. and 21 h., showed a range of $2'$, the deflection being to the West of the normal position. The V trace showed some trifling undulatory movements, the largest between 20 h. and $21\frac{1}{2}$ h.

At Honolulu the H trace showed some disturbance after 12 h. Between $13\frac{1}{2}$ h. and $15\frac{1}{2}$ h. there were some irregular movements, the largest of which had a double crest (maxima in H) between 14 h. 40 m. and 14 h. 50 m. After 15 h. there were only small irregularities until about 19 h. 55 m. Between 19 h. 55 m. and 21 h. 25 m. there was a marked bay (depression of H), the fall being 36γ and the recovery 19γ. For some hours subsequently there were only small oscillations. There were no large movements in the D and V curves, but there were numerous small irregularities, especially in V, and there was considerable interference with the ordinary regular diurnal variation.

At Helwan the H trace showed a close parallelism to that at Alibag. Successive undulations had their crests (maxima in H) at about 13 h. 55 m., 14 h. 35 m., 15 h. 35 m., 17 h. 5 m., 18 h. 55 m. and 20 h. 20 m. The amplitudes of the successive movements were $+ 4\gamma$, $- 17\gamma$, $+ 14\gamma$, $- 21\gamma$, $+ 10\gamma$, $- 33\gamma$, $+ 9\gamma$, $- 16\gamma$, $+ 17\gamma$, $- 8\gamma$, $+ 103\gamma$ and $- 95\gamma$. The D curve showed a few small movements, the largest forming a bay (deflection to East of normal) between 19 h. 45 m. and 21 h. The movement to the East was $3'\cdot 8$, the return movement $3'\cdot 0$. The V trace showed undulations from shortly before 14 h. until nearly 22 h. The largest led to a considerable bay from about $19\frac{1}{2}$ h. to after 21 h. Between 20 h. 0 m. and 21 h. 20 m. V fell 25γ and rose 42γ.

At Agincourt conditions were quiet until after 13 h., except that the fall normally proceeding between 12 h. and 13 h. was faster than usual. From 13 h. 40 m. until 18 h. minor oscillations were so prominent that the longer period oscillations during these hours do not stand out so clearly as at the more southern stations. Also in the earlier part of the disturbance it is the turning points representing *minima* in H that are much the more conspicuous. These occur at about 13 h. 55 m., 14 h. 50 m. and 15 h. 45 m. Later, there were two prominent maxima at about 18 h. 55 m. and 19 h. 55 m., followed by less prominent maxima at about 20 h. 50 m. and 21 h. 20 m. to 21 h. 35 m. Of the intermediate minima, occurring at about 19 h. 35 m., 20 h. 30 m. and 21 h. 10 m., the second was the most prominent. The largest of the oscillatory movements was that occurring between 19 h. 35 m. and 20 h. 30 m. It consisted of a rise of 64γ and fall of 93γ. H was practically quiet for two hours after 22 h. 40 m. The D trace at Agincourt contained some considerable oscillations between 13 h. 45 m. and 22 h. In the earlier oscillations the extreme easterly positions were the best marked, coming at about 13 h. 55 m., 14 h. 50 m. and 15 h. 45 m. They were nearly if not quite simultaneous with the minima already noted in H. The westerly movements following immediately after these turning points were rapid and represented respectively $6'$, $7\frac{1}{2}'$ and $11\frac{1}{2}'$. The subsequent oscillations had a more rounded outline. There were easterly extremes at about 18 h. 55 m. and 19 h. 55 m. These correspond to *maxima* in H, and not to minima as was the case with the easterly extremes earlier in the day. But while H fell continuously from 19 h. 55 m. to 20 h. 30 m., D during this time moved $8'$ to the West and swung back as much to the East. The return movement to the East, amounting in all to $12'$, was not concluded until nearly 20 h. 45 m. After 22 h. the D trace was quiet. An important feature is that while the Agincourt H and D traces both showed a succession of wave-like movements, these did not keep in phase.

At Eskdalemuir the 17th was very quiet until about 9 h. After 11 h. the short-period oscillations in N, which had gradually set in, became more prominent, but there were no considerable movements until after 13 h. Longer period oscillations then appeared. They were very irregular in form, but there were prominent maxima at about 13h. 55m., 14h. 55m., 15h. 50m. and 20h. 25m, and less prominent maxima about 17 h. 25 m., 18 h. 55 m. and 19 h. 55 m. There were fairly well marked minima at about 14 h. 25 m., 15 h. 25 m., 16 h. 45 m., 18 h. 25 m., 19 h. 10 m., 20 h. 5 m. and 21 h. 20 m. Taking the movements in pairs the amplitudes were as follows :—

From 13 h. 55 m. to 14 h. 55 m.	..	..	$-\ 72\gamma,\ +114\gamma$;
,, 14 h. 55 m. ,, 15 h. 50 m.	..	..	$-109\gamma,\ +127\gamma$;
,, 15 h. 50 m. ,, 17 h. 25 m.	..	..	$-122\gamma,\ +\ 57\gamma$;
,, 17 h. 25 m. ,, 18 h. 55 m.	..	..	$-\ 48\gamma,\ +\ 56\gamma$;
,, 20 h. 5 m. ,, 21 h. 20 m.	..	..	$+183\gamma,\ -211\gamma$.

There were no large movements after 21 h. 20 m., but minor oscillations persisted for a number of hours. The E trace at Eskdalemuir was exceedingly quiet until 9 h. or 10 h. After 11 h. it became decidedly disturbed, an algebraic fall of 30γ occurring between 11 h. 5 m. and 11 h. 25 m. Subsequently there were only small short-period oscillations until after 13 h. 40 m. There were three prominent peaks (minima in E) at about 13 h. 55 m., 14 h. 55 m. and 15 h. 50 m. The only prominent later movement occurred between 19 h. 40 m. and 20 h. 40 m.; during this time there was a rise (algebraic) of 177γ and fall of 128γ. The V trace showed little sign of disturbance until 14 h. As usual when disturbance occurs during the afternoon, V was decidedly above the normal from 16 h. to 20 h. After 20 h. 15 m. there was a fall of 46γ to a minimum at about 21 h. 5 m. During the next 2 hours there was a slow recovery.

At Sitka, though minor oscillations were present, conditions were fairly quiet until after 12 h. About 12 h. 20 m. the H and D traces started on what promised to be large excursions, but these had been in progress for less than 10 minutes when there came a gap in the record which continued until 16 h. 50 m. After registration was resumed, considerable disturbance prevailed until 23 h., when a quieter time appeared. There were pretty well marked minima in H at about 17 h. 40 m. and 20 h. 35 m. Between 19 h. 25 m. and 21 h. 50 m. H fell 100γ and rose 87γ. There were also numerous short-period oscillations. The D trace was also oscillatory. Between 19 h. 25 m. and 21 h. 10 m. there were movements of 19′ to the East and 17′ to the West. The V trace between 16 h. and 23 h. contained two or three shallow bays (enhancements of V), there being a general tendency in the element to rise, but there were no conspicuous movements.

The outstanding feature of the disturbance between 11 h. and 23 h. on September 17, 1912, was the tendency for the H or N traces to show a succession of waves. Crests representing maxima in these elements were recognisable at about 13 h. 55 m., 14 h. 45 m., 15 h. 45 m., 17 h. 15 m., 18 h. 55 m. and 20 h. 25 m. in the traces at Mauritius, Buitenzorg, Alibag, Helwan and Eskdalemuir. The Antarctic N′ trace showed algebraic maxima (numerical minima) at the first three of these hours. The Agincourt H trace had turning points at or near most of the above times, but the first three were minima not maxima.

Section 126.—The largest movements on September 17, 1912, appeared in general between $19\frac{1}{2}$ h. and 22 h. While there were notable differences between the different stations, all the H or N traces contained a deep bay. In the stations in lower latitudes the disturbance in the other elements was, as usual, less prominent. At some of the stations, especially the British ones, the disturbance was obviously of the rotating vector type discovered by R. B. Sangster. The phenomena seemed to merit minute study. Accordingly the curves were measured at 5-minute intervals from 19 h. 30 m. to 22 h. 0 m. Falmouth and Kew curves were included, as well as those from the Antarctic, Mauritius, Buitenzorg, Alibag, Honolulu, Helwan, Agincourt, Eskdalemuir and Sitka. Vertical force curves were not available for Mauritius or Agincourt. The arithmetic mean was taken of the 31 readings of each element, and the individual readings were expressed as differences from it. The N′ and E′ differences for the Antarctic and the H and D differences for Mauritius, Alibag, Honolulu, Helwan, Agincourt, Falmouth, Kew and Sitka were converted into the corresponding N and E differences, thus getting corresponding results for all the stations. The N, E, V differences are given in Table CLXXVI, and are shown graphically in Plate LVI. To economise space, in the headings of Table CLXXVI the stations are described by the first letter or two letters of the name. As usual in such cases, while the table should be studied for exact details, a general idea of the phenomena is most readily derived from the diagrams. We see at a glance that the fluctuations in N followed a similar course at Mauritius, Buitenzorg, Alibag, Helwan, Falmouth, Kew and Eskdalemuir, N rising to a maximum at 20 h. 25 m. or 20 h. 30 m., and then falling somewhat more gradually to about its original value. In the Antarctic and at Honolulu and Sitka the change is in the opposite direction to that elsewhere, N falling to a minimum at 20 h. 30 m. or 20 h. 35 m. and then rising. Agincourt presents transitional features. At first N rose, and at a rate greater than that exhibited at the same stage of the movement elsewhere. But after 19 h. 55 m. a reverse movement set in, and from then until 20 h. 30 m. the movement was oppositely directed to the movements at Helwan and Falmouth, the stations nearest in point of latitude. After $20\frac{1}{2}$ h. the changes in N at Agincourt were oscillatory and less prominent.

The remarkable similarity of the fluctuations in N at Mauritius and Alibag shown by Table CLXXVI should be noted. The results accord much more closely than those of either station with the Buitenzorg results.

There is a steady increase in the range of the N movement as we pass from Alibag to Helwan, from Helwan to Falmouth, from Falmouth to Kew, and from Kew to Eskdalemuir. The difference between Eskdalemuir and Kew exceeds that between Alibag and Helwan, or between Helwan and Falmouth. The N ranges at Sitka and the Antarctic are similar to those at Helwan, and are considerably less than at the

TABLE CLXXVI.—$19\frac{1}{2}$ h. to 22 h. September 17, 1912. Departures from mean (unit 1γ). Plates LVI and LVII.

Time. G.M.T.	ΔN.											ΔE.											ΔV.								
	An.	M.	B.	Al.	Ho.	He.	Ag.	F.	K.	E.	S.	An.	M.	B.	Al.	Ho.	He.	Ag.	F.	K.	E.	S.	An.	B.	Al.	Ho.	He.	F.	K.	E.	S.
h. m.																															
19 30	+62	−40	−24	−31	+21	−39	−1	−39	−43	−34	+57	+113	−3	−5	+4	+11	−4	−11	−39	−36	−45	−5	−33	−8	+1	+1	+4	+8	+15	+26	−11
19 35	+49	−34	−24	−30	+19	−32	−5	−38	−41	−31	+54	+101	−2	−3	+4	+8	−6	−6	−38	−36	−44	−5	−36	−7	+1	+1	+4	+8	+18	+25	−12
19 40	+28	−29	−22	−26	+17	−25	+13	−35	−37	−28	+35	+53	−2	−3	+3	+11	−6	−2	−41	−37	−47	+17	−48	−7	0	+2	+2	+8	+18	+25	−17
19 45	+6	−28	−20	−23	+16	−23	+31	−25	−32	−23	+18	+18	−3	−3	+2	+14	−9	−5	−39	−35	−46	+30	−52	−7	−2	+4	+1	+8	+15	+24	−20
19 50	+10	−23	−18	−21	+15	−15	+44	−17	−22	−16	−2	−11	−3	−3	0	+17	−6	−3	−28	−26	−36	+30	−40	−7	−1	+5	0	+9	+14	+23	−21
19 55	+47	−20	−12	−15	+16	−12	+59	−11	−13	−4	−14	−13	−5	−5	−2	+18	−4	−4	−22	−23	−30	+46	−13	−5	−3	+6	−2	+8	+12	+20	−25
20 0	+29	−16	−13	−13	+11	−3	+49	−14	−17	−21	−15	+18	−9	−3	−3	+15	−3	−4	−2	−9	−11	+41	+3	−4	−3	+3	−4	+8	+9	+17	−23
20 5	+5	−3	−7	−1	+5	+17	+31	−15	−20	−35	−23	−8	−14	−1	−7	+10	+6	−18	+41	+23	+36	+31	−9	−3	−3	+1	−4	+10	+5	+19	−18
20 10	−2	+16	+2	+15	0	+35	+19	−4	−6	−10	−33	−28	−15	+1	−10	+7	+12	−29	+85	+73	+79	+25	−5	−1	−7	−1	−10	+13	+7	+23	−19
20 15	−5	+30	+10	+28	−6	+52	+1	+14	+21	+35	−34	−58	−11	+2	−10	+4	+20	−27	+113	+109	+127	+3	−9	+2	−7	−3	−16	+19	+12	+24	−13
20 20	−28	+37	+14	+33	−10	+59	−12	+39	+65	+113	−34	−94	−4	+2	−11	0	+22	−26	+111	+108	+114	−13	−10	+5	−6	−5	−23	+24	+16	+22	−8
20 25	−32	+38	+18	+38	−13	+59	−15	+75	+96	+148	−43	−95	−1	+2	−12	−1	+17	−20	+77	+81	+79	−9	−5	+7	−6	−4	−27	+28	+19	+12	−11
20 30	−51	+39	+16	+38	−16	+55	−28	+87	+106	+139	−45	−101	+3	+2	−12	−4	+12	−8	+43	+46	+45	−17	−6	+9	−4	−4	−26	+24	+17	0	−9
20 35	−53	+39	+16	+34	−17	+51	−30	+86	+102	+126	−44	−114	+7	+4	−12	−4	+4	+10	+19	+26	+19	−8	−5	+9	−1	−3	−21	+17	+9	−5	−8
20 40	−39	+33	+11	+30	−15	+39	−16	+80	+80	+91	−37	−89	+9	+7	−9	−6	0	+16	+4	+8	+4	−9	+7	+9	+3	−2	−15	+9	+4	−8	−6
20 45	−37	+29	+9	+26	−14	+34	−10	+57	+62	+56	−30	−76	+12	+8	−4	−6	+1	+24	+4	+3	+10	−21	+11	+8	+6	−2	−10	+3	−1	−11	−1
20 50	−48	+26	+6	+20	−15	+27	−7	+46	+49	+33	−25	−52	+14	+10	+1	−8	+2	+17	+4	+5	+12	−18	+11	+7	+7	−3	−5	−2	−3	−13	+2
20 55	−41	+20	+5	+15	−12	+20	−1	+39	+39	+26	−19	−70	+14	+9	+2	−6	+2	+7	−1	−1	+6	−15	+3	+6	+7	−2	−3	−4	−6	−15	+4
21 0	−25	+13	+5	+10	−8	+10	−7	+27	+29	+17	−6	−15	+12	+9	+4	−9	−4	+2	−15	−15	−11	−18	+11	+5	+7	−1	+1	−8	−10	−18	+6
21 5	−6	+6	+6	+6	−5	−4	−16	+9	+9	−4	+1	0	+8	+7	+7	−9	−4	+1	−26	−21	−20	−20	+15	+4	+7	−1	+5	−11	−13	−20	+8
21 10	−9	+2	+6	+1	−2	−14	−23	−11	−17	−43	+2	+22	+6	+5	+9	−10	−2	+7	−23	−23	−19	−27	+11	+3	+5	−1	+10	−14	−13	−18	+11
21 15	−29	−4	+5	−3	−2	−18	−22	−22	−31	−55	+19	−7	+3	+2	+8	−8	−2	+15	−23	−21	−20	−15	+3	+2	+4	−1	+13	−16	−13	−16	+11
21 20	−4	−5	+5	−5	0	−20	−9	−29	−38	−63	+18	+6	+1	−1	+8	−8	−3	+15	−19	−17	−18	−11	+11	+1	+2	0	+13	−16	−16	−15	+12
21 25	−2	−6	+5	−8	+2	−23	0	−34	−41	−60	+19	+26	−2	−3	+4	−6	−3	+16	−16	−17	−14	−9	+17	−1	+1	+1	+13	−16	−15	−14	+17
21 30	−9	−12	+4	−10	+1	−25	−3	−35	−41	−52	+25	+25	−3	−4	+3	−8	−5	+13	−15	−16	−12	−7	+15	−2	+1	0	+13	−15	−15	−15	+19
21 35	+6	−14	0	−13	+1	−28	+1	−32	−36	−44	+25	+18	−3	−4	+3	−7	−7	+7	−19	−18	−20	−3	+15	−2	0	+1	+13	−15	−12	−15	+23
21 40	+42	−15	0	−14	+1	−30	+2	−34	−38	−43	+23	+45	−3	−5	+4	−5	−10	+2	−24	−23	−25	+4	+35	−3	0	+1	+12	−16	−13	−16	+23
21 45	+32	−17	+2	−15	+3	−32	−9	−37	−41	−49	+14	+80	−2	−5	+5	−5	−9	+2	−27	−26	−28	+1	+31	−4	−1	+1	+13	−16	−16	−17	+24
21 50	+26	−18	−1	−17	+2	−34	−13	−40	−46	−53	+40	+89	−3	−6	+4	−5	−7	+4	−27	−27	−29	+3	+23	−4	−1	+2	+13	−17	−16	−17	+22
21 55	+35	−22	−3	−20	+2	−38	−7	−43	−48	−52	+34	+103	−3	−6	+7	−5	−4	+6	−26	−27	−29	0	+25	−4	−1	+1	+13	−17	−16	−16	+22
22 0	+50	−22	−6	−20	0	−39	−15	−47	−53	−59	+25	+118	−4	−4	+8	−5	−3	+6	−25	−26	−29	+1	+17	−5	−1	+2	+13	−16	−15	−14	+21

British stations. While the variations at Falmouth, Kew and Eskdalemuir differ considerably in amplitude, they follow a remarkably similar course.

The Helwan, Falmouth, Kew and Eskdalemuir fluctuations in E resemble one another, though the range is much less at Helwan than at the British stations. The element rises to a maximum at 20 h. 15 m. or 20 h. 20 m., and then falls at a reduced rate to near its original value. The maximum in E appears decidedly earlier at these stations than the maximum in N, implying, as we shall see presently, a rotation of the horizontal force vector in an anti-clockwise direction. After 21 h., the changes in E at these four stations were small and somewhat oscillatory.

At Honolulu and Sitka E also showed a rise, followed by a fall; but the maximum was reached at 19 h. 55 m., and the element was falling during the principal part of the rise at Helwan and the British stations.

At Mauritius and Agincourt between $19\frac{1}{2}$ h. and $20\frac{1}{2}$ h. the E movement was distinctly opposite to that at the British stations, a minimum appearing at 20 h. 10 m.

The E movement at Buitenzorg was very small. After $20\frac{1}{2}$ h. it closely resembled that at Mauritius.

In the Antarctic E showed a marked fall, followed by an equal rise; but the minimum appeared considerably later than at Mauritius and Agincourt, or than the maximum at the British stations. Also the changes in the Antarctic after $20\frac{1}{2}$ h. were both absolutely and relatively much larger than at the other stations.

The changes in vertical force were comparatively small at all the stations. The sign, it should be noticed, has been counted positive when the force acting on a north pole is directed to the earth's centre. Thus motion up the sheet in Plate LVI implies a *numerical* fall of V in the Antarctic and at Buitenzorg.

The Antarctic diagram shows a sharp fall and rise between 19 h. 30 m. and 19 h. 45 m., which seems unrepresented elsewhere, except perhaps at Sitka. After that there is a gradual rise with minor oscillations superposed on it. There is also an initial fall at Sitka, but it is not rapid and continues until nearly 20 h. Subsequently there is a gradual rise, as in the Antarctic. The Helwan N and E diagrams resemble those from the British stations, but the Helwan V diagram shows a marked depression, the minimum coming at 20 h. 25 m., while the Falmouth and Kew diagrams show an oscillation in the opposite direction, the maximum coming at 20 h. 25 m. The Eskdalemuir diagram shows a less decided maximum, coming a little earlier. At the British stations, as is usual on the afternoons of disturbed days, V was distinctly above its normal value prior to $19\frac{1}{2}$ h.; and the fall shown in the Falmouth, Kew and Eskdalemuir diagrams after $20\frac{1}{2}$ h. may represent the decline usually encountered on disturbed days near midnight.

The Alibag V diagram shows a very slight depression, with minimum somewhat earlier than at Helwan. At Buitenzorg the movement seems in the opposite direction; but the ranges at Buitenzorg, Alibag and Honolulu are small.

Plate LVII contains vector diagrams showing the simultaneous progression of the N and E changes between $19\frac{1}{2}$ h. and 22 h. on September 17, 1912. The origin of the diagram is in all cases at the centre of the cross, the arms of which each represent 10γ. The line drawn from the origin to any point represents in direction and magnitude the force equivalent to the departure at the time from the mean value for the interval $19\frac{1}{2}$ h. to 22 h. When, as sometimes happens, one part of a diagram crosses another, the part that is later in time is dotted in the neighbourhood of the crossing point. For instance, at Falmouth the line connecting the points corresponding to the times 21 h. 5 m. and 21 h. 10 m. is dotted near where it crosses the line corresponding to the times 19 h. 50 m. and 19 h. 55 m. All the Antarctic 5-minute measurements were used, but they were smoothed after the formula $(a + 2b + c)/4$, to prevent the general features being obscured. At Falmouth, Kew and Eskdalemuir the 5-minute measurements were used unsmoothed; but near 22 h. the use of all would have unduly crowded the figure, so the data answering to the following times were omitted :—

At Falmouth	..	15 m, 25 m., 35 m., 45 m., and 55 m. after 21 h.;
At Kew ..	..	30 m., 35 m., 45 m., and 55 m. after 21 h.;
At Eskdalemuir	..	35 m., 45 m., and 55 m. after 21 h.

At the other seven stations account was taken only of the readings at 10-minute intervals commencing with 19 h. 30 m. Also to avoid confusing the figure, it was necessary to omit points answering to times later than 21 h. 40 m. at Honolulu and Agincourt, or than 21 h. 50 m. at Mauritius and Helwan.

When considering vector diagrams it has to be remembered that while the relative positions of consecutive points on the diagram are independent of the choice made of base or standard values in the elements, that is not true of the vector itself, which depends on the position of the origin. In the present case, the origin represents the mean value of the elements between $19\frac{1}{2}$ h. and 22 h., which certainly differed from the average undisturbed value for the same period of the day. If we had taken as our standards the mean values of N and E between 19 h. 55 m. and 21 h. 10 m., the origins for Falmouth, Kew and Eskdalemuir would have fallen near the centre of the complete loop, and the changes in the length and azimuth of the radius vector would have differed considerably from those exhibited in Plate LVII. Thus probably little, if any, significance really attaches to the fact that in the diagrams as drawn for the three British stations the direction of rotation of the vector shows a small reversal between 20 h. 40 m. and 20 h. 50 m.

Another point to be remembered is that we have made no attempt to eliminate the changes of force normal to the period of the day. If disturbance were simply something extraneous, superposed on the normal changes, an elimination of the latter would obviously be not merely easy but desirable. But disturbance modifies the regular diurnal variation, and to a degree which is different for the different elements and different for the different stations. Thus if one attempts to eliminate the regular diurnal changes one may be simply adding to the uncertainties. The time when the disturbance occurred is one during which the normal diurnal changes happen to be slow at most of the stations concerned. This is true especially of the stations in Great Britain. It is less true of Honolulu, Agincourt, Sitka and the Antarctic.

The rotation of the vector in Plate LVII is especially prominent at Falmouth, Kew and Eskdalemuir. At all three stations the tendency to rotate sets in at about 19 h. 55 m., and ceases to be prominent about 70 minutes later. In the course of that time the vector has travelled completely round the circle, in the anti-clockwise direction. The phenomena show a considerable resemblance to those observed at Kew and Eskdalemuir on August 22, 1916, about the same time of day. On that occasion also the vector diagram was almost a complete loop, the revolution occupying from 19 h. 48 m. to 20 h. 48 m. On both occasions the principal difference between Kew and Eskdalemuir was the greater range in N at the more northern station, but the excess was much greater on August 22, 1916, than on September 17, 1912. This suggests, of course, that the disturbance in 1916 may have been more local in its incidence than that of 1912.

Most of the vector diagrams in Plate LVII show a clear rotation of the vector, but the times when the rotation is most prominent and even the direction of rotation vary. On the whole, the direction is distinctly anti-clockwise in the Antarctic and at Helwan and Agincourt; but it is equally distinctly clockwise at Mauritius, Alibag, Honolulu and Sitka. At Buitenzorg there is a complete loop from about 20 h. 20 m. to 21 h. 20 m. which is described clockwise, but later the motion seems anti-clockwise. In the Antarctic and at Mauritius, Buitenzorg, Alibag, Honolulu and Helwan the elongation of the diagram in one direction is a more prominent feature than the existence of a closed or nearly closed loop. At Mauritius, Buitenzorg, Honolulu and Helwan the elongated direction is inclined slightly to East of North; at Alibag, however, the direction is slightly to West of North. In the Antarctic the elongated direction runs roughly from E.N.E. to W.S.W.

The positions on the diagram of the points corresponding to 19 h. 30 m. and 20 h. 30 m. are in all cases except Agincourt strongly opposed. But whereas the $19\frac{1}{2}$ h. point comes near the foot of the diagram at Mauritius, Buitenzorg, Alibag, Helwan, Falmouth, Kew and Eskdalemuir, it comes at the top in the Antarctic and at Honolulu and Sitka.

Section 127.—As measurements had been made at 5-minute intervals, the opportunity was taken of calculating " activities " by means of Bidlingmaier's formula, taken as $(1/8\pi)\Sigma\eta^2/31$, where η is the departure from the accepted standard value. What to take as standard value was something of a difficulty. In the case of an ordinary bay disturbance, occurring during an otherwise undisturbed time, the value of the element at the beginning of the disturbance, or the arithmetic mean of the values at the beginning and end, will usually make a close approach to the normal quiet day value at the same time; whereas the mean value for the time during which the disturbance lasts will usually depart considerably from the corresponding quiet day value. On September 17, 1912, the bay disturbance was preceded by other disturbances, which at some of the stations were of considerable amplitude. At the less disturbed stations the value of the element before the bay began was undoubtedly nearer the normal undisturbed value than was the mean derived from the 31 5-minute measurements. Considering the several uncertainties, it was decided to calculate two sets of "activities." The first set, given in Table CLXXVII, takes as standard the mean value of the element derived from the 31 measurements. The second set, given in Table CLXXVIII, takes as standard the value of the element at 19 h. 30 m., that being accepted as the time of commencement of the bay. The unit in both tables is 10^{-10} erg.

TABLE CLXXVII.—"Magnetic Activity" from 19 h. 30 m. to 22 h. 0 m., September 17, 1912 (unit 1×10^{-10} Erg per c. cm.). (The standard values are the mean values during the interval.)

Station.	H.	D.	N.	E.	V.	Horl. Plane.	Three Components.
Antarctic ...	64·7	153·5	42·7	175·3	19·0	218·2	237·3
Mauritius ...	21·4	3·6	23·1	2·2	—	25·0	—
Buitenzorg ...	—	—	5·6	1·0	1·2	6·6	7·8
Alibag	18·3	1·9	18·3	1·8	0·7	20·2	20·9
Honolulu... ...	5·6	2·2	4·8	3·0	0·3	7·8	8·0
Helwan	42·6	3·5	43·3	2·6	6·4	46·1	52·5
Agincourt ...	19·5	6·6	18·9	7·1	—	26·1	—
Falmouth ...	48·3	94·7	70·7	72·0	8·2	143·0	151·2
Kew	67·9	95·5	97·1	66·1	6·9	163·4	170·4
Eskdalemuir ...	—	—	154·5	80·2	12·7	234·7	247·4
Sitka	30·9	18·8	35·4	14·3	10·2	49·7	59·9

TABLE CLXXVIII.—"Magnetic Activity" from 19½ h. to 22 h. September 17, 1912 (unit 1×10^{-10} Erg per c. cm.). (The standard values are the values at 19 h. 30 m.)

Station.	H.	D.	N.	E.	V.	Horl. Plane.	Three Components.
Antarctic ...	294·8	584·3	195·8	684·0	62·4	879·2	941·6
Mauritius ...	82·0	6·8	86·8	2·6	—	88·8	—
Buitenzorg ...	—	—	28·5	2·0	3·8	30·5	34·3
Alibag	56·6	2·5	56·6	2·4	0·7	59·1	59·9
Honolulu... ...	24·9	4·2	22·4	7·8	0·3	29·0	29·3
Helwan	103·2	4·9	103·9	3·2	7·0	108·1	115·2
Agincourt ...	19·5	11·4	18·9	11·9	—	30·9	—
Falmouth ...	73·2	190·4	131·3	132·6	10·7	263·6	274·4
Kew	108·7	179·8	170·8	117·7	15·9	288·5	304·5
Eskdalemuir ...	—	—	200·6	160·9	39·6	361·4	401·1
Sitka	118·9	62·2	164·8	15·3	15·0	181·1	196·1

At the Antarctic and at the stations which recorded H and D, "activities" were calculated both from the original curve measurements and also from the corresponding values in N and E. The first two columns in Tables CLXXVII and CLXXVIII are headed H and D, the entries in them being derived from the measurements of H and D curves at all the stations except the Antarctic. But for the Antarctic the entry in the H column really refers to N′, and that in the D column to E′. Except at Buitenzorg and Eskdalemuir, the changes in N and E were calculated from the measured changes in H and D. In each case of course

$$\Delta N^2 + \Delta E^2 = \Delta H^2 + \Delta D^2,$$

but agreement to $0 \cdot 1\gamma^2$ could not be expected unless more significant figures were retained in the values of ΔN and ΔE than was actually done. The ΔH, ΔD figures being in nine cases out of the eleven the fundamental ones, the values of the "activity" in the horizontal plane were in these cases derived from the first two columns, retaining however in the calculation one figure beyond that actually shown. It will be found, however, that the sum derived from the third and fourth columns always comes close to the value assigned to the horizontal plane.

The last column is in general based on the figures in the first, second and fifth columns. It contains no entry for Mauritius or Agincourt, as vertical force curves were not available for these stations.

From the mathematical properties of the mean ordinate, when corresponding figures in Tables CLXXVII and CLXXVIII differ, the figure in Table CLXXVIII is necessarily the larger. There is a substantial difference in every case except at Agincourt, where the mean value of H between 19½ h. and 22 h. was practically identical with the value at 19 h. 30 m.

Both tables agree in making the " activity " from the vertical component everywhere small compared to that from the horizontal components. They also both make the contribution from D or E small compared with that from H or N at Mauritius, Buitenzorg, Alibag, Honolulu and Helwan; and they make the " activity " at Buitenzorg and Honolulu very decidedly less than at Mauritius, Alibag or Helwan. The two tables further agree on the following points : " activity " at Sitka exceeds that at Helwan, the contribution from D being much larger at the more northern station, but the "activity" in the horizontal plane is considerably less at Sitka than at the stations in Great Britain. " Activity " is slightly greater at Kew than at Falmouth, and considerably greater at Eskdalemuir than at Kew. The contribution from N exceeds that from E at Kew and Eskdalemuir, but at Falmouth the contribution from E is slightly the larger. The contribution from D considerably exceeds that from H at both Falmouth and Kew.

In the Antarctic the contribution from E′ much exceeds that from N′, and the contribution from E is still more in excess of that from N.

The view one takes as to the relative values of the " activity " in the Antarctic and in Britain depends on the view taken as to the standard value. According to Table CLXXVIII " activity " was much greater in the Antarctic than in Britain, whereas according to Table CLXXVII the Antarctic value, while exceeding the values at Falmouth and Kew, fell short of that at Eskdalemuir.

In the case of the measurements at 5-minute intervals during term hours it was found that $(1/12)\Sigma\eta^2/R^2$, where R is the range of the element for the hour and η the representative departure from the mean value for the hour, showed an approach to constancy, the mean value obtained for this constant being approximately 0·09. It was thus of interest to compare the values obtained in the present case for $(1/31)\Sigma\eta^2$ with the corresponding squares of the ranges for the total interval of $2\frac{1}{2}$ hours. This was done for the two horizontal components combined, and for all three components combined. In the first case the ratio was found which the sum of the values of $(1/31)\Sigma\eta^2$ from the two horizontal components bore to $R_1^2 + R_2^2$, and in the second case the ratio which the sum of the values of $(1/31)\Sigma\eta^2$ from the three components bore to $R_1^2 + R_2^2 + R_3^2$. Here R_1, R_2 and R_3 represent the ranges in the three components, as derived from the measurements at 5-minute intervals.

TABLE CLXXIX.—Ratios of "Magnetic Activity" to Squares of Ranges. September 17, 1912.

Station.	$\dfrac{(1/31)\Sigma\eta^2 \text{ in Horl. Plane.}}{R_1^2 + R_2^2.}$	$\dfrac{(1/31)\Sigma\eta^2 \text{ from 3 components.}}{R_1^2 + R_2^2 + R_3^2.}$
Antarctic	·082	·080
Mauritius	·089	—
Buitenzorg	·084	·087
Alibag	·098	·097
Honolulu	·088	·086
Helwan	·109	·108
Agincourt	·061	—
Falmouth	·088	·088
Kew	·088	·090
Eskdalemuir ...	·079	·081
Sitka	·079	·083
Mean	·086	·089

The results appear in Table CLXXIX. The value of the ratio is very sensibly lower at Agincourt and very sensibly higher at Helwan than at the other stations. The departures at the other nine stations from the value ·09 are comparatively small.

Section 128.—The Antarctic curves were interrupted for some time between 23 h. and 24 h. on September 17, and it was convenient for other reasons to consider the disturbances on the 17th and 18th separately, but there is no really clear line of separation, and they may well have been parts of a single disturbance. On the 18th the most disturbed times in the Antarctic were from 0 h. to 2 h., from 6 h. to 8 h., and from 11 h. to 13 h. Between 0 h. and 2 h. there were ranges of 102γ in N′, 100γ in E′, and 33γ in V. The chief E′ movement took the shape of a bay. Between 6 h. and 8 h. N′ had a range of 102γ, E′ of 110γ and V of 48γ. These movements were of a somewhat irregular character. Between 11 h. and 13 h. the N′ and E′ movements were more regular, the two elements executing a large oscillation, during a considerable part of which the movements were roughly in phase. The commencing movements were a rise (algebraic) in N′ and fall in E′, the movement in E′ being concluded before that in N′. The subsequent fall in N′ exceeded the rise, and during it E′ first rose smartly to a maximum and then fell to a minimum, which was practically coincident in time with a minimum in N′. The total ranges during the two hours were 126γ in N′, 155γ in E′, and 40γ in V.

At Mauritius the H trace received stopped at 13 h., but it is hardly likely that the range given in Table CLXXX was exceeded. In the case, however, of D, where the record stopped at 10 h., the range given in the table was probably exceeded. About 5 h. 20 m. there was a sharp rise of about 10γ in H, and the curve retained a crested appearance until 6 h. 50 m., when a rapid fall brought the trace to about its original level. From 8 h. to 11 h. 40 m. there was a steady fall, in all about 50γ. This is in the same direction as the normal change for the interval, but about four times as large. The D trace showed practically nothing but the normal diurnal variation.

TABLE CLXXX.—0 h. to 14 h. September 18, 1912, Plate LVIII.

Station.	Element.	Times of Maximum.		Times of Minimum.		Disturbance Range.	Inequality Range.
		h.	m.	h.	m.	γ	γ
Antarctic	N′	11	55	2	21	260	57
	E′	7	27	11	45	227	49
	V	0	35	12	40	87	33
Mauritius	H	6	25	11	40	64	19
	D	3	0	6	50	29	29
Buitenzorg	N	1	55	7	30	64	38
	E	7	25	2	50	32	31
	V	6	20	0	0	22	16
Alibag	H	6	20	3	5	34	29
Honolulu	H	11	55	3	37	35	10
	D	7	15	3	40	12	18
	V	11	35	3	35	10	16
Helwan	H	13	20	7	10	32	32
	D	5	35	10	45	72	52
	V	4	40	7	45	22	22
Agincourt	H	5	25	2	55	42	21
	D	1	0	3	50	80	24
Eskdalemuir... ...	N	6	20	11	43	82	36
	E	7	20	12	33	65	36
	V	14	0	1	59	24	8
Sitka	H	7	13	11	51	93	5
	D	7	8	11	44	107	21
	V	3	56	11	59	137	6

The Buitenzorg trace ceased at 10 h., and the range data in Table CLXXX are correspondingly restricted. The N trace showed numerous short-period oscillations. Between 6 h. and 7½ h. N fell 41γ. The natural change during this time is a fall, but only of about 15γ. After $7\frac{1}{2}$ h., instead of continuing to fall, as it would naturally have done for some hours, N showed at first a small rise, and then small oscillations about a nearly level value. The E and V traces showed small signs of disturbance.

From Alibag only H trace was received. There was a small elevation, centring about $6\frac{1}{3}$ h., and a small depression centring about $11\frac{1}{2}$ h., but there was no movement of any considerable size.

At Honolulu the H trace contained a succession of irregular movements between 4 h. and 13 h. Between 6 h. 0 m. and 7 h. 25 m. there was a fall of 10γ and rise of 15γ. Between 11 h. 25 m. and 11 h. 55 m. there was a rise of 19γ. These were the largest individual movements.

At Helwan there were a small elevation and depression in H corresponding to those at Alibag, but apart from these the trace was nearly quiet. The D trace was smooth, but the normal range was exceeded. The V trace contained small dimples, synchronous with the elevation and depression in H, but was otherwise quiet.

At Agincourt there was a decidedly quiet time between 23 h. on the 17th and 0 h. 30 m. on the 18th. The H trace was appreciably disturbed between 0 h. 30 m. and 8 h., and again between 11 h. and 13 h., the largest movements occurring between 1 h. and 4 h. Between 0 h. 40 m. and 3 h. 40 m., the following successive movements occurred : -22γ, $+31\gamma$, -40γ and $+33\gamma$. Superposed on these were at times small short-period oscillations. Between 8 h. and 11 h. there were only small oscillations. There was a bay (depression) between $11\frac{1}{4}$ h. and 13 h., the fall between $11\frac{1}{4}$ h. and $11\frac{3}{4}$ h. amounting to 22γ. The D trace showed almost continuous disturbance from 0 h. 40 m. to 13 h., except for a quiet interlude from $10\frac{1}{2}$ h. to $11\frac{1}{2}$ h. Between 0 h. 45 m. and 1 h. 5 m., there was an easterly swing of $7\frac{1}{2}'$. Between $3\frac{1}{2}$ h. and $4\frac{1}{2}$ h. there were movements of $14'$ to West and $10'$ to East. Between $6\frac{1}{4}$ h. and $8\frac{1}{4}$ h. there were the following movements, the first being slightly interrupted : $10\frac{1}{2}'$ to West, and $10\frac{1}{2}'$ to East. There was westerly deflection between 11 h. and 13 h., but not large.

At Eskdalemuir the N curve exhibited numerous small irregular movements until after 15 h. The largest movements occurred between 6 h. and 7 h., and between $11\frac{1}{2}$ h. and $12\frac{1}{2}$ h. Between 6 h. 5 m. and 6 h. 20 m. N rose 29γ, and between 6 h. 20 m. and 7 h. 20 m. it fell 44γ. Between 11 h. 30 m. and 12 h. 30 m. there was a fall of 30γ and rise of 67γ, the latter somewhat interrupted by minor oscillations. The E curve was generally disturbed until $15\frac{1}{2}$ h., when it became very quiet. The largest movements occurred between 0 h. 45 m. and 2 h., and between $11\frac{1}{2}$ h. and 13 h. Between 0 h. 45 m. and 2 h. 15 m. there was an algebraic fall of 26γ and rise of 39γ. Between 11 h. 25 m. and 12 h. 25 m. there was an algebraic rise of 17γ and fall of 33γ. During the 18th there were some undulatory movements in V, but of very trifling magnitude.

At Sitka the larger movements had subsided before the end of the 17th, but the H and D curves continued to show numerous small short-period oscillations. These remained prominent until 5 h. on the 18th, and recurred at intervals later in the day. Larger movements of longer period became more prominent in H and D after 2 h.

These were largest between $6\frac{1}{2}$ h. and $8\frac{1}{2}$ h., and between $11\frac{1}{2}$ h. and 13 h., when they were accompanied by considerable movements in V. Between 7 h. 0 m. and 7 h. 45 m. H rose 62γ and fell 49γ. Between 8 h. 0 m. and 9 h. 30 m. H fell 31γ, rose 49γ and fell 38γ. Between $11\frac{1}{2}$ h. and 13 h. there was a decided bay (depression) in H, but minor oscillations interfered with the regularity of its outline. D was throughout at least as much disturbed as H. Between 6 h. 15 m. and 8 h. 5 m. there was an irregular shaped bay, D at 7 h. 10 m. being $15\frac{1}{2}'$ more easterly than at 6 h. 15 m., and 24′ more easterly than at 8 h. 5 m. Between 11 h. 30 m. and 12 h. 30 m. there were swings of $13\frac{1}{2}'$ to the West, and 12′ to the East. V fell 46γ between 7 h. 5 m. and 7 h. 40 m. Between 9 h. 55 m. and 12 h. 0 m., there was a total fall of 100γ, interrupted about $11\frac{1}{2}$ h. by a sharp rise of 16γ. After 12 h. V rose at a gradually diminishing rate until about $14\frac{1}{2}$ h.; the rise between 12 h. and 14 h. amounted to 81γ.

The disturbance on September 18, 1912, though generally felt was nowhere very prominent. In the Antarctic the range was considerable, especially in N′, but the traces showed much less signs of agitation than during the 17th, and disturbance was much less persistent. The N range at Buitenzorg was also considerable, especially as the last 4 hours were unrepresented, but, apart from the numerous short-period oscillations the general aspect of the trace was much quieter than on the 17th. At Alibag and Helwan irregularities were inconspicuous. Eskdalemuir, though much more disturbed than these two stations, showed nothing like the disturbance of the previous day. Honolulu, relatively considered, showed a decidedly more disturbed state of matters so far as H is concerned. The range was considerably less than on the 17th, but the general aspect of the curve was decidedly disturbed. At all these stations the H or N curve was much more disturbed than the D or E curve. At Agincourt, however, the D trace was decidedly the more disturbed, and the range in that element was only a little less than on the 17th. At Sitka a fair comparison is impossible between the 17th and 18th, owing to loss of trace on the 17th. The disturbance on the 18th was, as usual, decidedly larger at Sitka than at any of the other co-operating stations. In H and D there were numerous oscillations of considerable size, and the excess in the activity of the disturbance over that at Eskdalemuir, for instance, was much greater than the mere ranges suggest. The V trace at Sitka was comparatively free from minor oscillations, but the range in that element exceeded the H and D ranges at Sitka and the V range in the Antarctic. The largest movements at all the stations occurred at one of the three times when the largest movements occurred in the Antarctic. In the Antarctic itself the disturbance between 11 h. and 13 h. made most appeal to the eye, and the same was true of Honolulu and Eskdalemuir and, on the whole, of Sitka. At Agincourt, however, the movements between 11 h. and 13 h. were less than those between 6 h. and 8 h., and very decidedly less than those between 1 h. and 3 h.

Section 129.—Disturbance existed throughout the greater part of September 24, 1912, and to a minor extent during the earlier hours of the 25th, but there was a comparatively quiet time from 12 h. to 14 h. on the 24th. It thus appeared the most convenient plan to consider separately what preceded and what followed 14 h. on the 24th.

In the Antarctic the disturbance on September 24 did not exceed that customary until about $1\frac{1}{2}$ h., when increased liveliness became apparent, especially in N′. The largest movement in N′ was a fall of 157γ—interrupted only by small oscillations—between 2 h. 50 m. and 3 h. 23 m., when the minimum (numerical maximum of S′) was reached. A general movement in the reverse direction followed until the attainment of the maximum at 9 h. 52 m. This rise had numerous short-period oscillations superposed on it, and was arrested once or twice for some time. On the whole, however, it was of the same general character as the normal change for the same time of day, only five times as large. After 10 h. N′ fell decidedly, returning to about its normal value by 13 h. Thus the phenomena in N′ may be described generally as an enhancement of the ordinary regular diurnal variation. The same was true of E′, only the enhancement in its case was less, and the rise to the maximum at 8 h. 38 m. was much less regular and more interrupted than in the case of N′. There were some rather rapid oscillations in E′ near 10 h., the following changes occurring between 9 h. 50 m. and 10 h. 20 m.: $+ 39\gamma - 71\gamma, + 60\gamma$ and $- 116\gamma$. E′ continued to fall somewhat rapidly after $10\frac{1}{2}$ h., and from 12 h. to 14 h. was somewhat below its normal value. V showed no really conspicuous rapid movements. The largest there were occurred near 10 h. The V trace had a general trend downwards (numerical increase) from 3 h. to the minimum at 10 h. 17 m. A decided reverse movement set in about 10 h. 40 m., and continued until a little after 14 h., when the element had returned to about its normal value. Thus in the Antarctic, in all the elements alike, the phenomena between 3 h. and 10 h. amounted in the main simply to an increase of the normal diurnal variation.

At Mauritius there was a general fall in H from 1 h. to 10 h., and then a rise until 14 h. There were a few interruptions, but the reverse movements were small. The maximum occurred about 3 hours before the usual time, and the minimum—which, however, is normally of a very rounded character—was also some hours early. The range, moreover, was about four times the normal. Between 9 h. 50 m. and 10 h. 15 m. three rapid changes in H, respectively $- 11\gamma$, $+ 9\gamma$ and $- 5\gamma$, appeal to the eye. The major movements in the D curve represented fairly the ordinary diurnal changes. There were, however, some short-period oscillations, the most prominent between 9 h. 40 m. and 10 h. 20 m., when the following movements occurred: $1\frac{1}{2}'$ to East, $1\frac{1}{2}'$ to West, $1'$ to East and $1'$ to West. Both H and D were very quiet between 13 h. and 14 h.

At Buitenzorg disturbance began to be manifest about 0 h. 20 m. From 0 h. 40 m. until the minimum was reached at 10 h., the general trend in N was downwards, the motion accelerating after 1 h. 40 m. There were numerous short-period oscillations and some minor reverse movements of longer period, but nothing very conspicuous. There were three sharp movements following one another in immediate succession between 9 h. 55 m. and 10 h. 15 m., being respectively a fall of 23γ, a rise of 29γ and a fall of 16γ. From 10 h. 15 m. to $12\frac{1}{2}$ h. there was a smart recovery, amounting in all to 76γ. The minimum occurred about the usual hour, but the preceding fall set in several hours earlier than usual and was about four times the usual size. Usually the N trace is almost level for some hours about the time of minimum, so the rise between 10 h. and 12 h. has no parallel in the regular diurnal variation. The E trace contained a few short-period oscillations. The minimum and maximum occurred about the usual time, but the range was enhanced. The most conspicuous departure from quiet conditions consisted of three movements near 10 h. The two largest and latest of these were respectively a fall and a rise, each of about 10γ in 10 minutes. From 10 h. 20 m. to 11 h. 45 m. there was a gradual fall of 26γ, from three to four times the normal change. The maximum (numerical minimum) of V occurred about the usual hour, but the minimum was reached some hours earlier than usual, and the range was nearly double the normal. There were sharp movements in V near 10 h., apparently synchronous with those in E, but less than two-thirds of their size.

At Alibag the minimum in H appeared several hours earlier than usual, and the previous fall was much above the normal. Instead of the usual fall of about 12γ between 10 h. and 13 h., there was a rise of 45γ. Between 13 h. and 14 h. the curve was nearly level. Thus the phenomena were closely similar to those observed in H at Mauritius and N at Buitenzorg.

The traces received from Honolulu did not commence until $3\frac{3}{4}$ h. At that time H was falling rapidly. According to the official publication, from which some of the information in Table CLXXXI is derived, the fall set in actively about $1\frac{1}{2}$ h. It was particularly rapid between $2\frac{1}{2}$ h. and $3\frac{1}{2}$ h., amounting to 32γ in the course of an hour. The fall to the minimum was very largely in excess of the normal, and the minimum was reached several hours before the usual time. Subsequent to the minimum, the general trend in H was upwards, but until $10\frac{3}{4}$ h. the rise was not rapid, and it was interrupted by oscillations. There was a somewhat conspicuous double oscillation between 9 h. 55 m. and 10 h. 20 m., consisting of the following movements: -12γ, $+10\gamma$, -7γ, $+3\gamma$. The first three of these movements seem to correspond with those described at Buitenzorg and Mauritius. After $10\frac{3}{4}$ h. the rise became more rapid and less interrupted, gradually falling off, however, in rapidity after 12 h. At 14 h. H was still decidedly below the normal. The D trace at Honolulu showed small signs of disturbance, but the needle pointed more easterly than usual between 8 h. and 11 h. The V trace also showed in general very little sign of disturbance, but there was a decided double oscillation near 10 h., -6γ, $+9\gamma$, -4γ, $+3\gamma$, synchronous apparently with the double oscillation in H already described.

At Helwan the morning fall in H was augmented. The hour of minimum appears delayed, but that arises from the fact that it was reached during the rapid oscillations which presented themselves there as elsewhere near 10 h. These movements closely resembled those at Alibag, the changes occurring during 20 minutes being -15γ, $+21\gamma$ and -7γ. The D trace was less disturbed, but it showed movements near 10 h. synchronous apparently with those in H. Owing to the interruption of the curve by the time mark, the nature of their commencement is somewhat indistinct. But the movements which corresponded to the two last in H were 1′·4 to the West and 0′·7 to the East respectively. The V trace was a little undulatory. Near 10 h. there was a somewhat rapid fall of 7γ in about 10 minutes, corresponding apparently with one of the movements in the other elements.

TABLE CLXXXI.—0 h. to 14 h. September 24, 1912. Plate LVIII.

Station.	Element.	Times of Maximum.		Times of Minimum.		Disturbance Range.	Inequality Range.
		h.	m.	h.	m.	γ	γ
Antarctic	N′	9	52	3	23	351	57
	E′	8	38	12	55	244	47
	V	1	20	10	17	210	33
Mauritius	H	0	20	10	0	74	19
	D	9	55	6	40	41	34
Buitenzorg	N	0	35	10	0	152	40
	E	7	35	2	5	50	31
	V	5	40	10	5	29	17
Alibag	H	0	30	10	0	96	20
Honolulu	H	0	32	6	11	96	10
	D	10	15	5	20	22	17
	V	10	7	4	35	17	16
Helwan	H	0	20	10	0	62	32
	D	2	55	10	5	44	52
	V	5	0	8	40	15	22
Agincourt	H	0	25	5	30	109	24
	D	6	10	9	55	253	24
Eskdalemuir... ...	N	2	45	9	59	126	34
	E	3	5	5	38	127	36
	V	14	0	5	0	60	8
Sitka	H	12	33	9	55	457	5
	D	10	17	2	45	291	21
	V	4	39	9	58	696	6

At Agincourt H began to fall decidedly after 0 h. 30 m., and became decidedly disturbed after $2\frac{1}{2}$ h. Disturbance remained active until $11\frac{1}{2}$ h. Between 4 h. and 10 h. H was markedly depressed. The largest movements occurred between $3\frac{1}{2}$ h. and 9 h. Between 3 h. 50 m. and 4 h. 40 m. H fell 84γ and rose 49γ. Between 4 h. 40 m. and 6 h. 20 m. it fell 58γ and rose 60γ. A very rapid oscillation, a fall of 27γ and rise of 31γ, occupying less than 10 minutes, occurred just before 10 h. The D curve was but little disturbed until after $2\frac{1}{2}$ h. From 3 h. until 11 h. there was a succession of considerable oscillations. Between 2 h. 50 m. and 4 h. there were movements of $18\frac{1}{2}'$ to the East, and $24\frac{1}{2}'$ to the West. Between 4 h. and 5 h. there was another oscillation, $24\frac{1}{2}'$ to the East, and 7′ to the West. Between 7 h. 25 m. and 9 h. 5 m. there were movements of 18′ to the West and 14′ to the East. Finally between 9 h. 5 m. and 11 h. there were movements of 30′ to the West and $30\frac{1}{2}'$ to the East.

At Eskdalemuir there was a good deal of minor disturbance on the 23rd, but this had pretty well disappeared by 22 h. Near midnight disturbance began to increase again in N, and the curve remained considerably disturbed until 12 h. on the 24th. The largest single movement was a fall of 71γ between 5 h. 55 m. and 6 h. 50 m. There were some rapid movements commencing about 9 h. 55 m., the first a sharp rise of 10γ, but the interruption of the trace by the hour mark somewhat obscures their real character. Apparently there were three movements; the second, slightly nterrupted, was a fall of apparently about 28γ. The E trace began to show slight disturbance shortly after 0 h., and there were considerable movements between $2\frac{1}{2}$ h. and $10\frac{1}{2}$ h. Between 2 h. 25 m. and 3 h. 5 m., E rose 46γ. Between the maximum at 3 h. 5 m. and the minimum at 5 h. 38 m. there was an almost continuous fall of 127γ. Between 9 h. 55 m. and 10 h. 25 m. there were some rapid movements, resulting on the whole in a fall of 64γ. The V curve showed no sign of disturbance until 2 h., when a fall became visible. After a slight recovery, a further fall set in about 3 h. 10 m., and continued until the minimum was reached at 5 h. The total fall between 2 h. and 5 h. amounted to 45γ. From 6 h. to 10 h. V rose gradually. Between 12 h. and 14 h. the trace was very quiet.

The curves received from Sitka did not commence until after 1 h.; at that time they already showed slight traces of disturbance, which gradually increased. After 3 h. the energy of disturbance markedly developed, and there was a still further increase after 7 h., the movements between 7 h. and 11 h. being very large indeed. The intensity of disturbance declined rapidly after 11 h. By 14 h. only small short-period oscillations remained, and the elements had nearly assumed their normal values. H was markedly depressed between 5 h. and 11 h., especially between 9 h. and $10\frac{1}{2}$ h. The trace was highly oscillatory throughout, some of the oscillations being large as well as rapid. Near 8 h. in the course of 5 minutes H increased 147γ. Between 9 h. 55 m. and 10 h. 20 m. there were two oscillations, the movements being $+216\gamma$, -211γ, $+158\gamma$ and -162γ; *i.e.*, the rises and falls were very nearly equal. Between 10 h. 20 m. and 10 h. 40 m. there was a rise of about 383γ. In the D trace larger movements began about 3 h. 20 m. From then until after 10 h. the trace was highly oscillatory. From $5\frac{1}{4}$ h. to 10 h. the general trend was to the East. Between $5\frac{1}{4}$ h. and $9\frac{1}{4}$ h. there was a succession of 10 oscillations of roughly equal periods superposed on the easterly drift, and these oscillations had in their turn smaller oscillations of much shorter period superposed upon them. The extreme easterly position was presumably shown too faintly in the original curve to be visible in the copy received, which shows a blank from 10 h. 5 m. to 10 h. 25 m. The details respecting it in Table CLXXXI are derived from the official publication. Between 10 h. 25 m. and 10 h. 55 m. there was a westerly movement of 32′. The V curve showed only minor movements until after 3 h., when a marked rise commenced. In the course of the next 40 minutes the element rose 87γ. Minor oscillations continued until about 6 h., when a decided fall began. This was interrupted by numerous small short-period oscillations, and by a rise of about 92γ between 7 h. 45 m. and 8 h. 5 m., and again by oscillations of moderate period between 9 h. 5 m. and 9 h. 35 m. The total fall between 6 h. and the minimum at 9 h. 58 m. amounted to 676γ. The recovery after 10 h. was also interrupted, but the total rise between 10 h. and 11 h. amounted to 498γ. Between 11 h. and 12 h. 45 m. there was a further rise of 108γ. Between 7 h. and 12 h. the depression in V was most conspicuous, the curve being pyramidal in appearance.

There are several interesting phenomena in this disturbance. The most prominent feature, except at the North American stations, was perhaps the enhancement of the regular diurnal variation in H or N. The time of the minimum in H or N was also in most cases advanced, and the rise after the minimum was abnormally rapid. At the American stations the disturbance occurred during the night, when the regular diurnal changes are naturally trifling. The prominent feature there in H or N was the large depression of the element near 10 h., and the subsequent rapid recovery. At Mauritius, Buitenzorg, Honolulu and Helwan the D or E and the V movements were as usual much smaller than those in H or N, but at Eskdalemuir the disturbance was quite as prominent in E as in N, while at Agincourt the D curve had a considerably larger range than the H. At all the stations there were oscillations near 10 h. which made a special appeal to the eye. Unfortunately some details were lost at all the stations where the 10 h. time mark interrupted the trace. Also short-period oscillations were generally superposed, thus it is difficult to say exactly what corresponded at different stations. At one and the same station the different elements showed in most cases a different number of movements near 10 h. Thus in the Antarctic one would naturally say that there were six movements (three oscillations) in N′, but only four movements (two oscillations) in E′ or V. At Buitenzorg, Alibag and Helwan there were only three prominent movements in N or H, but the first of these was preceded and the last followed by a less conspicuous movement in the opposite direction. At Honolulu the movement which preceded and the movement which followed the three prominent movements in the H trace were more conspicuous than at Helwan. At Agincourt there seemed to be only one oscillation in H or D, but the oscillation in D took double the time of that in H. At Sitka the H trace showed two very conspicuous oscillations about 10 h., but they were preceded by oscillations which were also of considerable though smaller size, and they were followed by an even larger movement which nearly wiped out the depression in H existing at the time.

In the Antarctic there was a considerable range in V, but the appearance of the curve was little more disturbed than usual. At Buitenzorg, Honolulu and Helwan there was no disturbance in V worth mentioning. At Eskdalemuir the only practical trace of disturbance in V was the depression characteristic of disturbance in the early morning. This depression, it should be noticed, had largely disappeared before the climax in V was reached at Sitka. Thus the enormous disturbance in V at Sitka seems quite apart from the phenomena at the other stations.

Section 130.—Results for Honolulu and Sitka are not included in Table CLXXXII because the curves received from these stations did not extend to the later part of the disturbance, when the larger movements were recorded elsewhere.

TABLE CLXXXII.—14 h. September 24 to 2 h. September 25, 1912. Plate LVIII.

Station.	Element.	Times of Maximum.	Times of Minimum.	Disturbance Range.	Inequality Range.
		h. m.	h. m.	γ	γ
Antarctic	N′	19 1 (24th)	23 7 (24th)	265	49
	E′	1 5 (25th)	23 12 (24th)	200	36
	V	0 10 (25th)	19 35 (24th)	103	28
Mauritius	H	23 15 (24th)	14 35 (24th)	32	15
	D	23 15 (24th)	22 30 (24th)	34	5
Buitenzorg	N	2 0 (25th)	14 20 (24th)	57	31
	E	23 15 (24th)	2 0 (25th)	39	21
	V	2 0 (25th)	14 40 (24th)	7	4
Alibag	H	23 40 (24th)	14 20 (24th)	24	5
Helwan	H	23 5 (24th)	22 5 (24th)	50	11
	D	21 25 (24th)	15 0 (24th)	47	9
	V	21 35 (24th)	22 55 (24th)	18	2
Agincourt	H	19 0 (24th)	23 10 (24th)	36	29
	D	23 10 (24th)	21 35 (24th)	118	43
Eskdalemuir... ...	N	22 57 (24th)	22 45 (24th)	169	20
	E	20 46 (24th)	14 15 (24th)	116	25
	V	20 14 (24th)	23 25 (24th)	64	10

In the Antarctic the minor oscillations, which had been less in evidence between 12 h. and 14 h. on September 24, 1912, became more conspicuous after 14 h. These oscillations were largest in E′ and least in V. Between 14 h. and 15 h. the oscillations in the three elements seemed roughly in phase, but this soon ceased to be the case. In N′ there was a most conspicuous bay (algebraic depression) between 20 h., and 24 h. Between 22 h. and 23 h. 45 m. N′ fell 157γ and rose 167γ. E′ showed a succession of considerable oscillations of varying periods between 19 h. and 24 h. Between 19 h. 5 m. and 19 h. 50 m. E′ rose 55γ and fell 100γ; between 19 h. 50 m. and 20 h. 30 m. it rose 61γ and fell 97γ; and between 22 h. 25 m. and 23 h. 15 m. it rose 74γ and fell 103γ. Superposed on these longer period oscillations were numerous short-period oscillations. Between 23 h. 15 m. on the 24th and 1 h. 10 m. on the 25th there was a rise of 194γ in E′, interrupted only by short-period oscillations. The chief movement in V was a fall (numerical rise) of 40γ and rise of 55γ between 20 h. 10 m.

and 20 h. 50 m. Between 22 h. and 24 h. on the 24th, the time when N′ and E′ were most disturbed, the V trace exhibited only small movements. The disturbance in the Antarctic gradually diminished after 0 h. on the 25th, and between 6 h. and 18 h. the curves were very quiet.

At Mauritius the H trace, which had been very quiet from 12 h. to 14 h. of the 24th, became obviously disturbed after 14 h. Between 14 h. and 17 h. 20 m. there was a succession of small but sharp oscillations, giving the trace a jagged appearance. These movements, though not absolutely large, appeal to the eye, partly because the trace was very quiet for more than an hour subsequently. As will be seen presently, corresponding movements were recorded at other stations. There was a conspicuous hump (enhancement of H) between 22 h. 35 m. of the 24th, and 0 h. 20 m. of the 25th, a rise of 28γ being followed by a fall of 19γ. The only conspicuous feature in the D trace was a bay (easterly deflection) between 22 h. 30 m. and 24 h. of the 24th. There was an easterly movement of 5′ and westerly movement of 3′.

At Buitenzorg on the 24th N was comparatively quiet between 13 h. and 14 h., and again between 17 h. 20 m. and 18 h. 20 m., but between 14 h. and 17 h. 20 m. there were movements which seem to correspond exactly with those just described at Mauritius. When H increased at Mauritius, N increased at Buitenzorg. During this time the Buitenzorg E and V traces appeared quiet to the eye. Small oscillations are, however, recognisable, and on superposing a tracing of the N curve on the E curve it can be seen that the two elements remained very closely in phase during at least the greater part of the time, E falling when N increased, and conversely. The V trace also showed tiny oscillations, but was too faint to admit of their exact nature being made out. Between 22 h. on the 24th and 1 h. on the 25th, there was a marked bay in N (depression). The recovery was more rapid than the fall. The lowest point may have been reached between 23 h. 10 m. and 23 h. 15 m., while the papers were being changed. E rose 25γ between 21 h. 0 m., and 23 h. 10 m., and fell 39γ between 23 h. 15 m. on the 24th and 2 h. on the 25th. These changes are in the same direction as the normal diurnal changes, but much larger. The V trace throughout was slightly undulatory, but differed very little from a straight line.

At Alibag conditions had been quiet between 13 h. and 14 h. on the 24th. But from 14 h. to 17 h. 20 m. there was a succession of oscillatory movements in H, corresponding very closely with those described at Mauritius. Also, as at Mauritius, there was a conspicuously quiet time after 17 h. 20 m. for nearly two hours. From 19 h. on the 24th to 0 h. 30 m. on the 25th there was some further disturbance, the trace including a small bay centring about 22 h. 40 m. The largest continuous movement was a rise of 17γ between 22 h. 40 m. and 23 h. 40 m.

The curves received from Honolulu stopped at 20 h. on the 24th. The oscillatory movements in H between 14 h. and 17 h. 20 m., though less conspicuous than at Alibag and Buitenzorg, are easily recognised. On superposing a tracing of the N oscillations at Buitenzorg—where the time scale is the same as at Honolulu—the movements at the two places are seen to correspond with considerable closeness. Oscillations at this time are also recognisable in the Honolulu V trace, and less distinctly in the D trace. The movements in D are very small. So far as recognisable, they appeared to be at least approximately in phase with the H movements, increase of H going with easterly movement in D. The V movements seemed also approximately in phase with those in H, the values of the two elements rising and falling together.

At Helwan conditions were very quiet on the 24th from 12 h. to 14 h. There then ensued in the H trace a series of oscillations, corresponding very exactly with those at Alibag. No corresponding oscillations can be made out in the D trace. Oscillations are visible in the V trace, but the trace and base line are very faint, and times consequently a little uncertain. So far as can be made out, a fall in V corresponded with a rise in H. After a quiet interlude, disturbance began to re-appear about 19 h., but the only movements of any size occurred some hours later. On the H trace there was a considerable hump (elevation of H) between 22 h. 35 m. on the 24th, and 0 h. 5 m. on the 25th, there being a rise of 48γ in 30 minutes, followed by a fall of 34γ during the next hour. The D trace showed some disturbance between 19 h. and 24 h. There was a bay (westerly deflection) between 22 h. 40 m. and 24 h., a westerly movement of $2'$ during the first half-hour being followed by a slower easterly movement of $1\frac{1}{2}'$. The V trace became a little disturbed after 20 h., but the only movement of any size was a bay (depression) between 22 h. 40 m. and 24 h. The fall and rise were each about 15γ, but the fall took only about 20 minutes, so had much the steeper gradient. After 0 h. on the 25th conditions at Helwan were very quiet for some hours.

At Agincourt no clear oscillations in H were visible near 14 h., but the trace was rather faint. The D trace clearly showed oscillations both before and after 14 h. Those between 14 h. and 15 h. were much larger than those preceding 14 h. The difference between the time scale at Agincourt and at the other stations makes comparison of short-period movements difficult. So far as one can judge, the first two or three movements in the Agincourt D trace after 14 h. do correspond approximately in time with those elsewhere, movement to the East at Agincourt going with increase of H at Alibag and Helwan, but no correspondence can be traced after 15 h. The H trace at Agincourt became gradually somewhat more disturbed, there being a good deal of oscillation, though of no great amplitude, between 19 h. and 24 h. Between 22 h. and $23\frac{1}{2}$ h. was the most disturbed time. The following changes occurred between 22 h. 40 m. and 23 h. 30 m. : $+ 17\gamma$, $- 18\gamma$, $+ 20\gamma$, $- 24\gamma$ and $+ 18\gamma$, the last being slower than the others. The D trace was practically quiet from 16 h. until nearly 20 h., but exhibited a deep bay (easterly deflection) between 22 h. and 24 h. The swing to the East was $22'$ and the return swing $18'$. Superposed on the former swing were some short-period oscillations.

At Eskdalemuir there was a comparatively quiet interval before 14 h. and a second after $17\frac{1}{2}$ h. Between whiles the N curve contained a succession of movements corresponding very closely with the synchronous movements at the other stations. Corresponding movements, though smaller, were also fairly conspicuous in the E curve. The two elements remained approximately in phase throughout, rise in N going with fall in E. Corresponding though much smaller oscillations were also recognisable in the V trace, fall in V going with rise in N. Disturbance increased again after 19 h., and was of considerable size from 20 h. to 24 h. Between 22 h. 45 m. and 22 h. 57 m. N rose 169γ, falling 126γ in the course of the next 50 minutes. Between 19 h. and the maximum at 20 h. 46 m. E rose 95γ. Between 20 h. 46 m. and 23 h. 25 m. there was a total fall of 105γ interrupted, however, by several minor oscillations, and between 23 h. 25 m. on the 24th and 0 h. 5 m. on the 25th there was a rise of 67γ. The V trace after 19 h. began to show a small rise above the normal. After the maximum at 20 h. 14 m. a fall set in, which was very slow at first, but continued almost uninterruptedly until the minimum at 23 h. 25 m. The rate of fall was especially rapid between 22 h. 55 m. and 23 h. 5 m. After 23 h. 25 m. a rise set in, which continued until about 2 h. on the 25th, but after 0 h. 20 m. the rate of rise was slow.

The curves received from Sitka stopped at 17½ h. on the 24th. There was a relatively quieter time from 13 h. to 14 h. After 14 h. oscillations were more in evidence, especially in D. So far as can be made out, there was in general a pretty close correspondence in phase between H and D movements, increase of H going with westerly movement. The earlier D movements had a close resemblance to the earlier N movements at Buitenzorg, westerly movement at Sitka going with increase of N at Buitenzorg. But later short-period movements prevailed at Sitka and obscured any parallelism that may have existed with the movements elsewhere. The Sitka V trace also contained oscillations, though of smaller size, after 14 h. The earlier of these appeared fairly in phase with the D movements, rise in V going with westerly movement.

The disturbance between 19 h. and 24 h. on September 24, 1912, was very considerable at most of the stations from which complete records were obtained. So far as can be judged from the published data, the disturbance was fairly represented at Sitka, but did not approach the disturbance recorded there during the forenoon. It is even doubtful whether it was as large as the simultaneous disturbance at Eskdalemuir.

The most prominent feature of this later disturbance in the Antarctic was a depression in N′ (numerical rise), greatest about 23 h. A corresponding depression appeared in the N trace at Buitenzorg. At Alibag there was a slight depression of H until after 22½ h., but the rapid recovery from this is a more prominent feature. The same is true, and to an increasing extent, of H at Helwan and N at Eskdalemuir. At Agincourt H was conspicuously oscillatory at the time. The Honolulu and Sitka publications show that at both stations H was decidedly depressed. Disturbances in D or E were as usual of secondary importance at Buitenzorg and Helwan; but they were fairly prominent at Eskdalemuir and very prominent at Agincourt. At Sitka, according to the official publication, the needle was on the whole considerably deflected to the West between 20 h. and 24 h. There would seem to have been but little disturbance in V at any of the stations.

Section 131.—The series of movements between 14 h. and 17½ h. on September 24, 1912, was so remarkable that measurements were made of the oscillations which were recognisable at the majority of stations. Nine oscillations were recognisable at Mauritius, Buitenzorg, Alibag, Helwan and Eskdalemuir. Five of these were recognisable at Honolulu, and three at Agincourt and Sitka. Some of the curves had a slight slope on them at the time, so that the most suitable quantity to compare was the sum of the two movements which were accepted as going together to form an oscillation. This might be regarded as double the amplitude. At the same time it is proper to explain that the movements were not ordinary regular oscillations. The to and fro movements as a rule differed in duration, as well as in amplitude, and in one or two cases what may have been shorter period oscillations seemed to be superposed. Some of the movements were very small, and as a good many of the curves had, like most copies, no very sharp outline, no great accuracy can be claimed for the measurements. The results are shown in Table CLXXXIII. The results in

TABLE CLXXXIII.—Oscillations near 14 h. September 24, 1912. Amplitudes as Percentages of Means from Mauritius, Buitenzorg, Alibag, Helwan and Eskdalemuir.

Station.	Element.	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.	No. 7.	No. 8.	No. 9.	All combined.
Mauritius ...	H	43	39	45	53	35	58	43	35	41	44
Buitenzorg ...	N	96	67	83	91	78	76	89	71	78	81
Alibag	H	67	55	62	74	65	64	66	71	57	65
Helwan ...	H	80	108	85	92	75	84	82	85	85	85
Eskdalemuir ...	N	206	194	210	180	233	218	212	230	244	215
,, ...	W	109	136	117	111	113	100	108	108	95	110
Honolulu ...	H	39	20	35	29	—	—	—	—	28	—
Agincourt ...	D	110	213	102	—	—	—	—	—	—	—
Sitka	D	121	115	103	—	—	—	—	—	—	—

each column are presented as percentages of the mean double amplitude in the first six rows. For instance, in the case of the ninth oscillation the range in H at Mauritius was 0·41 of the mean of the following six ranges: H at Mauritius, N at Buitenzorg, H at Alibag, H at Helwan, N at Eskdalemuir and W at Eskdalemuir. The figures for Honolulu, Agincourt and Sitka were expressed as percentages of the same means as served for the other stations. It is obvious at a glance that the sequence of the phenomena was generally similar at the various stations. The amplitude, however, was very different at the different stations, being on the average about five times as large for N at Eskdalemuir as for H at Mauritius. At Buitenzorg the magnetic and astronomical meridians are so nearly the same that the difference between H and N is insignificant. Thus the data from the first four stations in Table CLXXXIII should be fairly comparable. In one case, oscillation No. 8, the amplitude for Alibag equals that for Buitenzorg, but in every other case amongst the first three stations Buitenzorg takes the first place and Mauritius the last. Honolulu, however, falls distinctly short of Mauritius. Helwan, on the average, slightly exceeds

Buitenzorg, but the two run close together. Agincourt and Sitka are in excess of Helwan, but fall decidedly short of N at Eskdalemuir. On the average, the amplitude in N at Eskdalemuir is about double that in W. The vector representing (mean ΔW/mean ΔN) at Eskdalemuir is inclined to North at an angle of 27°, or 8°·8 to the West of the magnetic meridian. Thus the oscillations were much more conspicuous in the E trace than they would have been on a D trace, if one had existed. At Agincourt and Sitka the movements could not be clearly made out in the H curves, being obscured by short-period oscillations, presumably from a more local source. But it is probable that at these two stations the amplitude was less in the magnetic meridian than in the perpendicular direction.

Section 132.—Table CLXXXIV is intended to bring out more clearly the relative size of the different oscillations of September 24, 1912, at one and the same station. The entry is the percentage which the amplitude of the particular oscillation bears to the mean amplitude of all the oscillations observed at that station. For instance, at Mauritius the amplitude of the first oscillation was $8{\cdot}5\gamma$, while the mean of the nine amplitudes was $7{\cdot}83\gamma$, and $(8{\cdot}5/7{\cdot}83) \times 100$ is 109. At the stations for which all nine oscillations were measured, the mean from the whole nine, the mean from the first three, and the mean from Nos. 1, 2, 3, 4 and 9 differed but little. Thus the figures obtained for Honolulu, Agincourt and Sitka are probably fairly comparable with the others. On the whole, oscillation No. 2 was decidedly below and oscillation No. 3 decidedly above the average. The others make at least a fair approach to equality.

TABLE CLXXXIV.—Oscillations near 14 h. September 24, 1912. Amplitudes as Percentages.

Station.	Element.	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.	No. 7.	No. 8.	No. 9.
Mauritius ...	H	109	54	135	121	82	121	88	82	109
Buitenzorg ...	N	130	49	133	111	97	84	97	89	111
Alibag	H	114	51	126	114	101	90	90	114	102
Honolulu... ...	H	133	38	141	88	—	—	—	—	100
Helwan	H	103	76	130	107	90	90	85	103	116
Agincourt ...	D	95	100	105	—	—	—	—	—	—
Eskdalemuir ...	N	105	54	128	83	110	92	87	110	132
" ...	W	109	74	139	101	105	83	87	101	101
Sitka	D	118	62	120	—	—	—	—	—	—
All	—	109	60	131	100	101	91	89	103	116

The phenomenon was obviously due to some wide-seated cause, which maintained itself with little alteration in situation or in energy throughout fully three hours. The large size of the Eskdalemuir oscillations suggests a northern site, but varying distance from the source could hardly be the sole cause of difference in amplitude. Helwan and Buitenzorg seem nearly equally affected, and any place equidistant from these two places would be remote from Eskdalemuir. Except at the American stations, the direction of the oscillating force undoubtedly was not far removed from the magnetic meridian. This suggests a fluctuation somehow produced in the earth's own magnetic moment; but how such a fluctuation could produce five or six times as large an oscillation at Eskdalemuir as at Honolulu or Mauritius it is difficult to imagine.

Section 133.—The disturbance of September 30 to October 1, 1912, began with an s.c. at about 21 h. 36 m. on September 30, and continued until about 18 h. on October 1.

In the Antarctic there were interruptions in the record during October 1 with consequent loss of trace between 4 h. 40 m. and 5 h. 55 m., between 8 h. 45 m. and 10 h. 10 m., and finally for some hours after 15 h. 10 m. From the general appearance of the curves it is probable that the true maximum and minimum in N′ and V and the true minimum in E′ were recorded. But the true maximum in E′ almost certainly occurred between 4 h. 30 m. and 5 h. 55 m., and so failed to be recorded. Thus the range assigned to E′ in Table CLXXXV is probably an underestimate. The s.c. itself in the Antarctic was a large oscillation in all the elements, of the kind usual there; but the subsequent movements, so far as recorded, appealed to the eye only from the large ranges they supplied. The change in E′ between 4 h. 35 m. and 5 h. 55 m., even if continuous in one direction, must have been pretty rapid, because there was a rise in the aggregate of 129γ. During the first 25 minutes after registration was resumed there was a fall of 72γ, and if, as is probable, the fall had been in progress for some little time prior to 5 h. 55 m., both the rise and the fall may have considerably exceeded those actually shown.

The minimum in N′ presented itself several hours later than usual. There was a considerable bay between 4 h. and 7 h. on October 1. The rise which followed the minimum at 6 h. 2 m. experienced several slight reversals, and showed numerous superposed short-period oscillations. The maximum occurred about the usual time. The phenomena on the whole represented simply an enlargement of the normal diurnal variation. The same remark applies with even greater exactness to the changes in E′ and V. The main features in E′ were a gradual rise from 22 h. on September 30 to 6 h. on October 1, and a gradual fall after 6 h. until registration stopped about 15 h. 10 m. The rise and fall were a good deal interrupted, but the superposed oscillations, whether of longer or shorter period, were comparatively small. The V trace, apart from the s.c., was not more oscillatory than usual. So far as the trace enables one to judge, there was a nearly steady fall from 4 h. to the minimum (numerical maximum), which occurred about the usual time. This was followed by a gradual rise. The Antarctic curves on the present occasion bore a considerable resemblance to those containing the disturbances of April 15 and September 24, 1912.

At Mauritius the H trace showed a "crest" lasting until about 2 h. 50 m. on October 1. During its persistence H on the whole rose slightly, the maximum presenting itself immediately before the small rapid fall terminating the crest. Following this there was an almost unbroken fall to the minimum at 13 h. 5 m.

This fall was generally slow, but was accelerated between 6 h. and 8 h. The phenomena in H represented on the whole an enhancement of the normal diurnal variation, the range being four or five times the normal, with some acceleration of the times of maximum and minimum. The D trace received stopped at 8 h. on October 1. The movements shown were all slow. There was westerly movement from 21 h. on September 30 to 2 h. on October 1, and again from $3\frac{1}{2}$ h. to $5\frac{1}{2}$ h. on the 1st. The total range shown on the trace $3\frac{3}{4}'$ somewhat exceeds the normal, but the curve appears quiet to the eye.

TABLE CLXXXV.—21 h. September 30 to 18 h. October 1, 1912. Plate LIX.

Station.	Element.	Times of Maximum.	Times of Minimum.	Disturbance Range.	Inequality Range.
		h. m.	h. m.	γ	γ
Antarctic	N′	12 49 (Oct. 1)	6 2 (Oct. 1)	226	59
	E′	5 55 (Oct. 1)	21 40 (Sept. 30)	288	76
	V	22 10 (Sept. 30)	13 10 (Oct. 1)	180	44
Mauritius	H	2 50 (Oct. 1)	13 5 (Oct. 1)	96	21
Buitenzorg	N	2 55 (Oct. 1)	8 15 (Oct. 1)	137	30
	E	7 35 (Oct. 1)	2 35 (Oct. 1)	68	48
	V	5 20 (Oct. 1)	1 10 (Oct. 1)	33	32
Alibag	H	2 50 (Oct. 1)	12 25 (Oct. 1)	103	44
	D	11 0 (Oct. 1)	1 20 (Oct. 1)	31	29
	V	10 0 (Oct. 1)	6 5 (Oct. 1)	34	28
Honolulu	H	2 34 (Oct. 1)	9 10 (Oct. 1)	114	14
	D	17 10 (Oct. 1)	23 32 (Sept. 30)	34	49
	V	12 32 (Oct. 1)	22 2 (Sept. 30)	22	32
Helwan	H	2 45 (Oct. 1)	15 30 (Oct. 1)	80	23
	D	5 45 (Oct. 1)	12 25 (Oct. 1)	46	42
	V	5 35 (Oct. 1)	21 40 (Sept. 30)	15	20
Agincourt	H	21 40 (Sept. 30)	7 55 (Oct. 1)	89	22
	D	9 15 (Oct. 1)	5 30 (Oct. 1)	107	36
Eskdalemuir... ...	N	21 42 (Sept. 30)	11 11 (Oct. 1)	108	28
	E	3 23 (Oct. 1)	15 50 (Oct. 1)	69	28
	V	16 10 (Oct. 1)	7 0 (Oct. 1)	55	6
Sitka	H	5 29 (Oct. 1)	11 2 (Oct. 1)	196	24
	D	11 2 (Oct. 1)	5 39 (Oct. 1)	173	41
	V	6 3 (Oct. 1)	11 0 (Oct. 1)	251	9

The curves received from Buitenzorg stopped at $8\frac{1}{4}$ h. on October 1, while N apparently was still falling. Thus the ranges in Table CLXXXV, at least in N, are probably underestimates. After the s.c. N continued to rise with short interruptions until the maximum at 2 h. 55 m. on October 1. After 3 h. N showed a decided tendency to fall. The earlier part of the fall was somewhat interrupted, but after $4\frac{1}{2}$ h the only interruptions consisted of small short-period oscillations. The movements differed from the normal only in being larger, and in presenting the maximum a little earlier than usual. The E and V traces showed little sign of disturbance. The maximum and minimum in either case appeared near the usual hours, but the movements in E exceeded the normal.

At Alibag the maximum in H, like the maxima in H at Mauritius and in N at Buitenzorg, occurred just before the "crest" terminated. But after the fall from the crest there was a slight recovery, and a decided fall did not set in until about $5\frac{1}{2}$ h. on October 1, which is near the time of the ordinary maximum. A nearly continuous fall then ensued, until about $12\frac{1}{2}$ h. The subsequent rise was at first slow, and was interrupted between $14\frac{1}{2}$ h. and $15\frac{1}{2}$ h. After 16 h. there was a steady rise for four hours. Thus the movements closely resembled those of the normal day, except that they were much larger. The D and V curves appeared about as quiet as usual.

At Honolulu the maximum in H was reached shortly before the "crest" terminated. There was an almost uninterrupted fall from 3 h. to 9 h. 10 m. on October 1, and after this there was a nearly uninterrupted rise until 19 h. Except for the s.c. and the "crest," the delay in the hour of maximum and the large size of the movements are the only phenomena which differ essentially from those of the ordinary day.

At Helwan the maximum in H was attained shortly before the "crest" disappeared. It occurred about the hour of a secondary inconspicuous maximum usually recognisable in the morning at Helwan. The principal maximum usually met with from 10 h. to 11 h. was only faintly indicated, the general direction of movement being a fall from 2 h. 45 m. to 15 h. 30 m. The fall was nowhere rapid, and was interrupted by several undulatory movements of small amplitude. After the minimum, at about the usual hour, H continued to rise for some hours. The D and V traces, apart from a small depression in the latter at the time of the s.c., showed practically no sign of disturbance.

At Agincourt the maximum in H occurred about the usual time of the afternoon maximum, but until the "crest" disappeared near 3 h. on October 1 the trace was nearly level, and apart from the existence of the "crest," would pass as quiet. After 3 h. there was a fall, once or twice interrupted, especially between 5 h. 20 m. and 5 h. 40 m., to the minimum at 7 h. 55 m. There was then a marked rise, occasionally interrupted, until 11 h. The trace received stopped about $13\frac{1}{2}$ h., when a gradual fall had been in progress for $1\frac{1}{2}$ hours. The normal diurnal variation at Agincourt in September and October shows an inconspicuous secondary minimum about 8 h. with two not very widely different maxima about 11 h. and 22 h., the principal and much the more conspicuous minimum occurring between 15 h. and 16 h. Thus the trace on the present occasion exhibited not very well defined maxima about the usual times. But instead of the usual intermediate poorly defined minimum, there was a conspicuous minimum, with a lower value of H than that usually encountered at the principal minimum. In the D trace neither the s.c. nor the "crest" was more than faintly indicated, there being almost no sign of disturbance until after 4 h. on October 1. Between 4 h. 10 m. and

5 h. 30 m. there was a considerable bay (easterly deflection), an easterly movement of $7\frac{1}{2}'$ being followed by a westerly movement of $9'$. Between 5 h. 30 m. and 9 h. 15 m. the needle swung $22\frac{1}{2}'$ to the East. This movement was slightly interrupted at intervals near 6 h., 7 h., 8 h. and 9 h., as if an oscillation of small amplitude with a period of nearly an hour were superposed on an easterly drift. Between 9 h. 15 m. and 10 h. 30 m. there was a smart recovery of $15\frac{1}{2}'$. On a normal day the extreme easterly position is not reached until 13 h., and there is but little movement before 8 h. In short the principal disturbance occurred in what were at Agincourt the early morning hours, when the normal changes are very small.

At Eskdalemuir after the s.c. there was little further sign of disturbance until $2\frac{1}{2}$ h. on October 1, when some activity appeared. There were some slow undulatory movements in N, and short-period oscillations were numerous between 11 h. and 17 h., but there was no striking movement. The principal feature was the depression of the element for some hours before and after the normal hour of minimum, representing practically an enhancement of the usual diurnal variation. After 18 h. N was practically quiet. The maximum in E presented itself several hours earlier than usual. From 6 h. to 16 h. E was considerably below its normal value (*i.e.*, W was numerically enhanced), the minimum occurring about the usual hour. After 17 h. E was practically quiet. The V trace showed a sensible depression from 5 h. to 12 h., but the gradient was everywhere very slight.

The trace received from Sitka extended only from $1\frac{1}{2}$ h. to 17 h. on October 1, and so did not show the s.c. movement. The observatory publication shows, however, that the trace received included all the principal maxima and minima. Until 4 h. there were only minor oscillations. Considerable disturbance then presented itself in all the elements, and the traces remained highly oscillatory most of the time, the V trace being unusually oscillatory for it.

The H trace contained numerous short-period oscillations, and a succession of considerable oscillations of longer period, but its general trend was clearly downwards from 6 h. to 11 h., and thereafter clearly upwards until 15 h. or 16 h. The most rapid of the large movements was a rise of 100γ between 11 h. 2 m. and 11 h. 8 m., introducing the recovery after the minimum. The minimum in H occurred two hours after local midnight, an hour when the normal diurnal changes are exceedingly slow. Short-period oscillations though numerous were less prominent in the Sitka D trace, but longer period oscillations were somewhat conspicuous. There was a continual succession of them from 5 h. to 12 h., superposed on a general drift of the needle to the East. Owing to the drift, the swings to the East appear larger than those to the West. Thus between 5 h. 40 m. and 6 h. 50 m. we have swings of $15'$ E and $13'$ W, between 6 h. 50 m. and 7 h. 50 m. swings of $16'$ E and $9'$ West, and between 7 h. 50 m. and 8 h. 30 m. swings of $13\frac{1}{2}'$ East and $10'$ West. These were amongst the largest of the oscillations. In the cases selected, the turning point which represented westerly maxima were particularly clearly indicated, and the intervals between successive turning points were markedly different. The Sitka V trace was nearly level until 4 h.

when a rise set in, which continued with only slight interruption until the maximum at 6 h. 3 m. Subsequently until 13 h. there were numerous short-period oscillations, some of considerable size. The fall from the maximum to the minimum at 11 h. 0 m. and the subsequent recovery were considerably interrupted, and the curve had less than usual of the pyramidal appearance customary during large V disturbances at Sitka. A somewhat rapid recovery had been in progress for an hour when the trace stopped.

Small short-period oscillations were fairly in evidence at most of the stations, but if we except Sitka the larger movements were of a comparatively non-oscillatory character. At the stations at which the disturbance was active during hours when the diurnal changes are normally considerable, the phenomena represented in the main an intensification of the normal diurnal variation. Disturbance was not, however, especially developed at these stations, as the ranges recorded at Honolulu, Agincourt and Sitka compare well with the others. As usual, the disturbance in H or N was markedly larger than in the other elements at Buitenzorg, Alibag, Honolulu and Helwan; but at Agincourt and Sitka the disturbance in D was of similar order. As on various previous occasions V at Sitka had a larger range than H or D at that station, or than V in the Antarctic.

Section 134.—In the Antarctic on October 12, 1912, conditions became gradually more disturbed after 16 h. The N′ trace remained quiet until 23 h., but for some hours previously the behaviour of the instrument is open to suspicion. A deflection experiment made about 23 h. was accompanied by a discontinuity, and subsequently activity suddenly appeared. This suggests that the magnet had been sticking. Between 23 h. on the 12th and 1 h. on the 13th there were some rapid oscillations. From 3 h. on the 13th until the maximum at 11 h. 6 m. the general trend of N′ was upwards, and there were only small interruptions. Thus in the main there was simply an enhancement of the normal diurnal change. The E′ trace was decidedly oscillatory from 20 h. to 24 h. on the 12th. Between 23 h. 30 m. on the 12th and 0 h. 5 m. on the 13th there was a fall of 68γ and rise of 71γ synchronous with considerable movements in N′ and V. Up to 5 h. 40 m. on the 13th there was a general rise, interrupted by short-period oscillations. This rise may be regarded as an enhancement of that natural to the time of day. There were rather conspicuous movements, a rise of 52γ and fall of 90γ, between 5 h. 25 m. and 6 h. 0 m. The movements in V were of no great size, but short-period oscillations were rather prominent between 19 h. on the 12th and 1 h. on the 13th.

At Mauritius the largest H movements were a rise of 14γ between 23 h. 30 m. on the 12th, and 0 h. 5 m. on the 13th, a fall of 13γ between 5 h. 30 m. and 5 h. 50 m., and a fall of 16γ between 9 h. 20 m. and 11 h. 15 m. The last represented part of a bay extending from 9 h. 20 m. to about 12 h. 40 m. The ordinary diurnal inequality at Mauritius contains a fall of H between 9 h. and 11 h., but not so large as the above; also in the normal day H continues to fall for some hours after 12 h. The D trace showed little beyond the normal changes.

TABLE CLXXXVI.—20 h. October 12 to 12 h. October 13, 1912. Plate LIX.

Station.	Element.	Times of Maximum.		Times of Minimum.		Disturbance Range.	Inequality Range.
		h.	m.	h.	m.	γ	γ
Antarctic	N′	11	6 (13th)	23	50 (12th)	216	54
	E′	5	40 (13th)	23	50 (12th)	246	76
	V	0	2 (13th)	11	50 (13th)	109	42
Mauritius	H	0	5 (13th)	11	15 (13th)	36	15
	D	10	20 (13th)	5	30 (13th)	46	37
Buitenzorg	N	0	55 (13th)	9	45 (13th)	53	33
	E	5	40 (13th)	2	25 (13th)	34	48
	V	5	35 (13th)	0	45 (13th)	32	32
Alibag	H	5	35 (13th)	11	10 (13th)	46	44
Helwan	H	0	5 (13th)	6	10 (13th)	44	21
	D	6	10 (13th)	23	50 (12th)	42	42
	V	5	50 (13th)	9	5 (13th)	21	20
Agincourt	H	22	45 (12th)	1	55 (13th)	36	6
	D	2	5 (13th)	6	20 (13th)	97	25
Eskdalemuir... ...	N	23	36 (12th)	10	36 (13th)	77	31
	E	1	32 (13th)	23	47 (12th)	76	24
	V	9	25 (13th)	0	8 (13th)	48	14

The traces received from Buitenzorg stopped before 10 h. on the 13th. Thus the ranges in Table CLXXXVI may have been slightly exceeded. Short-period oscillations occurred in the N and E curves, especially between 0 h. and 1 h. on the 13th, but the only movements of any prominence occurred between 5 h. and 6 h. In N there was a fall of 24γ between 5 h. 30 m. and 5 h. 50 m. This was followed by a small recovery, interrupting the fall natural to the hour. The E and V curves also had movements at the same time, which were distinctive though not large. In E the movement took the shape of an acceleration between 5 h. 30 m. and 5 h. 40 m. of the rise naturally in progress, and a smaller reverse movement between 5 h. 40 m. and 5 h. 50 m., the curve then resuming its natural trend upwards. The V trace, after reaching a rounded maximum (algebraic) about 5 h. 35 m. on the 13th, showed a rather marked fall of 11γ during the next 25 minutes.

At Alibag the only movement which appeals to the eye in the H trace was a fall of 17γ between 5 h. 35 m. and 5 h. 55 m. on the 13th.

At Helwan, except for a rise of 20γ between 23 h. 25 m. and 23 h. 45 m. on the 12th, and a fall of 16γ between 5 h. 35 m. and 5 h. 55 m. on the 13th, the H trace was almost of normal quietness. The D trace, though mostly very quiet, contained a well-marked bay (westerly deflection) between 23 h. 30 m. on the 12th and 0 h. 20 m. on the 13th. The westerly and easterly movements were each about $2\frac{1}{2}'$. The V trace showed a slight dimple (depression) at the same time as the bay in D, but was generally very quiet. It contained, however, a slight undulation commencing about $5\frac{1}{2}$ h. on the 13th.

At Agincourt H remained as quiet as usual until 23 h. 20 m. on the 12th. After that there was a succession of bays (depressions) indenting the curve, but none of any great depth. In the first and largest, extending from 23 h. 20 m. on the 12th to 0 h. 30 m. on the 13th, there was a fall of 27γ and rise of 16γ. In the last, extending from 5 h. 30 m. to 6 h. 20 m. on the 13th, there was a fall of 12γ and rise of 18γ. After this there was little sign of disturbance in H. The D trace was very quiet until 23 h. 25 m. on the 12th, when a large bay (easterly deflection) commenced, which continued until 0 h. 40 m. on the 13th. The movements to East and to West were each $15\frac{1}{2}'$, but the easterly movement was the more rapid. Between 1 h. 40 m. and 2 h. 30 m. there were movements of $15\frac{1}{2}'$ to the East and $12'$ to the West. There were some minor bays, including one with easterly deflection from 3 h. to 4 h., a second with westerly deflection from 6 h. 10 m. to 6 h. 40 m., and a third protracted one with westerly deflection from $10\frac{1}{4}$ h. to 12 h. Between 5 h. and 6 h. the trace was almost quiet.

At Eskdalemuir between 23 h. 30 m. on the 12th and 0 h. 15 m. on the 13th N rose 28γ and fell 38γ. There was a protracted bay (depression of N) of no great depth between 1 h. 15 m. and 3 h. 45 m. on the 13th, and another of trifling depth between 10 h. 20 m. and 12 h. Between 5 h. 30 m. and 6 h. there were some minor oscillations. The E trace showed one considerable oscillation between 23 h. 15 m. on the 12th and 0 h. 25 m. on the 13th, the fall and rise, about 75γ, being approximately equal. There was a trifling oscillation between 5 h. 40 m. and 6 h.

The disturbance of October 12–13, 1912, was not a large one, but it included movements between 23 h. on the 12th and 1 h. on the 13th, and between $5\frac{1}{2}$ h. and 6 h. on the 13th, which were fairly in evidence at most stations. In the Antarctic the earlier disturbance was the better developed, and the same was true of Helwan, Agincourt and especially of Eskdalemuir. The disturbance between $5\frac{1}{2}$ h. and 6 h. on the 13th was, however, more in evidence at Buitenzorg and Alibag. At Mauritius the earlier disturbance was somewhat the larger, but the later was the more rapid.

Section 135.—In the Antarctic conditions had been fairly quiet for some hours before the disturbance of October 14–15, 1912. The N′ and V curves remained quiet until after $7\frac{1}{2}$ h. on the 14th, and in E′ prior to that hour the only abnormal feature was the exceptional rapidity of the rise after 6 h. Between 7 h. 34 m. and 8 h. 30 m. there was a disturbance of the special type, already dealt with in Table CXL. This was followed by a series of less regular oscillations of moderate variable periods, having superposed on them shorter period oscillations. In N′ between 12 h. 40 m. and 13 h. 30 m. there was a rise and fall each of 116γ. Between 13 h. 45 m. and 14 h. 35 m. N′ rose 102γ and fell 130γ. Between 14 h. 35 m. and 16 h. 15 m. it rose 133γ and fell 112γ. This rise and fall were both considerably interrupted. Between 23 h. 25 m. on the 14th and 1 h. 25 m. on the 15th there was a somewhat conspicuous bay (depression in N′), the fall and rise being each approximately 157γ. After this the longer period oscillations tended to disappear. E′ was similarly disturbed to N′. At times, *e.g.*, between 12 h. 40 m. and 14 h. 35 m. on the 14th, the two traces seemed to be rather closely in phase, E′ and N′ rising and falling together; but at this time the E′ oscillations were decidedly the smaller. After the minimum at 21 h. 3 m. E′ was less oscillatory, but the rise at times was rapid. Thus between 21 h. 3 m. and 21 h. 33 m. there was a rise of 131γ. Between 23 h. 35 m. on the 14th and 1 h. 10 m. on the 15th there was a total rise of 197γ. The V trace also contained a good many oscillations, but these were much smaller than those in N′ and E′. Perhaps the largest was a rise of 41γ and fall of 71γ between 21 h. 3 m. and 21 h. 43 m. on the 14th.

At Mauritius, after the maximum at 6 h. 30 m. on the 14th, there was a very gradual fall of H, interrupted at times, until 13 h. 10 m. During the next 2 hours there was a slight recovery. Between 15 h. 5 m. and 16 h. 0 m. there was rather a sharp fall of 24γ. Between 17 h. 0 m. and 19 h. 10 m. there was a prominent oscillation, H rising 42γ and falling 41γ. There was another similar oscillation between 20 h. 20 m. and 22 h. 20 m., H rising 42γ and falling 29γ. The D trace showed little beyond the normal diurnal change. There was, however, a sensible oscillation, $1\frac{1}{2}'$ to West then $1\frac{1}{2}'$ to East, between 16 h. 45 m. and 17 h. 50 m., and the trace was slightly undulatory between 18 h. and 22 h.

At Buitenzorg there were quick-run curves from 9 h. 53 m. to 13 h. 54 m. on the 14th, and from 22 h. 57 m. on the 14th to 6 h. 49 m. on the 15th. N was falling at 6 h. on the 14th, as was natural at the hour, but shortly thereafter the motion accelerated. The fall between 6 h. and 8 h. 15 m. amounted to 48γ. During the next $1\frac{1}{4}$ hours there was a slight recovery, so that the curve had a considerably indented outline. Oscillations then followed. Between 10 h. 45 m. and 12 h. 0 m. N rose 20γ and fell 13γ, and between 13 h. 20 m. and 14 h. 20 m. it rose 26γ and fell 12γ. The most prominent oscillation, however, was a rise of 41γ and fall of 31γ between 20 h. 20 m. and 21 h. 45 m., the rise occupying only about 25 minutes. There was an earlier considerable oscillation between 16 h. 45 m. and 19 h. 10 m., with a rise of 30γ and fall of 25γ. The E and V traces showed only some minor oscillations. In V two of these coincided fairly in time with the oscillations last mentioned in H. In the earlier, between 16 h. 45 m. and 19 h. 10 m., the rise and fall in V were each about 10γ. In the later, between 20 h. 20 m. and 22 h. 0 m., there was a rise of 16γ and fall of 13γ.

At Alibag between 6 h. 30 m. and 10 h. 40 m. on the 14th H fell 57γ. Until this time, except for the large size of the fall, there was little suggestion of disturbance. But subsequently the curve became wavelike, the amplitudes and periods of the oscillations varying. Two of the oscillations were much more prominent than the others. During the first of these, between 16 h. 50 m. and 19 h. 15 m., H rose 47γ and fell 43γ. During the second, between 20 h. 25 m. and 22 h. 30 m., H rose 48γ and fell 43γ. In both cases the rise was considerably the faster movement. Conditions were normally quiet by 24 h.

At Helwan the H trace was practically level from 6 h. until 8 h. on the 14th, when small oscillations of long period presented themselves. There was no considerable movement until an oscillation which lasted from about 17 h. to 19 h. 10 m. During it H rose 58γ and fell 58γ. A similar oscillation occurred between 20 h. 20 m. and 22 h. 20 m., during which H rose 56γ and fell 49γ. A third oscillation—also recognisable at Alibag, but relatively smaller there—occurred between 22 h. 20 m. on the 14th and 0 h. 20 m. on the 15th, H rising 31γ and falling 27γ. The D trace showed some smaller oscillations. During the most prominent, between 20 h. 15 m. and 21 h. 5 m., a swing of $3\frac{1}{2}'$ to the East was followed by a swing of 4′ to the West. The next most prominent oscillation occurred between 23 h. and 24 h.; it consisted of an easterly swing of $2\frac{1}{2}'$ followed by an equal westerly swing. The V trace also showed a succession of undulations, two much larger than the others. During the first of these, between 17 h. 0 m. and 18 h. 25 m. V fell 20γ and rose 20γ. During the second, between 20 h. 25 m. and 21 h. 45 m. V fell 25γ and rose 25γ.

At Agincourt the H curve was very quiet from 5 h. to 6 h. on the 14th. But shortly after 6 h. it became a little disturbed, and disturbance continued without intermission until 2 h. on the 15th. The next three hours were only slightly disturbed, but from 5 h. until after 6 h. on the 15th there were moderate oscillations. The disturbance in H, though persistent most of the time, was not very striking. The most conspicuous movements were a rise of 53γ between 18 h. and 18 h. 50 m., an oscillation consisting of an interrupted fall of 53γ and a rise of 40γ between 20 h. 20 m. and 21 h. 50 m., an oscillation consisting of a rise of 75γ and a fall of 53γ between 23 h. 50 m. on the 14th and 0 h. 40 m. on the 15th, and a rise of 38γ between 0 h. 40 m. and 1 h. 30 m. D became considerably disturbed after $7\frac{1}{2}$ h. on the 14th. Between 7 h. 45 m. and 10 h. 15 m. there was a considerable bay, composed of an easterly movement of $11\frac{1}{2}'$ and westerly movement of 9′. Between 10 h. 15 m. and 11 h. 5 m. there was an easterly swing of $7\frac{1}{2}'$. Less regular movements of shorter period and smaller amplitude followed. Much the most prominent D movements occurred between 23 h. 30 m. on the 14th and 1 h. 35 m. on the 15th. They consisted of the following swings, making a sort of double bay: $33\frac{1}{2}'$ to East, 28′ to West, $14\frac{1}{2}'$ to East and 16′ to West. After 1 h. 50 m. the trace was nearly level until 5 h. During the next 2 hours two oscillations occurred, but their amplitudes were only 2′ or 3′.

At Eskdalemuir the N trace shows a decided bay (depression) between 7 h. and 9 h. on the 14th, the fall between 7 h. and 8 h. 5 m. amounting to 35γ. A quiet time intervened from 10 h. to 12 h. While there were no very large movements between 12 h. and 17 h., N was decidedly disturbed. Between 17 h. 10 m. and 18 h. 20 m., N rose 134γ and fell 131γ. Between 19 h. 40 m. and 20 h. 30 m., it fell 71γ. Between 20 h. 30 m. and 21 h. 30 m. there was a rise of 147γ and fall of 143γ. Between 23 h. 5 m. and 24 h. there was a fall of 113γ, and between 0 h. 0 m. and 1 h. 0 m. of the 15th there was a rise of 74γ. The E trace was normally quiet until 7 h. on the 14th. Between 7 h. 30 m. and 9 h. 20 m. there was a slight but decided hump (algebraic fall of E). Between 10 h. and 16 h. the disturbance in E was trifling, and decidedly less than that in N. Between 17 h. 5 m. and 18 h. 5 m. there was a deep bay, with a rise (numerical fall) of 128γ, and fall of 104γ. At 20 h. 12 m. there was a small but very rapid fall resembling an s.c. Between 20 h. 20 m. and 21 h. 20 m. there was a rise (numerical fall) of 160γ and fall of 125γ, and between 22 h. 25 m. on the 14th, and 0 h. 40 m. on the 15th there was a rise of 91γ and fall of 142γ. After 2 h. there were only small short-period oscillations. The V trace showed a very slight bay (depression) between 8 h. and 10 h. Between 10 h. and 15 h. the trace appeared normal. Between 17 h. and 18 h. there was a rise of 24γ and fall of 28γ. Between 20 h. 25 m. and 20 h. 40 m. there was a rather sharp rise of 18γ, followed between 20 h. 40 m. and 21 h. 20 m. by a fall of 57γ. Between 23 h. 40 m. on the 14th and 0 h. 25 m. on the 15th there was a further fall of 33γ, forming the introduction to a bay (depression of V), the recovery from which gradually slackened but remained perceptible until after 3 h. The trace was very quiet after 4 h.

TABLE CLXXXVII.—6 h. October 14 to 6 h. October 15, 1912. Plate LX.

Station.	Element.	Times of		Disturbance Range.	Inequality Range.
		Maximum.	Minimum.		
		h. m.	h. m.	γ	γ
Antarctic	N′	13 8 (14th)	0 15 (15th)	336	59
	E′	8 8 (14th)	21 3 (14th)	477	76
	V	2 33 (15th)	13 47 (14th)	162	45
Mauritius	H	6 30 (14th)	16 0 (14th)	62	21
	D	10 10 (14th)	3 30 (15th)	46	37
Buitenzorg	N	2 55 (15th)	13 20 (14th)	75	39
	E	8 0 (14th)	2 30 (15th)	52	48
	V	5 50 (15th)	0 50 (15th)	48	32
Alibag	H	6 30 (14th)	16 30 (14th)	77	44
Helwan	H	20 50 (14th)	19 5 (14th)	59	23
	D	20 50 (14th)	11 55 (14th)	81	42
	V	15 55 (14th)	20 50 (14th)	26	20
Agincourt	H	11 50 (14th)	23 50 (14th)	85	29
	D	24 0 (14th)	17 50 (14th)	179	36
Eskdalemuir... ...	N	17 43 (14th)	23 58 (14th)	185	31
	E	20 39 (14th)	14 8 (14th)	219	29
	V	17 27 (14th)	0 21 (15th)	102	24
Sitka	H	7 48 (14th)	21 19 (14th)	117	20
	D	10 41 (14th)	21 23 (14th)	158	23
	V	0 19 (15th)	13 18 (14th)	201	5

At Sitka conditions had been quiet for some hours before 6 h. on the 14th, and V continued quiet until 7½ h. Shortly after 6 h., some signs of disturbance appeared in H, and still more in D. From then until nearly 2 h. on the 15th there was continuous disturbance. The ranges in Table CLXXXVII are in this case rather a misleading guide to the extent of the disturbance. There were no very large departures from the normal in either direction, but there were a number of considerable oscillations, especially in D, and for part of the time in V. Between 7 h. 30 m. and 8 h. 20 m. H rose 58γ and fell 75γ. Between 15 h. 20 m. and 16 h. 0 m. it fell 56γ, and between 16 h. 50 m. and 17 h. 30 m. it again fell 40γ. Between 17 h. 30 m. and 18 h. 30 m. there was a rise, somewhat interrupted, of 56γ. Between 19 h. 10 m. and 22 h. 55 m. there was an irregular indented bay (depression of H), a fall of 69γ taking place between 19 h. 10 m. and 21 h. 20 m., and a rise of 80γ between 21 h. 20 m. and 22 h. 55 m. Short-period oscillations were particularly prominent in the H curve between 17 h. on the 14th and 2 h. on the 15th. In D between 6 h. 40 m. and 8 h. 5 m. on the 14th there was an easterly swing of $19\frac{1}{2}'$, followed by a westerly swing of $16\frac{1}{2}'$. Smaller movements followed from 8 h. 5 m. to 9 h. 5 m. Up to this time the movements in the three elements showed no sort of parallelism. But after 9 h. 5 m., for about 6 hours, there was a truly remarkable connection between the D and V movements, the elements remaining approximately in phase throughout a succession of large oscillations, swings to the West going with increase in V. The one trace is a rough image of the other. Between 9 h. 40 m. and 11 h. 30 m. we have in D an easterly movement of $20\frac{1}{2}'$ and westerly movement of $18\frac{1}{2}'$, associated with a fall of 83γ and rise of 60γ in V. Between 11 h. 30 m. and 12 h. 55 m. we have an easterly movement of $11'$ and westerly movement of $15'$, associated with a fall of 60γ and rise of 49γ in V. Between 12 h. 55 m. and 14 h. 5 m. we have an easterly movement of $16'$ and westerly movement of $10'$, while V fell 62γ and rose 65γ. Between 14 h. 5 m. and 15 h. 10 m. there was an easterly movement of $6'$ and westerly movement of $8\frac{1}{2}'$, V falling 14γ and rising 32γ. During the next two hours D had a westerly tendency, while V tended to fall. But superposed on these general movements there were several minor oscillations in both traces, which showed an approach to agreement in phase as before. After 17 h. D became more disturbed again, a succession of five bays appearing between 17 h. 10 m. and 21 h. 25 m. The durations of the bays and the amplitudes of the successive movements were as follows :—80 minutes, $11\frac{1}{2}'$ E, $10\frac{1}{2}'$ W ; 45 minutes, $5'$ E, $4'$ W ; 45 minutes, $4\frac{1}{2}'$ E, $5'$ W ; 40 minutes, $4'$ E, $6\frac{1}{2}'$ W ; 45 minutes, $5'$ E, $9'$ W.

After 17 h. 40 m. V had been rising almost continuously, and this went on, with minor interruptions, until 0 h. 20 m. on the 15th. The rate was considerably accelerated after 23 h. 40 m., the rise in the course of the next 40 minutes amounting to 65γ. From 0 h. 20 m. to 1 h. 20 m. on the 15th V fell 68γ. Between 0 h. 0 m. and 0 h. 30 m. D moved $14'$ to the east. After 2 h., while there were short period oscillations of small amplitude, there was no serious disturbance until after 8 h.

The activity of disturbance on October 14 to 15, 1912, at Mauritius, Buitenzorg, Alibag, Helwan, Agincourt and Eskdalemuir was mainly confined to two or three comparatively short intervals. At Mauritius, Buitenzorg, Alibag and Helwan disturbance was conspicuously larger during the two periods 17 h. to 19 h. and $20\frac{1}{3}$ h. to $22\frac{1}{3}$ h. on the 14th than at any other time. Agincourt and Eskdalemuir, while showing special disturbance at these two periods, showed disturbance of the same order during a third period near 24 h. In fact, at Agincourt the disturbance near 24 h. was decidedly the largest. This disturbance near 24 h. is recognisable in the curves at the more southern stations, especially at Helwan, but is comparatively small. In the Antarctic and at Sitka the activity of disturbance was much more uniformly distributed, and on the whole the maximum of activity preceded 17 h. on the 14th, and so came at a time when the stations at intermediate latitudes were comparatively undisturbed. The disturbance component perpendicular to the magnetic meridian was relatively more important than usual. According to the ranges in Table CLXXXVII, the horizontal components of disturbance were larger at Eskdalemuir than at Sitka, an unusual phenomenon, but active disturbance was much more persistent at the latter station than at the former. V disturbance was more active at Sitka than in the Antarctic. It was quite of a different order at Sitka from what it was at any of the other stations outside the Antarctic.

Section 136.—The disturbance of October 20 to 21, 1912, had an s.c. at about 17 h. 20 m. on the 20th, which has been already dealt with.

The s.c. movement in the Antarctic was of unusually short duration, and the two movements composing it were unusually alike in size. Though there were no really large movements in the Antarctic, quite a lively disturbance continued until 1 h. on the 21st. Short-period oscillations had existed for some hours before the s.c., and they were still more active for some time after it. Between 18 h. 30 m. and 18 h. 40 m. N′ rose 85γ, and between 18 h. 40 m. and 19 h. 40 m. it had a total fall of 123γ. Between 23 h. 10 m. on the 20th and 0 h. 15 m. on the 21st there was a bay (algebraic depression of N′), with a fall of 82γ and rise of 82γ. The E′ trace was very oscillatory until 22½ h. on the 20th. Between 22 h. 25 m. on the 20th and 0 h. 35 m. on the 21st there were the following larger movements, with short-period oscillations superposed: -87γ, $+63\gamma$, -63γ, $+89\gamma$ and -63γ. The V trace contained a good many short-period oscillations until after 22 h. on the 20th. Between 23 h. 5 m. on the 20th and 0 h. 55 m. on the 21st V rose 122γ and fell 83γ.

At Mauritius, apart from the s.c. itself, and the "crest" which persisted for fully an hour, there was very little disturbance. The H trace contained a slight hump (elevation of H) from 22½ h. on the 20th to 0 h. 45 m. on the 21st, and there was a trifling bay (easterly deflection) in the D trace between 23 h. 10 m. on the 20th and 0 h. 10 m. on the 21st.

At Buitenzorg there were short-period oscillations in N until after 24 h. on the 20th, but after 20 h. none of the traces contained any considerable movement.

At Alibag after 20 h. on the 20th there were only small oscillations.

At Honolulu the ranges were relatively larger than usual, especially in V, but, apart from small short-period oscillations, there were few signs of disturbance.

Conditions at Helwan were very similar to those at Alibag.

At Agincourt the H curve contained numerous short-period oscillations up to 23 h. on the 20th, but there was little sign of disturbance after 1 h. on the 21st. The D trace, except during the actual s.c. and for a short time before 24 h. on the 20th, was practically quiet.

TABLE CLXXXVIII.—17 h. October 20 to 1 h. October 21, 1912. Plate LX.

Station.	Element.	Times of Maximum.	Times of Minimum.	Disturbance Range.	Inequality Range.
		h. m.	h. m.	γ	γ
Antarctic	N′	18 43 (20th)	23 40 (20th)	180	57
	E′	20 37 (20th)	17 20 (20th)	110	19
	V	0 2 (21st)	23 3 (20th)	122	29
Mauritius	H	17 25 (20th)	19 50 (20th)	21	12
	D	17 25 (20th)	0 30 (21st)	14	3
Buitenzorg	N	0 10 (21st)	17 0 (20th)	32	10
	E	23 10 (20th)	1 0 (21st)	20	2
	V	17 30 (20th)	0 45 (21st)	16	4
Alibag	H	17 25 (20th)	19 20 (20th)	25	6
	D	19 20 (20th)	1 0 (21st)	14	8
	V	19 10 (20th)	17 25 (20th)	8	5
Honolulu	H	22 3 (20th)	17 10 (20th)	28	12
	D	18 0 (20th)	23 39 (20th)	44	29
	V	17 28 (20th)	21 53 (20th)	40	19
Helwan	H	17 25 (20th)	19 20 (20th)	29	4
	D	23 55 (20th)	17 50 (20th)	14	3
	V	19 20 (20th)	17 25 (20th)	15	2
Agincourt	H	21 35 (20th)	17 0 (20th)	42	26
	D	17 25 (20th)	19 15 (20th)	20	28
Eskdalemuir... ...	N	17 25 (20th)	17 20 (20th)	34	7
	E	23 54 (20th)	18 1 (20th)	38	8
	V	22 33 (20th)	17 25 (20th)	11	8
Sitka	H	23 37 (20th)	19 1 (20th)	26	14
	D	17 27 (20th)	23 39 (20th)	51	23
	V	23 39 (20th)	19 29 (20th)	14	5

At Eskdalemuir, after the s.c., the N and E curves were unrestful rather than disturbed, small oscillations being visible until after 1 h. on the 21st.

At Sitka small oscillations were present in the H and D curves before the s.c., and after it they were more in evidence, especially in D. There were somewhat larger movements between 23 h. 20 m. on the 20th and 0 h. 20 m. on the 21st, an hour during which there were also larger movements in the Antarctic.

October 20–21, 1912, is a case when a disturbance followed immediately after an s.c., but came to very little except in the Antarctic, and even there was of very moderate amplitude. In this instance Sitka and Agincourt showed no marked excess of disturbance over the other co-operating stations. The range in V at Sitka was below the average, a most unusual feature.

CHAPTER XIV.

COMPARISON OF MAGNETIC DISTURBANCE AND AURORA.

Section 137.—Large magnetic disturbance and aurora are both rare events in the South of England. Thus the fact that aurora is seldom if ever seen there unaccompanied by considerable magnetic disturbance seems sufficient evidence of some connection between the two phenomena. In higher latitudes, where aurora and large magnetic disturbance are comparatively common, evidence of inter-relationship is more conflicting. On the one hand, Arctic observers have described definite movements of the compass needle as associated with the passage overhead of auroral curtains. On the other hand, comparisons of magnetic curves with aurora have shown that the times of greatest intensity of development in the two phenomena by no means always accord. This is the conclusion to which I came when discussing the magnetic and auroral phenomena observed in the Antarctic in 1902–03,* and similar conclusions have been reached at various times by Arctic observers.

In 1911–12, during the months when aurora could be seen, hourly observations were made at Cape Evans, omitting a few hours near mid-day. Books in which the results of observation had been entered or copied were put at my disposal by Captain C. S. Wright, to whose co-operation in this investigation I am much indebted. On some days a good many observations failed to be taken. There were times of course of persistent blizzard, when the absence of visible aurora could be taken for granted, and there was a good deal of overcast weather, especially in 1912. Besides observations at or within a few minutes of exact hours, there were not infrequent entries of aurora at intermediate times. On nights of specially brilliant aurora, it was natural for some one to view the heavens at other than the statutory times of observation, but no inference could safely be drawn as to the presence or absence of aurora unless an explicit statement occurred in the books. This is one of the reasons why it is difficult to estimate the parallelism between the two phenomena. Naturally only a small fraction of the most conspicuous magnetic movements occur within a few minutes of an exact hour. Thus when auroral observations occur only at hourly intervals, the chance of seeing what auroral phenomenon corresponds to the most rapid magnetic change during a magnetic storm is not great. It is in fact difficult to see how a really satisfactory comparison of the two phenomena can be made without something equivalent to continuous registration of aurora.

Section 138.—Taking the auroral observations at Cape Evans in 1911, I attacked

* National Antarctic Expedition, 1901-04. Magnetic Observations, pp. 193-200.

the problem in various ways. First I took out the hours of the most notable aurora and examined the corresponding magnetic curves. Then I took out the shorter-period magnetic storms and considered the corresponding auroral observations. In the case of disturbances of the "special type," the result was disappointing. It was only in a small minority of instances that definite information was forthcoming. In the following cases aurora certainly occurred :—

Date.	Disturbed interval (Time of 180° E.).	Aurora seen at
1911.		
May 2	20 h. 19 m. to 21 h. 10 m. ...	21 h. 0 m.
May 20	20 h. 25 m. to 20 h. 58 m. ...	20 h. 40 m.
July 18	18 h. 36 m. to 19 h. 43 m. ...	19 h. 30 m.

On the other hand, on May 3, 13 and 19, 1911, there were disturbances of the "special type," during each of which one observation was made and no aurora was visible. In the great majority of instances there was no information as to aurora. Many of the disturbances occurred at hours of the day when there were no auroral observations. Others missed the hours of observation. In other cases again the sky was overcast or there was bright moonlight.

Of the short-period disturbances described in Chapter XI, ten occurred during the winter months of 1911. The results for these were as follows, the times being all G.M.T.

April 30, 7 h.–10 h.—The entry under each of the hours, 7 h., 8 h., 9 h. and 10 h. is "clear, no aurora." This, it may be said at once, is the one case in which one of these marked bay-like disturbances of general incidence would seem to have been unaccompanied by visible aurora. Curiously, however, it was preceded by a "fairly brilliant aurora" visible for about 10 minutes shortly after 6 h.

May 16, 2 h.–8 h.—Conspicuous aurora was noted several times during this disturbance. At 3 h. 30 m. there was a very bright yellow curtain, changing rapidly in form. Again at 5 h. 18 m. there is a note of a bright corona, slightly to N.E. of the zenith, in rapid rotation. This answers in time to the centre of a very deep bay in the Antarctic curves.

May 21, 9 h.–12 h.—Observations made a few minutes after 9 h. and at 12 h.—*i.e.*, just before the disturbance proper began and shortly after it was practically over—showed no aurora, but aurora is recorded as seen on five occasions between 9 h. 55 m. and 11 h. At 10 h. 10 m. and 10 h. 25 m. it was bright or very bright.

June 5, 7 h.–10 h.—No aurora was seen, but the sky was overcast at all the times of observation.

July 3, 7 h.–10 h.—There was no aurora at 6 h. The next observation, at 8 h., showed aurora varying from faint to moderately bright. At 9 h. no aurora was seen, but the sky was then hazy.

July 11, 6 h.–9 h.—Blizzard is reported, but no definite observation is recorded prior to 9 h. No aurora was then seen, but only the zenith was free from cloud.

July 12, 7 h.–10 h.—No observation is entered until 11 h., but a general note remarks that it was overcast all day.

July 20, 6 h.–9 h.—Blizzard prevailed at first. The earliest observation was at 9 h., when a moderate auroral curtain was reported.

July 31, 8 h.–10 h.—At 8 h. and at 10 h. no aurora was seen, the sky being wholly or nearly clear, but aurora was reported from 9 h. 0 m. to 9 h. 30 m. From 9 h. 0 m. to 9 h. 10 m. it was fairly bright to bright, and there was both colour and motion. At 9 h. 30 m. it was faint.

August 24, 8 h.–10 h.—There was no observation until 10 h., when it was overcast with a blizzard.

It will be seen that during these ten short-period disturbances, with the exception of that on April 30, aurora was seen, when the disturbance was active, on all the occasions when the meteorological conditions were reasonably favourable. During the disturbances of May 16 and May 21, the auroral manifestations would seem to have been particularly striking at the time when magnetic disturbance was most active.

Section 139.—Next I went systematically to work and took out all the auroral observations, examining the curves at all the corresponding times. There seemed a good deal of correspondence on some days, but little if any on others. Not infrequently conditions which for the Antarctic were unusually quiet synchronised with faint aurora. Sometimes, on the other hand, there was active magnetic disturbance when the conditions were favourable for seeing aurora, and no aurora or only faint aurora was seen.

To reach some sort of definite numerical conclusion, the following method eventually suggested itself. The observers aimed at conveying the impression they derived as to the vividness of the aurora. Four degrees of intensity: very bright, bright, faint and very faint could fairly well be made out. When aurora was brighter in one direction than another it was classified according to its brightest part. So again, if there were several observations in the course of an hour, the brightest manifestation fixed the class. The magnetic "character" of each hour had been assigned long before, and was thus free from prejudice. If an auroral observation had been taken at an exact hour, or within 10 minutes of an hour, the arithmetic mean was taken of the magnetic "character" figures assigned to the 60 minutes which ended and the 60 minutes which began at the hour in question. If the interval between the observation and the nearest hour exceeded 10 minutes, the one hour's magnetic "character" was taken. In this way, answering to each auroral observation, there was a magnetic "character" figure, either 0, 0·5, 1, 1·5, or 2. On a few occasions, of course, no "character" figure could be assigned owing to lack of magnetic record. The observations were confined to the six months April to September, the observations in the first and last of these months being comparatively few. In the following Table the results for June and July form one group, and those for the other four months another, so as to bring out better the consistency that prevailed.

TABLE CLXXXIX.—Aurora in 1911 at Cape Evans and Magnetic "Character."

Months.	Auroral Intensity.	Number of Observations.	Number of occasions when Magnetic "character" was 0	0·5	1	1·5	2	Mean "Character."
June, July	I	24	4	1	7	2	10	1·27
	II	112	18	7	55	18	14	1·01
	III	102	20	11	43	21	7	0·92
	IV	13	4	4	4	1	0	0·58
April, May, August, September	I	22	2	3	6	2	9	1·29
	II	57	6	5	25	9	12	1·14
	III	118	21	15	54	13	15	0·94
	IV	15	4	2	7	2	0	0·73

The mean magnetic "character" for all hours was 0·83 for June and July, and 0·90 for the other four months. The hours when auroral observations were nearly always taken clustered round midnight, while those when observations were hardly ever taken clustered round noon. The consequence, as is obvious on considering Table LXXX, was that the average hour at which observations were taken was sensibly less disturbed than the average hour of the day. This makes the high magnetic "characters" found for the two brightest classes of aurora all the more decisive.

Combining all the months of 1911 we obtain the following percentage figures for the incidence of the several magnetic characters.

Auroral Intensity.	Magnetic "Character." 0	0·5	1	1·5	2
I	13	9	28	9	41
II	14	7	47	16	16
III	19	12	44	15	10
IV	29	21	39	11	0

Thus while 41 per cent. of the auroras of the first class were associated with magnetic "character" 2, no single aurora of the fourth class was so associated.

Treating the observations of 1912 in the same way as those of 1911, the following results were obtained:

TABLE CXC.—Aurora in 1912 at Cape Evans and Magnetic "Character."

Auroral Intensity.	Total Occurrences.	Absolute occurrences of Magnetic "Character." 0	0·5	1	1·5	2	Percentage occurrences of Magnetic "Character." 0	0·5	1	1·5	2	Mean "Character."
I	14	4	2	4	0	4	29	14	29	0	29	0·93
II	67	23	9	31	3	1	34	13	46	5	2	0·63
III	74	20	15	31	4	4	27	20	42	5	5	0·71
IV	4	3	0	1	0	0	75	0	25	0	0	0·25

The mean " character " figure for all hours of the six months April to September, 1912, was 0·77. If the results for 1912 stood alone they would hardly justify any positive conclusion. The reason, however, for the indefinite nature of the results became at once apparent on considering the incidence of magnetic " character " 2. Hours to which it had been allotted were nearly all overcast, if there was no actual blizzard in progress. There were a few exceptions, but on most of them, as it so happened, there was bright moonlight. These climatic conditions were no doubt partly responsible for the great drop in the number of auroral observations in 1912 as compared with 1911. The decline can, however, be only partly accounted for in this way, and it is at least natural to associate it also with the marked decline in magnetic disturbance described in previous chapters.

Section 140.—Besides the Cape Evans observation books I had an opportunity of studying the record made of auroral observations during 1911 at Cape Adare. Either aurora tended to be brighter at Cape Adare than at Cape Evans, or the observers at the former station had a lower standard of brightness than those at the latter. Whatever the explanation may be, it proved necessary to combine auroras described as faint at Cape Adare with those described as very faint, to get a sufficiently numerous Class IV of intensity. Auroras of Class I were pretty clearly marked. The division of those of intermediate intensity between Classes II and III was more difficult, and very probably in some cases my decision would not have recommended itself to the observers. In passing judgment I was largely guided by the numerous sketches entered in the observation book. The results obtained are given in Table CXCI.

TABLE CXCI.—Aurora in 1911 at Cape Adare and Magnetic " Character."

Auroral Intensity.	Total Occurrences.	Absolute occurrences of Magnetic " Character."					Percentage occurrences of Magnetic " Character."					Mean " Character."
		0	0·5	1	1·5	2	0	0·5	1	1·5	2	
I	69	4	4	26	14	21	6	6	38	20	30	1·32
II	92	9	8	33	19	23	10	9	36	20	25	1·21
III	170	24	20	74	36	16	14	12	44	21	9	1·00
IV	66	19	4	25	11	7	29	6	38	17	11	0·87

The apparent association here of magnetic disturbance and aurora is quite as close as in Table CXC. This may at first sight appear a little surprising. But it should be remembered that whatever may be true of aurora, magnetic disturbance is in general not a local phenomenon. We may be reasonably certain that though Cape Adare and Cape Evans were several hundred miles apart, hours that were highly disturbed magnetically at Cape Evans were with rare exceptions also highly disturbed at Cape Adare.

At Cape Adare, unlike Cape Evans, regular observations were usually confined to the even hours. Even allowing for this, the number of cases in which the auroral observations utilised at the two stations answered to the same hour was less than might have been expected. The way in which auroral intensity was classified for these common occasions was as follows :

Cape Evans Intensity.	Cape Adare Intensity.				Total.
	I.	II.	III.	IV.	
I	3	4	5	3	15
II	5	13	15	7	40
III	5	11	17	9	42
IV	0	2	2	1	5
Total	13	30	39	20	102

It does not of course at all follow that it was the same aurora that was estimated at the two stations.

The mean magnetic " character " for the 12 occasions when the auroral intensity estimate was either (I, I), (I, II) or (II, I) was 1·7, while the corresponding mean for the 12 occasions on which the estimate was either (IV, IV), (III, IV) or (IV, III) was only 0·8.

Section 141.—Captain Wright had the kindness to supply me with a list of the days which he regarded as possessing the most intense auroral character during 1911. His knowledge of the idiosyncrasies of the individual observers makes his choice more authoritative than any I could myself have made. Uncertainties due to variability of the visual conditions of course remain. Magnetic " character " data were lacking in Table LXXIII for only two of the days. The others and their magnetic " characters " were as follows :

Date.	" Character."	Date.	" Character."	Date.	" Character."
April 28	1*i*	June 7	1	July 28	2
May 1	1	" 8	1	" 29	2
" 2	1	" 22	2	" 30	1
" 3	0	" 23	2	" 31	2
" 6	1	" 24	2	August 5	2
" 7	2	" 25	0	" 7	1
" 8	2	" 28	1	" 26	2
" 9	1	" 29	1	" 29	1
" 15	2	" 30	0	September 3	0
" 16	2	July 1	2	" 7	1
" 19	2	" 2	2	" 13	2
" 21	2	" 3	2	" 14	1
" 22	2	" 19	2	" 16	2
June 5	2	" 20	2	" 17	2
" 6	1	" 21	1	" 22	2

The mean " character " figure for these 45 days is 1·47. The corresponding mean for all days of the six months April to September, 1911, according to Table LXXIII, is 1·15.

Section 142.—What has been written above must not be regarded as in any sense a discussion of the auroral data as aurora. For that the reader must consult the full discussion which I hope Captain Wright will find time for. My original intention was to wait for that discussion before considering the bearing of auroral phenomena on magnetic disturbance, but the delay occasioned by the war has rendered the present course necessary.

It seems perfectly clear from the present investigation that the quietest magnetic conditions experienced in the Antarctic, at the quietest season of the year, may be accompanied by aurora. Throughout the most disturbed part of the year no aurora, however bright, could possibly be seen, unless of course it were visible in full daylight. What is seen as very faint aurora under favourable visual conditions has almost no chance of being seen in faint moonlight or with slight haze. Under favourable conditions at midwinter aurora seems to be generally visible at some hour of the 24 in high latitudes. The most natural inference is that the electrical conditions which when visible are known as aurora are generally, if not always, existent. If they are due to electrical discharges from the sun, then these discharges are not rare events, occurring only during so-called magnetic storms, but are every day if not hourly occurrences. They are undoubtedly much more intense on some occasions than others, but what I think is really open to doubt is whether they are ever totally absent.

None of the observation books I had seen stated explicitly what time was observed at Cape Adare. Local time there differs from that of longitude 180° E by 39·5 minutes, but this being less than for Cape Evans I supposed the same time to be observed at the two stations when calculating the results given in Section 140. After slip proofs had appeared, Capt. Wright expressed a doubt on the subject, and members of the Cape Adare party were consulted with conflicting results. The first of the meteorological volumes of the Expedition then appeared, with an explicit statement by Dr. Simpson, on p. 9, that local time was observed at Cape Adare. It was practically certain *a priori* that this could make little difference, but the calculations were repeated *de novo*, assuming local time employed at Cape Adare. The mean values obtained for the magnetic " character " answering to auroral intensities I, II, III and IV at Cape Adare were respectively 1·44, 1·23, 1·02 and 0·84. These are even more favourable than the figures in Table CXCI to a close association between magnetic disturbance at Cape Evans and auroral intensity at Cape Adare.

The auroral observations at the two stations being mostly close to the hour—time of 180° in the one case, time of 170° 9′ in the other—there were few identical times. A calculation was, however, made on the same lines as in the latter part of Sect. 140, in which observations were treated as corresponding if their real times did not differ by more than 30 minutes. As in the text, there were 12 occasions when the auroral intensity estimate was (I, I), (I, II) or (II, I), and the corresponding mean magnetic " character " was 1·75. The occasions when the estimate was (IV, IV), (III, IV) or (IV, III) were only five, and for one of them there was no magnetic trace. Thus the fact that the corresponding mean magnetic " character " was only 0·50 merits less weight. Still here, as in the previous case, the conclusions in the text are substantially borne out.

CHAPTER XV.

COMPARISONS OF INSTRUMENTS, AND INSTRUMENTAL "CONSTANTS." FIELD OBSERVATIONS, PRINCIPALLY AT CAPE ADARE.

Section 143.—The tables of D, H and I at Cape Evans in Chapter I represent the results of the absolute observations without any instrumental corrections. It appeared convenient to defer to a later stage a statement of the reasons why no corrections were applied. In an ordinary case the giving of corrections implies the general acceptance of some standard. In the case, for instance, of a measure of length, there is an international standard metre, which is believed to remain invariable to the degree of accuracy to which readings are ordinarily taken. A correction given to another metre bar is intended to make its readings when corrected accord with those of the international standard. It is believed that accordance to the degree of accuracy which the corrections profess to give can be secured in this way when a certain procedure is followed. In the case, however, of the elements of terrestrial magnetism, there is no recognised ultimate standard. The strength of a magnetic field, it is true, is defined in terms of the C.G.S. system of units, and so theoretically is dependent only on the ultimate standards of length, mass and time, which suggests a degree of accuracy answering to a small fraction of 1γ. But this has no immediate practical bearing on the subject, until we have instruments which can be relied on to measure a magnetic field accurately to a fraction of 1γ, and to do this not occasionally or accidentally, but every time. Such instruments, so far as I know, do not yet exist. The comparisons made under the auspices of the International Magnetic Committee and those made by the Carnegie Institution of Washington alike show differences between the instruments in use at the leading observatories, and what is worse these differences do not seem to remain constant. It is difficult to say how far the apparent differences and their fluctuations are real, and how far they represent observational uncertainties. The comparison of the standard instruments at two distant observatories is effected through observations made with a third instrument at both places. This third instrument is necessarily exposed to the vicissitudes of travel. To judge exactly what these are, and what degree of reliance is justified in results so obtained, we really require a series of comparisons in immediate succession, the observer travelling backwards and forwards between the two stations, and the observations extending from a cold to a warm season or conversely. Also desirably more than one travelling instrument of each type should be used as an intermediary. We do not know whether two instruments which agree at one station will agree at a remote station. We have little more reason for believing this than we should have for believing that two thermometers which agree at one temperature will necessarily agree at another.

It has never been customary at Kew Observatory to issue corrections to unifilar magnetometers. This has been due to a recognition of two facts: (1) that the Kew magnetometer has no unique claim to be a perfect instrument; (2) that it would require a much larger number of observations than is usually taken to make the probable error in the mean difference resulting from the observations negligible. Even supposing the Kew instrument were invariable and recognised as the ultimate standard, and that the number of observations sufficed for deducing a reliable correction to a second instrument when used at Kew, this would not settle the correction to be applied when it was used at a remote station. The difference between two magnetometers as measurers of H may be due to a variety of causes. It may, of course, arise merely from error in the value accepted for the moment of inertia of one or both of the collimator magnets. In that event the difference between the values obtained for H at any station will be proportional to the local value of H. If we were sure that this was the sole cause of difference between the Kew magnetometer and a second being tested at Kew, we could of course obtain a correction factor to the latter which would be generally applicable. But there may be other contributory causes, *e.g.*, the presence of magnetic material, or error in the measurements of the deflection bar.

In the case of dip circles it has been customary to give corrections to the dip needles when requested to do so, but a warning is then issued against regarding the "corrections" as necessarily more than a historical presentation of the mean results of the comparison with the Kew dip circle, taken out to the nearest $0'\cdot 5$. The differences may be partly or wholly observational accidents. If real, they may be entirely due to the needles, or partly to the needles and partly to the circle. In neither case is there any reason to suppose that the same differences would be obtained if the comparison could be repeated at a station differing widely in dip from Kew. The behaviour of a dip needle is largely determined by the state of its axle, and the parts of the axle which are vital are quite different at two stations differing widely in dip.

Section 144.—The Expedition was provided with two unifilar magnetometers, but only one of these, No. 25, was used. This magnetometer had three collimator magnets 25A, 25B and 25D. Of these, 25B, was fitted up for declination and all the declination observations were taken with it. The other two were intended for horizontal force. The magnet 25D had, however, an undesirably large temperature coefficient, and all the H observations were taken with 25A. The constants of all the magnets were determined at Kew Observatory in May, 1910, before the Expedition set sail.

It is usual on such occasions for observations of H and D to be taken by the magnetic assistant or the superintendent, to make sure that the instrument is complete and works satisfactorily, and that no serious error exists in the table of constants.

There was, however, a press of work at the time, owing to the large number of magnetic instruments being tested for the Expedition, and so no observations could be taken by the observatory staff. Two observations of H and one of D were taken by Dr. Simpson, who was undergoing a course of magnetic instruction. These sufficed to show that unifilar No. 25 was in good working order, and gave results in reasonable accordance with those of the Kew unifilar, but they were not sufficient for determining differences between the two instruments. The two H observations gave somewhat widely discrepant values for the distribution constant P. The torsion in the suspension of both the H and D magnets was excessive, and in the D observation the torsion correction—always an uncertain element when large—was nearly 2′. A comparison of unifilar No. 25 with the unifilar of Christchurch Observatory (Cambridge Scientific Instrument Co. No. 1) was made when the Expedition was on its way home on May 8 and 10, 1913. Three simultaneous observations gave the following results for the easterly declination :—

——	D by No. 25.	D by Camb. Inst. Co. No. 1.
	° ′	° ′
May 8, 1913	16 41·1	16 40·5
„ 9, 1913	43·7	43·5
„ 10, 1913	36·5	39·2
Mean	16 40·4	16 41·1

The difference, if there is one, is hardly outside the limits of observational error.

Two simultaneous observations of H were made on the same two days. These gave unfortunately very discrepant values for P, the one positive, the other negative. As I have shown elsewhere, when the second distribution constant Q is neglected, P depends in reality on the two deflection distances actually used. At Christchurch the distances were those usually adopted, viz., 30 and 40 cms., so that the value given by the Antarctic observations was not immediately applicable. A value might have been deduced from the Antarctic value by means of a formula, but it seemed more satisfactory to accept the value, $-1\cdot71$, which was given by six fairly consistent observations made at Kew Observatory later in the year. Doing so we find :—

——	H by No. 25.	H. by Camb. Inst. Co. No. 1.
May 8, 1913	·22489	·22457
„ 10, 1913	·22473	·22422
Mean	·22481	·22440

The excess of No. 25 is much above the probable error of observation.

After the return of the Expedition to England, a number of observations were taken by Capt. Wright at Kew Observatory, on September 24–26, 1913, simultaneously with observations taken by Mr. T. W. Baker and myself with the Kew unifilar. Other simultaneous observations were made later, on September 29 and October 3, in which the observations with No. 25 were taken by myself. The results of these observations were as follows:—

——	D by No. 25.	D by Kew Unifilar.	Excess of No. 25.
1913.	° ′	° ′	′
September 24...	15 37·2	15 38·2	−1·0
" 25...	34·3	36·5	−2·2
" 26...	37·6	38·4	−0·8
" 26...	35·7	37·5	−1·8
October 3	35·3	35·3	0·0
			Mean −1·2

——	H by No. 25.	H by Kew Unifilar.	Excess of No. 25.
1913.			γ
September 24...	·18494	·18480	+14
" 25...	505	487	18
" 26...	517	501	16
" 26...	525	499	26
" 29...	526	493	33
" 29...	524	493	31
			Mean +23

There would seem to be a small difference in the case of the declination. At the same time the agreement on October 3, when both observers were thoroughly accustomed to the conditions at Kew, was perfect. As regards H, there seems an unmistakable difference, the Kew observer getting in that case a larger difference than Capt. Wright.

If we accepted the Kew instrument as standard, and supposed that the difference between it and No. 25 was due to error in the accepted value of the moment of inertia of magnet 25A, an error of 23γ at Kew would imply an error of about 28γ at Christchurch. The fact that the actual difference observed at Christchurch is larger than this is not really unfavourable to this view, because when the Christchurch unifilar was verified at Kew in 1901, judging by the result of three H observations, it read decidedly low.

There are, however, various sources of uncertainty. In the first place the deflection bar of No. 25 was missing in September, 1913, and its place had to be taken by another bar which happened to fit in No. 25. This bar had been recently measured at the National Physical Laboratory, and there is no reason to doubt the accuracy of the measurements any more than there was in the case of the original bar. Still the fact that the two were distinct bars is a possible source of a small difference in the value of H. Again, the Q distribution constant was probably neglected in the Christchurch instrument, and it certainly was neglected in all the observations taken with No. 25, and in the original comparison in 1901 of the Kew and Christchurch instruments. The only case in which this neglect was likely to have no sensible effect was the Antarctic observations made with No. 25, when big deflection distances were used.

The relation between the Kew and Christchurch instruments might finally have altered in the course of 12 years. In the case of the Kew instrument we are in fact obliged to assume either that some reduction has taken place in the moment of inertia of the magnet, or that the moment in use in 1901 was too large. Thus perhaps all we are entitled to say is that the H observations at Christchurch and Kew show a decided tendency in No. 25 to give too high values in 1913, and are on the whole not unfavourable to the conclusion that the cause was too high a value in the accepted moment of inertia. The most likely alternative explanation, viz., the presence of magnetic material in No. 25, is rendered improbable by the smallness of the declination differences observed between it and the other unifilars. A small reduction in the moment of inertia would be a not unlikely consequence of the vicissitudes natural to the Antarctic climate. Thus it is on the whole probable that during 1911 and 1912 No. 25 gave more accurate values of H than it did during 1913.

If we accept 23γ as the error at Kew, and assume an overestimate of the moment of inertia to be the cause, we should have an error of about 6γ in the Antarctic. An error of this order in H and of the order of $1'$ in D would be insignificant in view of the local disturbance observed at Cape Evans.

Section 145.—The Expedition had three ordinary land dip circles, a modern circle No. 186, by A. W. Dover, and two old circles, Nos. 26 and 27, by J. Dover. The two latter were fitted for total force observations, as well as for ordinary dips. No. 26 was the circle in regular use at Cape Evans. It had five needles. The "corrections" given to these in the certificate issued at Kew in May, 1910, were as follows :—

——	No. 2.	No. 3.	No. 4.	No. 5.	No. 8.
"Correction"	$+1'\cdot5$	$+1'\cdot5$	$+2'\cdot0$	$+1'\cdot5$	$0'\cdot0$

Nos. 3 and 4 were so-called "statical" needles, which were never reversed after leaving Kew, but were tested there as reversible needles. Nos. 2, 5 and 8 were used at Cape Evans for the ordinary dip observations. The later observations were made, still in No. 26, with needles Nos. 1 and 2 of circle 186. At Kew in 1910 these two needles were tried only in their own circle, so no significance could attach to the results obtained with them then.

Observations were made by Capt. Wright at Christchurch on March 8 and 10, 1913, using needles Nos. 1 and 2 of circle 186 in circle 26.

Simultaneous observations were made by Mr. H. F. Skey, Director of Christchurch Observatory, with the Christchurch circle, Dover 147, with three needles, Nos. 1, 2 and 3. The results were as follows :—

1913.	Circle No. 26.			Circle No. 147.			
	No. 1 of 186.	No. 2 of 186.	Mean.	No. 1.	No. 2.	No. 3.	Mean.
	° ′	° ′	° ′	° ′	° ′	° ′	° ′
March 8 ...	67 57·57	67 57·62	67 57·60	67 57·52	67 59·75	67 56·92	67 58·06
„ 10 ...	67 57·67	67 58·31	67 57·99	67 59·12	57 59·90	67 57·87	67 59·00

Circle No. 147 was tested at Kew in 1901. The certificate issued gave no "corrections," merely stating that the results obtained were in close agreement with those given by the Kew circle.

Needles 1 and 2 of circle 186 were also tried in circle 26 at Kew by Capt. Wright on September 24, 25 and 26, 1913, simultaneous observations being taken with the Kew circle by Mr. Baker or myself. The needles were also tried on October 3 by myself, observations with the Kew needles in the Kew circle being interpolated, so as to get the same mean time for the observations with the two circles. The results were as follows :—

1913.	Circle No. 26.			Kew Barrow Circle.		
	Needle 1 of 186.	Needle 2 of 186.	Mean.	No. 1.	No. 2.	Mean.
	° ′	° ′	° ′	° ′	° ′	° ′
September 24 ...	66 55·41	66 55·74	66 55·58	66 55·97	66 55·44	66 55·70
„ 25 ...	55·66	55·72	55·69	56·12	56·37	56·25
„ 26 ...	54·28	54·86	54·57	55·81	54·56	55·18
October 3... ...	55·85	55·85	55·85	55·59	55·50	55·55
Means ...	66 55·30	66 55·54	66 55·42	66 55·87	66 55·47	66 55·67

It is hardly necessary to say that the accordance between all four needles displayed here is quite exceptionally good.

Capt. Wright also observed on September 25 and 26 with needles Nos. 2 and 8 of circle 26 in their own circle. I repeated these observations on October 7 and 8, and on the latter date also observed with needle No. 5 of circle 26. The observations with Nos. 2 and 8 on September 25 immediately preceded those with needles 1 and 2 of circle 186, while the observations with the first pair of needles on September 26 followed immediately after those with the second pair. Thus we may regard the dips obtained with the Kew circle on September 25 and 26 as fairly corresponding.

On October 7 and 8 I observed with both the Kew and Antarctic circles, in such a way as to obtain the same mean time for the observations. The results were as follows :—

1913.	Circle No. 26.			Kew Barrow Circle.	
	No. 2.	No. 5.	No. 8.	No. 1.	No. 2.
	° ′	° ′	° ′	° ′	° ′
September 25...	66 55·56	—	67 2·34	66 56·12	66 56·37
,, 26...	66 54·88	—	66 59·19	66 55·81	66 54·56
October 7 ...	66 55·89	—	66 59·50	66 58·94	—
,, 8 ...	—	66 56·44	66 58·03	—	66 55·78

There is here a decided difference between needles 2 and 8 of circle 26; the former gave slightly lower, and the latter decidedly higher values than the Kew needles. All three needles Nos. 2, 5 and 8, it will be remembered, had been discarded for faulty behaviour before the end of the Antarctic observations. Thus any later comparison could throw no certain light on their behaviour when at their best, but only on the extent to which they were unreliable when at their worst. When tried in 1913 they were undoubtedly inferior to needles Nos. 1 and 2 of circle 186, but they were still in a pretty fair state of preservation, so far, at least, as concerns the parts of the axles in use at Kew.

Circle, J. Dover, No. 27 was tested at Kew Observatory in May, 1910. The certificate then issued gave the following " corrections " to the five needles :—

—	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.
" Correction "	+0′·5	−0′·5	+0′·5	0′·0	+0′·5

The differences from the Kew needles were hardly outside the limits of experimental error. Needles Nos. 3 and 4 were the so-called " statical " needles. They were tested as reversible needles, but were not reversed again after leaving Kew.

Circle No. 27 was mainly used for observations taken at Cape Adare by Lieut. (now Commander) V. Campbell, R.N., and Surgeon G. Murray Levick, R.N. The conditions were not favourable for very accurate work. Also the needles seemed to have somewhat deteriorated before the Expedition returned to England. Thus it is unnecessary to enter on details of the comparisons made after the return to England with the reversible needles. The note which I made after trying needles Nos. 1 and 2 in their own circle in December, 1913, was as follows :—" No. 1 behaves fairly; No. 2 distinctly bad in one position, suspicious in others." Still the results obtained were fairly good, the means being only from 1′ to 2′ lower than those given by the Kew needles in the Kew circle.

Section 146.—Some total force observations were made with both the circles Nos. 26 and 27, especially the latter. The method of determining total force with a dip circle is not given in ordinary textbooks, and I do not know any textbook where there is a full explanation. Thus a few remarks seem desirable.

Three operations with the same dip circle are usually involved.

(i) An ordinary dip observation is taken with at least one of the reversible needles, say No. 1. If only one such observation is taken, it is best to take the observations with pole A dipping before and those with pole B dipping after the two next operations, so as to get the same mean time for the dip as for the other observations. If time permits, complete dip observations, preferably with two reversible needles, say Nos. 1 and 2, the one before, the other after operations (ii) and (iii) should be taken.

(ii) An observation is taken of the dip shown by the statical needle No. 4 carrying a weight, which is screwed into a hole in the blade. The same process is gone through as in an ordinary dip observation, except that the magnetism of No. 4 is not reversed.

(iii) A deflection experiment is made in which statical needle No. 4 deflects statical needle No. 3. During this operation No. 3 occupies only one position, *e.g.*, it has its face to the face of the instrument, and the instrument faces East. No. 4 is secured in a holder attached to the frame which carries the two reading microscopes of the circle, in such a way that the length (magnetic axis) of No. 4 is perpendicular to the line joining the axes of the microscopes. Thus when the two ends of No. 3 are at the centres of the fields of view of the two microscopes, the magnetic axes of Nos. 3 and 4 are at right angles to one another. These two axes are in parallel vertical planes. Assuming symmetry in No. 3, its plane is midway between the two agate edges on which the needle rolls. No. 4 is necessarily outside the box which contains No. 3. The centres of the needles should be in the same horizontal plane, and the line joining them should be perpendicular to the agate edges. In the ordinary circle the needles have lengths of about 3½ inches, and the distance between their centres is about 7 cms.

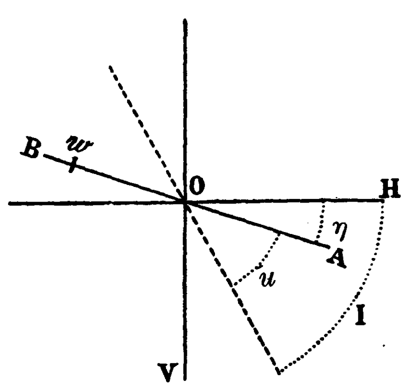
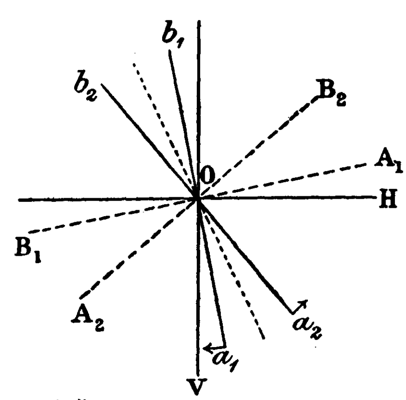


FIG. 5.



The operations are shown graphically in the accompanying diagrams. In both OH represents the horizontal, OV the vertical direction, and A is the dipping end of the needle. In the first diagram AB represents the actual position of needle No. 4 when weighted, the dotted line represents the true dip. In the second diagram a_1b_1 and a_2b_2 represent the two deflected positions of needle No. 3; while A_1B_1 and A_2B_2 are the two corresponding positions of needle No. 4. The dotted line midway between a_1b_1 and a_2b_2 represents the true dip. The inclinations of a_1b_1 and a_2b_2 to the horizon will be termed I' and I'' respectively. What is actually observed is the angle a_1Oa_2, and $\frac{1}{2}\, a_1Oa_2$ is accepted as the value of u' the deflection angle. The diagram represents the simplest case, when the two positions Oa_1, Oa_2 are in the same quadrant. In a station in high latitudes Oa_1 usually falls on the opposite side of the vertical from OA_1, while in low latitudes Oa_2 will usually lie above OH.

In general neither needle will have its centre of gravity absolutely coincident with the axis of rotation. In a well-made needle, however, the centre of gravity will be very close to if not actually in the line joining the ends of the needle. For simplicity we may suppose the C.G. in both needles actually in this line. Let w_3 and w_4 be the weights of needles 3 and 4 and let c_3 and c_4 denote the distances of their centres of gravity from their axles. Also let w be the auxiliary weight used in the second operation, and c its distance from the axle. We shall assume that the reversible needle used gave the true dip I, and that the dip and the total force R remained constant throughout the whole observation.

The couple arising from the action of needle 4 on needle 3 will be proportional to the magnetic moments m_4 and m_3 of the two needles, and so may be represented by $m_3m_4f(r)$, where $f(r)$ is a function of r, the distance between corresponding poles of the two needles when their magnetic axes are perpendicular. From operation (ii) we have, see the diagram on the left on p. 417,

$$m_4 R \sin (I - \eta) = (wc + w_4c_4) \cos \eta,$$

and from operation (iii)

$$m_3 R \sin (I' - I) = m_3m_4 f(r) - w_3c_3 \cos I'$$

$$m_3 R \sin (I - I'') = m_3m_4 f(r) + w_3c_3 \cos I''.$$

It is usually tacitly assumed that w_4c_4 and w_3c_3 are zero or negligible. In that event it is obvious that

$$I' - I = I - I'' = \tfrac{1}{2}(I' - I'') = u' \text{ say};$$

so that we have

$$m_4 R \sin u = wc \cos \eta,$$

$$m_3 R \sin u' = m_3m_4 f(r).$$

Multiplying up and eliminating m_3m_4, we finally get

$$R^2 = wc\, f(r) \cos \eta / \sin u \sin u'.$$

Suppose the suffix $_o$ to distinguish data for a base station where the value of the total force is known, then we have

$$R_o^2 = wc\, f(r) \cos \eta_o / \sin u_o \sin u_o';$$

whence $\quad wc\, f(r) = R_o^2 \sin u_o \sin u_o' / \cos \eta_o,$

$\quad = A$, say, a known quantity,

and finally $R^2 = A \cos \eta / \sin u \sin u'$.

Here A is the so-called "constant," corresponding to the particular weight which has been used. Usually there are several weights of different mass, a lighter or a heavier weight being selected according to the local conditions.

Various simplifying assumptions have been made, such for instance as that the magnetic moment is the same in all positions of the needle. It is usual to regard A as an absolute constant for each weight, but it is obvious that it must be slightly variable unless observations are taken at a fixed temperature. As we have seen, A stands for $wc\,f(r)$. r will vary if the poles of either needle alter their distance from the axle, or if the distance between the planes of the two needles changes. Temperature change will naturally alter both these distances directly, and may besides influence the distribution of magnetism, and so the "pole distance" in the needles. The instruction not to reverse the magnetism of the needles is intended to reduce the chance of change in the pole-distance. The magnetic moments, however, will naturally tend to diminish, and this may not improbably affect the distribution of magnetism as well. Supposing no wear in the weight, or in the hole in No. 4 into which it screws, the length c should be constant, except for changes of temperature, and so should be the mass of the weight. But, and this I think has been generally overlooked, the weight itself must necessarily vary according to the value of gravity at the place of observation. This latter variation should be negligible if observations are confined to places not far removed from the base station, a procedure which is desirable for other reasons. But in the present instance that was not the case, so far at least as circle No. 27 was concerned.

Let g_a, g_c, g_k represent the values of gravity in C.G.S. units at the Antarctic station, Christchurch and Kew respectively. Then we have approximately*

$$g_a = 983\cdot 0,\ g_c = 980\cdot 5 \text{ and } g_k = 981\cdot 2\,;$$

whence $$g_a/g_c = 1\cdot 0025,\ g_a/g_k = 1\cdot 0018 \text{ and } g_k/g_c = 1\cdot 0007.$$

If A_a, A_c and A_k represent the values which the constant for a given weight should have at the three stations, then as $A = \{wc\,f(r)\}^{\frac{1}{2}}$, we have

$$A_a/A_c = 1\cdot 0012,\ A_a/A_k = 1\cdot 0009, \text{ and } A_k/A_c = 1\cdot 0004.$$

Thus for accuracy to 1 part in 1,000, or even 1 part in 500, it would not be legitimate to apply in the Antarctic without correction a value determined for A at Christchurch or Kew. I do not think that even the lower accuracy can be claimed in the present case, but others may think differently.

The neglect of w_3c_3 is one of the steps most likely to arouse criticism. An approximate value of w_3c_3 is easily found, at least theoretically. We have, in fact,

$$w_3c_3\,(\cos I'' + \cos I') = m_3\,R\,\{\sin (I - I'') - \sin (I' - I)\},$$

and so $$2w_3c_3 \cos \tfrac{1}{2}\,(I' + I'') \cos \tfrac{1}{2}\,(I'' - I') = 2\,m_3\,R \sin \{I - \tfrac{1}{2}\,(I + I'')\} \cos \tfrac{1}{2}(I' - I'')\,;$$

whence approximately

$$w_3c_3 = m_3\,R \sin \{I - \tfrac{1}{2}\,(I' + I'')\} \sec I,$$

since $\frac{1}{2}\,(I' + I'')$ must equal I to a first approximation.

* National Antarctic Expedition, 1901–1904. Physical Observations, p. 34.

The larger R sec I, the smaller must be $I - \frac{1}{2}(I' + I'')$. Near a magnetic pole R and sec I are both relatively large.

We should thus expect in high magnetic latitudes like Cape Evans or Cape Adare $\frac{1}{2}(I' + I'')$ to give a closer approach to the true dip than in ordinary latitudes.

It seems to be immaterial whether c_4 vanishes or not. If it does not vanish the value of A becomes $(wc + w_4c_4) f(r)$, and there is no reason why w_4c_4 should be more variable than wc.

Section 147.—In the case of circle No. 26 only one total force observation was taken to determine the constant A for one weight. It was made in the magnetic hut at Cape Evans, on June 9, 1911, between 15 h. 22 m. and 16 h. 5 m. Accepting for the true dip 86° 27′·4, the mean of the absolute observations of the month, and for the total force ·68168, being the value derived from the above value of the dip and ·04213 the mean of the absolute observations of H, the value obtained for $\log_{10}$ A was $\bar{1}$·66310. The observed value of $\frac{1}{2}(I' + I'')$ was 86° 28′·6, and so was very close to the true dip as given by the reversible needles.

The value of A for one weight was found for circle 27 at Christchurch Observatory on November 16 and 17, 1916. On November 16 there were two complete determinations. For the first the observation with needles 3 and 4 was taken between 11 h. 0 m. and 11 h. 54 m. The value accepted for the true dip was derived from observations taken with needle 1 between 10 h. 30 m. and 10 h. 55 m. (pole A dipping), and between 12 h. 0 m. and 12 h. 23 m. (pole B dipping). For the second determination, on the same day, the observation with needles 3 and 4 was taken between 16 h. 0 m. and 16 h. 43 m. For the dip, observations were taken with needle 2 between 15 h. 37 m. and 15 h. 58 m. (pole A dipping), and between 16 h. 50 m. and 17 h. 9 m. (pole B dipping). On November 17 the observation with needles 3 and 4 occupied from 11 h. 30 m. to 12 h. 10 m. The dip observations, taken with needle 1, occupied from 11 h. 0 m. to 11 h. 24 m., and from 12 h. 17 m. to 12 h. 35 m. The three values of R—supplied presumably by the Christchurch authorities—are given by Dr. Simpson as ·59854, ·59872 and ·59855 respectively. The three values found for $\log_{10}$ A were $\bar{1}$·54088, $\bar{1}$·54016 and $\bar{1}$·54053. Their mean $\bar{1}$·54052 has been accepted. The following is a summary of the angles observed :—

Observation.	I.	$\frac{1}{2}$ (I′+I″).	u'.	u.	η.
	° ′	° ′	° ′	° ′	° ′
1	67 54·19	67 54·41	26 23·58	43 45·06	24 9·13
2	56·00	50·67	19·17	37·79	18·21
3	55·91	50·58	18·58	50·74	5·17
Mean ...	67 55·37	67 51·89	26 20·44	43 44·53	24 10·84

The difference here between the mean values of I and $\frac{1}{2}(I' + I'')$, though not large, is sensible. The weight was obviously a very suitable one for total force observations near the magnetic latitude of Christchurch, and the three values obtained for A showed a satisfactory accordance.

A second set of dip and total force observations was made by Capt. Wright and Dr. Levick at Christchurch with circle 27, employing the same weight as before, on March 7 and 9, 1913. The following is a summary of results :—

Date.	Time. From	Time. To	Needle.	I.	$\frac{1}{2}$ (I′ + I″).	u'.	u.	η.
1913.	h. m.	h. m.	No.	° ′	° ′	° ′	° ′	° ′
March 7 ...	12 0	12 35	2	67 59·58	—	—	—	—
„ 7 ...	14 30	14 45	3 and 4	—	67 58·58	25 47·22	42 17·04	25 41·15
„ 7 ...	15 0	15 30	2	67 56·80	—	—	—	—
„ 7 ...	15 30	16 15?	2	68 6·33	—	—	—	—
„ 7 ...	16 25	16 40	3 and 4	—	68 7·58	25 57·25	42 18·67	25 44·23
„ 7 ...	16 45	17 20	2	67 59·48	—	—	—	—
March 9 ...	9 5	9 35	1	68 1·65	—	—	—	—
„ 9 ...	9 40	10 0	3 and 4	—	67 59·67	25 20·67	43 0·82	24 59·33
„ 9 ...	10 0	10 24	1	67 58·65	—	—	—	—
„ 9 ...	10 25	10 45	1	68 1·52	—	—	—	—
„ 9 ...	10 57	11 12	3 and 4	—	67 59·33	26 9·33	40 43·00	27 18·25
„ 9 ...	11 15	11 32	1	68 0·98	—	—	—	—
Means ...	—	—	—	68 0·62	68 1·29	25 48·62	42 4·88	25 55·71

The times assigned in the observation book for the third observation with needle 2 on March 7 obviously contain one or more clerical errors; the assumed times given here may be slightly in error. It has also been assumed that an angle given as 38° in the first deflection experiment on March 9 was really 42°, as in the other similar observations; because the resulting value of $\frac{1}{2}$ (I′ + I″), viz., 65° 59′·67, was altogether impossible. In calculating u, the true dip has been taken as the arithmetic mean of the dips given by the immediately preceding and following observations taken with a reversible needle.

No final value was deduced for A, no value of R seemingly having been supplied by the Christchurch authorities. If we assume the same mean value for R as was used in 1910, and accept the above mean values of u, u' and η, we should find the 1913 value of A to be 0·982 of that found in 1910. The observations in 1910 were much more harmonious amongst themselves than those of 1913, and were considerably nearer in time to the observations at Cape Evans and Cape Adare, for which the value of the constant was desired. Thus it seemed best to accept the 1910 value, regarding the 1913 observations as affording merely a general confirmation of its accuracy.

A final set of observations with No. 27 was made at Kew in December, 1913, by Dr. Levick and myself. On December 11 Dr. Levick took two complete observations of dip with needles 1 and 2, and three total force observations with needles 3 and 4; while I took a dip observation with the Kew circle and needles, simultaneously with his first dip observation. On December 15, observing with circle 27, I took dip observations with needles 1 and 2, and two total force observations with needles 3 and 4. Finally, on December 16 I took a third total force observation. In the calculations, 66° 55′ was accepted for the true dip, and ·47177 for the total force, these being the mean values—to the nearest 0′·5 and 1γ—for the month. Also 66° 55′·09 was the dip obtained with the Kew circle on December 11. A principal reason for taking I from the Kew circle was the considerable size of the difference—4′·9 for needle 1, and 7′·7 for needle 2—between the values of the dip obtained by Dr. Levick with circle 27. The mean results were as follows :—

Observer.	Dip by No. 1.	Dip by No. 2.	$\frac{1}{2}$ (I′ + I″).	u'.	u.	η.	$\log_{10}$ A.
	° ′	° ′	° ′	° ′	° ′	° ′	
Levick	66 53·52	66 51·73	66 49·75	34 9·75	11 26·11	78 21·11	$\bar{1}$·54447
Chree	66 53·72	66 55·84	66 47·07	31 21·18	11 45·83	78 40·83	$\bar{1}$·54010
All observations...	66 53·59	66 53·10	66 48·41	32 45·46	11 35·97	78 30·97	$\bar{1}$·54228

The dips deduced from the values of $\frac{1}{2}$(I′ + I″) in needle 3 rule decidedly low. The difference between the mean values obtained for u' by the two observers is difficult to explain, as Dr. Levick's three values varied only 20′ amongst themselves, and my three only 18′.

If we take the mean value of $\log_{10}$ A from the six determinations, we find

(A in 1913 at Kew)/(A in 1910 at Christchurch) = 1·004.

The theoretical difference arising from the difference of gravity is, it will be remembered, in the same direction as that observed above, but only one-tenth as large.

While the agreement is not perfect, it is very much closer than I had at all expected. It is especially noteworthy in view of the fact that, owing to the dip being northerly at Kew and southerly at Christchurch, the weight which was in the end appropriate to the southern station was in the dipping end at Kew, and so increased the dip there, instead of diminishing it as at Christchurch.

From the observed values of u' at the two stations, and the values of total force, a comparison may be instituted between the values of the magnetic moment of needle 4 in November, 1910, and December, 1913. The moment would seem to have diminished by only about 2 per cent. in the course of the three years, a very satisfactory result.

More space has been given to the total force observations with circle 27 than their intrinsic importance may seem to justify, but the results possess a considerable interest from the instrumental and observational points of view.

Section 148.—The special observations made on sea ice over deep water about 2,835 yards from the absolute hut at Cape Evans during December, 1911, and

January, 1912, were included in Tables I, II and III, and discussed in Chapter III. But some earlier observations were taken on sea ice with circles 26 and 27. They commenced shortly before midnight on January 5, 1911, and continued until after 4 h. of the subsequent day. The observations with the two circles went on simultaneously, so the positions of the circles could not have been absolutely identical. In the case of circle 26 the position is described as "Ice off Cape Evans 120 fathoms," while the position of circle 27 is variously described as "Off Cape Evans," or "Off Skuary, Ross Island."

The dips taken with the reversible needles were as follows :—

Circle.	Needle.	Time. From	Time. To	Dip.	Mean dip for circle.
		h. m.	h. m.	° ′	° ′
26	2 ?	23 30	0 38	86 48·68	—
26	8	3 0	3 38	86 49·00	86 48·84
27	1	23 15	0 31	86 49·03	—
27	2	23 39	0 15	86 47·50	—
27	?	3 22	4 2	86 48·90	86 48·48
Final mean ...	...	...	...	...	86 48·66

The individual results are very harmonious, and suggest a quiet time, but as the magnetographs were not then in action no confirmation is possible from the curves. The final mean is larger by 19′ than the earliest observation recorded in the magnetic hut at Cape Evans, which was the biggest dip observed there, while the observations made on sea ice in December, 1911, and January, 1912, had a mean excess of only 9′·8 over those then made on land. This cannot be said to be favourable to the view that the effects of local disturbance were inappreciable even on the sea ice.

Total force observations were also made on the same occasion (January 6, 1911) with both circles with the following results :—

Circle.	Time. From	Time. To	$\frac{1}{2}$ (I′+I″).	u'.	u.	η.	Total Force.	Mean Total Force.
	h. m.	h. m.	° ′	° ′	° ′	° ′	γ	γ
26	1 20	2 17	86 48·10	28 13·9	62 50·6	23 58·2	67831	—
26	2 20	3 0	86 49·67	28 13·5	63 19·2	23 29·6	67820	67825
27	1 20	1 52	86 50·50	23 8·3	6 17·9	80 30·6	67892	—
27	1 53	2 28	86 45·58	23 6·7	6 30·2	80 18·3	67565	67729
Means	—	—	86 48·46	—	—	—	—	67777

In the total force reductions the value accepted for I was 86° 48′·8 for circle 26, and 86° 48′·5 for circle 27. The values accepted for $\log_{10}$ A were $\bar{1}$·66310 for circle 26

(Cape Evans Observation, June 9, 1911), and $\bar{1}\cdot54052$ for circle 27 (Christchurch Observation, November 16 and 17, 1910). If we applied to the Christchurch value of A the correction appropriate to the excess of gravity in the Antarctic, we should increase the mean value for the total force by circle 27 to 67810γ, and the corresponding mean from the two circles to 67817γ.

The accordance between the results from the two circles, if we apply the gravity correction to No. 27, cannot be assigned very great significance, in view of the large difference between the two values given by that circle. The fact is that the weight used in circle 27 was undesirably light for Antarctic use. The value of u was so small that any small error in its determination was serious. The weight used in circle 26 erred perhaps a little in the opposite direction, but was much more suitable.

The accordance between $\frac{1}{2}(\mathrm{I}' + \mathrm{I}'')$ and the true dip was again eminently satisfactory for both circles.

Section 149.—Magnetic observations were taken at Cape Adare (71° 18′ S. lat., 170° 9′ E. long.) by Commander V. Campbell, R.N., and Dr. G. Murray Levick from March to December, 1911. They included observations of declination, dip and total force, the two last elements with circle by J. Dover, No. 27.

Two of the declination observations were taken on the sea ice on Robertson Bay, some distance from shore. The other observations were apparently all taken on the "site of Magnetic Tent in Borchgrevink Expedition." This is explicitly stated to be true of the earliest dip observations taken on March 14. In all the other dip observations the site is described as "Ridley Beach" or "basaltic pebble beach." The same description is assigned in the case of the total force observations, with the additional information that the geographical position was 71° 18′ 0″ S. and 170° 9′ 0″ E. The site of the two land declination observations is similarly described to that of the total force observations. The accepted position of the observation station of the Borchgrevink (or "Southern Cross") Antarctic Expedition of 1899 to 1900 being 71° 18′ S., 170° 9′ E., the identification seems complete.

The first of the two declination observations made on the sea ice was taken on May 3. The site is described as 440 yards from shore, over water 17 fathoms deep, lat. 71° 18′ 19″ S., long. 170° 9′ 0″ E. The same depth of water and the same geographical co-ordinates are entered in the case of the second observation on sea ice, taken on November 6, but the distance from shore is given as 336 yards.

In each instance the declination was obtained by comparing the true bearings of a series of objects, taken with a 4-inch theodolite, with the magnetic bearings observed with "No. 1 Arctic Shore Azimuth Compass." From two to four different pivots were used on each occasion, and in every case a correction of + 4′ was applied to the compass card reading. As the "basaltic pebble beach" was presumably a source of local magnetic disturbance, the declination observations made on sea ice are the most important.

On May 3 compass readings were taken for seven different true bearings, and in each case separate readings were taken with each of three pivots, the resulting value of the declination being 70° 59′·8 E. On this day magnetic conditions at Cape Evans were decidedly quiet. On November 6 compass readings were taken for eight different true bearings, two pivots being used in each case. The resulting value of the declination was 70° 57′·3 E. On this day the magnetic curves showed about the usual amount of disturbance for the season. The close accordance of the two results would naturally inspire confidence in the final mean value 70° 58′·5 E., but a consideration of the observational details is less re-assuring. On May 3, on the average, the declinations obtained using pivots ii and iii exceeded those obtained when using pivot i by 21′·7 and 1° 14′·1 respectively. On November 6 the two pivots used agreed much better, still the mean declination using pivot ii was 10′·2 in excess of that found with pivot i. It must also be remembered that during November the diurnal range of declination is large. Even if the exact times of observation had been given, which was not the case, it would not have been possible to derive from the records obtained at Cape Evans corrections for diurnal variation applicable to Cape Adare. It is probably not underestimating the various uncertainties if we regard the probable value of declination on sea ice as 71° ± 1° E.

The two land observations of declination were taken in the same way as those on the sea ice. On the first occasion, March 21, compass readings were taken for seven different true bearings, four pivots being used in each case. The resulting mean declination obtained was 65° 7′·4 E. The values derived from six of the objects varied only between 64° 9′·0 and 64° 42′·7, whilst the seventh gave 69° 17′·5. This strongly suggests an error of 5° in the value assigned to the true bearing. If we omit this one object, the mean becomes 64° 24′·6 E. On this occasion the differences between the pivots were very large, the mean declinations obtained from pivots ii, iii and iv exceeding those obtained from pivot i by 1° 14′·3, 2° 28′·6 and 2° 20′·7 respectively. Magnetic conditions at Cape Evans on March 21 were rather highly disturbed, and some of the irregularities at Cape Adare were no doubt due to magnetic disturbance. On the occasion of the second land observation, taken on December 13, compass readings were taken for eight different true bearings, pivots i, ii and iii being used in each case. The differences between the several pivots were less than on March 21, the mean declinations obtained with pivots ii and iii exceeding that obtained with pivot i by 40′·1 and 17′·6 respectively. The mean declinations deduced from the different objects varied from 68° 20′·3 to 69° 18′·7, the final mean from the eight combined being 68° 46′·8 E. Magnetic conditions on this day at Cape Evans were fairly quiet.

If we accept the revised value for the declination on March 21, the mean from the two days' observations on the beach at Cape Adare becomes 66° 35′·7 E., or 4° 22′·8 less than the mean from the observations on sea ice. In view of the large differences between the land observations on March 21 and December 13, no very exact value can be assigned for the difference between the two stations; but we may reasonably infer that the declination on the beach is reduced by at least several degrees through purely local disturbance.

The mean declination observed on the beach in 1899–1900 by the "Southern Cross" observers, Mr. L. C. Bernacchi and Captain W. Colbeck, was 55° 49′·4 E. These observers had a very much superior instrument in Unifilar Dover No. 138. Their individual results, 54 in number, taken at very various hours of the day, and so very variously affected by the diurnal variation, varied between 54° 39′·4 and 57° 37′·9 ; but on several occasions when magnetic conditions were specially disturbed observations were left unfinished. If we accept the land values at the two epochs as applying to the same spot, we have an increase of 10° 46′·3 in twelve years, giving the secular change the very high value of 54′ per annum.

Section 150.—The dip and total force observations with circle 27 at Cape Adare were all made on shore, at the station on the "basaltic pebble beach" on the "site of Magnetic Tent in Borchgrevink Expedition." Attempts were made on November 7 and 9 to observe the dip on the sea ice off Ridley Beach, but these were unsuccessful "owing to movement of the ice."

TABLE A.—Dip at Cape Adare.

Date.	Needle.	Observer.	Time. From	Time. To	Mean Dip.	Magnetic Condition at Time.
1911.			h. m.	h. m.	° ′	
March 14	2	V.C.	15 0	17 0	86 36·10	d_1
,, 22	1	V.C.	10 0	11 15	86 41·51	d_2
,, 22	2	V.C.	12 30	13 30	86 42·55	d_2
May 25	2	V.C.	10 30	12 0	86 41·70	q
June 6	1	V.C.	10 45	12 45	86 41·81	d_1
,, 6	1	V.C.	14 30	15 45	86 36·25	q
July 21	?	V.C.	11 45	13 0	86 40·19	q
August 23	1	G.M.L.	10 30	12 15	86 37·85	q
,, 23	1	G.M.L.	14 25	15 5	86 39·69	q
October 19... ...	1	G.M.L.	14 30	15 0	86 39·72	q
,, 19... ...	1	G.M.L.	15 30	16 15	86 43·10	q
November 9 ...	1	G.M.L.	10 30	11 15	86 36·97	d_2
,, 9 ...	1	G.M.L.	11 45	12 30	86 55·40	d_2
December 11 ...	2	V.C.	12 0	13 0	86 58·38	d_2
,, 11 ...	2	V.C.	14 45	15 50	86 44·81	d_2
Mean from all the 15 observations					86 42·4	
Mean from 9 observations with needle No. 1					86 41·4	
Mean from 5 observations with needle No. 2					86 44·7	

Table A gives particulars of the dips obtained at Cape Adare with the reversible needles Nos. 1 and 2. The observers are distinguished by their initials. The magnetic conditions specified were derived from the curves at Cape Evans, q denoting quiet, d disturbed conditions, the suffix $_2$ implying very considerable, the suffix $_1$ only moderate disturbance. In these high latitudes disturbance is probably comparatively local at times, and inferences drawn as to magnetic conditions at

Cape Adare from those experienced at Cape Evans are naturally less reliable than in the case of two stations a similar distance apart in Great Britain.

Observations were only once taken with the two needles on the same day, March 22, and on that occasion the mean times of the two observations differed by 2 h. 22 m. It is thus impossible to say whether the difference 3′·3 between the mean dips obtained with the two needles was of instrumental origin or accidental. The observations were mostly taken at very low temperatures, and so under trying conditions. Some of them, moreover, took an unusually long time, and so were very likely to suffer from magnetic variations. Whatever the cause, there were several very large differences between successive readings of the same end of the needle. When such differences occur, more than usual uncertainty cannot but attach to the final dip. The largest of these differences were as follows: 1° 20′ on May 25; 0° 52′ on June 6; 0° 35′ and 0° 34′ on November 9; and 0° 54′ and 0° 44′ on December 11. Differences such as these look very large, but it should be remembered that an error of 1° in a single reading would only affect the final result by about 2′.

The mean dip 86° 42′·4 in Table A is 8′·0 higher than the corresponding mean found by Messrs. Bernacchi and Colbeck in 1899–1900. If we accept the results as applying to the same spot, we deduce a mean annual increase of dip of 0′·67.

TABLE B.—Total Force Observations at Cape Adare.

Date.	Time of Total Force Observation.		Temp. C.	Magnetic Conditions.	Dip by		u'.	u.	η.	Total Force.
	From	To			No. 1 or 2 86° +	No. 3 86° +				
1911.	h. m.	h. m.	°		′	′	° ′	° ′	° ′	γ
March 22	11 30	12 30	−20	d_2	42·03	69·37	22 16·13	7 9·09	79 32·94	68077
June 6 ...	11 30	12 0	−21	d_1	41·81	43·50	22 26·00	6 7·00	80 34·81	69635
July 21 ...	14 0	14 45	−16	q	40·19	74·12	21 55·38	6 19·00	80 21·19	70137
August 23	14 0	14 20	−29	q	39·69	41·38	22 16·13	6 55·75	79 43·94	68527
October 19	15 0	15 30	−18	q	41·41	40·38	22 34·38	6 51·66	79 49·75	68091
Nov. 9 ...	11 15	11 45	− 6	d_2	46·18	21·62	22 24·88	7 3·12	79 43·06	67798
Dec. 11 ...	14 15	14 35	+ 1	d_2	44·81	40·25	22 23·00	6 32·93	80 11·88	68718
Means ...	—	—	—	—	42·30	47·23	22 19·41	6 42·65	79 59·65	68712

Total force observations with the "statical" needles 3 and 4 were made at Cape Adare on seven of the days on which dip observations were taken with one or other of the reversible needles. Particulars of the observations are given in Table B. In the calculations the value taken for the dip was that given by the reversible needle used on the same day. The reversible needle result is given in the table for comparison with that resulting from the value of $\frac{1}{2}(I' + I'')$ in needle No. 3. The values assigned to the total force are based on the value obtained for A at Christchurch uncorrected for gravity. Particulars are given as to u, u' and η to show the degree of consistency of the observations. The magnetic conditions shown by the Cape Evans curves are given as before.

The time assigned to the total force observation on June 6, viz. from 11 h. 30 m. to 12 h. 0 m., is half-an-hour earlier than that given in the total force observation book, because according to the dip observation book the observations with needle No. 1 occupied from 10 h. 45 m. to 11 h. 30 m. and from 12 h. 0 m. to 12 h. 45 m., and the total force observations must have come in the interval.

The variability in the values of u in Table B appears larger than usual, and the dips derived from needle 3 do not appear at all as satisfactory as those obtained on January 5 and 6 near Cape Evans. It is thus hardly surprising that the values obtained on the different occasions for the total force are not very accordant. A very considerable probable error must be allowed even to the final mean. If we applied a correction for gravity—assuming the value of g at Cape Adare to be that normal for the latitude 71° 18′, viz. 982·7, an hypothesis accurate enough for the present purpose—we should raise the final mean value of the total force to about 68788γ. If we accept this for the total force, and 86° 42′·4 for the dip, we find 68674γ and 3952γ respectively for the vertical and horizontal components. The corresponding mean values obtained by Messrs. Bernacchi and Colbeck were ·6926, and ·04143, giving ·6938 for the total force. Accepting these figures as applicable to the same spot, we find a reduction to have occurred in all three elements during the twelve years. The resulting mean annual changes are $-$ 16γ in H, $-$ 49γ in V and $-$ 49γ in total force.

There is nothing at all out of the way in the secular changes we have deduced for Cape Adare, except in the case of D. But no great weight can be claimed for the results in view of the observational uncertainties, and the very considerable local disturbance indicated by Messrs. Campbell and Levick's declination observations. It may however be added that a substantial increase in easterly declination at Cape Adare would harmonise with the observed secular increase in H at Cape Evans. Both phenomena would be explained by a movement of the South magnetic pole in a north-westerly direction. The value of the declination observed on sea ice near Cape Adare seems to fit fairly well with the observations on board ship dealt with in the next chapter.

CHAPTER XVI.

OBSERVATIONS AT SEA, &c., AS REDUCED UNDER THE SUPERVISION OF COMMANDER HARRY PENNELL, R.N.

This chapter includes observations of declination and dip reduced by or under the supervision of Commander Harry Pennell, R.N., who lost his life during the war. He had handed over the tables of results, the reductions, and the observation books to my charge before going on active service. We had discussed a variety of points, without, however, reaching any final decision. Some of the assumptions made, and some of the corrections applied, seemed to me somewhat arbitrary, and I felt doubtful whether it might not be well to have some of the decisions reconsidered. Further, a certain number of total force observations had been made on board ship and partly reduced, but no final results had been reached, owing mainly, as I understood, to uncertainties about the corrections called for by the presence of iron in the ship. Obviously, if numerical results were to be reached, a series of somewhat arbitrary decisions would have to be taken; but I entertained a hope that co-operation between a magnetician and a naval observer, familiar with the actual conditions on board ship, might lead to results worth printing. As matters have turned out, it has seemed best to publish the declination and dip tables as Commander Pennell left them, with merely a few verbal alterations, and to leave the total force results alone.

The material consists mainly of observations taken on board the "Terra Nova," but includes a few observations on sea ice, and also the interesting series of declination results obtained by Lieut. (now Captain) Evans and Lieut. Bowers during Captain Scott's sledge journey to the South Pole.

Commander Pennell consistently used the term "magnetic variation" for declination, and as it is a term naval men seem loth to part with I have let it remain. The same remark applies to the use of "Barrow circle" to denote the ordinary land dip circle. In his day Barrow was the leading English maker of dip circles, and a few of his circles still survive, including the standard circle in use at Kew Observatory at the present time. But the land circles actually used by the Expedition were all Dover circles, the older ones by J. Dover, the new ones by A. W. Dover. The sea dip circles of the Lloyd-Creak pattern—usually designated L.-C. circles by Commander Pennell—were all made by A. W. Dover.

A large number of dip and total force observations had been taken by the observers of the Expedition at Simons Town (Cape Colony), Christchurch Observatory and Kew Observatory, treated as base stations, and corrections to the dip based on these observations were systematically applied. These corrections I have left unaltered. There is undeniably a much stronger argument for applying a correction to a Lloyd-Creak circle than to a land circle. In skilled hands the L.-C. circle gives much better results than one would expect, considering the friction that naturally prevails and the operation with the "scratcher" that is designed to overcome the friction. But on land the instrument is not the equal of the ordinary good Dover circle, so that there is much to be said for applying to the inferior instrument a correction based on its comparison with the superior one. There is a further practical reason in the general tendency exhibited by L.-C. circles to give a higher dip than the land circle. The fault might of course lie with the latter, but on this point the land circle has the support of the dip inductor, which is usually considered an instrument of superior type.

Commander Pennell divided the observations as a whole into two classes, the first including observations made in temperate latitudes, the second observations made in high southern latitudes, and the results have been shown in two charts* which he had prepared. The results as soon as worked out were, I believe, communicated to the Admiralty for charting purposes, and so have already served one of the principal purposes for which they were intended. They should be compared with the already published observations taken on board the "Galilee" and "Carnegie," the survey ships of the Carnegie Institution of Washington. The "Terra Nova" did not have that freedom from ship's magnetism enjoyed by the "Carnegie," and the reduction of the observations made on board her was a much more difficult and delicate task.

OBSERVATIONS FOR VARIATION TAKEN ON BOARD S.Y. "TERRA NOVA," BRIT. ANT. EXPEDN., 1910–13.

I. ("Variation.")

North of 60° S. Latitude.

A.—Absolute Variation obtained by "Swinging Ship."

Date.	Latitude.	Longitude.	Variation.	Swing.	Remarks.
	° ′	° ′	° ′		
1910.					
June 16	50 26 N.	5 19 W.	17 52 W.	II	Swing both ways.
,, 26	32 36 N.	16 56	18 25 W.	III... ...	,, ,,
July 25	20 10 S.	29 21 W.	19 10 W.	IV	,, ,,
Sept. 2	34 10	18 29 E.	27 50 W.	V	,, ,,
,, 29	41 24	100 27	23 34 W.	VI	,, ,,
Nov. 29	45 46 S.	170 50 E.	17 18 E.	VII ...	,, ,,

* Preserved at Kew Observatory.

I.—*Continued.*

North of 60° S. Latitude.

A.—Absolute Variation obtained by "Swinging Ship"—continued.

Date.	Latitude.	Longitude.	Variation.	Swing.	Remarks.
1911.	° ′	° ′	° ′		
March 31	43 37 S.	173 12 E.	16 51 E.	XIII ...	To port
July 27	34 32	172 02	13 19 E.	XIV ...	To starboard.
Aug. 3	34 28	173 08	14 13 E.	XV ...	Swing both ways.
Oct. 1	37 36	178 24	14 37 E.	XVI ...	To port.
„ 2	39 55	178 12	15 49 E.	XVII ...	„
„ 3	41 18	176 28	16 09 E.	XVIII ...	To starboard.
Dec. 9	43 34	172 53	15 09 E.	XIXA	Bottom apparently "disturbed."
„ 11	43 34	172 53	17 13 E.	XIXB	
„ 17	47 17	173 14	17 16 E.	XX ...	To port.
„ 20	54 08	173 18	21 17 E.	XXI ...	To starboard.
22	57 55	175 13	24 38 E.	XXII ...	„
1912.					
April 1	43 57	173 03	16 51 E.	XXVIII ...	„
Nov. 26	43 34	172 56	15 36 E.	XXIX ...	„
1913.					
Feb. 9	47 04	170 32	17 44 E.	XXXIII ...	„
„ 11	43 58	172 57 E.	17 00 E.	XXXIV ...	„
March 23	56 02	155 51 W.	24 14 E.	XXXV ...	„
April 13	52 09	63 47	13 14 E.	XXXVI ...	„
„ 19	40 18	54 48	3 31 E.	XXXVII ...	„
May 3	22 02	39 34	12 59 W.	XXXVIII	
„ 6	18 48 S.	33 28	17 54 W.	XXXIX ...	
„ 18	5 08 N.	23 50 W.	20 43 W.	XL. ...	

B.—Absolute Variation obtained with Landing Compass on Shore.

Date.	Latitude.	Longitude.	Variation.	No. of Obs.	Remarks.
1910.	° ′ ″	° ′ ″	° ′		
June 26	32 37 47 N.	16 55 04 W.	18 47·5 W.	I	At Madeira.

C.—Variation from Single Observations.†

Date.	Latitude.	Longitude.	Variation.	Remarks.
1910.	° ′	° ′	° ′	
June 15	51 17 N.	4 03 W.	17 43 W.	* Too much motion for great accuracy.
„ 17	47 56	11 03	19 03 W.	
„ 18	46 44	11 31	19 07 W.	
„ 18	45 43 N.	12 01 W.	18 41 W.	

† The deviations used in correcting the Total Errors have been deduced from the foregoing "swings"; the horizontal force and dip for the various positions being taken from Admiralty charts 3603 and 3598.

Formulæ were used as in "Admiralty Manual of Deviations."

I.—*Continued.*

North of 60° *S. Latitude.*

C.—Variation from Single Observations—continued.

Date.		Latitude.	Longitude.	Variation.	Remarks.
1910.		° ′	° ′	° ′	
June	19	44 33 N.	12 30 W.	18 41 W.	* Too much motion for great accuracy.
,,	20	42 08	13 30	18 10 W.	
,,	20	40 51	13 58	18 20 W.	
,,	21	39 09	14 30	18 00 W.	
,,	21	37 57	14 56	17 27 W.	
,,	22	35 10	15 46	17 37 W.	
,,	28	28 33	19 25	17 35 W.	
,,	28	27 48	19 49	17 23 W.	
,,	29	27 22	20 15	18 03 W.	
,,	30	26 09	20 58	18 38 W.	
July	1	25 29	21 27	18 34 W.	
,,	1	25 04	21 40	18 34 W.	
,,	2	23 49	22 22	18 34 W.	
,,	3	22 52	22 47	18 51 W.	
,,	3	22 10	23 13	18 45 W.	
,,	5	19 24	24 42	18 57 W.	
,,	7	15 56	25 31	18 51 W.	
,,	7	15 17	25 19	18 50 W.	
,,	8	13 19	24 59	19 09 W.	
,,	9	11 46	24 36	19 31 W.	
,,	10	9 30	24 21	19 39 W.	
,,	11	7 19	24 03	19 33 W.	
,,	14	3 05	21 11	20 24 W.	
,,	14	2 06	21 24	20 22 W.	
,,	15	0 55 N.	22 06	21 09 W.	
,,	16	1 48 S.	21 27	20 57 W.	
Aug.	1	26 34	22 45	22 19 W.	
,,	1	27 05	22 09	22 32 W.	
,,	2	28 52	20 39 W.	21 51 W.	
Sept.	4	38 15	19 18 E.	27 25 W.	
,,	4	38 18	19 21	27 12 W.	
,,	8	39 54	31 45	28 11 W.	
,,	15	39 44	52 20	24 07 W.	
,,	16	40 01	58 18	*26 16 W.	
,,	20	38 44	75 07	*28 02 W.	
,,	22	39 06	81 18	*28 02 W.	
,,	24	39 22	85 10	*26 00 W.	
,,	26	40 33	92 01	*27 10 W.	
,,	27	40 43	93 44	24 49 W.	
,,	27	40 52	94 47	*24 27 W.	
,,	28	41 00	98 02	*24 21 W.	
,,	29	41 10	99 20	*25 02 W.	
,,	30	41 46	101 58	23 37 W.	
,,	30	41 59	102 50	24 05 W.	
Oct.	1	42 11	105 25	21 29 W.	
,,	3	42 14	111 57	15 56 W.	
,,	6	41 45	122 18	6 01 W.	
Nov.	30	46 54	170 45	16 52 E.	
,,	30	48 13	170 25	17 50 E.	
Dec.	5	57 31 S.	176 48 E.	26 12 E.	

I.—*Continued.*

North of 60° *S. Latitude.*

C.—Variation from Single Observations—continued.

Date.	Latitude.	Longitude.	Variation.	Remarks.
	° ′	° ′	° ′	
1911.				
March 14	58 37 S.	161 22 E.	*24 43 E.	* Too much motion for great accuracy.
„ 14	58 22	162 00	*21 25 E.	
„ 15	58 18	161 26	*23 20 E.	
„ 15	58 07	161 35	*23 49 E.	
„ 16	56 34	162 45	*24 04 E.	
„ 17	56 14	163 56	21 50 E.	
„ 17	56 16	163 55	20 10 E.	
„ 17	56 17	163 33	21 16 E.	
„ 18	56 30	162 48	20 09 E.	
„ 23	54 50	160 32	19 37 E.	
July 14	36 49	177 25	14 33 E.	
„ 15	35 07	174 23	13 01 E.	
„ 16	34 13	172 15	13 25 E.	
Dec. 15	44 30	172 37	16 51 E.	
„ 16	45 01	172 18	16 50 E.	
„ 16	45 50	172 41	17 37 E.	
„ 17	48 14	172 49	18 19 E.	
„ 18	50 15	171 35	19 33 E.	
„ 19	51 19	172 08	19 08 E.	
„ 20	53 15	173 06	19 18 E.	
„ 21	55 02	173 05	21 24 E.	
„ 21	55 48	172 59	22 11 E.	
„ 21	56 08	172 59	22 50 E.	
„ 22	57 06	174 00	22 21 E.	
„ 23	58 44	177 06	24 21 E.	
1912.				
March 27	52 16	167 32	19 57 E.	
„ 27	52 11	167 25	20 00 E.	
„ 28	51 57	167 38	20 10 E.	
Dec. 14	44 01	173 34	17 26 E.	
„ 15	45 21	174 31	17 33 E.	
„ 15	45 36	174 38 E.	19 38 E.	
„ 18	51 42	179 02 W.	*20 51 E.	
„ 21	54 38	176 45	*21 31 E.	
„ 22	55 26	174 44 W.	22 18 E.	
1913.				
Feb. 3	58 40	157 47 E.	*22 23 E.	
„ 4	56 32	160 08	*20 25 E.	
March 14	45 34	175 04	*16 23 E.	
„ 15	47 12	176 18	*16 07 E.	
„ 16	48 41	178 43 E.	18 10 E.	
„ 17	49 41	179 36 W.	18 40 E.	
„ 17	52 12	175 39	20 03 E.	
„ 17	52 17	174 50	20 55 E.	
„ 18	53 41	171 50	*20 12 E.	
„ 19	55 05	166 18	*21 26 E.	
„ 20	55 35	163 49	21 40 E.	
„ 20	55 55 S.	163 11 W.	21 54 E.	

North of 60° *S. Latitude.*

C.—Variation from Single Observations—continued.

Date.		Latitude.	Longitude.	Variation.	Remarks.
1913.		° ′	° ′	° ′	
March 22	... ...	56 21 S.	160 22 W.	*23 58 E.	* Too much motion for great accuracy.
„ 24	... ...	55 58	153 27	24 22 E.	
„ 24	... ...	55 55	152 00	*23 29 E.	
April 1	... ...	55 11	120 03	27 18 E.	
„ 3	... ...	55 11	109 27	*28 56 E.	
„ 4	... ...	55 01	104 40	27 59 E.	
„ 5	... ...	55 02	100 56	28 09 E.	
„ 5	... ...	55 05	99 50	29 19 E.	
„ 6	... ...	55 13	95 21	28 22 E.	
„ 7	... ...	55 23	89 39	27 07 E.	
„ 7	... ...	55 24	89 12	26 20 E.	
„ 8	... ...	55 30	83 23	24 19 E.	
„ 9	... ...	55 30	78 06	22 25 E.	
„ 12	... ...	53 49	64 13	14 54 E.	
„ 16	... ...	46 58	60 24	9 49 E.	
„ 17	... ...	44 17	57 23	6 54 E.	
„ 18	... ...	42 46	55 28	5 23 E.	
„ 19	... ...	39 56	54 32	3 45 E.	
„ 20	... ...	38 49	52 52	1 31 E.	
„ 21	... ...	36 57	51 21	0 11 E.	
„ 25	... ...	28 00	46 00	6 54 W.	
May 1	... ...	23 03	42 50	10 45 W.	
„ 2	... ...	22 56	41 34	12 52 W.	
„ 2	... ...	22 39	40 53	12 54 W.	
„ 3	... ...	21 41	38 52	14 17 W.	
„ 4	... ...	20 54	37 34	14 51 W.	
„ 4	... ...	20 29	36 45	14 56 W.	
„ 5	... ...	19 30	34 45	17 26 W.	
„ 5	... ...	19 23	34 32	17 01 W	
„ 6	... ...	18 22	32 36	18 33 W.	
„ 7	... ...	17 43	31 17	19 08 W.	
„ 7	... ...	16 51	30 45	18 56 W.	
„ 8	... ...	14 42	29 30	19 42 W.	
„ 9	... ...	12 11	29 02	20 21 W.	
„ 10	... ...	10 30	28 31	20 39 W.	
„ 10	... ...	9 21	28 19	20 14 W.	
„ 11	... ...	7 38	27 50	20 13 W.	
„ 13	... ...	4 40	27 21	20 52 W.	
„ 13	... ...	4 23	27 18	20 42 W.	
„ 14	... ...	3 53	27 07	20 25 W.	
„ 14	... ...	2 52 S.	26 37	21 00 W.	
„ 16	... ...	0 22 N.	25 05	20 46 W.	
„ 17	... ...	2 48	24 45	20 44 W.	
„ 19	... ...	6 54	24 06	20 33 W.	
„ 25	... ...	22 50	35 09	19 33 W.	
„ 26	... ...	24 11	34 41	19 32 W.	
„ 26	... ...	25 08	34 19	19 47 W.	
„ 29	... ...	29 36	33 44	21 13 W.	
„ 30	... ...	33 07	34 18	22 13 W.	
„ 31	... ...	34 05	33 39	*22 53 W.	
June 1	... ...	37 01 N.	30 09 W.	22 52 W.	

OBSERVATIONS FOR VARIATION TAKEN ON BOARD S.Y. "TERRA NOVA," BRIT. ANT. EXPEDN., 1910–13.

II. ("VARIATION").

Antarctic Regions (for this purpose taken as South of 60° S.).

II. ANTARCTIC REGIONS.

A.—Absolute Variation obtained by "Swinging Ship."

Date.	Latitude.	Longitude.	Variation.	Swing.	Remarks.
	° ′	° ′	° ′		
1911.					
Jan. 1... ...	73 53 S.	174 09 E.	92 46 E.	VIII	
Feb. 8... ...	77 46	166 15	153 14 E.	IX	
„ 20... ...	71 20	170 00	66 52 E.	X	
„ 23... ...	69 43	163 24	51 54 E.	XI	Cardinal points only.
Mar. 4... ...	67 06	160 54 E.	36 03 E.	XII	„ „ „
Dec. 27... ...	65 31	176 28 W.	39 07 E.	XXIII	Cardinal points and S.W. only.
1912.					
Jan. 6... ...	73 49	171 51 E	96 24 E.	XXIV	
„ 7... ...	74 39	168 10	119 18 E.	XXV	Cardinal points only.
„ 12... ...	76 24	167 43	139 10 E.	XXVI	„ „ „
„ 12... ...	76 54	166 39 E.	144 50 E.	XXVII	
Dec. 29... ...	69 48	166 17 W.	52 37 E.	XXX	Cardinal points only.
1913.	(Arctic Shore Compass No. 2, shipped in L.C. position.)				
Jan. 16... ...	75 24	173 05 E.	112 57 E.	XXXI	
„ 19... ...	77 41	166 06	151 41 E.	XXXII	L.C. Position.
„ 19... ...	77 41 S.	166 06 E.	151 05 E.	XXXII	Standard.

B.—Absolute Variation obtained with Landing Compass on Ice.

Date.	Latitude.	Longitude.	Variation.	No.	Remarks.
	° ′	° ′	° ′		
1910.					
Dec. 14	67 28·2 S.	177 58·8 W.	43 47 E.	II	
„ 15	67 23	177 59	43 59 E.	II	
„ 20	68 40	179 28	47 09 E.	III	
1911.					
Dec. 29	66 45·7	177 48 W.	41 02 E.	IV	
1912.					
Jan. 11	76 03	165 55 E.	142 25 E.	V	
„ 12	76 55·2	166 39	144 43 E.	VI	
„ 15	77 21·5	166 01	151 04 E.	VII	
„ 20	77 10·8	164 13	156 03 E.	VIII	
„ 23	77 09·7	164 10 E.	153 49 E.	IX	
1913.					
Jan. 1	71 35	166 01 W.	61 24 E.	X	
„ 4	71 26·7	165 44	62 05 E.	XI	
„ 6	71 38·7	166 47	62 47 E.	XII	
„ 8	71 49·1	167 31 W.	62 50 E.	XIII	
„ 20	77 46·7	166 08 E.	152 04 E.	XIV	
„ 22	77 01	163 11 E.	154 43 E.	XV	
„ 26	74 56 S.	163 46 E.	135 56 E.	XVI	

II. Antarctic Regions—*Continued.*

C.—Variation from Single Observations.

Date.	Latitude.	Longitude.	Variation.	Remarks.
	° ′	° ′	° ′	
1910.				
Dec. 7... ...	62 02 S.	179 03 W.	*33 09 E.	* Too much motion for great accuracy.
„ 8... ...	63 11	177 29	*31 38 E.	
„ 8... ...	63 46	177 15	33 06 E.	
„ 9... ...	64 50	177 05	35 18 E.	
„ 9... ...	64 51	177 07	34 53 E.	
„ 9... ...	65 32	178 05	39 54 E.	
„ 10... ...	66 38	178 47	42 58 E.	
„ 10... ...	66 50	178 51	42 38 E.	
„ 13... ...	67 30	177 58	41 45 E.	
„ 14... ...	67 28	177 59	42 51 E.	
„ 14... ...	67 28	177 59	42 18 E.	
„ 15... ...	67 23	177 58	41 29 E.	
„ 17... ...	67 24	177 34	42 02 E.	
„ 19... ...	67 37	178 18	44 52 E.	
„ 19... ...	68 05	178 38	49 22 E.	
„ 20... ...	68 40	179 28	47 40 E.	
„ 20... ...	68 40	179 28	45 46 E.	
„ 21... ...	68 33	179 14	48 54 E.	
„ 21... ...	68 34	179 11	48 50 E.	
„ 22... ...	68 26	179 08	47 22 E.	
„ 22... ...	68 26	179 08	48 35 E.	
„ 22... ...	68 26	179 08	49 35 E.	
„ 24... ...	69 03	178 26	53 41 E.	
„ 28... ...	69 17	179 43	52 07 E.	
„ 28... ...	69 17	179 43 W.	55 01 E.	
„ 30... ...	72 12	177 15 E.	74 04 E.	
„ 30... ...	72 44	176 52	78 38 E.	
„ 31... ...	72 57	174 55	82 11 E.	
„ 31... ...	72 51	174 55	74 18 E.	
1911.				
Jan. 1... ...	72 45	174 14	78 20 E.	
„ 1... ...	72 51 S.	174 15 E.	86 39 E.	

Notes on Method used for determining Deviation.

In Ross Sea, i.e., *taken as South of* 66° *S.*

The total force has been taken as constant for the whole of this area. Hence in this area :—

The deviations caused by parameters P and Q (varying inversely as the horizontal force) will vary inversely as cos dip.

The deviation caused by parameter "little c" varies as tan dip. At these extreme values of dip the secant and tangent are for practical purposes the same.

Coefficient *B* varies therefore as tangent dip.
Coefficient *C* „ „ „ secant dip.

The dip has been taken from the chart of lines of equal dip given on Plate 19 (Magnetic Observations) in "Physical Observations" of the *Discovery* Expedition.

Between 60° *S. and* 66° *S. Latitude.*

The horizontal force and dip used have been taken from Admiralty Charts 3603 and 3598, the dip checked when possible by our own observations.

When the coefficients used have been deduced from a swing in the Ross Sea, the total force for the Ross Sea has been taken as ·69.

C.—Variation from Single Observations—continued.

Date.		Latitude.	Longitude.	Variation.	Remarks.
1911.		° ′	° ′	° ′	
Jan.	1...	73 29 S.	174 03 E.	90 36 E.	
"	1...	73 43	174 10	91 49 E.	
"	1...	73 43	174 10	91 52 E.	
"	2...	74 27	173 55	101 50 E.	
"	2...	74 51	173 57	106 19 E.	
"	2...	75 16	173 28	115 04 E.	
"	2...	75 35	172 59	119 24 E.	
"	3...	76 38	170 57	135 58 E.	
"	3...	77 00	170 36	140 08 E.	
"	28...	77 17	166 10	152 02 E.	
"	28...	77 06	166 13	147 22 E.	
"	28...	77 05	166 23	147 27 E.	
"	28...	77 25	169 30	140 46 E.	
"	29...	78 08	175 16	134 00 E.	
"	29...	78 10	176 03	133 41 E.	
"	29...	78 20	176 18	131 35 E.	
"	29...	78 20	176 59	128 33 E.	
"	29...	78 26	178 00	133 15 E.	
"	29...	78 23	179 24 E.	130 21 E.	
"	30...	78 24	178 20 W.	125 03 E.	
"	30...	78 24	177 50	126 47 E.	
"	30...	78 25	176 10	125 40 E.	
"	30...	78 25 S.	175 35 W.	120 01 E.	

NOTES ON METHOD USED FOR DETERMINING DEVIATION.—*Continued.*

In Ross Sea.

Owing to stores being embarked and disembarked the coefficients for different periods have been taken as follows :—

Voyage South, 1910–11 *Season.*

From Swing VIII ... $B - 18°{\cdot}7$, $C + 12°{\cdot}5$, $D + 0°{\cdot}8$, in Dip 86° 04′.

1910–11 *Season—Period Jan.* 28, 1911, *to Feb.* 17, 1911.

From Swing IX ... $B - 20°{\cdot}0$, $C + 5°{\cdot}9$, $D + 0°{\cdot}2$, in Dip 86° 27′.

Voyage North, 1910–11 *Season.*

From Swings {X, XI, XII} $B - 26°{\cdot}71$, $C + 5°{\cdot}52$, $D + 0°{\cdot}8$, in Dip 86° 51′.

Voyage South, 1911–12 *Season.*

From Swings {XXIV, XXV, XXVI, XXVII} $B - 27°{\cdot}30$, $C + 7°{\cdot}65$, $D + 0°{\cdot}7$, in Dip 86° 32′.

Voyage North, 1911–12 *Season and all* 1912–13 *Season.*

From Swings {XXX, XXXI, XXXII} $B - 28°{\cdot}61$, $C + 4°{\cdot}52$, $D + 0°{\cdot}8$, in Dip 86° 28′.

1912–13 *Season—L.C. Position.*

From Swings {XXXI, XXXII} $B - 1°{\cdot}6$, C Nil, in Dip 86° 20′.

From Various $D + 1°{\cdot}0$.

II. Antarctic Regions—*Continued.*

C.—Variation from Single Observations—continued.

Date.	Latitude.	Longitude.	Variation.	Remarks.
1911.	° ′	° ′	° ′	
Jan. 31... ...	78 33 S.	174 04 W.	117 01 E.	* Too much motion for great accuracy.
„ 31... ...	78 33	173 54	111 55 E.	
„ 31... ...	78 32	172 14	115 09 E.	
„ 31... ...	78 29	170 35	112 38 E.	
„ 31... ...	78 28	169 53	110 32 E.	
„ 31... ...	78 28	169 58	112 46 E.	
„ 31... ...	78 26	170 40	113 14 E.	
„ 31... ...	78 22	171 32	113 41 E.	
„ 31... ...	78 14	170 41	109 52 E.	
„ 31... ...	78 21	171 31	111 55 E.	
Feb. 1... ...	77 50	168 00	103 28 E.	
„ 1... ...	77 30	164 42	94 51 E.	
„ 2... ...	76 52	159 04	88 17 E.	
„ 2... ...	76 56	158 43	88 10 E.	
„ 2... ...	77 00	158 48	91 10 E.	
„ 2... ...	77 06	157 54	90 25 E.	
„ 2... ...	77 06	157 54	89 09 E.	
„ 2... ...	77 06	157 54	87 02 E.	
„ 2... ...	77 05	158 14	91 31 E.	
„ 2... ...	77 19	158 25	94 34 E.	
„ 3... ...	77 30	158 20	94 25 E.	
„ 3... ...	77 32	158 18	94 51 E.	
„ 3... ...	77 37	158 25	95 17 E.	
„ 3... ...	77 43	158 35	97 02 E.	
„ 3... ...	77 50	158 59	97 13 E.	
„ 3... ...	77 54	159 17	97 59 E.	
„ 3... ...	78 17	162 21	102 36 E.	
„ 3... ...	78 23	163 21	102 44 E.	
„ 5... ...	78 15	170 42	112 54 E.	
„ 5... ...	78 07	172 18 W.	113 38 E.	
„ 8... ...	76 53	170 00 E.	134 16 E.	
„ 8... ...	77 08	166 19	147 20 E.	
„ 8... ...	77 17	166 09	154 03 E.	
„ 8... ...	77 25	166 07	152 50 E.	
„ 10... ...	76 09	166 15	143 07 E.	
„ 10... ...	76 05	166 40	138 53 E.	
„ 10... ...	76 01	166 47	139 40 E.	
„ 11... ...	75 09	168 04	124 46 E.	
„ 11... ...	74 38	168 55	120 18 E.	
„ 11... ...	73 56	169 53	111 53 E.	
„ 15... ...	69 47	173 00	53 59 E.	
„ 16... ...	70 08	169 45	52 54 E.	
„ 17... ...	70 57	168 24	57 15 E.	
„ 17... ...	71 00	168 30	59 32 E.	
„ 17... ...	71 14	168 57	64 23 E.	
„ 17... ...	71 24	169 32	68 54 E.	
„ 17... ...	71 27	169 43	68 58 E.	
„ 21... ...	68 41	167 36	*43 32 E.	
„ 21... ...	68 40	166 45	*44 01 E.	
„ 22... ...	68 45	165 48	44 50 E.	
„ 22... ...	69 07	164 58	51 15 E.	
„ 22... ...	69 23 S.	163 59 E.	55 27 E.	

C.—Variation from Single Observations—continued.

Date.		Latitude.	Longitude.	Variation.	Remarks.
	1911.	° ′	° ′	° ′	
Feb.	22... ...	69 27 S.	163 47 E.	54 24 E.	* Too much motion for great accuracy.
,,	22... ...	69 38	163 36	57 22 E.	
,,	22... ...	69 43	163 24	54 19 E.	
,,	23... ...	69 34	163 00	48 14 E.	
,,	23... ...	69 33	162 58	48 34 E.	
,,	23... ...	69 40	163 10	49 14 E.	
,,	23... ...	69 30	162 49	51 20 E.	
,,	23... ...	69 19	162 14	52 56 E.	
,,	26... ...	68 53	158 09	45 01 E.	
,,	26... ...	68 52	158 34	46 07 E.	
,,	26... ...	68 47	158 36	43 58 E.	
,,	26... ...	68 43	158 37	45 45 E.	
,,	26... ...	68 41	158 35	44 00 E.	
,,	26... ...	68 38	158 27	41 50 E.	
,,	28... ...	68 18	160 34	42 46 E.	
,,	28... ...	68 14	160 38	40 38 E.	
,,	28... ...	68 12	160 35	39 23 E.	
,,	28... ...	67 54	160 22	38 02 E.	
Mar.	1... ...	67 32	159 32	34 10 E.	
,,	2... ...	67 36	160 14	36 11 E.	
,,	2... ...	67 36	160 22	34 28 E.	
,,	5... ...	66 44	161 18	32 25 E.	
,,	5... ...	66 43	161 26	34 14 E.	
,,	5... ...	66 35	161 40	36 34 E.	
,,	5... ...	66 20	161 38	32 20 E.	
,,	6... ...	65 23	161 28	31 14 E.	
,,	7... ...	65 01	161 24	27 39 E.	
,,	7... ...	65 00	161 22	30 54 E.	
,,	7... ...	64 54	161 08	29 39 E.	
,,	11... ...	61 16	163 11	*28 24 E.	
,,	11... ...	61 10	163 01 E.	*24 49 E.	
Dec.	24... ...	60 57	178 00 W.	29 44 E.	
,,	26... ...	63 46	175 45	33 59 E.	
,,	28... ...	66 11	177 06	38 09 E.	
,,	29... ...	66 46	177 48	39 25 E.	
,,	29... ...	66 46	177 48	41 46 E.	
	1912.				
Jan.	1... ...	68 22	178 04 W.	46 27 E.	
,,	1... ...	69 02	179 48 E.	52 12 E.	
,,	2... ...	70 28	174 03	57 48 E.	
,,	2... ...	70 37	173 38	58 18 E.	
,,	3... ...	71 08	171 11	63 11 E.	
,,	4... ...	71 10	170 10	71 34 E.	
,,	4... ...	71 10	170 10	67 30 E.	
,,	4... ...	71 10	170 10	67 07 E.	
,,	5... ...	71 58	172 12	71 09 E.	
,,	5... ...	72 39	172 18	80 52 E.	
,,	6... ...	73 55	171 19	99 25 E.	
,,	6... ...	74 00	171 18	99 02 E.	
,,	6... ...	74 03	171 19	100 30 E.	
,,	6... ...	74 14	170 30	105 16 E.	
,,	6... ...	74 19 S.	169 38 E.	107 03 E.	

II. Antarctic Regions—*Continued.*

C.—*Variation from Single Observations*—continued.

Date.		Latitude.	Longitude.	Variation.	Remarks.
		° ′	° ′	° ′	
1912.					
Jan.	6... ...	74 25 S.	169 50 E.	105 07 E.	* Too much motion for great accuracy.
,,	7... ...	74 35	169 00	117 35 E.	
,,	7... ...	74 50	168 07	119 18 E.	
,,	7... ...	75 32	169 09	124 34 E.	
,,	7... ...	75 34	169 33	124 42 E.	
,,	7... ...	75 38	169 22	128 01 E.	
,,	7... ...	75 48	169 05	128 42 E.	
,,	7... ...	75 47	168 19	130 30 E.	
,,	7... ...	75 45	167 35	133 05 E.	
,,	8... ...	75 35	166 58	137 46 E.	
,,	8... ...	75 32	166 23	136 32 E.	
,,	8... ...	75 09	163 59	133 27 E.	
,,	9... ...	75 00	163 56	134 57 E.	
,,	12... ...	76 01	167 03	136 33 E.	
,,	12... ...	76 02	167 16	137 16 E.	
,,	12... ...	76 34	167 23	143 51 E.	
,,	12... ...	76 47	167 04	147 00 E.	
,,	12... ...	76 49	166 47	149 36 E.	
Mar.	7... ...	74 48	170 39	109 05 E.	
,,	8... ...	73 50	174 11	92 39 E.	
,,	8... ...	73 17	174 00	86 43 E.	
,,	10... ...	70 43	174 06	*61 00 E.	
,,	14... ...	68 46	172 38	*44 35 E.	
,,	15... ...	68 03	169 33	*44 20 E.	
,,	16... ...	66 51	164 47	*34 35 E.	
,,	17... ...	65 36	161 41	*27 46 E.	
,,	17... ...	65 14	161 28 E.	*30 03 E.	
Dec.	25... ...	62 09	167 57 W.	*33 12 E.	
,,	27... ...	65 26	166 01	*37 12 E.	
,,	27... ...	66 18	166 04	*39 05 E.	
,,	28... ...	67 42	166 05	45 09 E.	
,,	28... ...	68 20	166 10	48 00 E.	
,,	29... ...	68 48	166 10	49 00 E.	
,,	29... ...	69 13	166 15	50 03 E.	
,,	29... ...	69 41	166 15	53 50 E.	
,,	30... ...	70 01	166 17	54 27 E.	
,,	30... ...	70 09	166 17	*56 07 E.	
,,	30... ...	70 57	166 11	58 44 E.	
,,	30... ...	70 57	166 11	58 05 E.	
,,	31... ...	71 07	166 15	58 23 E.	
,,	31... ...	71 24	166 00	61 26 E.	
1913.					
Jan.	1... ...	71 35	166 01	62 22 E.	
,,	3... ...	71 29	166 00	61 19 E.	
,,	3... ...	71 29	166 00	61 45 E.	
,,	4... ...	71 25	165 48	59 52 E.	
,,	5... ...	71 36	166 30	61 43 E.	
,,	6... ...	71 41	166 47	63 00 E.	
,,	6... ...	71 41	166 47	63 08 E.	
,,	6... ...	71 41	166 47	62 25 E.	
,,	8... ...	71 49	167 31	62 05 E.	
,,	9... ...	71 44 S.	167 57 W.	61 34 E.	

II. Antarctic Regions—*Continued.*

C.—Variation from Single Observations—continued.

Date.		Latitude.	Longitude.	Variation.	Remarks.
	1913.	° ′	° ′	° ′	
Jan.	9... ...	71 44 S.	167 57 W.	61 22 E.	* Too much motion for great accuracy.
"	9... ...	71 44	167 57	62 48 E.	
"	12... ...	72 00	168 17 W.	63 57 E.	
"	16... ...	74 51	177 04 E.	98 41 E.	
"	16... ...	74 58	176 34	*98 44 E.	
"	16... ...	75 11	175 32	*103 42 E.	
"	16... ...	75 38	171 47	116 44 E.	
"	17... ...	75 44	170 57	123 07 E.	
"	17... ...	75 50	170 28	122 31 E.	
"	17... ...	76 03	169 31	129 58 E.	
"	17... ...	76 05	169 24	130 52 E.	
"	17... ...	76 14	168 59	134 21 E.	
"	17... ...	76 18	168 51	136 26 E.	
"	17... ...	76 19	168 49	137 22 E.	
"	17... ...	76 27	168 47	136 43 E.	
"	17... ...	76 33	169 05	139 43 E.	
"	17... ...	76 34	169 05	141 50 E.	
"	18... ...	77 02	168 14	138 16 E.	
"	18... ...	77 02	168 10	144 03 E.	
"	18... ...	77 05	167 33	146 18 E.	
"	18... ...	77 05	167 33	146 00 E.	L.C. Position
"	23... ...	76 39	165 35	141 30 E.	
"	23... ...	76 39	165 35	146 56 E.	L.C. Position.
"	24... ...	76 20	167 07	138 17 E.	
"	24... ...	76 14	167 11	136 02 E.	
"	24... ...	76 14	167 11	143 33 E.	L.C. Position.
"	24... ...	75 58	167 45	134 48 E.	
"	24... ...	75 58	167 45	136 28 E.	L.C. Position.
"	25... ...	75 22	166 27	133 04 E.	
"	25... ...	75 22	166 27	131 40 E.	L.C. Position.
"	25... ...	75 18	166 06	130 13 E.	
"	25... ...	75 18	166 06	131 52 E.	L.C. Position.
"	25... ...	75 15	165 52	128 55 E.	
"	25... ...	75 15	165 52	131 39 E.	L.C. Position.
"	25... ...	75 08	165 20	126 47 E.	
"	25... ...	75 08	165 20	131 52 E.	L.C. Position.
"	25... ...	75 02	164 53	129 43 E.	
"	25... ...	75 02	164 53	131 26 E.	L.C. Position.
"	26... ...	74 56	163 46	139 17 E.	
"	26... ...	74 50	168 03	121 54 E.	
"	26... ...	74 50	168 03	119 34 E.	L.C. Position.
"	26... ...	74 44	168 24	117 38 E.	
"	26... ...	74 44	168 24	116 43 E.	L.C. Position.
"	26... ...	74 38	168 35	116 48 E.	
"	26... ...	74 38	168 35	116 01 E.	L.C. Position.
"	26... ...	74 28	169 21	108 03 E.	
"	26... ...	74 28	169 21	105 35 E.	L.C. Position.
"	27... ...	74 20	171 48	107 43 E.	
"	27... ...	74 11	172 11	105 01 E.	
"	27... ...	74 11	172 11	105 11 E.	L.C. Position.
"	28... ...	72 23	174 58	81 44 E.	
"	30... ...	67 18 S.	167 51 E.	41 36 E.	

B. A. E.

VARIATION OBSERVED ON BARRIER AND PLATEAU, 1911 AND 1912, BY LIEUTENANTS E. R. EVANS AND H. BOWERS.

Variation by Observations taken on Southern Journey.

Date.	Latitude.	Longitude.	True Bearing.	Comp. Bearing.	Variation.	Remarks.
	S.	E.				
	Observations by Lieutenant Evans.					
	° ′ ″	° ′	° ′	° ′	° ′	
1911.						
Nov. 10	79 40 00	169 22	N. 28 36 W.	N. 177 05 E.	154 19 E.	
,, 16	80 31 40	169 23	N. 78 30 W.	N. 124 26 E.	157 04 E.	
,, 24	81 14 53	170 01	N. 62 53 E.	N. 95 19 W.	158 12 E.	
,, 29	82 20 57	170 31	N. 54 00 W.	N. 145 15 E.	160 45 E.	
Dec. 16	84 13 52	170 49	S. 54 17 W.	N. 70 20 E.	163 57 E.	
,, 19	84 44 15	166 47	S. 59 23 W.	N. 69 45 E.	169 38 E.	
,, 22	85 13 29	161 55	S. 55 04 W.	N. 59 20 E.	175 44 E.	
,, 24	85 35 11	159 08	S. 72 43 W.	N. 73 01 E.	179 42 E.	
,, 26	86 02 00	160 20	S. 72 42 W.	N. 73 56 E.	178 46 E.	
,, 28	86 27 02	161 01	S. 80 02 W.	N. 82 12 E.	177 50 E.	
,, 31	86 55 47	161 38	N. 84 19 W.	N. 98 05 E.	177 36 E.	
1912.						
Jan. 2 ...	87 19 06	160 45	N. 86 05 W.	N. 95 16 E.	178 39 E.	
	Observations by Lieutenant Bowers.					
1912.						
Jan. 5	87 57 00	159 13	S. 86 34 W.	N. 85 28 E.	178 54 W.	Nothing in observation to explain this difference.
,, 7	88 10 45	159 43	N. 53 10 E.	N. 124 56 W.	178 06 E.	
,, 9	88 25 00	159 18	S. 78 46 W.	N. 79 27 E.	179 19 E.	
,, 10	88 34 44	159 48	S. 85 50 W.	N. 87 41 E.	178 09 E.	Only accurate to nearest degree.
,, 12	88 57 25	160 21	S. 83 05 W.	N. 83 24 E.	179 41 E.	
,, 13	89 08 54	160 58	S. 83 35 W.	N. 85 08 E	178 27 E.	
,, 15	89 33 15	160 57	S. 82 23 W.	N. 83 50 E.	178 33 E.	
	Variation taken on Depot Journey by Lieutenant Evans.					
1911.						
Jan. 30	77 54 18	167 17	N. 8 30 W.	S. 22 00 W.	149 30 E.	

The above observations are all time azimuths; the error of the watch on S.A.T. (solar apparent time) being ascertained at the same time in the sights taken for position; and therefore the S.A.T. used is independent of any error in position arising from a possibly erroneous G.M.T.

Compass bearings taken with compass needle attached to theodolite.

OBSERVATIONS FOR DIP TAKEN ON BOARD S.Y. "TERRA NOVA," R.Y.S. B. A. E., 1910–13.

SUMMARY OF RESULTS AND DISCUSSION.

I.

Outside Antarctic Regions (i.e., *for this purpose counted as North of* 61° *S.*).

II.

Inside Antarctic Regions (*South of* 66° 30′ *S.*).

The corrections were applied as follows :—

1st. Correction for instrumental differences.

2nd. The value of N calculated from formula (ii) or (iii) below.

3rd. $\varDelta$ calculated from (iv) and applied to N gives tangent of corrected dip.

Notation used and Formulæ.

The notation adopted is that used in " The Admiralty Manual of Deviations of the Compass " ; also—

V = Vertical force on board due to permanent magnetism.

Z = Vertical force absolute.

d = Coefficient of vertical force due to induction in soft iron.

$\varDelta$ = Correction due to vertical force of the ship.

N = Natural tangent of dip on board before correction for vertical force of ship and after correction for ship's head.

H = Horizontal force absolute.

z = Magnetic course. z' Compass course at L.C. position.

S = Maximum effect on the dip caused by " rod g " (Ad. Man.).

θ' = Dip as observed, corrected for instrumental error only.

θ = Dip absolute.

θ_n = Dip as represented by $\tan^{-1}$ N.

Formulæ.

(i) $1 + d + \dfrac{V}{Z} = \mu.$

$$\left.\begin{array}{ll}
\text{(ii)} & S\cos z + N = \\
& \left(\cos z + \dfrac{\sin B}{1+\sin D}\right)\sec z' \tan\theta' \text{ (For N and S quadrants)} \\
\text{(iii)} & S\cos z + N = \\
& \left\{(1-\sin D)\sin z - \dfrac{\sin C}{1+\sin D}\right\}\operatorname{cosec} z' \tan\theta' \text{ (For E and W quadrants)}
\end{array}\right\} \text{Correction for Direction of Ship's Head.}$$

(iv) $\varDelta = \dfrac{V}{A_1 H} + d\tan\theta.$ Correction for vertical force.

(v) $A_1 \doteq \lambda\,(1 + \sin D).$

(vi) $\operatorname{Tan}\theta = \tan\theta_n \cdot \dfrac{\lambda}{\mu}$ (for Antarctic only. See after).

OUTWARD VOYAGE—ENGLAND TO AUSTRALIA, JUNE–OCTOBER, 1910.

Between England and Australia the same values have been used for V and d as were found between New Zealand and England (Homeward Voyage).

Owing to the stores on board these values can only be considered approximate, the reliability of the results in the more unknown parts of the ocean can be judged from comparing how closely those in the Atlantic agree with the true.

$$\left.\begin{array}{l} V + \cdot 00793 \\ d + \cdot 0095 \end{array}\right\}\text{For discussion, see under Homeward Voyage.}$$

S — ·00757. Mean of values found at Spithead, False Bay, Port Phillip.

λ ·9644. Mean of values found at Spithead and False Bay.

D + 1° 35′. Mean of five swings between Spithead and False Bay.

II to VIII. Observed with Lloyd-Creak Circle 149, Needle 1.

IX to XV. Observed with Lloyd-Creak Circle 143, Needle 1.

No.	Date.	Latitude.	Longitude.	Observed Dip.	Corrected Dip.	Remarks.
	1910.	° ′	° ′	° ′	° ′	Results approximate, see remarks above.
II ...	June 26 ...	32 36 N.	16 57 W.	54 50·6N.	54 42N.	
III ...	„ 29 ...	27 02	20 25	47 46·4	47 45	
IV ...	July 7 ...	15 30	25 22	34 01	34 57	
V ...	„ 9 ...	10 59	24 34	26 55	26 49	
VI ...	„ 15 ...	0 47 N.	22 00	6 19 N.	7 27N.	
VII ...	Aug. 3 ...	30 09 S.	19 35 W.	36 33·7 S.	35 36 S.	
VIII ...	„ 13 ...	35 27	9 50 E.	58 03·6	57 23	
IX ...	Sept. 2 ...	34 15	18 31	60 44·7	60 16	
X ...	„ 12 ...	39 55	39 45	67 18·7	66 50	
XI ...	„ 16 ...	40 02	57 04	67 24	66 58	
XII ...	„ 24 ...	39 20	84 52	69 03·7	68 55	
XIII ...	„ 28 ...	40 54	97 12	71 31·7	71 20	
XIV ...	Oct. 1 ...	42 13	104 27	73 46	73 25	
XV ...	„ 5 ...	41 50 S.	117 45 E.	74 27 S.	74 05 S.	

Instrumental Corrections.

L.C. Circle 149, Needle 1,— 7′. Observed at Kew, May, 1910.
— 4′. Observed at Simonstown, August, 1910.

L.C. Circle 143, Needle 1,— 6′·5. Observed at Simonstown, August, 1910.
— 3′·3. Observed at Christchurch (various times), 1910–12.

End of observations whose corrections must be considered approximate.

The following "approximate co-efficients" of the L.C. compass were ascertained by comparison with the standard compass when "swinging ship."

Swing.	Date.	Latitude.	Longitude.	A.	B.	C.	D.	E.
	1910.			° ′	° ′	° ′	° ′	° ′
I ...	June 3rd	Spithead.	Spithead.	+0 45	—0 12	—1 12	+1 38	—0 03
II ...	„ 16	50 26 N.	5 19 W.	+0 54	—0 17	—0 30	+1 38	—0 05
III ...	„ 29	32 36 N.	16 56 W.	+0 42	—0 16	—0 40	+1 30	+0 26
IV ...	July 29	20 10 S.	29 21 W.	+0 42	—0 37	—0 29	+1 31	—0 14
V ...	Sept. 2	34 10 S.	18 29 E.	+0 51	+0 12	—0 39	+1 35	+0 11

A is taken as apparent only—due to faulty Lubber's Point.
E is neglected as occurring from faulty observation probably.

New Zealand to 61° S. Seasons 1910–11, 1911–12, 1912–13.

Observations for dip were not taken when ship had stores on board stowed so that they might affect the L.C. Position.

$$V = + \cdot 00793,\ d = + \cdot 0095,$$

as found from the formula $1 + d + \frac{V}{Z} = \mu$ from :—

June 13, 1913, in Bristol Channel, where $H = \cdot 185$ and dip 66° 59′ N., μ was found 1·0277.

March 31, 1911, outside Lyttelton, where total force = ·5986 and dip 67° 58′ S., μ was found ·9952.

S = — ·01708. Mean of three values found off Banks Peninsula { 9, XII, 1911. 31, III, 1911. 26, XI, 1912.

λ = 1·000. " " " " " " "

D = + 1° 24′. Mean of two swings off Banks Peninsula.

Observed with L.C. Circle 143, Needle No. 1.

No.	Date.	Latitude.	Longitude.	Observed Dip. S.	Corrected Dip. S.	Remarks.
		° ′	° ′	° ′	° ′	
XX ...	Mar. 11, 1911 ...	61 11 S.	163 05 E.	80 57	80 45	
XXI ...	—	—	—	—	—	Conditions unsatisfactory.
XXII ...	Dec. 17, 1911 ...	47 36	173 07 E.	70 01·2	69 51	
XXIII ...	" 18, 1911 ...	49 50	171 39 E.	71 47·3	71 37	
XXIV ...	" 21, 1911 ...	55 25	173 02 E.	76 03·8	75 45	
XXV ...	" 22, 1911 ...	57 20	174 17 E.	77 27·8	77 06	
XXVI ...	" 23, 1911 ...	58 58	177 38 E.	78 22·6	77 56	
XXVII ...	" 24, 1911 ...	60 37	178 43 W.	78 49	78 23	
XXXV A, B, C, D.	—	—	—	—	—	Not entirely satisfactory. See Mag. Log. and Work Book A.
XXXVI ...	Dec. 15, 1912 ...	45 21 S.	174 27 E.	69 04·8	68 47	

In reducing the above observations a mean was taken from the two following sets of approximate coefficients of the L.C. compass, which were ascertained by comparison with the standard compass when "swinging ship."

Swing.	Date.	Latitude.	Longitude.	A.	B.	C.	D.	E.
		° ′	° ′	° ′	° ′	° ′	° ′	° ′
XIII ...	Mar. 31, 1911 ...	43 37 S.	173 12 E.	+0 18	+0 40	+0 33	+1 20	+0 10
XXIX ...	Nov. 26, 1912 ...	43 34 S.	172 56 E.	+0 43	+0 07	+0 05	+1 27	–0 09

New Zealand to England, 1913.

As before, $V + \cdot 00793$, $d + \cdot 0095$,

$S - \cdot 01524$. From mean of values, March 31, 1911, and November 26, 1912, off Banks Peninsula, and June 13, 1913, in Bristol Channel.

$\lambda = \cdot 980$. From mean of values, March 31, 1911, off Banks Peninsula, and June 13, 1913, in Bristol Channel.

$D = + 1° 24'$.

Observed with L.C. Circle 143, Needle No. 1.

No.	Date.	Latitude. S.	Longitude. W.	Observed Dip. S.	Corrected Dip. S.	Remarks.
	1913.	° ′	° ′	° ′	° ′	
XLI z ...	Mar. 23	56 02	156 29	73 40·6	73 12	
XLII ...	April 13	51 54	63 44	46 33	45 44	
XLIII ...	„ 16	47 35	60 58	41 37	40 18	
XLIV ...	„ 18	42 42	55 28	36 36	35 14	
XLV ...	„ 19	40 00	54 35	33 52	32 04	
XLVI ...	„ 20	38 50	52 53	33 34	31 43	
XLVII ...	„ 23	33 09	49 16	27 26	25 13	
XLVIII	„ 25	28 02	46 01	21 57	19 48	
XLIX ...	May 2	22 51	41 23	18 18	15 59	
L ...	„ 3	21 58	39 27	17 18	14 58	
LI ...	„ 4	20 51	37 29	17 12	14 54	
LII ...	„ 5	19 41	35 08	17 24	15 06	
LIII ...	„ 6	18 49	33 30	17 03	14 46	
LIV ...	„ 7	17 44	31 18	17 10	14 55	
LV ...	„ 8	14 44	29 31	14 23	12 06	

Instrumental Correction.

L.C. Circle 143, Needle No. 1,— 3′·3. Observed at Christchurch (various times), 1910–12.
— 4′·5. Observed at Kew, October, 1913.
— 6′·5. Observed at Simonstown, August, 1910.

In the reduction of the above observations use was made of the following approximate coefficients of the L.C. compass, which were obtained by comparison with the standard compass when "swinging ship."

Swing.	Date.	Latitude.	Longitude.	A.	B.	C.	D.	E.
		° ′	° ′	° ′	° ′	° ′	° ′	° ′
XIII ...	Mar. 31, 1911 ...	43 37 S.	173 12 E.	+0 18	+0 40	+0 33	+1 20	+0 10
XXIX ...	Nov. 26, 1912 ...	43 34 S.	172 56 E.	+0 43	+0 07	+0 05	+1 27	—0 09
XXXVI	April 13, 1913 ...	52 09 S	63 47 W.	+0 40	+0 21	+0 56	+1 45	—0 20

A mean from swings XIII and XXIX was combined with swing XXXVI.

II.—ANTARCTIC REGIONS.

The method of correction adopted is that used by Captain Chetwynd for the "Discovery" observations, as explained in Section IX (p. 144) of Physical Observations (Nat. Ant. Expedition, 1901–04).

On p. 146 Captain Chetwynd shows that—

$$\tan\theta = \tan\theta_n \times \frac{\lambda V}{V_1},$$

where V = absolute vertical force, V_1 = mean vertical component on board,

but $\frac{V_1}{V}$ is μ

$$\therefore \tan\theta = \tan\theta_n \times \frac{\lambda}{\mu}$$

λ and μ were found in $\begin{cases} 77° \; 10' \text{ S.} \\ 164° \; 10' \text{ E.} \\ 23, \text{I}, 1912. \end{cases}$ $\begin{cases} 77° \; 41° \text{ S.} \\ 166° \; 06' \text{ E.} \\ 19, \text{I}, 1913. \end{cases}$

λ 1·0072 1·0094

μ ·9966 ·9985

$\therefore \lambda = 1{\cdot}0083$, taken as $1{\cdot}000$,

$\mu = {\cdot}998 \therefore \frac{\lambda}{\mu} = 1{\cdot}002.$

Mean value of S is $+ {\cdot}0364$ (from $g = - {\cdot}054$ and $+ {\cdot}128$). As all the reliable values of S outside the Antarctic are $-^{ve}$, this is probably erroneous and S is taken as zero.

This is a small matter for with S of value ·0364—

The maximum correction (*i.e.*, on N. or S.) in a dip of 85° is under 2′.

The maximum correction (*i.e.*, on N. or S.) in a dip of 87° is under 1′.

$D = + 1° \; 00'.$

The total force for the whole of the Ross Sea has been assumed to be constant and is taken as 0·69, the value found by the "Discovery."

Hence in determining the values of B and C, B may be taken as varying directly as tan dip; C directly as sec dip.

The following "approximate co-efficients" of the L.C. compass were ascertained by comparison with the standard compass when "swinging ship" (except XXXII, which is from direct observations taken with the "Arctic compass" shipped in the L.C. position).

Swing.	Date.	Latitude. S.	Longitude. E.	A.	B.	C.	D.	E.
		° ′	° ′	° ′	° ′	° ′	° ′	° ′
X ...	Feb. 19, 1911 ...	71 20	170 00	+1 59	+1 15	−0 06	+1 20	+0 07
XXIV ...	Jan. 6, 1912 ...	73 49	171 51	+1 01	+1 29	+5 10	+1 22	−0 20
XXVII	„ 12, 1912 ...	76 54	166 39	+1 06	+1 07	+3 19	+0 36	−1 00
XXXI ...	„ 16, 1913 ...	75 24	173 05	−0 05	−1 35	+1 11	+0 54	+0 10
XXXII	„ 19, 1913 ...	77 41	166 06	—	−1 35	−1 08	+0 49	+0 40

Instrumental Errors.

L.C. Circle 143, Needle No. 1.

Jan. 5 and 6, 1911. On ice, over 120 fathoms, off Cape Evans (*cf.* p. 423).

	° ′		° ′
L.C. 143, Needle 1	87 01·6	Barrow Circle 27, Needle 1	86 49·0
,, ,, ...	01·3	,, 27 ,, 2	47·5
Mean	87 01·5	,, 27 ,, spare	48·9
		,, 26 ,, 2?	48·7
Excess of L.C. 143, Needle 1,	13′	,, 26 ,, 8	49·0
		Mean ...	86 48·6

Checked by synchronous observations, January 21, 1913, which, however, proved to be ragged, and above is taken as more accurate.

Antarctic Regions.

Observed with L.C. Circle 143, Needle 1.

No.	Date.	Latitude.	Longitude.	Observed Dip. S.	Corrected Dip. S.	Remarks.
		° ′	° ′	° ′	° ′	
XVI ...	Feb. 22, 1911	69 17·5 S.	164 16·1 E.	86 06	86 15	
XVII ...	,, 26, 1911	68 53	158 39 E.	87 43	87 16	
XVIII ...	,, 28, 1911	68 07	160 31 E.	86 26	86 02	
XIX ...	Mar. 4, 1911	67 03	160 57 E.	85 47	85 29	
XXVIII ...	Dec. 29, 1911	66 46	177 48 W.	82 52	82 33	
XXIX ...	Jan. 1, 1912	69 07	179 27 E.	84 00	84 09	
XXX ...	,, 5, 1912	72 10	172 10 E.	86 43	86 30	
XXXI ...	,, 7, 1912	75 43	169 03 E.	87 11	86 46	
XXXII ...	,, 13, 1912	76 54	166 39 E.	—	86 18	Mean of corrected observations on N., E., S. and W., see p. 449.
XXXVII	,, 3, 1913	71 29	166 00 W.	83 14	82 54	
XXXVIII	,, 6, 1913	71 41	166 47 W.	83 26	83 02	
XXXIX ...	,, 9, 1913	71 44 S.	167 57 W.	83 50	83 22	

The following absolute values were found by Barrow dip circles taken on ice over deep water, the observations on January 5 and 6 being taken about 1 mile off Cape Evans.

No.	Date.	Latitude S.	Longitude.	Dip S.	Circle used.	Remarks.
		° ′	° ′	° ′		
XV (C to G)	Jan. 5 and 6, 1911	77 38	166 26 E.	86 48·6	Barrow Nos. 26 and 27	Mean of 5 needles.
XXXIII ...	Jan. 15, 1912	77 21·5	166 01 E.	86 14	Barrow No. 27	Mean of 2 needles.
XXXIV ...	,, 23, 1912	77 09·7	164 10 E.	86 18	Barrow No. 27	Mean of 2 needles.
XXXVIIIA	,, 6, 1913	71 40·7	166 47 W.	83 21	Barrow No. 27 Needle No. 1	
XL (A to G)	,, 21, 1913	77 46·7	166 08 E.	85 55	Barrow Nos. 27 and 186	Mean of 4 needles.
XLI (A to D)	,, 22, 1913	77 01	163 11 E.	86 22	Barrow Nos. 27 and 26	Mean of 4 needles.

On January 13, 1912, in 76° 54′ S., 166° 39′ E., observations for dip were made with ship's head N., E., S. and W. The observed values were—

Head.	Observed Dip.
	° ′
N.	86 33·6
E.	86 42
S.	86 09·1
W.	86 47·2

After correcting for instrumental error, and for direction of ship's head by formulæ (ii) and (iii), these values were :—

Head.	Dip (Tan^{-1} N).	Deviation from Mean.	Head.	Dip (Tan^{-1} N).	Deviation from Mean.
	° ′	′		° ′	′
N.	86 21	+3	S.	85 56	−22
E.	86 19	+1	W.	86 36	+18

The values of the dip so reduced (*i.e.*, Tan^{-1} N) should be the same for all directions of the ship's head. It will be seen that the differences are considerable.

The differences as found were plotted and a curve drawn from which the correction for any direction of ship's head could be measured, and these corrections were applied as a constant for the particular direction of the ship's head during each observation.

The procedure was as follows :—

1st. Correction for instrumental differences.
2nd. Correction applied as taken from curve.
3rd. The value of N obtained by formulæ (ii) or (iii).
4th. Final dip obtained from formula $\tan \theta = \tan \theta_n \dfrac{\lambda}{\mu}$ (see before).

Hourly Values.

E′—February, 1911.

Day.	2000γ (·02 C.G.S. Unit) +														
	0 h.	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	12 h.	13 h.	14 h.
	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
5	—	—	—	—	—	—	—	—	—	—	—	152	193	278	337
6	350	350	281	306	251	249	213	195	158	150	150	186	212	234	236
7	313	288	252	299	250	231	160	210	176	126	264	227	305	208	251
8	326	313	268	288	318	276	237	251	229	324	165	197	195	206	281
9	296	268	313	307	229	238	260	270	202	231	320	191	277	260	281
10	341	300	286	289	292	248	225	233	260	218	158	193	209	215	224
11	305	289	260	242	266	235	260	238	260	249	273	275	255	275	257
12	295	311	299	263	247	221	199	208	168	204	191	227	231	273	273
13	294	286	284	288	267	257	273	268	255	236	215	209	244	202	208
14	281	315	281	249	244	279	297	107	133	115	154	63	160	234	236
15	268	309	247	244	228	—	—	—	—	—	—	—	—	—	—
16	—	—	—	—	—	—	—	—	—	—	—	—	197	252	215
17	278	323	260	279	281	215	199	229	227	194	211	197	238	207	215
18	302	255	276	275	244	179	215	225	240	255	300	257	235	283	295
19	284	268	283	295	225	240	222	204	218	189	251	210	183	247	286
20	277	273	273	273	260	264	225	206	227	217	150	215	275	286	253
21	289	288	279	273	257	251	234	208	183	218	176	167	223	281	296
22	311	311	215	195	196	160	76	76	122	150	150	235	225	226	244
23	319	286	215	236	253	186	144	145	—24	182	191	81	212	229	292
24	320	264	268	228	260	193	208	195	167	225	109	105	173	240	170
25	278	295	289	236	244	169	286	262	171	102	206	273	286	215	268
26	288	286	240	251	226	286	292	204	210	180	180	247	152	212	202
27	310	299	266	255	247	268	211	244	251	240	265	178	264	273	291
28	311	281	240	231	215	225	160	193	89	208	251	255	251	167	241

E′—March, 1911.

1	302	262	248	245	210	221	203	139	181	110	108	192	116	180	303
2	289	259	204	260	260	208	245	234	171	244	253	268	241	248	279
3	274	270	266	279	237	215	261	286	300	279	281	243	265	283	281
4	302	283	257	252	239	223	213	168	163	239	218	224	204	253	295
5	283	273	270	252	252	252	275	218	153	165	213	218	268	301	217
6	305	239	281	174	220	178	153	234	235	223	184	205	216	239	237
7	294	264	247	265	252	237	210	253	215	264	180	186	190	239	226
8	397	273	264	249	231	228	204	213	197	191	181	176	181	206	234
9	339	262	245	276	241	233	252	242	244	304	229	218	231	230	287
10	277	271	268	244	248	249	231	212	207	237	281	207	191	212	224
11	272	272	265	263	260	258	255	245	242	220	237	222	257	249	248
12	275	266	270	266	265	260	255	249	228	219	235	252	268	281	291
13	276	284	281	259	255	247	241	232	229	232	234	233	250	253	255
14	286	275	268	272	268	262	255	248	202	191	181	195	222	203	232
15	268	276	271	271	268	252	253	262	217	163	170	191	175	206	203
16	281	261	271	255	255	252	233	274	231	202	202	162	253	258	245
17	273	268	289	241	231	210	231	223	212	174	237	203	222	223	233
18	284	277	260	263	264	255	266	258	268	261	268	243	268	270	257
19	278	277	270	264	268	263	268	246	239	245	233	239	246	246	259
20	281	275	270	271	266	268	264	264	268	262	259	270	262	259	272
21	294	235	265	220	171	168	192	93	129	166	168	176	205	234	301
22	343	223	259	223	144	158	95	180	224	224	246	184	166	224	210
23	316	261	243	266	264	222	255	239	157	229	220	188	45	84	262
24	265	297	252	218	181	171	155	165	221	171	128	241	129	226	275
25	250	294	249	265	241	253	242	246	236	182	149	178	219	252	189
26	284	270	258	258	242	241	192	224	188	235	178	78	188	255	297
27	301	236	265	226	253	221	164	181	170	100	94	190	265	297	306
28	307	284	226	278	259	252	263	243	65	117	217	223	139	146	246
29	274	278	274	272	287	253	217	223	158	157	249	279	201	213	175
30	294	250	283	248	197	247	241	265	266	272	261	274	297	287	286
31	294	276	276	271	270	259	242	235	274	220	258	252	249	272	295

Hourly Values.

E′—February, 1911.

2000γ (·02 C.G.S. Unit) +										Maximum Reading and Time.			Minimum Reading and Time.		
15 h.	16 h.	17 h.	18 h.	19 h.	20 h.	21 h.	22 h.	23 h.	24 h.						
γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	h.	m.	γ	h.	m.
—	—	—	—	—	—	—	—	—	—	—	—		—	—	
—	—	—	—	—	—	—	—	—	—	—	—		—	—	
—	—	—	—	—	—	—	—	—	—	—	—		—	—	
—	—	—	—	—	—	—	—	—	—	—	—		—	—	
307	342	333	354	389	355	360	331	397	350	—	—		—	—	
262	296	309	308	341	370	339	373	378	313	408	22	17	81	10	52
283	331	334	342	366	403	403	339	299	326	439	20	20	60	9	10
273	270	311	346	397	395	372	359	361	296	494	19	28	94	7	55
295	273	280	312	331	326	344	341	341	341	384	9	39	116	7	58
251	352	320	319	347	331	390	441	362	305	481	22	0	103	9	35
264	271	294	288	299	309	315	315	309	295	341	0	7	178	10	15
302	309	286	291	291	315	302	304	297	294	354	1	20	149	10	28
244	236	286	306	362	379	323	328	289	281	406	19	57	129	13	21
241	397	373	324	328	336	370	397	349	268	449	16	20	—32	6	52
—	—	—	—	—	—	—	—	—	—	383	18	30	61	10	40
252	305	324	338	350	331	294	318	296	278	357	19	10	145	8	40
257	286	315	335	331	344	376	341	331	302	397	20	30	52	9	8
292	305	307	322	323	347	335	311	297	284	377	0	10	110	12	22
281	325	352	346	326	310	310	305	293	277	367	17	32	100	8	42
273	267	294	311	311	308	324	310	293	289	355	20	45	129	9	8
352	378	347	337	359	364	397	397	322	311	438	21	15	145	8	53
430	432	365	363	384	438	296	315	313	319	598	14	58	— 6	6	25
300	313	357	324	320	364	326	333	328	320	494	17	29	—92	7	58
227	322	344	397	430	421	417	357	289	278	483	20	10	—42	14	13
300	307	335	328	333	336	308	347	322	288	364	21	58	65	8	48
268	404	361	432	373	372	339	341	330	310	525	17	59	87	9	38
202	289	308	323	328	328	333	326	337	311	404	23	16	129	8	2
313	383	389	300	335	291	362	348	326	302	486	16	52	38	13	22

E′—March, 1911.

276	276	326	314	349	414	365	331	304	289	502	20	0	—17	9	35
(279)	(279)	278	286	326	323	320	275	284	274	369	18	31	115	8	12
272	277	284	287	313	347	378	297	307	302	405	21	0	199	4	45
310	292	289	297	301	297	291	279	275	283	364	0	23	111	7	32
223	284	321	316	288	294	363	384	292	305	436	22	0	47	8	47
261	257	306	372	328	289	319	297	332	294	418	18	7	95	2	40
260	252	294	284	292	291	317	283	281	297	378	17	46	121	6	50
233	250	262	287	292	302	300	305	350	339	391	22	37	100	9	31
275	265	299	294	304	321	303	274	278	277	386	0	0	179	9	20
228	249	271	278	283	286	284	288	278	272	307	21	37	160	9	45
249	264	271	274	276	287	286	281	272	275	292	12	15	205	9	2
294	283	268	310	323	307	297	281	274	276	348	19	23	192	9	0
264	265	265	281	289	310	302	301	294	286	317	19	45	215	8	10
233	210	278	314	361	373	303	275	268	268	394	19	37	130	11	10
221	281	268	276	284	284	276	268	272	281	357	16	10	95	9	17
276	265	270	291	334	323	300	301	284	273	363	19	0	84	8	35
255	263	276	287	291	316	301	295	273	284	332	20	24	102	9	0
294	308	299	302	287	284	284	278	281	278	318	16	2	201	7	28
260	259	275	286	288	288	283	281	277	281	297	19	5	208	10	43
307	332	405	399	390	362	383	402	371	294	463	22	32	231	13	17
323	281	385	433	331	297	358	352	299	343	525	17	38	37	7	13
286	344	350	316	357	331	330	333	292	318	429	16	32	20	6	23
284	325	352	370	398	374	330	352	295	265	457	19	13	—34	12	15
352	319	319	313	330	350	361	337	306	250	394	15	10	53	9	26
261	328	350	361	407	391	339	321	287	284	500	19	12	73	10	19
325	401	329	326	368	372	316	288	281	301	455	15	39	48	11	22
294	337	439	407	413	392	323	355	326	307	523	16	44	31	9	32
330	333	354	385	375	321	291	281	303	274	452	17	34	5	8	15
235	339	336	315	297	306	310	299	318	294	410	16	23	102	8	38
284	302	342	343	336	337	350	307	295	294	383	17	50	169	3	58
284	318	330	330	378	342	302	286	291	284	407	19	20	189	8	42

Hourly Values—*continued.*

E′—April, 1911.

2000γ (·02 C.G.S. Unit) +

Day.	0 h.	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	12 h.	13 h.	14 h.
	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
1	283	277	278	276	270	243	205	192	230	245	273	265	276	275	286
2	282	287	258	267	288	251	227	203	261	215	211	199	247	273	299
3	290	283	272	267	243	254	258	256	251	251	231	218	238	209	228
4	301	277	271	274	257	247	242	216	227	225	235	234	241	219	257
5	305	299	251	276	285	248	235	228	230	199	251	252	262	274	275
6	276	276	273	273	269	271	271	271	272	269	252	256	263	271	275
7	275	285	280	273	272	273	264	263	242	221	267	276	288	290	273
8	276	280	280	280	261	256	225	254	228	230	177	227	247	230	251
9	289	247	261	240	275	265	267	265	202	161	125	50	172	160	112
10	359	278	241	238	256	252	259	270	261	273	269	199	293	280	234
11	283	293	240	267	251	264	259	259	234	235	192	120	102	185	261
12	283	285	265	275	277	270	259	274	269	249	216	185	234	249	229
13	283	293	286	273	234	252	209	185	267	—	—	—	—	—	—
14	—	—	—	—	—	—	—	—	—	249	252	244	248	251	261
15	282	280	273	271	274	275	275	275	277	277	275	275	280	285	288
16	283	280	276	277	280	277	276	271	275	264	244	243	264	249	248
17	294	265	231	138	209	190	94	179	207	147	204	231	241	271	285
18	309	244	267	280	270	211	229	267	234	167	207	248	256	240	258
19	280	280	296	240	238	249	248	232	254	231	234	212	165	240	294
20	287	264	296	282	273	247	220	209	233	202	251	278	223	251	280
21	299	267	280	282	273	271	270	267	258	151	172	267	246	220	305
22	301	273	293	257	303	260	212	104	112	146	172	187	204	230	282
23	286	254	280	212	242	236	191	179	170	209	256	244	221	262	305
24	271	300	288	282	261	271	261	256	244	269	269	246	240	280	290
25	319	299	276	247	241	246	225	262	280	269	218	232	232	258	267
26	313	267	288	288	293	276	271	273	276	275	261	271	264	262	291
27	302	293	289	274	276	272	286	278	273	258	247	243	288	306	305
28	290	291	299	287	288	282	273	278	283	280	287	291	260	262	316
29	—	—	—	—	—	—	—	238	287	277	260	215	228	258	283
30	300	278	280	280	274	282	274	267	273	274	273	267	249	269	264

E′—May, 1911.

Day.	0 h.	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	12 h.	13 h.	14 h.
1	288	317	256	230	225	152	175	254	188	56	185	203	234	278	288
2	278	274	280	277	275	274	275	274	264	280	272	275	264	262	265
3	288	283	275	270	275	275	272	269	270	256	274	274	278	283	278
4	277	286	285	281	272	272	262	248	267	269	268	265	269	275	278
5	282	274	275	277	277	275	275	272	272	275	269	264	275	275	268
6	288	283	285	252	274	265	262	240	209	206	222	213	234	262	281
7	285	282	278	275	243	243	233	234	212	193	217	217	251	296	293
8	330	295	253	283	224	243	253	243	248	225	207	235	226	215	194
9	299	282	274	275	272	269	275	261	256	281	280	278	266	254	263
10	295	275	285	301	270	272	272	272	265	285	272	257	259	243	251
11	285	277	282	286	269	248	259	253	272	277	275	267	235	183	192
12	285	280	256	283	254	151	190	230	257	239	264	239	257	285	283
13	285	286	278	279	277	270	267	270	275	274	272	272	267	272	269
14	285	282	283	288	286	281	280	277	278	275	262	282	279	275	282
15	288	285	288	285	283	252	251	259	261	263	250	123	123	194	308
16	275	275	267	246	254	272	253	180	168	237	195	177	254	265	299
17	299	248	263	267	267	244	188	196	263	259	230	220	268	264	272
18	290	285	248	243	249	250	259	261	228	256	282	281	259	286	269
19	288	277	293	265	261	259	255	239	213	282	259	230	233	251	261
20	278	305	285	297	280	249	239	213	223	266	240	199	228	280	297
21	312	288	263	246	267	246	234	270	280	278	243	259	262	277	282
22	275	277	303	259	197	275	240	263	235	190	227	252	259	295	288
23	279	272	296	279	278	275	272	262	252	279	278	272	282	275	278
24	282	279	278	269	278	283	275	275	281	278	248	217	250	274	265
25	285	285	283	267	285	274	278	272	268	274	274	274	278	278	275
26	307	293	278	262	257	240	272	256	269	259	265	264	269	269	254
27	277	285	280	268	275	219	240	275	259	269	256	280	270	277	262
28	292	275	263	268	277	269	274	274	270	269	261	252	272	268	235
29	280	277	277	279	270	270	272	253	261	259	272	272	272	272	275
30	282	279	277	279	275	278	280	272	275	275	264	269	268	265	268
31	288	294	256	244	217	226	227	233	211	188	171	207	233	246	253

E′—April, 1911.

2000γ (·02 C.G.S. Unit) +										Maximum Reading and Time.			Minimum Reading and Time.		
15 h.	16 h.	17 h.	18 h.	19 h.	20 h.	21 h.	22 h.	23 h.	24 h.						
γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	h.	m.	γ	h.	m.
289	293	299	296	296	301	306	286	285	282	320	20	30	121	8	44
318	324	325	309	316	296	309	289	276	290	353	16	43	110	7	18
228	262	302	303	293	303	304	307	325	301	344	23	0	170	11	30
257	285	280	291	290	302	309	318	290	305	346	21	46	173	8	59
267	277	283	290	288	293	286	283	286	276	347	0	12	155	8	58
275	283	288	296	291	307	316	305	286	275	327	21	20	246	10	1
291	296	298	291	306	300	294	288	285	276	323	16	48	201	8	35
243	273	289	300	298	300	285	290	271	289	361	23	28	154	9	55
251	335	356	399	430	422	448	454	409	359	537	21	29	19	10	53
305	316	318	354	328	304	300	309	277	283	377	17	40	139	11	15
249	258	265	273	273	287	290	290	290	283	320	1	5	72	12	20
251	254	261	342	340	324	328	288	304	283	384	18	21	130	11	0
—	—	—	—	—	—	—	—	—	—	324	0	57	159	6	50
264	267	276	283	283	293	286	280	280	282	307	20	4	219	10	33
290	283	286	286	288	289	286	287	286	283	309	15	0	251	14	48
302	335	356	370	383	372	304	293	287	294	413	18	47	191	9	22
240	296	322	386	472	424	373	338	283	309	519	18	36	63	6	7
278	325	335	296	296	336	372	358	331	280	429	20	45	104	9	12
364	359	362	393	348	333	318	331	311	287	453	15	5	130	11	38
332	332	409	357	402	367	343	303	303	299	473	16	40	134	8	42
296	366	388	335	348	348	322	325	300	301	565	16	29	55	9	5
309	358	375	343	342	331	344	309	313	286	415	16	5	36	7	14
293	313	356	370	351	364	345	299	330	271	404	20	25	127	7	28
293	330	330	344	333	328	285	340	360	319	389	23	15	205	5	52
296	317	338	366	316	299	303	300	293	313	402	17	31	183	10	5
280	300	325	309	360	322	296	290	289	302	437	19	9	212	11	38
304	301	304	309	312	351	327	296	293	290	382	19	50	217	11	5
305	300	294	307	299	312	397	—	—	—	415	21	14	161	12	55
296	299	299	320	356	369	313	309	313	300	408	19	37	177	10	40
283	283	294	300	328	425	335	311	316	296	527	20	7	211	11	37

E′—May, 1911.

274	288	288	285	290	288	285	286	282	278	330	1	1	28	9	0
275	291	288	310	323	336	336	285	285	288	398	20	28	225	7	48
286	293	288	301	316	314	298	283	293	277	353	19	14	228	3	29
282	282	285	286	291	288	288	288	278	282	308	8	18	233	8	5
283	288	298	308	334	327	321	296	288	288	381	18	37	254	11	0
281	286	311	293	301	286	282	299	293	285	324	16	40	170	11	5
291	307	335	372	383	372	383	304	319	330	425	20	37	164	11	17
233	265	301	343	321	352	324	297	285	299	423	20	12	157	13	48
277	282	275	303	301	303	301	288	285	295	324	18	25	222	7	25
267	280	285	298	303	314	314	311	297	285	335	3	2	188	8	14
275	301	304	295	292	288	283	281	285	285	343	15	44	117	13	35
297	295	334	361	292	290	282	283	283	285	466	17	32	119	5	10
285	283	288	292	301	324	305	299	282	285	358	20	12	253	7	5
290	297	299	299	301	305	319	336	312	288	351	21	21	252	10	18
327	392	409	403	334	341	347	321	292	275	493	17	34	9	11	31
274	306	338	370	334	359	369	338	292	299	491	16	39	—11	17	25
285	299	330	372	372	330	347	334	301	290	422	18	37	166	5	58
319	291	314	325	332	348	327	306	280	288	377	20	28	177	1	35
272	314	340	327	327	383	327	281	307	278	412	19	43	196	9	50
321	288	301	295	304	308	366	312	312	312	390	20	40	140	11	24
285	288	286	291	293	317	327	297	330	275	413	21	50	41	22	22
281	317	317	341	310	299	295	288	283	279	361	18	15	143	3	52
286	286	288	295	312	285	282	280	282	282	364	18	51	238	8	20
269	279	282	294	295	295	291	288	291	285	310	18	48	192	11	22
277	275	279	275	293	282	285	292	288	307	312	18	35	253	3	5
285	286	278	285	278	279	280	283	288	277	328	1	38	180	7	29
217	251	282	286	301	347	332	319	299	292	387	20	4	156	15	19
267	263	290	369	312	307	299	288	286	280	408	17	45	204	14	12
279	282	288	303	293	285	275	280	275	280	374	18	28	228	7	24
277	285	290	280	282	283	286	283	283	288	314	23	27	253	9	56
291	305	321	337	369	328	306	304	314	312	407	18	37	139	9	28

E′—June, 1911.

Day.	2000γ (·02 C.G.S. Unit) +														
	0 h.	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	12 h.	13 h.	14 h.
	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
1	315	283	264	246	238	227	218	202	195	220	218	220	236	249	291
2	275	299	259	266	246	228	258	242	262	251	242	238	267	244	253
3	275	278	267	273	273	275	273	272	275	266	262	268	256	278	281
4	278	271	272	277	269	264	260	266	265	267	266	268	275	275	277
5	278	278	275	278	281	272	214	160	175	251	238	188	229	268	283
6	270	259	266	270	247	206	255	255	225	240	255	247	249	259	264
7	264	262	259	278	257	244	249	267	239	237	244	262	246	240	244
8	278	270	275	288	267	274	217	278	268	251	272	262	269	269	257
9	278	275	271	271	273	275	272	257	253	267	270	267	275	272	280
10	275	275	272	278	278	281	275	260	280	246	227	199	220	242	304
11	291	254	288	256	264	253	230	214	214	—	—	—	—	—	—
12	—	—	—	—	—	—	—	—	—	240	246	251	236	226	269
13	269	285	280	271	244	252	265	218	246	233	231	264	259	240	249
14	298	275	255	227	229	223	270	272	272	272	271	272	260	273	277
15	285	268	264	285	266	271	273	249	256	226	202	201	213	252	252
16	280	278	272	275	277	275	273	249	199	211	257	242	257	262	272
17	271	268	278	273	229	237	218	226	191	233	227	246	244	266	273
18	283	273	284	275	275	275	268	270	272	270	271	271	270	275	270
19	281	269	272	275	275	277	271	278	277	269	270	266	267	268	275
20	275	270	278	275	277	271	266	273	262	275	278	270	271	283	278
21	278	288	275	275	277	275	270	272	257	268	268	253	266	253	258
22	289	283	262	262	249	236	233	259	252	244	233	199	246	262	249
23	297	265	278	278	272	271	259	244	258	275	271	275	270	269	269
24	294	298	280	281	267	282	256	—	—	—	—	—	258	273	278
25	291	278	282	277	278	277	270	268	277	277	277	277	272	275	270
26	278	280	277	272	270	277	275	275	270	270	268	268	275	271	275
27	278	277	278	283	275	275	277	277	280	278	275	277	277	278	278
28	278	278	277	277	275	278	275	273	267	271	277	270	277	275	269
29	297	236	269	278	281	277	277	281	262	281	273	262	246	266	280
30	278	267	272	275	275	280	275	278	277	273	277	277	273	277	275

E′—July, 1911.

1	293	293	278	289	290	289	289	288	291	283	275	256	257	261	260
2	316	309	291	275	236	247	288	283	251	258	262	277	264	260	212
3	285	298	289	289	283	275	262	267	264	264	251	247	245	263	299
4	300	283	293	275	286	251	243	235	241	277	287	289	283	283	288
5	289	283	280	283	286	272	225	256	270	258	246	264	283	269	269
6	293	288	293	283	283	258	262	251	262	286	267	285	283	286	282
7	293	288	309	283	246	283	260	286	273	288	260	275	272	282	296
8	302	298	211	243	243	244	247	267	274	277	259	247	241	198	271
9	283	290	238	269	234	227	249	248	251	282	256	198	225	286	289
10	312	271	278	278	283	272	276	265	271	258	267	278	274	286	286
11	296	293	294	286	290	293	280	283	272	271	256	180	212	258	258
12	285	287	291	286	262	248	273	269	264	254	256	276	244	242	251
13	277	274	280	296	261	262	262	269	254	219	221	254	230	223	278
14	286	287	285	288	283	283	282	280	286	280	277	274	282	282	286
15	289	285	285	282	289	267	272	277	283	277	278	276	278	283	288
16	287	285	276	276	278	278	280	280	271	282	273	276	285	283	283
17	285	287	283	288	290	254	260	283	286	283	283	286	283	288	286
18	293	277	280	288	283	(269)	(254)	(240)	225	217	198	172	248	258	276
19	293	290	293	238	287	251	259	260	225	262	218	202	219	238	254
20	287	302	269	270	285	225	238	249	251	232	236	234	258	263	275
21	288	283	282	275	270	264	245	251	247	254	251	254	259	267	277
22	277	280	265	282	276	272	269	262	256	217	238	271	267	273	296
23	283	283	272	278	276	257	252	254	275	247	269	260	263	264	262
24	280	276	275	277	273	277	283	275	277	270	267	273	280	276	286
25	293	283	278	264	256	207	267	270	282	278	269	282	280	282	288
26	282	282	285	282	280	275	267	267	276	274	275	276	277	285	291
27	285	278	282	282	280	265	275	260	265	276	282	283	283	280	282
28	282	282	282	283	283	271	241	231	247	264	275	275	258	274	274
29	280	309	267	256	263	245	185	162	123	193	202	252	183	170	249
30	328	286	277	265	247	273	249	241	264	221	262	220	227	194	262
31	280	269	296	258	234	278	245	221	234	264	271	274	274	254	262

HOURLY VALUES—*continued.*

E′—June, 1911.

2000γ (·02 C.G.S. Unit) +										Maximum Reading and Time.			Minimum Reading and Time.		
15 h.	16 h.	17 h.	18 h.	19 h.	20 h.	21 h.	22 h.	23 h.	24 h.						
γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	h.	m.	γ	h.	m.
296	311	333	341	357	352	333	317	286	275	373	20	13	182	6	52
291	294	296	293	296	308	309	289	288	275	322	20	43	183	6	36
281	311	302	302	295	288	278	277	277	278	350	16	0	241	11	50
277	278	288	294	289	288	283	283	277	278	299	18	0	251	8	40
282	285	291	296	344	386	309	298	281	270	435	20	5	109	8	17
270	278	278	280	284	288	335	328	302	264	357	21	13	176	5	30
264	288	284	293	296	297	295	284	273	278	335	2	52	199	6	52
278	283	324	298	288	288	277	277	277	278	349	16	53	199	6	1
277	283	281	282	289	283	283	275	277	275	294	19	20	231	10	52
304	361	404	320	390	359	310	302	284	291	529	16	10	154	11	1
—	—	—	—	—	—	—	—	—	—	312	2	2	156	7	10
286	296	342	339	324	304	262	300	304	269	380	17	15	201	10	41
267	281	337	317	343	335	277	288	307	298	451	19	28	193	7	25
281	289	317	346	356	341	343	295	268	285	386	17	55	182	5	2
272	302	317	289	306	314	289	283	280	280	348	17	17	162	10	31
277	278	298	333	306	294	294	296	311	271	377	18	24	182	8	6
285	280	291	291	310	304	295	295	281	283	333	19	28	160	8	2
270	284	281	278	285	278	288	294	283	281	304	21	45	262	5	42
288	286	284	285	291	302	315	288	283	275	325	21	0	257	11	52
275	288	307	328	293	285	306	309	285	278	372	17	39	249	8	20
266	285	288	300	346	285	285	304	283	289	408	18	57	231	11	32
288	309	278	293	361	337	309	302	291	297	390	19	0	140	11	10
278	273	294	304	325	319	311	343	310	294	377	19	35	199	7	5
277	288	286	284	297	289	291	296	275	291	328	0	10	209	1	37
278	281	281	286	291	280	283	278	278	278	317	19	25	260	0	41
271	277	283	283	288	283	288	282	278	278	291	17	3	260	10	37
277	275	281	282	284	288	288	285	277	278	299	20	35	259	9	6
267	288	291	299	309	304	285	291	302	297	322	19	40	259	15	2
273	294	300	298	315	307	306	293	309	278	330	19	10	186	1	2
277	278	281	285	281	285	277	281	282	288	296	23	50	260	2	7

E′—July, 1911.

283	307	320	393	375	320	327	340	314	316	471	18	32	242	12	10
251	294	305	311	315	373	341	317	291	285	404	20	15	157	3	33
275	283	322	330	313	325	351	314	294	300	464	20	12	—158	20	25
287	289	290	299	312	314	314	299	301	289	338	19	23	198	7	48
276	299	300	307	305	299	291	301	293	293	335	17	58	193	5	46
283	286	293	289	293	306	305	316	296	293	333	21	38	233	6	48
290	342	289	287	303	309	377	366	318	302	411	21	33	227	10	4
293	309	318	296	367	380	361	360	298	283	416	22	0	135	2	13
290	296	300	288	293	294	304	325	293	312	335	21	49	155	11	1
283	282	305	311	304	318	306	293	293	296	327	20	30	233	9	10
263	293	303	342	389	307	283	296	280	285	431	18	50	127	11	7
264	293	296	293	322	375	325	313	289	277	451	19	58	217	12	18
276	291	293	291	300	293	293	291	293	286	312	19	27	183	8	35
285	286	305	322	314	330	327	309	293	289	362	20	22	269	8	46
286	296	296	307	296	303	294	296	287	287	317	17	45	260	5	22
285	293	291	296	285	288	291	285	288	285	329	17	45	251	8	7
289	289	296	304	300	329	327	303	296	293	358	19	34	230	5	27
288	283	316	317	398	340	316	288	307	293	456	19	17	138	10	40
251	333	409	290	283	305	356	341	312	287	490	17	7	158	7	57
283	263	288	312	385	328	280	278	273	288	428	18	57	175	9	7
269	286	275	288	305	309	287	288	283	277	345	19	15	236	8	33
280	299	288	309	325	320	322	333	276	283	385	21	22	174	9	30
263	273	293	309	311	322	283	289	288	280	333	19	40	206	8	57
283	287	285	287	291	289	288	288	285	293	307	18	40	260	8	40
288	290	286	282	282	282	282	280	280	282	301	0	27	178	4	57
289	294	290	288	288	282	285	287	282	285	303	16	50	243	8	50
283	283	288	287	285	282	283	280	278	282	301	16	7	230	5	55
275	283	303	307	325	305	313	349	280	280	382	22	23	159	23	19
280	275	290	298	347	353	335	309	299	328	389	19	36	78	7	58
293	303	301	309	340	311	338	325	267	280	369	18	36	172	12	48
289	286	275	305	322	324	370	336	290	280	401	20	38	188	7	58

E′—August, 1911.

Day.	2000γ (·02 C.G.S. Unit) +														
	0 h.	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	12 h.	13 h.	14 h.
	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
1	292	279	289	281	285	272	273	274	279	287	260	274	274	286	295
2	289	290	301	285	270	292	286	275	273	275	279	281	283	292	289
3	290	292	290	294	292	277	273	285	289	263	294	288	292	283	302
4	279	310	288	270	286	277	282	272	247	260	263	268	275	254	261
5	285	295	292	294	281	263	271	288	268	275	257	237	300	279	258
6	299	302	284	275	279	270	252	255	279	282	253	192	245	270	288
7	289	301	284	288	283	284	281	289	283	283	274	261	283	297	298
8	288	287	294	295	286	283	285	290	289	289	287	288	295	294	295
9	292	295	300	295	288	289	286	283	282	277	286	285	289	289	286
10	299	294	290	290	294	288	289	281	285	283	288	289	285	292	301
11	292	287	290	289	288	288	287	285	286	285	287	287	287	286	295
12	292	290	292	295	292	292	289	286	279	260	274	281	289	297	294
13	292	289	287	287	295	292	292	292	294	284	292	292	295	295	298
14	290	289	288	287	288	281	279	289	289	292	289	281	282	(280)	277
15	314	286	287	284	288	292	279	277	289	276	279	274	272	286	297
16	299	287	289	288	272	253	273	283	287	281	286	288	294	287	315
17	276	271	270	279	289	279	284	241	274	288	286	268	266	259	270
18	292	279	279	279	289	285	294	287	283	282	273	273	271	261	264
19	298	279	289	284	287	294	283	281	277	281	287	287	297	294	295
20	308	308	292	303	269	242	269	289	257	250	177	192	246	292	306
21	290	292	289	271	266	276	279	286	286	288	287	284	299	287	289
22	295	288	292	290	290	292	289	288	287	285	290	286	289	292	295
23	292	290	294	295	292	292	287	288	289	290	292	292	297	287	294
24	305	311	315	111	246	240	244	177	212	210	233	113	176	230	250
25	305	298	289	283	244	248	199	204	186	197	233	270	272	263	257
26	316	302	266	302	276	235	244	261	268	255	233	233	218	254	253
27	294	300	281	252	283	268	192	231	279	246	227	211	250	246	235
28	301	313	295	269	257	258	217	216	283	252	244	205	234	250	271
29	286	295	287	272	229	270	263	255	224	241	277	269	294	295	279
30	283	288	294	279	260	281	284	292	287	284	279	272	277	268	284
31	289	302	292	281	284	268	241	239	270	279	281	266	288	294	300

E′—September, 1911.

1	293	317	250	256	274	279	272	278	260	287	279	272	282	284	290
2	298	289	292	297	292	290	280	269	279	282	271	—	—	—	297
3	293	282	290	297	289	287	285	285	286	278	282	288	289	288	295
4	297	297	295	295	295	293	290	290	290	288	290	291	297	298	303
5	298	295	295	297	284	288	282	282	287	284	288	290	288	291	297
6	292	303	282	288	285	288	285	262	256	256	262	273	277	297	309
7	290	298	298	295	284	269	280	284	284	286	287	287	291	301	306
8	292	301	302	290	292	286	284	282	287	295	277	288	282	285	288
9	289	292	295	289	277	262	279	282	271	277	273	273	282	282	286
10	293	293	291	287	282	272	266	277	271	282	253	263	276	273	274
11	300	286	290	288	271	272	276	269	287	266	253	255	282	284	298
12	311	269	297	245	232	237	220	251	229	205	224	236	262	266	290
13	305	285	290	282	234	266	253	242	253	253	251	267	271	302	309
14	324	306	287	279	285	292	285	276	273	273	282	278	264	269	285
15	298	292	293	272	284	286	279	290	264	267	269	273	282	295	291
16	311	303	295	286	288	301	269	288	288	288	256	259	273	300	314
17	305	248	286	280	259	224	218	263	290	275	275	269	271	273	264
18	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
19	—	—	—	—	—	—	—	—	—	—	—	—	—	280	304
20	305	301	303	300	290	275	266	269	227	185	196	222	224	249	266
21	297	290	292	246	253	251	217	240	234	230	243	203	245	259	308
22	280	319	304	193	224	224	206	233	195	271	229	146	215	230	263
23	290	295	300	297	279	240	243	226	269	249	262	174	198	204	231
24	295	313	282	291	277	287	277	238	215	232	195	253	261	266	289
25	297	298	297	313	309	298	300	290	277	249	269	275	297	282	292
26	308	287	288	298	298	301	280	279	273	263	266	266	282	291	291
27	292	298	293	293	297	290	273	261	249	263	226	232	245	232	298
28	297	269	301	287	297	285	286	287	298	308	288	284	278	291	304
29	293	292	288	292	291	289	291	298	295	305	271	290	305	298	311
30	297	295	295	295	285	288	291	289	284	—	—	—	—	—	—

E′—August, 1911.

2000γ (·02 C.G.S. Unit) +										Maximum Reading and Time.			Minimum Reading and Time.		
15 h.	16 h.	17 h.	18 h.	19 h.	20 h.	21 h.	22 h.	23 h.	24 h.						
γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	h.	m.	γ	h.	m.
298	295	305	302	315	311	302	301	289	289	332	18	50	226	7	33
292	306	299	321	311	302	303	300	300	290	339	18	2	251	8	11
315	317	334	342	337	334	359	317	305	279	384	21	9	223	8	45
287	321	367	354	345	337	334	341	295	285	389	16	35	221	13	20
274	289	313	305	311	315	303	301	292	299	332	17	20	190	11	18
327	305	279	317	328	323	310	289	299	289	367	18	34	127	10	50
305	297	306	337	321	325	305	300	294	288	365	17	49	232	11	5
294	298	306	300	310	310	305	297	297	292	326	18	55	273	5	47
295	300	298	302	305	300	298	295	299	299	315	15	32	248	9	54
298	306	312	311	305	327	325	317	301	292	345	20	20	270	6	45
298	300	297	300	300	297	297	300	302	292	326	15	22	258	9	56
298	300	303	302	305	318	311	299	294	292	334	19	50	252	9	0
311	303	305	334	330	360	384	300	301	290	424	20	18	273	8	12
289	301	299	316	324	342	314	305	305	314	356	19	55	268	5	58
294	299	308	311	324	311	305	295	294	299	350	19	8	268	11	30
319	350	373	410	421	403	360	317	290	276	442	18	33	244	5	17
266	297	305	302	298	305	316	305	292	392	332	21	30	210	6	56
289	300	308	308	302	305	301	300	300	298	313	17	18	237	13	19
298	299	300	308	310	311	314	308	302	308	321	20	8	259	7	50
332	313	323	339	352	344	317	308	292	290	373	19	12	137	9	55
294	308	306	316	321	311	302	297	298	295	332	18	32	255	3	23
298	306	300	299	302	314	318	300	298	292	327	20	48	274	9	56
311	301	318	313	317	329	382	399	398	305	452	21	54	271	13	35
300	382	332	395	345	337	384	360	345	305	481	15	42	—42	2	58
250	308	303	341	390	358	332	317	319	316	438	19	7	147	6	10
260	298	300	330	341	328	357	343	312	294	400	22	32	177	10	25
272	308	321	356	343	312	319	321	302	301	374	18	42	134	10	59
295	337	306	329	392	328	299	300	298	286	445	19	2	151	5	37
295	299	303	300	313	319	299	299	298	283	341	19	41	193	4	23
282	306	316	316	334	308	308	318	306	289	363	18	56	237	3	32
297	325	334	357	358	379	408	332	306	290	474	20	28	208	6	37

E′—September, 1911.

318	326	339	324	315	308	309	297	298	298	356	16	45	224	8	1
301	309	311	306	335	324	311	298	304	293	366	19	12	253	10	10
318	320	320	314	308	300	303	298	301	297	332	17	7	269	9	45
303	308	308	303	303	300	297	300	298	298	309	15	45	280	9	2
302	314	322	320	320	347	332	303	298	292	375	20	14	269	9	47
305	308	304	314	318	303	298	305	304	290	335	18	50	229	7	17
320	324	331	320	324	315	302	303	311	292	351	19	14	262	4	50
305	311	324	303	306	309	309	305	301	289	342	17	22	249	9	39
297	298	303	316	324	320	311	304	297	293	339	18	18	243	7	30
284	287	329	305	329	321	328	317	328	300	356	19	12	247	11	55
309	313	322	331	331	337	331	308	297	311	369	17	27	230	7	13
324	340	340	339	301	301	324	301	305	305	371	16	22	174	9	11
308	335	359	345	319	318	333	368	316	324	392	17	5	206	10	5
300	305	321	321	311	321	329	309	298	298	368	17	32	241	8	52
295	343	369	350	339	319	311	302	313	311	404	16	59	232	8	15
346	331	381	439	426	368	339	327	322	305	508	18	25	214	9	58
311	332	—	—	—	—	—	—	—	—	372	15	52	202	5	7
—	—	330	332	311	—	—	—	—	—	342	17	45	304	20	25
318	—	321	318	321	—	308	311	304	305	332	19	22	277	12	58
308	332	340	350	417	456	381	408	370	297	503	19	39	158	9	20
316	327	347	350	428	416	427	411	314	280	471	19	13	174	11	3
318	342	400	346	377	340	366	363	347	290	542	16	55	100	10	25
279	308	415	350	327	348	313	308	311	295	486	17	22	122	10	50
300	311	314	313	309	315	316	309	305	297	331	1	24	133	9	39
297	314	321	319	317	314	309	314	311	308	329	17	36	226	9	1
298	316	316	321	334	332	308	298	298	292	352	19	55	248	8	13
298	327	333	355	324	331	333	304	329	297	370	17	52	206	13	0
324	324	330	329	331	308	313	302	306	293	370	16	54	233	11	38
314	319	335	348	330	309	314	297	297	297	360	18	7	247	10	8
—	—	—	—	—	—	—	298	298	309	318	23	37	277	4	45

Hourly Values—*continued.*

E′—October, 1911.

Day.	2000γ (·02 C.G.S. Unit) +														
	0 h.	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	12 h.	13 h.	14 h.
	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
1	310	296	287	296	298	291	294	290	298	296	299	289	280	280	299
2	299	298	293	298	292	293	290	291	293	286	289	309	299	317	319
3	289	291	262	256	263	275	296	281	274	252	252	251	265	276	287
4	299	305	292	293	289	279	254	259	250	241	262	289	309	310	305
5	304	299	302	299	288	276	258	268	259	236	254	246	286	294	318
6	294	289	296	291	286	312	280	270	270	270	272	270	265	312	325
7	304	298	287	280	265	263	280	285	283	280	276	267	251	280	285
8	292	309	299	296	233	252	262	245	276	235	270	235	228	228	241
9	317	283	279	262	293	292	286	278	283	250	223	233	225	225	258
10	303	286	278	247	258	261	267	278	289	267	261	280	274	299	302
11	319	280	285	270	214	164	137	99	67	64	102	104	155	190	217
12	277	276	261	267	289	261	215	191	183	186	149	298	328	275	334
13	294	292	293	292	287	312	310	281	280	283	283	263	249	296	301
14	304	283	291	299	276	265	274	283	274	270	281	250	310	299	301
15	293	292	288	287	304	257	233	272	288	265	292	265	270	244	273
16	285	288	289	289	288	285	283	288	283	268	279	285	296	298	304
17	309	283	280	277	254	227	223	220	183	228	160	248	227	270	279
18	314	309	283	245	256	235	218	230	270	237	273	260	239	248	257
19	304	259	270	245	251	235	190	141	204	177	241	220	299	293	315
20	303	307	303	276	272	261	223	205	220	209	251	279	285	288	290
21	302	303	265	280	250	257	275	241	257	257	259	236	251	220	241
22	290	296	283	270	268	273	254	209	225	254	244	219	252	248	286
23	304	309	283	277	267	263	249	238	237	247	199	265	270	301	319
24	298	291	298	293	280	254	219	246	259	235	250	294	312	341	315
25	310	293	307	294	245	264	283	279	310	294	270	235	273	276	322
26	293	294	293	296	296	287	278	190	210	239	312	267	275	277	289
27	309	294	302	296	312	309	304	302	294	285	280	280	293	299	328
28	312	299	296	289	283	292	294	283	234	289	252	296	323	338	336
29	315	299	302	301	291	296	299	303	287	292	279	267	298	310	320
30	306	299	305	274	292	310	299	267	264	322	299	336	322	315	347
31	305	296	298	299	299	291	285	288	303	278	273	272	272	294	310

E′—November, 1911.

1	309	289	298	301	290	289	289	289	282	276	188	209	237	263	301
2	295	301	287	298	291	276	256	258	247	250	249	256	272	277	277
3	321	285	274	285	290	274	269	267	252	239	278	293	265	281	307
4	289	294	265	272	243	222	227	209	149	164	254	206	239	219	316
5	301	292	316	292	278	249	233	207	216	229	243	259	247	232	292
6	301	327	285	269	272	252	239	212	203	198	224	248	267	241	289
7	288	294	281	274	279	248	249	234	236	219	211	240	266	237	259
8	312	287	285	270	272	270	265	248	238	252	260	276	304	303	304
9	300	295	298	282	267	269	308	343	336	285	181	235	285	319	373
10	278	283	288	285	311	241	247	253	151	132	196	157	199	227	285
11	283	312	303	300	303	295	212	195	216	239	253	269	285	290	298
12	311	270	282	293	314	280	274	295	209	203	218	227	237	280	274
13	287	288	290	287	288	321	250	209	157	165	162	201	138	203	225
14	340	306	278	261	194	182	209	209	140	128	73	141	232	227	239
15	379	295	276	232	247	236	256	220	190	143	127	174	176	194	269
16	290	321	272	254	247	243	212	198	149	145	198	199	201	217	246
17	303	275	263	272	282	277	274	289	282	199	146	182	190	205	225
18	308	305	280	272	264	256	223	210	252	233	214	221	254	274	300
19	298	291	277	282	272	265	282	269	280	267	281	301	298	308	329
20	290	301	323	281	260	266	236	233	195	162	248	278	373	287	309
21	285	279	279	311	309	274	324	282	317	300	282	340	216	201	330
22	285	274	289	308	330	303	278	274	251	314	266	319	304	318	322
23	307	321	327	295	307	309	269	261	287	283	274	289	311	304	311
24	319	294	289	266	280	308	317	307	308	291	298	253	296	311	312
25	300	322	293	300	293	272	290	303	259	266	259	256	279	308	318
26	308	304	289	314	337	327	330	335	314	219	145	235	212	207	246
27	289	285	283	280	267	275	269	256	218	192	192	224	221	235	298
28	291	285	298	287	287	252	206	254	267	267	282	291	269	288	291
29	306	288	296	301	280	278	280	272	285	285	293	298	285	288	305
30	303	323	289	274	230	194	214	248	199	172	188	188	217	241	265

Hourly Values—*continued.*

E′—October, 1911.

2000γ (·02 C.G.S. Unit) +										Maximum Reading and Time.			Minimum Reading and Time.		
15 h.	16 h.	17 h.	18 h.	19 h.	20 h.	21 h.	22 h.	23 h.	24 h.						
γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	h.	m.	γ	h.	m.
320	325	330	325	312	304	304	303	304	299	340	17	1	272	12	18
319	329	328	367	346	343	341	343	328	289	401	18	24	262	10	51
312	322	319	312	317	325	310	306	299	299	334	20	17	227	3	37
310	302	316	317	317	321	310	304	302	304	333	20	0	214	8	58
322	325	325	317	314	314	315	315	318	294	336	14	30	214	8	43
329	328	338	354	334	319	315	312	302	304	383	18	15	243	12	10
296	296	349	370	378	361	328	304	302	292	396	19	27	243	11	38
298	341	359	369	349	356	325	351	319	317	387	21	48	210	13	12
256	302	378	388	338	320	348	351	351	303	411	17	27	203	11	22
306	310	341	332	345	334	332	333	310	319	369	16	57	214	3	21
287	316	420	428	425	405	372	354	286	277	504	17	20	37	7	35
299	307	310	320	314	306	309	306	301	294	369	12	2	104	10	15
299	316	345	340	325	317	304	301	309	304	365	17	12	194	11	18
325	334	335	321	322	341	321	306	296	293	362	20	28	201	8	17
288	331	348	389	360	345	333	310	293	285	454	18	8	216	12	54
309	296	335	317	321	325	309	317	302	309	347	17	5	258	9	25
294	309	351	370	360	358	367	386	343	314	449	22	11	117	9	59
289	315	328	345	413	373	393	383	322	304	462	19	10	149	6	42
315	321	330	356	371	380	358	318	332	303	407	20	24	73	6	25
314	316	314	331	341	390	340	325	329	302	466	19	59	159	6	59
285	310	315	331	332	358	365	322	317	290	379	20	23	199	13	32
307	310	323	347	352	340	318	296	296	304	378	18	17	177	10	52
304	298	319	347	343	325	341	317	320	298	364	18	25	168	10	2
315	322	330	341	388	362	360	362	292	310	409	19	2	175	6	36
354	351	362	351	345	341	312	291	296	293	380	14	45	201	10	21
312	319	330	327	317	310	310	309	310	309	359	5	33	155	6	42
329	330	338	341	344	333	329	309	320	312	357	18	48	251	11	12
322	354	354	336	318	328	317	302	312	315	369	16	58	168	7	54
309	328	333	330	331	331	317	317	302	306	346	15	57	225	10	48
317	330	317	312	321	320	317	307	302	305	354	5	19	220	7	40
321	322	338	327	330	327	323	309	305	307	349	16	33	241	9	57

E′—November, 1911.

312	324	336	334	337	331	338	332	306	295	355	20	25	151	10	0
291	301	333	336	351	356	354	347	324	321	369	21	41	230	6	45
335	429	333	314	324	321	322	321	343	289	491	16	9	135	8	53
306	387	342	356	367	375	330	330	308	301	414	15	40	54	8	10
285	298	353	378	374	382	350	345	323	301	395	19	54	167	8	22
295	294	338	353	362	338	330	295	301	288	377	17	52	170	8	55
269	282	312	333	330	351	332	314	309	312	373	19	29	180	9	28
301	307	319	332	335	325	316	309	303	300	340	18	30	227	7	38
362	354	384	345	348	340	334	312	331	278	416	16	54	108	10	47
332	358	365	378	364	375	359	364	301	283	406	19	54	9	10	30
325	338	338	356	351	337	319	314	293	311	377	18	49	145	7	38
269	301	298	325	330	327	321	306	309	287	358	4	46	151	7	38
309	334	348	389	414	350	338	360	362	340	506	23	26	54	9	44
251	288	345	349	340	353	343	347	360	379	413	22	56	50	10	3
330	306	324	432	391	332	327	337	321	290	480	17	48	67	9	10
256	281	311	347	343	323	340	342	318	303	364	19	0	103	7	33
275	304	314	321	324	314	345	372	327	308	407	21	51	109	9	3
312	312	323	330	322	319	312	300	293	298	340	17	40	179	9	35
343	348	336	340	336	325	311	289	285	290	361	18	37	227	8	59
356	363	382	405	393	361	306	330	321	285	460	18	12	31	9	17
353	366	380	385	346	334	361	415	347	285	438	22	7	166	12	12
343	366	340	350	347	327	330	290	298	307	379	16	7	191	7	54
308	311	324	327	336	332	330	319	321	319	358	5	22	229	6	40
314	333	358	347	340	337	317	300	291	300	371	16	42	212	11	7
317	320	347	336	330	330	314	319	308	308	359	16	55	203	8	31
254	291	319	332	336	335	322	321	293	289	369	3	0	64	10	1
300	295	290	318	324	322	317	311	293	291	334	19	57	148	10	43
320	330	358	330	314	311	305	306	306	306	380	16	48	164	6	23
338	347	343	340	336	320	314	314	311	303	360	15	47	206	10	48
301	303	296	295	278	305	298	295	285	279	349	0	50	145	8	52

Hourly Values—*continued*

E′—December, 1911.

Day.	0 h.	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	12 h.	13 h.	14 h.
	2000γ (·02 C.G.S. Unit) +														
	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
1	288	281	309	284	291	244	220	192	210	166	241	236	267	239	286
2	307	363	278	250	320	220	207	162	197	217	197	226	246	252	252
3	303	292	283	281	278	268	298	258	184	188	155	207	345	305	327
4	303	310	289	250	212	194	179	186	270	248	214	186	243	259	271
5	289	286	281	285	283	273	262	239	220	236	210	229	273	303	317
6	297	287	286	299	268	255	239	256	208	236	227	265	261	276	278
7	378	345	349	296	293	236	128	168	391	330	320	257	321	332	317
8	330	320	304	296	298	285	332	341	323	272	315	312	327	299	302
9	304	317	310	313	309	278	286	289	250	272	288	259	283	294	314
10	320	301	307	313	305	310	296	318	309	281	289	294	310	316	287
11	307	302	313	327	321	332	373	352	375	334	405	382	97	35	184
12	309	298	315	229	231	212	165	139	166	93	177	205	173	218	265
13	307	289	296	283	285	278	267	239	236	239	281	239	239	229	239
14	283	279	278	287	310	288	304	285	294	291	300	289	263	294	243
15	313	257	214	236	173	113	119	139	136	162	199	210	223	236	265
16	312	294	318	320	300	287	256	236	265	232	228	229	217	250	246
17	321	316	289	289	320	315	336	274	321	296	288	291	287	271	298
18	369	320	292	346	307	367	272	210	287	298	349	339	260	258	333
19	336	300	315	304	298	341	339	120	265	201	221	272	283	273	244
20	307	349	270	290	285	336	380	389	371	310	367	398	398	356	320
21	312	313	310	312	334	340	347	372	384	394	349	321	320	279	231
22	320	301	304	305	329	328	323	346	352	288	261	259	273	307	334
23	326	323	307	296	317	302	328	307	298	284	349	330	332	334	227
24	296	289	290	299	302	326	370	362	367	380	334	279	294	302	345
25	301	305	321	320	289	289	226	271	252	258	201	228	245	270	267
26	294	291	323	270	268	242	244	259	245	161	165	218	265	252	290
27	267	252	304	307	223	197	188	158	97	141	227	171	179	227	309
28	314	345	278	272	239	243	192	184	239	220	184	188	239	179	249
29	292	291	330	305	291	239	216	185	208	259	226	247	248	275	278
30	285	287	281	271	258	262	263	257	258	218	255	248	257	270	278
31	330	325	299	267	292	303	286	281	313	309	323	271	271	258	232

E′—January, 1912.

Day.	0 h.	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	12 h.	13 h.	14 h.
1	275	263	288	281	215	204	154	176	334	357	312	312	328	274	310
2	320	305	309	239	332	232	290	283	339	333	299	286	306	265	289
3	314	303	304	301	318	349	345	348	368	288	296	248	213	241	266
4	303	297	292	301	299	308	307	297	296	325	312	309	309	328	320
5	318	315	305	309	312	303	307	294	236	238	141	165	170	270	279
6	303	297	279	333	279	303	302	296	372	385	283	272	251	248	210
7	294	309	325	320	312	308	319	320	341	286	283	297	305	319	330
8	320	307	318	303	288	286	272	246	243	207	194	202	249	257	247
9	319	288	279	265	266	270	267	249	299	262	246	241	260	276	270
10	312	280	260	266	290	267	209	236	215	220	189	206	233	267	347
11	310	293	279	253	234	195	205	202	297	176	178	202	207	232	247
12	299	292	262	252	248	247	247	212	180	160	171	178	171	219	221
13	365	336	323	283	290	236	239	299	292	346	186	195	253	337	367
14	350	303	262	288	254	228	264	367	389	268	260	241	201	211	290
15	325	339	299	275	266	273	321	331	374	387	286	296	338	328	310
16	320	328	315	309	317	314	333	315	334	363	354	323	312	301	314
17	365	328	328	315	325	328	330	341	320	339	224	293	293	257	279
18	394	338	321	294	244	263	272	328	253	238	168	315	237	178	290
19	326	305	280	277	305	281	278	296	302	267	262	249	288	299	314
20	283	296	288	304	312	295	288	309	289	176	194	228	270	297	309
21	281	284	291	294	284	288	283	294	262	224	236	257	247	255	268
22	290	296	268	295	281	275	283	276	274	265	253	247	238	217	244
23	328	341	308	277	277	251	221	257	151	124	133	202	260	281	262
24	301	270	270	283	374	266	264	199	178	186	204	199	217	213	219
25	338	320	286	238	243	262	283	323	318	302	280	279	246	220	241
26	295	284	301	279	272	244	215	234	250	225	212	222	223	237	268
27	297	289	280	288	299	244	221	207	207	199	193	230	266	299	297
28	297	292	283	283	281	275	274	270	261	304	293	261	281	286	257
29	326	320	314	290	259	268	289	337	341	357	262	386	346	357	318
30	291	283	299	290	266	277	280	278	270	277	267	243	264	295	286
31	339	309	307	294	288	278	273	264	270	273	241	239	234	267	303

E′—December, 1911.

2000γ (·02 C.G.S. Unit) + 15 h.	16 h.	17 h.	18 h.	19 h.	20 h.	21 h.	22 h.	23 h.	24 h.	Maximum Reading and Time.			Minimum Reading and Time.		
γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	h.	m.	γ	h.	m.
302	300	305	309	298	289	320	302	300	307	345	20	52	102	9	32
269	281	303	309	304	320	294	268	267	303	409	0	35	136	6	30
334	320	333	320	318	343	323	342	307	303	380	12	20	115	9	23
291	307	304	305	316	307	326	334	307	289	349	22	0	137	5	48
302	290	316	330	336	338	330	330	310	297	347	18	49	192	9	59
317	346	365	351	372	367	360	346	328	378	489	23	59	176	8	27
325	328	360	355	357	358	351	345	336	330	483	9	7	15	6	30
294	304	359	371	346	343	333	330	315	304	381	18	20	166	9	45
320	317	328	343	331	325	320	320	310	320	355	3	35	223	7	54
330	346	365	365	352	341	351	336	321	307	376	17	45	273	9	23
175	257	440	455	546	569	567	425	291	309	664	20	27	—63	13	30
259	286	317	333	345	336	338	323	299	307	412	0	13	22	9	2
243	256	296	343	341	354	357	334	309	283	369	20	8	137	8	55
261	283	299	305	314	345	342	351	338	313	373	23	10	229	13	58
298	314	309	317	325	342	323	329	326	312	347	19	54	86	6	5
316	317	326	320	327	325	339	346	334	321	360	21	55	165	9	20
297	310	317	307	309	307	325	484	442	369	544	22	40	226	6	52
339	332	326	342	352	328	330	310	305	336	486	2	40	160	8	18
256	283	320	333	332	367	397	375	331	307	431	21	3	113	8	52
357	358	358	380	378	369	355	339	330	312	460	7	41	231	9	1
245	334	371	373	362	328	349	346	330	320	428	6	45	225	15	0
341	332	325	355	352	333	320	333	345	326	396	6	51	231	10	5
300	346	332	320	332	347	320	310	279	296	380	16	13	201	14	4
355	352	357	349	339	343	330	339	310	301	431	6	47	252	11	32
278	313	340	338	331	334	344	336	320	294	356	21	17	188	9	49
261	270	292	307	354	391	401	362	330	267	470	21	25	115	8	35
358	328	317	345	345	323	309	307	296	314	386	14	58	5	7	37
304	340	373	369	360	332	327	305	304	292	402	17	45	79	10	48
294	296	323	323	305	309	307	301	281	285	340	17	50	154	7	17
272	284	281	289	309	328	328	307	325	330	351	21	9	205	9	17
179	281	328	326	336	363	336	330	307	270	391	19	45	145	14	44

E′—January, 1912.

—	—	350	404	393	408	346	317	370	320	496	8	39	83	6	10
334	345	359	348	360	359	337	315	315	314	410	4	7	197	6	53
272	293	323	312	344	331	346	336	320	303	410	8	17	168	11	33
332	348	350	367	344	334	328	334	337	318	380	17	57	257	7	58
315	332	359	348	360	347	315	320	307	303	391	4	25	94	10	25
330	320	328	360	325	328	303	297	286	294	441	8	20	163	9	58
336	332	325	317	314	319	321	336	319	320	367	7	52	249	9	10
281	304	331	312	306	315	318	325	315	319	348	2	13	146	11	29
294	321	341	328	315	317	310	304	309	312	354	17	12	213	9	32
335	325	315	317	312	318	314	318	315	310	363	14	3	184	10	33
266	266	299	303	299	307	299	299	303	299	336	1	32	81	9	49
272	351	379	404	420	398	399	393	398	365	443	18	43	120	6	33
403	452	430	427	564	362	396	337	341	350	737	19	0	115	10	15
357	317	308	350	312	244	317	350	326	325	467	8	23	146	12	28
336	317	322	328	331	345	359	350	330	320	457	9	3	197	10	15
335	344	334	339	346	335	336	323	328	335	425	8	25	272	4	22
289	302	323	333	344	325	335	363	380	394	441	23	33	181	9	50
328	343	419	390	367	332	293	315	337	326	438	16	52	146	10	15
314	354	354	352	357	338	326	314	294	283	385	18	47	236	11	12
314	315	325	326	341	315	310	293	286	281	383	7	0	139	9	16
254	281	322	330	312	312	308	312	306	290	343	17	30	193	8	45
284	284	305	326	349	334	322	306	325	328	363	18	38	189	9	7
310	297	354	335	328	351	320	299	299	301	387	1	37	60	9	37
255	288	280	302	305	305	310	315	330	338	361	24	0	142	7	27
274	318	346	345	344	328	315	315	303	295	381	0	21	197	12	16
320	347	343	362	362	349	334	325	338	297	370	18	37	197	10	13
283	291	301	306	312	325	320	309	294	297	335	19	41	167	10	39
312	356	344	318	309	337	317	307	322	326	368	16	16	225	13	39
315	304	322	337	346	354	333	318	325	291	473	8	43	100	9	37
306	336	344	322	361	362	326	341	334	339	376	19	1	197	10	37
293	319	337	349	341	359	341	314	332	317	382	23	17	219	12	35

E′—February, 1912.

Day.	0 h.	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	12 h.	13 h.	14 h.
	2000γ (·02 C.G.S. Unit) +														
	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
1	321	308	296	300	321	305	235	235	253	228	290	237	266	301	240
2	299	316	277	276	296	312	299	292	277	261	239	282	290	306	303
3	309	310	297	307	287	283	259	287	277	268	190	298	311	343	349
4	323	290	310	293	285	278	335	306	282	263	290	295	312	324	327
5	322	311	300	287	290	279	290	290	322	345	352	311	305	309	329
6	303	287	293	287	277	281	298	303	281	256	240	236	248	270	316
7	281	284	290	283	287	287	293	281	293	276	277	294	283	305	301
8	327	288	282	326	292	292	257	309	305	261	203	254	290	297	322
9	314	297	282	274	290	266	288	272	242	265	274	269	272	256	290
10	300	296	284	299	287	292	300	298	295	313	292	270	234	309	303
11	332	321	321	300	232	269	285	339	361	374	279	186	179	252	329
12	316	311	280	257	287	281	252	210	225	259	221	190	247	256	239
13	306	306	294	322	252	238	252	216	215	316	299	251	330	351	312
14	319	305	270	279	284	240	217	282	245	223	247	221	293	301	325
15	319	297	308	292	277	299	298	297	293	277	290	296	288	266	296
16	324	300	294	281	299	307	316	274	288	283	280	274	274	303	282
17	305	300	308	294	293	265	257	254	234	158	188	167	226	219	248
18	323	295	264	264	274	267	237	174	227	277	253	190	195	201	205
19	298	295	287	276	272	274	269	261	237	271	238	259	242	268	284
20	299	297	295	287	274	271	259	248	258	292	277	287	279	277	268
21	301	292	295	292	287	278	288	296	303	324	299	308	307	309	316
22	305	299	303	298	288	287	285	266	254	253	221	239	248	276	290
23	303	303	303	296	300	297	277	270	250	251	264	269	296	316	309
24	326	312	295	272	248	257	293	284	271	280	310	327	318	271	316
25	311	294	307	300	287	292	277	259	245	—	—	—	—	214	261
26	324	318	301	—	—	—	—	—	—	—	—	—	—	—	—
27	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
28	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
29	—	—	—	—	—	—	—	—	—	272	293	303	324	313	326

E′—March, 1912.

Day.	0 h.	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	12 h.	13 h.	14 h.
1	304	299	294	297	294	296	279	291	289	295	286	287	284	273	280
2	302	322	300	299	291	282	286	308	286	280	273	271	286	287	297
3	311	309	298	292	294	284	286	279	279	275	262	291	302	306	328
4	306	306	308	302	304	299	286	236	220	218	312	329	291	260	273
5	304	300	299	297	297	297	297	305	306	310	281	264	282	292	302
6	322	317	299	275	267	280	266	271	284	260	253	249	247	260	334
7	306	315	302	281	284	271	270	291	286	258	225	238	233	296	333
8	318	296	297	267	287	276	273	263	282	286	295	276	268	256	291
9	309	312	265	302	265	218	205	224	239	209	244	237	297	253	317
10	317	310	278	284	277	292	263	256	222	265	265	246	262	296	310
11	318	297	287	284	266	236	234	231	198	234	218	227	277	291	296
12	304	308	305	302	298	296	289	307	321	312	310	335	344	331	344
13	318	318	302	273	273	267	286	302	297	295	296	324	339	300	311
14	318	305	295	296	304	300	309	312	304	299	304	305	305	312	324
15	311	322	289	297	297	307	289	264	293	267	260	266	266	265	271
16	306	297	298	305	302	296	292	293	308	291	273	208	223	252	276
17	321	296	282	297	300	294	294	287	293	287	297	283	273	283	318
18	307	305	305	304	302	302	291	284	286	286	281	273	280	291	299
19	310	302	300	298	299	300	297	296	278	276	268	278	278	283	294
20	308	307	302	295	296	295	298	298	295	283	276	282	289	305	304
21	310	306	302	298	294	289	291	293	293	284	287	286	283	289	315
22	304	307	298	311	296	293	297	305	278	262	275	244	248	268	258
23	308	308	297	305	289	273	300	247	233	281	—	—	—	—	—
24	—	—	—	—	—	—	—	—	—	302	289	302	299	294	297
25	308	305	307	306	304	306	297	287	293	315	298	293	297	305	313
26	317	312	312	305	300	305	305	304	289	294	284	—	277	277	315
27	295	291	287	287	282	280	268	250	236	235	244	215	233	263	300
28	293	292	290	277	274	277	276	269	266	268	284	287	291	294	313
29	294	287	291	286	277	242	247	267	276	277	263	262	271	274	291
30	294	308	313	274	184	247	249	278	282	256	253	248	276	284	278
31	289	282	284	290	291	284	282	278	278	275	277	276	287	287	284

Hourly Values—*continued.*

E′—February, 1912.

15 h.	16 h.	17 h.	18 h.	19 h.	20 h.	21 h.	22 h.	23 h.	24 h.	Maximum Reading and Time.			Minimum Reading and Time.		
2000γ (·02 C.G.S. Unit) +															
γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	h.	m.	γ	h.	m.
292	329	364	312	324	330	345	345	316	299	374	17	0	192	6	36
350	348	329	324	335	350	354	329	337	309	392	15	22	159	9	35
361	352	353	372	360	358	330	329	319	323	402	18	35	161	10	4
313	330	358	337	336	332	329	319	312	322	379	16	59	230	9	32
334	325	327	330	322	319	307	298	294	303	383	8	27	253	7	35
321	270	271	303	325	314	308	298	294	281	330	19	20	203	9	17
305	316	329	332	351	338	327	324	323	327	364	19	32	250	9	33
334	316	334	327	353	351	361	366	335	314	377	21	57	175	9	45
299	285	308	326	345	330	324	305	301	300	353	19	25	214	8	1
294	337	337	355	383	371	378	325	332	332	402	18	55	204	12	1
341	332	371	364	374	396	402	352	332	316	427	7	57	133	11	15
278	288	306	306	323	351	369	311	297	306	400	21	12	113	6	54
282	298	316	367	394	400	358	339	308	319	434	20	26	175	7	30
319	353	345	366	340	329	325	313	316	319	383	17	33	160	5	47
312	392	352	405	345	329	327	341	336	324	437	16	3	224	9	30
293	316	295	282	319	316	324	311	307	305	340	19	22	214	11	50
314	409	377	345	325	324	312	300	290	323	436	16	5	98	10	43
222	245	283	303	316	313	305	294	288	298	361	9	22	80	7	32
325	332	378	311	310	310	311	308	306	299	402	17	15	211	8	25
290	313	300	306	318	332	335	322	306	301	342	20	49	230	8	1
314	334	332	332	332	329	322	321	316	305	345	16	13	256	7	58
281	299	316	323	332	325	324	311	309	303	340	19	12	201	10	27
339	345	343	335	352	351	350	348	324	326	371	21	25	205	9	9
332	361	392	379	387	368	342	316	308	311	405	19	8	221	3	38
330	341	343	352	339	337	347	337	327	324	368	18	14	185	8	31
—	—	—	—	—	—	—	—	—	—	—	—		—	—	
—	—	—	—	—	—	—	—	—	—	—	—		—	—	
—	—	—	—	—	—	—	—	—	—	—	—		—	—	
335	335	332	340	327	334	319	316	319	305	365	17	45	201	8	37

E′—March, 1912.

315	324	329	362	386	389	331	307	300	302	420	19	25	255	13	35
320	329	331	336	344	359	340	328	320	311	380	19	59	216	11	38
328	315	309	323	329	324	321	315	308	306	344	14	25	251	10	5
297	318	325	325	321	321	312	308	307	304	352	11	17	187	8	24
306	305	313	318	322	321	335	325	328	322	345	21	18	247	10	22
310	322	318	315	321	322	328	325	324	306	365	14	10	226	7	59
331	328	329	346	344	326	329	335	318	318	357	17	32	207	8	48
323	307	370	386	388	357	367	373	368	309	425	22	55	238	12	40
357	370	389	381	378	360	352	328	310	317	407	18	2	114	9	35
340	331	349	347	348	341	359	331	312	318	368	18	5	195	8	3
289	304	351	363	363	354	351	321	308	304	370	18	30	183	7	48
351	364	373	357	355	321	337	352	326	318	384	16	29	274	6	20
325	328	337	349	389	337	335	338	320	318	412	19	0	246	5	18
324	331	338	346	338	328	324	329	318	311	360	17	35	281	9	27
275	312	323	318	320	320	322	333	325	306	368	21	37	195	7	35
305	320	310	315	315	320	331	336	328	321	346	22	3	192	11	23
304	317	312	313	311	315	313	310	310	307	329	14	0	239	11	15
307	310	313	321	323	331	336	320	313	310	342	20	44	256	10	43
311	307	305	313	326	328	315	312	315	308	336	19	40	249	10	15
294	299	310	315	321	318	315	320	315	310	324	20	3	263	8	43
336	329	324	329	324	328	355	376	331	304	413	22	2	269	11	10
347	365	364	349	336	322	340	321	305	308	394	17	7	208	11	4
—	—	—	—	—	—	—	—	—	—	318	9	17	211	8	19
308	315	324	331	335	329	313	311	315	308	365	19	20	271	9	43
318	328	325	328	326	(325)	(324)	323	317	317	336	16	20	258	8	30
333	317	317	311	302	304	297	293	298	295	347	15	21	252	10	38
317	305	311	307	313	306	298	294	291	293	321	15	35	195	10	53
309	310	318	319	326	340	333	310	286	294	359	20	20	252	9	32
286	287	300	317	313	305	308	303	297	294	337	18	39	216	5	27
282	300	300	313	361	342	326	302	294	289	395	18	39	163	4	1
297	300	300	302	302	298	298	297	292	289	315	16	30	258	11	35

Hourly Values—*continued*.

E′—April, 1912.

Day.	0 h.	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	12 h.	13 h.	14 h.
	2000γ (·02 C.G.S. Unit) +														
	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
1	289	287	289	287	287	282	278	280	282	277	279	276	281	290	295
2	292	292	287	286	277	281	282	271	277	277	284	287	274	289	292
3	293	290	290	289	284	255	238	253	255	258	258	252	242	264	294
4	297	287	284	279	282	258	249	248	246	266	276	284	298	306	303
5	292	287	291	290	291	282	277	255	258	263	271	279	268	286	282
6	318	305	269	276	251	226	266	222	145	151	236	194	174	277	340
7	289	271	298	281	255	229	242	224	215	204	274	279	267	267	324
8	295	290	302	295	266	238	229	250	242	233	280	280	292	294	306
9	295	284	291	292	286	286	289	286	286	289	286	297	278	291	297
10	294	289	287	289	291	284	271	266	267	263	256	275	279	256	274
11	276	281	286	289	273	242	264	277	281	275	278	267	266	266	271
12	297	287	289	287	286	284	282	287	287	287	281	276	267	282	284
13	304	284	280	287	287	281	271	279	291	(291)	(290)	(290)	290	292	275
14	289	287	284	278	284	281	280	286	282	281	274	258	267	269	282
15	289	297	297	293	293	294	287	260	262	237	271	284	300	308	313
16	271	303	267	292	276	277	281	279	287	287	277	274	264	279	300
17	333	297	297	284	267	268	252	235	264	286	256	271	279	268	298
18	287	300	295	300	269	219	251	255	245	271	275	200	246	281	298
19	310	300	286	295	275	280	289	251	266	263	258	292	297	303	311
20	293	295	302	287	287	277	281	262	277	271	206	260	294	302	297
21	294	280	292	262	287	291	287	281	281	292	293	287	284	287	287
22	293	294	298	292	292	292	289	280	280	266	255	253	271	300	303
23	304	297	295	280	282	282	286	277	275	277	293	298	294	298	303
24	294	297	297	298	279	261	263	250	242	240	242	297	293	287	298
25	293	300	284	287	284	281	284	286	277	286	284	284	275	286	300
26	309	273	289	292	287	290	292	287	293	295	292	291	291	294	298
27	303	294	300	297	293	294	293	292	276	292	287	290	295	302	311
28	304	297	297	297	290	293	287	286	286	284	289	297	298	294	297
29	297	291	289	289	287	287	284	292	289	286	287	287	284	287	293
30	290	297	297	291	291	293	293	293	291	287	291	298	303	303	305

E′—May, 1912.

Day.	0 h.	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	12 h.	13 h.	14 h.
1	302	292	302	294	295	292	298	299	302	302	302	291	294	305	309
2	300	305	297	292	292	296	294	294	292	285	282	283	289	300	300
3	298	296	289	287	272	267	234	251	261	(278)	294	285	272	263	280
4	296	302	285	278	289	285	285	276	265	—	—	—	—	—	—
5	312	316	313	299	297	276	256	278	230	258	267	252	269	243	267
6	234	297	279	280	281	278	270	251	271	276	261	266	273	270	265
7	318	289	297	291	232	282	286	295	292	284	270	267	254	263	278
8	305	292	302	305	302	294	282	286	247	273	252	243	279	269	276
9	310	291	292	278	294	297	270	284	289	291	285	292	285	292	291
10	295	294	292	292	294	289	281	284	282	289	292	291	294	289	292
11	302	292	299	296	294	292	292	294	289	292	291	294	292	292	294
12	300	300	300	292	283	279	268	285	283	266	276	267	285	265	266
13	305	274	283	287	280	276	278	280	258	244	130	243	243	302	276
14	297	289	289	287	280	286	267	244	192	205	196	252	236	245	270
15	287	307	294	285	260	273	279	257	239	260	269	260	278	296	289
16	284	299	300	294	292	285	286	285	292	294	294	291	296	291	296
17	305	296	279	302	292	292	286	286	271	287	294	291	285	291	285
18	305	289	292	295	297	286	292	295	302	294	289	292	295	302	287
19	295	302	300	295	283	292	285	296	284	282	294	297	300	302	305
20	310	302	291	289	297	297	289	284	253	258	295	294	276	276	292
21	297	296	299	297	298	296	274	269	276	289	295	296	295	294	300
22	296	295	298	289	282	297	286	302	298	299	298	297	297	297	289
23	299	303	303	298	292	295	291	302	297	298	298	297	297	297	302
24	302	297	302	299	300	302	302	302	302	292	300	298	302	302	303
25	303	302	302	305	305	303	302	302	300	299	291	287	286	295	302
26	305	303	302	292	295	302	292	296	295	298	300	300	302	303	302
27	303	302	303	296	298	297	296	297	296	292	298	297	300	295	302
28	300	298	299	300	300	299	303	298	302	296	295	297	292	302	302
29	305	305	303	300	298	302	299	302	299	300	299	300	298	302	302
30	305	296	292	305	298	302	294	294	292	291	292	294	299	302	303
31	303	302	300	300	289	273	274	280	249	249	276	286	297	302	312

E′—April, 1912.

2000γ (·02 C.G.S. Unit) +										Maximum Reading and Time.			Minimum Reading and Time.		
15 h.	16 h.	17 h.	18 h.	19 h.	20 h.	21 h.	22 h.	23 h.	24 h.						
γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	h.	m.	γ	h.	m.
298	304	304	300	300	300	303	311	293	292	324	21	55	260	6	37
300	303	303	309	310	311	305	302	297	293	324	19	28	247	6	32
317	335	344	339	334	308	300	303	297	297	361	18	11	231	12	48
310	328	323	315	309	315	320	300	294	292	344	20	42	227	7	32
313	362	323	337	318	329	336	339	305	318	410	15	41	242	7	46
370	328	313	313	313	309	322	323	316	289	390	14	40	79	8	38
298	309	309	308	307	313	342	342	304	295	374	21	55	189	8	25
310	309	310	313	313	305	307	297	294	295	329	2	10	207	9	5
297	304	317	317	313	297	298	293	297	294	344	12	10	260	12	3
284	294	313	342	344	335	382	366	275	276	418	21	50	240	9	3
275	292	298	298	300	319	304	300	298	297	350	19	41	227	4	41
293	290	298	305	304	308	317	318	302	304	336	21	35	250	12	18
287	294	303	326	331	336	342	326	307	289	354	20	39	255	13	59
293	300	298	298	307	319	309	300	293	289	329	20	12	237	10	53
324	376	391	417	449	441	370	339	320	271	490	19	24	215	8	43
307	337	324	339	363	390	391	315	320	333	476	20	38	245	5	31
293	308	318	371	390	302	300	368	337	287	478	18	33	208	5	38
310	321	344	358	355	339	326	333	324	310	389	22	25	181	10	43
318	308	306	302	302	298	303	308	305	293	328	15	32	218	6	50
307	326	331	352	335	322	311	307	302	294	368	18	23	165	10	24
298	303	300	302	304	298	300	300	295	293	309	11	45	269	12	54
310	317	316	326	359	359	333	308	297	304	393	19	48	240	9	38
307	315	328	329	306	300	300	300	300	294	340	16	37	264	7	53
306	309	313	322	337	332	320	326	313	293	357	19	8	226	10	22
297	295	300	307	320	318	319	308	311	309	332	20	45	234	11	40
300	303	300	300	302	302	308	309	306	303	320	23	53	236	1	1
313	305	308	309	318	302	309	328	313	304	337	21	45	264	8	2
300	305	305	313	310	311	310	300	303	297	326	17	50	273	9	15
300	305	306	303	(303)	(303)	303	300	300	290	315	15	59	276	4	25
305	308	308	305	307	308	305	304	304	297	313	17	12	256	23	48

E′—May, 1912.

309	321	327	350	340	324	305	303	300	300	366	18	0	282	5	3
292	302	316	327	355	315	314	298	305	298	400	19	7	273	9	42
314	307	329	327	344	349	308	314	298	296	387	18	52	200	6	48
—	—	—	303	303	302	302	297	302	312	320	1	3	244	6	28
291	310	318	320	309	334	379	344	347	234	404	20	23	105	23	47
291	302	297	299	302	300	302	323	327	318	345	23	23	189	7	18
296	297	305	305	314	313	305	313	323	305	336	1	27	200	3	53
280	289	308	299	298	305	325	341	310	310	383	21	58	194	9	43
296	299	300	302	302	311	311	296	296	295	319	20	26	239	6	27
302	309	338	313	299	303	308	305	303	302	384	17	7	268	6	57
297	297	302	303	302	305	303	302	300	300	312	0	4	284	7	40
313	362	363	380	399	375	302	321	296	305	455	19	37	229	23	12
297	323	376	349	349	422	420	379	302	297	473	20	15	94	9	57
307	310	342	391	386	367	284	289	289	287	442	17	21	136	9	38
309	325	310	305	328	318	314	308	312	284	360	15	47	216	7	37
300	308	311	316	313	309	321	310	302	305	327	18	30	268	5	30
299	308	318	318	318	315	305	302	299	305	332	18	27	258	7	25
303	305	305	303	300	298	297	297	296	295	315	15	10	271	0	42
302	302	309	310	307	318	322	305	299	310	339	20	30	271	9	3
314	308	316	321	307	305	297	299	297	297	328	18	24	232	8	12
310	323	318	310	305	298	302	298	299	296	331	16	35	261	7	12
300	315	305	310	309	305	303	302	303	299	323	15	46	265	6	20
303	303	307	308	305	303	305	300	303	302	310	21	12	286	4	8
303	303	305	303	303	308	308	303	303	303	316	20	45	289	9	45
305	305	308	308	303	302	303	303	303	305	316	16	53	269	11	30
308	305	310	313	316	311	334	305	302	303	353	21	10	284	6	35
305	309	305	305	311	311	315	302	300	300	324	20	55	286	9	34
303	318	327	326	323	305	299	303	302	305	368	16	45	284	12	2
307	307	309	314	311	314	308	310	310	305	327	23	33	292	9	37
309	305	305	305	303	303	300	303	308	303	326	2	14	278	6	57
312	312	312	310	305	305	305	311	308	302	328	17	41	207	8	10

Hourly Values—*continued.*

E′—June, 1912.

Day.	2000γ (·02 C.G.S. Unit) +														
	0 h.	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	12 h.	13 h.	14 h.
	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
1	299	299	299	291	295	299	288	297	305	247	270	283	294	297	300
2	307	286	300	291	294	292	294	294	286	289	291	288	289	292	296
3	300	294	299	302	286	286	291	278	275	262	260	286	275	273	289
4	300	302	296	294	292	299	294	296	299	297	275	275	286	292	299
5	312	305	302	295	299	295	284	265	284	295	300	297	300	302	300
6	300	297	307	289	291	299	299	288	296	293	299	299	299	306	304
7	299	302	300	297	300	299	299	299	297	295	286	291	299	302	302
8	302	300	299	300	300	300	302	305	304	291	289	277	263	291	312
9	288	286	260	276	268	276	286	264	202	208	276	282	289	299	260
10	269	305	296	258	275	277	275	286	265	215	210	234	221	289	278
11	297	293	305	284	275	279	195	218	271	292	277	276	286	291	297
12	306	296	294	302	305	294	284	297	299	286	294	284	289	282	300
13	304	299	299	291	292	296	283	291	302	289	293	292	291	299	299
14	295	297	291	296	292	286	275	292	292	288	292	293	294	300	302
15	295	296	304	279	289	294	297	294	284	291	296	289	276	299	304
16	296	299	300	297	297	295	294	292	294	—	—	—	—	—	—
17	—	—	—	—	—	—	—	—	—	281	292	293	302	300	299
18	297	297	299	299	300	289	286	286	302	286	299	295	292	292	299
19	299	295	300	289	289	299	300	297	292	297	295	282	292	288	289
20	299	299	297	297	296	299	296	297	294	302	299	299	299	299	299
21	299	299	300	300	295	295	297	295	295	296	299	295	297	299	300
22	302	293	299	297	304	297	289	286	291	293	283	288	293	304	299
23	304	297	291	292	284	289	291	299	302	305	302	296	296	296	302
24	302	293	304	302	302	297	288	277	264	262	273	264	289	291	299
25	315	304	304	289	291	297	292	296	295	299	289	296	295	276	297
26	292	299	299	299	297	297	294	289	291	297	300	297	291	294	299
27	302	299	293	299	295	295	294	293	286	284	294	296	302	302	299
28	304	282	291	296	300	294	292	289	289	289	277	270	229	288	302
29	295	315	275	292	296	295	281	277	280	273	277	275	250	271	291
30	308	311	299	289	304	295	291	260	240	264	283	283	281	289	289

E′—July, 1912.

Day.	0 h.	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	12 h.	13 h.	14 h.
1	303	303	297	293	293	298	297	294	292	293	281	284	282	295	295
2	300	297	279	298	303	294	301	296	295	—	—	—	—	—	—
3	—	—	—	—	—	—	—	—	—	296	296	290	297	295	300
4	309	306	301	295	303	253	249	269	271	279	293	261	258	277	310
5	308	285	267	263	292	293	287	256	254	261	278	248	219	170	301
6	319	319	271	296	290	259	237	266	232	188	267	277	301	287	297
7	316	294	297	300	295	269	267	295	278	290	267	255	287	300	303
8	301	301	303	300	303	294	280	271	293	282	271	287	281	265	301
9	303	298	280	300	276	271	290	295	284	263	284	296	300	303	303
10	294	298	295	300	297	293	294	290	289	301	300	301	301	303	300
11	300	298	303	301	301	300	294	287	284	301	294	298	301	294	289
12	300	296	298	300	301	297	300	298	297	296	298	300	300	301	301
13	300	292	295	306	300	300	303	300	295	296	293	290	296	297	303
14	298	296	298	296	300	300	297	295	295	297	295	295	298	300	301
15	300	300	297	308	303	301	300	300	297	294	296	303	301	300	301
16	301	300	297	301	300	297	292	289	297	294	289	293	295	287	292
17	290	290	290	295	296	297	303	298	287	292	295	290	294	297	300
18	298	300	307	290	255	279	266	265	258	267	261	274	279	287	296
19	300	300	301	301	301	300	300	295	295	296	298	293	290	295	300
20	301	300	296	298	303	301	300	295	293	295	292	298	282	281	297
21	306	306	297	303	298	301	289	301	298	284	280	267	283	290	276
22	303	303	300	308	303	300	300	300	308	296	296	290	293	303	303
23	307	308	301	300	297	294	298	300	295	297	292	289	295	303	312
24	303	303	301	295	294	306	303	301	300	300	300	303	300	301	303
25	303	301	303	303	301	303	300	296	283	289	287	297	300	298	307
26	308	300	300	310	306	301	259	278	289	295	303	281	301	303	300
27	327	300	306	305	266	290	295	285	278	272	265	270	282	295	295
28	297	303	300	287	285	287	278	290	290	290	300	300	303	310	305
29	308	308	305	300	300	300	290	300	295	300	297	300	298	303	305
30	303	300	300	297	303	300	300	303	297	300	300	301	296	298	300
31	(317)	308	294	295	284	284	284	271	284	285	290	289	(286)	283	295

Hourly Values—*continued.*

E′—June, 1912.

2000γ (·02 C.G.S. Unit) +										Maximum Reading and Time.			Minimum Reading and Time.		
15 h.	16 h.	17 h.	18 h.	19 h.	20 h.	21 h.	22 h.	23 h.	24 h.						
γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	h.	m.	γ	h.	m.
302	309	363	355	353	357	384	304	300	307	419	20	50	187	8	39
302	312	341	333	386	328	306	306	295	300	475	19	9	260	0	27
313	323	328	419	346	306	307	311	304	300	494	17	52	242	10	10
296	295	300	312	306	311	302	310	310	312	326	18	7	260	9	58
295	299	299	311	322	306	306	299	302	300	348	18	35	249	6	47
295	302	307	321	307	302	299	302	299	299	346	17	37	279	6	46
302	300	300	302	302	302	299	300	300	302	308	13	53	282	10	32
310	355	341	348	417	368	355	313	336	288	507	19	14	255	11	26
267	318	325	341	341	315	311	306	320	269	365	18	48	133	8	31
294	294	315	361	324	322	309	300	313	297	397	17	40	141	9	17
309	309	319	311	322	331	328	313	297	306	374	17	48	158	5	58
307	318	320	328	315	308	311	306	296	304	346	16	43	254	10	9
300	300	305	312	304	307	308	307	306	295	346	18	27	266	9	15
300	313	339	325	335	328	320	315	306	295	367	16	45	278	8	38
299	305	302	304	306	309	309	299	297	296	333	19	30	252	2	58
—	—	—	—	—	—	—	—	—	—	309	1	33	286	7	40
300	300	299	297	299	300	302	302	307	297	316	23	21	268	8	50
300	302	302	305	307	312	305	302	307	299	320	19	37	262	6	56
293	299	299	302	306	318	305	302	302	299	328	19	55	268	3	23
299	302	302	300	305	302	300	300	299	299	310	18	45	284	8	18
300	302	308	312	320	309	302	302	302	302	338	18	38	281	9	3
300	302	302	304	306	308	305	307	306	304	321	20	10	275	9	53
300	309	305	302	304	305	318	308	304	302	320	23	15	275	3	45
295	302	311	300	317	324	333	300	299	315	346	20	40	236	10	55
296	299	302	302	304	309	307	299	302	292	321	1	43	264	13	8
296	291	299	300	299	300	300	296	299	302	307	17	23	270	15	47
302	304	302	310	319	372	384	320	333	304	435	20	45	275	1	57
299	302	302	317	337	368	353	295	291	295	381	20	18	202	11	52
291	302	305	304	325	331	344	349	328	308	381	20	39	217	12	15
297	300	302	307	312	304	307	309	307	302	352	22	32	207	8	5

E′—July, 1912.

301	316	361	349	314	311	316	319	298	300	387	17	18	263	9	28
—	—	—	—	—	—	—	—	—	—	316	2	55	253	1	40
300	303	303	308	305	307	310	312	310	309	322	22	50	287	11	22
301	353	355	366	362	392	322	301	303	308	427	20	12	218	10	27
327	349	248	319	342	345	340	336	318	319	387	21	44	66	12	38
278	300	319	310	307	303	309	310	324	316	343	0	58	168	9	17
305	312	306	311	321	316	306	303	298	301	347	19	12	235	10	45
289	305	307	308	303	306	300	301	306	303	324	17	10	237	9	57
303	303	311	314	314	321	334	303	310	294	347	20	40	226	1	58
300	308	306	306	305	301	301	303	301	300	316	2	48	279	8	25
300	308	308	308	306	300	303	301	298	300	320	18	45	276	7	45
303	308	308	308	312	310	309	303	303	300	320	19	35	289	8	57
305	305	303	303	303	301	301	301	301	298	314	3	20	289	10	50
303	310	309	308	309	305	301	303	301	300	323	17	50	295	9	30
301	309	311	314	320	312	316	301	301	301	339	18	10	289	8	40
300	301	319	338	364	393	329	320	301	290	403	20	14	276	13	21
(301)	(302)	303	303	303	301	316	308	300	298	340	21	3	269	9	50
312	318	316	313	311	308	303	301	300	300	323	15	23	230	4	7
311	321	314	312	321	306	305	311	306	301	327	16	18	282	11	45
307	301	307	314	348	377	332	332	327	306	411	19	45	274	13	0
294	307	318	327	318	307	303	308	306	303	360	18	30	250	11	2
301	307	312	316	322	332	310	309	310	307	342	19	43	278	9	12
303	307	306	316	347	318	300	305	309	303	363	19	24	280	8	12
309	309	306	309	307	311	312	306	305	303	320	18	49	282	3	23
308	309	308	308	308	308	308	314	316	308	321	22	36	276	9	37
306	309	316	337	329	324	326	347	332	327	366	21	48	243	10	45
316	334	356	319	325	319	310	303	301	297	376	16	41	248	8	26
308	308	308	310	309	311	316	308	311	308	321	20	40	264	4	16
305	306	308	(315)	323	334	314	309	303	303	350	19	48	276	6	10
307	309	310	313	335	350	343	(334)	(326)	(317)	366	20	10	282	8	13
(311)	326	336	351	351	339	334	332	314	303	366	19	10	263	6	55

Hourly Values—*continued.*

E′—August, 1912.

Day.	2000γ (·02 C.G.S. Unit) +														
	0 h.	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	12 h.	13 h.	14 h.
	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
1	294	303	305	285	289	260	232	241	257	239	263	265	246	267	273
2	294	294	292	297	294	292	292	280	258	274	291	294	284	289	292
3	302	296	275	268	299	294	288	291	296	291	285	289	301	287	286
4	291	284	291	291	294	294	294	289	291	292	284	281	291	292	298
5	298	296	292	292	294	297	298	299	294	291	292	291	294	298	301
6	301	298	296	299	304	294	286	284	294	—	—	—	—	—	—
7	—	—	—	—	—	—	—	—	—	289	287	278	281	281	275
8	294	299	294	292	289	267	262	272	276	294	294	287	286	299	297
9	296	297	297	289	289	288	289	291	291	285	274	278	297	292	292
10	296	289	289	294	294	287	281	286	286	283	285	291	281	276	303
11	307	299	296	294	291	291	289	274	249	256	257	256	271	269	292
12	297	302	294	291	294	291	289	289	287	283	291	292	294	297	297
13	296	291	294	294	294	284	281	284	291	286	287	288	287	291	291
14	297	296	296	296	294	292	294	292	292	292	289	294	299	303	307
15	305	296	296	287	286	286	283	281	278	272	283	284	289	286	288
16	298	298	299	296	296	292	292	294	289	289	285	278	288	291	301
17	298	291	294	294	292	292	286	285	273	291	254	226	194	196	289
18	316	292	284	283	280	278	272	280	281	287	260	291	281	289	294
19	291	294	294	285	289	286	268	245	158	(180)	(202)	223	174	243	307
20	294	307	294	300	285	275	272	278	284	285	285	255	271	271	270
21	300	292	291	296	287	270	281	285	267	256	249	262	272	280	287
22	313	299	271	288	284	278	267	272	272	269	244	219	232	226	242
23	305	296	314	254	236	243	236	217	223	239	216	189	226	232	265
24	294	298	273	261	291	275	245	210	236	236	187	231	267	299	297
25	291	298	301	281	276	263	273	278	256	283	273	265	281	272	281
26	287	294	307	294	288	278	281	274	267	276	265	275	280	284	296
27	302	294	286	291	291	289	280	281	272	281	267	267	268	284	289
28	316	323	310	305	275	299	252	256	267	285	270	271	281	303	312
29	298	297	299	284	252	284	281	276	274	292	292	294	274	281	307
30	302	294	299	294	285	263	234	274	252	281	286	280	284	299	300
31	296	296	294	292	294	292	288	288	284	278	255	271	286	304	315

E′—September, 1912.

1	305	305	311	295	301	300	285	269	278	282	285	289	276	255	283
2	308	303	303	300	305	303	300	300	300	298	303	303	305	309	313
3	301	297	300	303	306	303	303	300	300	295	294	305	310	312	318
4	308	308	303	305	303	303	303	301	301	301	(298)	295	258	265	278
5	318	295	300	303	300	268	261	276	287	278	283	284	306	311	308
6	303	308	303	300	303	303	287	287	285	265	251	274	255	259	276
7	307	295	305	306	309	301	290	295	297	296	281	269	267	298	300
8	310	308	300	306	305	294	284	285	300	290	289	293	297	298	318
9	301	310	303	298	300	298	290	283	284	295	296	289	282	306	293
10	310	295	306	285	292	296	293	290	289	272	277	271	276	274	281
11	309	298	300	306	281	287	290	295	293	289	287	294	290	308	283
12	300	301	303	306	306	298	294	283	300	279	268	269	276	279	283
13	323	303	292	293	290	290	279	271	253	232	277	278	284	283	293
14	306	297	300	300	305	298	274	227	224	194	276	298	274	279	316
15	300	303	301	301	296	297	298	280	274	272	281	282	287	312	321
16	308	307	309	306	303	297	300	303	300	303	301	307	311	313	311
17	307	300	298	296	296	297	301	(300)	(300)	298	303	314	313	306	312
18	331	323	314	281	274	209	196	190	181	123	256	309	278	258	270
19	290	318	290	287	300	297	289	272	241	214	258	287	280	284	303
20	312	307	311	303	278	250	258	256	287	209	293	250	258	268	269
21	308	310	300	303	292	287	294	278	300	287	297	298	308	303	320
22	318	314	300	289	277	274	274	282	249	242	242	272	255	267	278
23	297	295	313	296	283	280	266	269	272	248	287	252	300	290	298
24	295	296	310	301	290	278	224	280	285	306	311	312	310	303	310
25	287	276	271	280	287	290	268	258	203	180	179	185	263	321	329
26	309	309	303	305	303	298	303	314	308	306	305	307	281	290	332
27	303	305	311	308	298	295	287	271	239	250	289	305	307	311	316
28	297	309	305	303	303	290	293	309	306	307	300	297	307	323	329
29	313	301	305	306	301	303	300	300	294	(301)	308	303	301	300	322
30	309	311	308	307	303	293	283	279	282	293	268	279	311	287	293

E′—August, 1912.

2000γ (0·02 C.G.S. Unit) + 15 h.	16 h.	17 h.	18 h.	19 h.	20 h.	21 h.	22 h.	23 h.	24 h.	Maximum Reading and Time.			Minimum Reading and Time.		
γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	h.	m.	γ	h.	m.
281	430	338	315	312	305	303	294	297	294	508	16	19	185	8	33
302	307	323	310	303	301	307	300	300	302	341	17	10	247	8	2
298	305	323	351	345	328	323	307	296	291	372	18	20	249	2	48
307	309	299	301	298	300	302	298	298	298	321	14	37	269	11	32
303	302	305	299	299	301	307	303	296	301	314	21	32	284	10	52
—	—	—	—	—	—	—	—	—	—	314	3	20	261	7	21
289	298	304	310	310	318	297	296	288	294	357	20	15	221	11	27
301	301	302	310	315	299	299	298	298	296	328	18	47	254	5	41
292	303	309	320	322	305	304	307	303	296	331	19	2	265	10	38
311	307	305	304	299	307	301	299	297	307	325	16	10	259	12	48
299	299	304	303	303	305	318	300	296	297	329	16	35	226	7	58
298	299	299	298	300	302	299	303	301	296	311	21	30	275	7	10
296	300	303	307	307	307	304	296	298	297	312	18	58	273	8	38
311	314	323	309	313	318	312	315	307	305	339	20	30	280	9	58
309	317	326	309	312	302	297	294	294	298	334	17	12	254	9	12
304	307	305	307	305	302	307	302	294	298	315	15	3	272	11	35
294	318	375	359	365	357	330	336	328	316	470	17	15	176	12	48
291	302	305	304	313	307	307	299	299	291	333	0	7	236	9	46
320	322	323	317	325	333	357	333	328	294	411	21	19	59	8	20
299	307	302	311	307	304	320	314	315	300	331	20	40	234	5	35
301	298	297	328	339	322	297	338	347	313	373	23	8	234	8	25
314	394	323	318	336	358	323	333	311	305	433	16	18	181	10	52
278	327	338	365	353	359	338	320	318	294	389	18	48	161	11	12
310	307	312	316	367	353	336	307	301	291	422	19	12	179	9	50
294	307	323	327	346	340	305	323	297	287	365	18	50	215	8	15
316	320	336	312	316	307	307	303	300	302	351	16	30	225	9	28
309	310	320	336	351	316	318	325	331	316	380	18	53	247	10	30
323	320	311	310	314	314	303	301	303	298	354	15	18	218	6	10
307	318	320	320	315	314	305	301	301	302	338	16	55	221	3	55
311	317	323	314	325	314	298	301	299	296	351	19	32	223	8	23
330	307	307	307	307	302	303	302	298	296	338	14	29	245	10	22

E′—September, 1912.

305	326	337	334	321	312	312	309	309	308	347	18	20	241	13	0
319	316	318	319	318	322	322	303	314	301	340	19	57	284	2	35
319	320	319	314	321	310	309	308	307	308	325	16	40	259	8	55
284	320	331	321	322	319	316	320	316	318	339	19	5	239	13	13
309	313	325	324	318	325	334	334	342	303	357	23	20	241	5	27
309	327	342	349	340	337	360	340	309	307	395	17	32	211	9	48
314	311	319	329	348	334	319	320	308	310	358	18	57	256	10	28
320	319	331	324	329	374	332	326	316	301	400	19	45	272	7	7
307	320	334	334	335	340	345	337	326	310	364	21	0	259	11	35
287	308	305	308	312	309	312	313	311	309	337	17	55	254	12	2
290	311	342	340	343	347	324	325	308	300	366	20	14	243	11	32
298	329	349	382	385	342	369	329	294	323	416	18	18	256	8	59
314	332	331	326	331	316	316	308	309	306	342	18	42	198	8	37
308	310	314	329	323	329	340	329	312	300	358	21	2	166	9	2
319	318	324	323	316	316	314	313	309	308	327	17	0	237	10	54
320	325	336	339	337	339	337	327	307	307	350	18	50	290	7	55
323	332	334	335	326	318	316	312	324	331	348	16	33	272	8	36
339	354	371	336	389	355	342	322	342	290	442	19	27	56	8	35
297	311	321	321	320	325	322	313	303	312	373	0	27	194	9	0
300	332	331	329	351	353	332	316	311	308	376	19	25	168	8	39
316	311	311	318	314	329	332	334	322	318	345	22	8	240	7	21
278	271	322	354	339	339	334	329	314	297	362	17	48	211	9	37
316	332	329	337	338	329	313	342	312	295	368	22	7	210	6	52
367	374	367	374	439	442	471	424	332	287	508	20	38	218	5	40
327	322	332	329	319	318	314	314	310	309	345	17	40	135	11	12
329	320	334	320	318	332	331	311	307	303	345	20	10	263	14	33
322	331	329	329	316	316	314	314	321	297	337	16	17	205	8	8
339	340	332	326	323	314	314	308	308	313	350	15	38	274	5	45
336	327	337	342	324	319	310	311	310	309	348	17	0	282	7	55
294	316	326	324	327	323	319	318	310	303	334	17	55	239	10	5

E′—October, 1912.

Day	2000γ (0·02 C.G.S. Unit) +														
	0 h.	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	12 h.	13 h.	14 h.
	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
1	311	309	309	311	309	302	295	290	282	308	256	303	316	327	327
2	363	324	287	282	—	—	—	—	—	—	279	277	273	301	309
3	314	317	317	306	308	314	308	311	317	305	297	266	255	263	277
4	321	324	306	316	313	305	305	302	275	288	271	295	322	311	—
5	—	—	—	—	—	—	—	—	—	275	282	279	284	295	311
6	324	317	322	324	313	313	309	311	314	320	311	315	334	346	340
7	316	314	311	308	300	295	288	303	328	324	316	309	329	346	339
8	318	322	334	289	303	309	304	292	279	273	267	272	280	269	274
9	315	311	304	297	302	311	328	277	262	249	260	271	262	274	286
10	316	317	308	311	305	313	308	301	289	—	—	—	—	—	—
11	—	—	—	—	—	258	262	251	253	222	219	—	—	298	319
12	295	321	318	273	227	243	263	253	213	227	256	240	224	309	333
13	317	320	301	297	292	280	288	274	240	238	224	248	231	262	282
14	308	316	292	301	292	290	(288)	(286)	(284)	282	271	282	263	260	277
15	368	308	300	280	253	215	221	201	202	82	156	178	185	290	320
16	319	277	269	285	231	233	206	251	207	236	180	219	240	263	282
17	306	308	334	271	278	240	262	311	195	260	276	244	220	226	235
18	301	308	295	308	315	292	245	234	295	293	288	290	293	291	308
19	308	304	304	309	304	301	298	293	298	298	295	295	298	305	317
20	316	309	297	298	302	308	302	305	306	286	279	298	303	322	333
21	311	309	308	308	306	288	291	322	322	353	335	309	311	285	295
22	311	335	295	279	295	292	295	320	300	318	290	298	300	322	320
23	302	301	289	291	302	309	303	337	342	344	337	337	342	334	337
24	318	302	311	306	306	300	297	278	282	286	286	291	295	314	318
25	317	313	300	298	293	308	315	289	280	274	251	264	255	251	279
26	303	301	295	298	291	286	295	314	290	295	303	292	295	289	301
27	302	304	—	—	—	—	—	—	—	273	251	262	266	295	284
28	328	313	302	282	273	269	269	257	277	267	285	293	272	292	340
29	308	297	306	302	278	269	269	276	301	250	220	245	250	267	284
30	306	304	308	302	306	285	277	313	324	295	303	282	306	315	332
31	315	317	282	286	298	291	278	249	236	256	240	236	250	266	289

E′—November, 1912.

1	316	311	295	292	305	295	278	282	269	229	229	248	253	240	269
2	313	295	308	284	269	263	253	256	233	243	230	238	263	274	276
3	301	293	316	300	303	316	287	237	272	291	297	309	322	333	342
4	308	313	305	328	320	304	334	302	329	315	300	308	297	308	337
5	308	303	306	314	311	316	322	282	269	306	289	300	340	343	337
6	308	308	305	288	288	224	227	195	213	202	—	—	—	—	—
7	—	—	—	—	—	—	—	—	—	—	263	257	269	311	311
8	346	317	274	278	275	292	287	249	261	258	235	276	285	288	298
9	321	315	306	288	262	278	236	204	219	—	—	—	—	—	—
10	—	—	—	—	—	—	—	—	—	309	330	258	300	303	319
11	361	277	284	279	256	246	232	195	195	288	213	289	284	267	234
12	298	305	287	266	243	226	217	213	208	255	(255)	(256)	257	273	279
13	292	293	292	316	311	324	320	298	282	260	266	251	279	271	277
14	316	311	313	311	315	303	282	272	240	—	—	—	—	—	—
15	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
16	311	319	314	324	343	342	374	303	348	298	389	373	274	200	221
17	314	300	297	290	285	297	302	274	272	193	193	277	—	—	—
18	—	—	—	—	—	—	—	—	—	—	260	348	366	319	332
19	318	293	275	326	366	305	255	320	275	—	258	285	267	280	—

Hourly Values—*continued*.

E′—October, 1912.

2000γ (·02 C.G.S. Unit) +										Maximum Reading and Time.			Minimum Reading and Time.		
15 h.	16 h.	17 h.	18 h.	19 h.	20 h.	21 h.	22 h.	23 h.	24 h.						
γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	h.	m.	γ	h.	m.
351	405	—	484	447	456	—	—	398	363	514	17	55	226	9	40
320	324	337	339	331	328	321	319	316	314	366	0	12	264	10	19
318	342	356	355	350	340	339	332	328	321	368	17	59	234	11	45
—	—	—	—	—	—	—	—	—	—	376	11	36	237	9	11
321	334	326	340	360	357	340	337	331	324	382	19	8	258	9	7
333	343	345	343	350	337	331	329	330	316	361	13	46	298	11	25
342	356	348	348	340	335	340	331	319	318	361	16	0	277	5	55
324	333	333	363	366	366	346	343	330	315	387	19	45	206	10	20
318	350	376	368	366	358	353	327	314	316	412	16	45	190	9	5
—	—	—	—	—	—	—	—	—	—	335	6	33	261	8	31
324	309	324	324	328	322	343	357	337	295	364	21	20	167	12	10
353	356	382	385	359	364	357	337	339	317	411	17	45	184	7	7
303	340	363	366	330	334	342	340	333	308	415	17	40	169	11	50
298	311	316	339	381	453	373	395	347	368	500	20	8	230	12	41
351	329	337	357	357	344	360	322	329	319	388	19	3	23	9	3
311	332	350	350	347	374	362	332	330	306	390	19	58	131	8	57
308	327	350	362	356	355	346	335	305	301	373	19	10	174	7	37
314	337	337	340	334	335	337	329	308	308	355	18	23	209	7	2
326	337	344	340	331	318	318	318	318	316	361	17	20	282	10	28
346	350	335	342	331	330	327	320	315	311	359	16	22	271	8	40
329	318	327	340	335	330	334	331	311	311	368	8	37	258	5	18
331	340	342	335	332	339	337	320	311	302	364	20	50	266	3	8
366	377	337	339	339	343	319	318	318	318	387	15	23	273	5	47
337	353	348	340	337	333	328	316	311	317	368	5	45	255	8	5
289	316	339	337	329	(334)	340	326	308	303	361	20	30	226	9	52
327	340	351	340	350	346	329	316	306	302	370	19	46	248	12	47
311	343	372	359	344	347	335	324	328	328	393	17	10	232	10	31
302	295	363	356	339	330	343	339	311	308	382	17	7	227	9	47
287	337	351	348	350	347	327	311	311	306	361	16	43	190	9	55
327	330	343	329	320	315	314	311	303	315	369	15	35	262	6	5
301	319	320	318	319	320	314	306	317	316	344	0	40	213	10	25

E′—November, 1912.

280	308	317	357	388	363	362	366	358	313	406	19	28	200	9	0
295	340	337	368	377	385	386	392	334	301	406	22	0	203	8	23
328	334	342	332	324	322	308	324	332	308	355	16	45	222	7	2
353	353	358	353	344	343	332	331	317	308	369	16	45	279	5	7
342	353	366	353	330	326	322	309	313	308	387	17	2	229	7	25
—	—	—	—	—	—	—	—	—	—	355	1	50	140	8	32
300	291	304	316	333	356	353	363	348	346	377	21	47	237	11	35
327	342	342	340	353	392	351	321	305	321	408	20	22	193	7	56
—	—	—	—	—	—	—	—	—	—	329	0	0	156	7	22
333	370	322	316	406	435	424	350	292	361	473	19	22	232	11	0
250	279	311	337	363	424	366	333	357	298	448	19	38	142	8	25
298	328	353	351	332	329	329	324	302	292	359	17	33	165	8	5
297	322	337	337	324	324	311	308	308	316	358	5	20	135	8	52
—	—	—	—	—	—	—	—	—	—	330	5	51	226	8	20
—	—	335	328	337	322	326	317	313	311	351	18	33	298	23	26
293	368	350	330	357	335	390	334	303	314	503	10	53	142	7	10
—	—	—	—	—	—	—	—	—	—	387	2	12	108	9	35
300	329	339	337	358	339	345	340	327	318	402	11	29	203	9	35
—	—	—	—	—	—	—	—	—	—	406	3	35	132	7	35

Hourly Values—*continued.*

S′—February, 1911.

Day.	3000γ (0·03 C.G.S. Unit) +														
	0 h.	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	12 h.	13 h.	14 h.
	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
5	381	365	362	354	337	345	344	392	384	408	440	486	477	447	440
6	355	354	364	350	368	379	339	364	328	390	395	482	489	502	502
7	368	386	359	374	367	427	354	403	385	443	458	462	461	544	553
8	423	411	414	414	412	392	377	436	454	489	469	474	493	498	496
9	433	386	433	390	432	421	436	447	491	476	496	531	499	500	505
10	440	438	443	452	423	417	429	458	500	506	504	522	521	524	557
11	440	451	456	454	455	447	429	440	487	496	498	513	520	513	513
12	467	451	432	416	421	420	451	447	467	515	526	502	530	515	561
13	476	462	467	456	438	439	462	458	471	477	498	520	504	577	579
14	469	469	473	458	465	418	515	399	487	458	546	618	594	694	669
15	414	421	430	420	—	—	—	—	—	—	—	—	588	612	630
16	473	456	478	477	452	490	—	—	—	—	—	—	542	531	574
17	483	465	423	396	398	462	478	537	566	513	542	548	522	571	583
18	454	452	454	471	436	421	482	535	495	521	533	549	553	533	539
19	500	458	442	399	440	478	509	498	483	527	531	552	565	583	608
20	499	493	491	502	496	478	471	537	509	526	543	552	540	549	586
21	502	498	498	484	491	496	491	526	496	508	543	544	601	593	590
22	469	392	288	333	399	423	432	439	461	549	586	559	540	610	684
23	425	364	366	425	473	447	464	471	484	559	572	630	583	527	564
24	430	392	420	486	432	471	423	469	484	535	533	606	601	610	816
25	469	460	442	456	418	471	447	458	473	491	537	548	564	610	570
26	344	—	433	432	449	449	455	511	478	520	540	546	653	546	610
27	394	427	403	447	491	469	520	504	511	482	515	521	511	546	618
28	471	438	407	394	469	418	443	449	447	489	511	526	557	675	606

S′—March, 1911.

Day.	0 h.	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	12 h.	13 h.	14 h.
1	469	438	416	451	485	486	495	508	523	551	573	632	664	655	598
2	466	447	482	500	515	480	493	520	524	544	537	555	607	585	592
3	493	498	502	491	484	504	522	517	515	539	520	515	517	528	544
4	401	431	413	449	453	500	467	504	469	550	545	554	561	544	574
5	501	501	501	506	504	524	482	462	526	520	528	539	551	524	610
6	489	501	454	457	416	484	435	522	545	539	545	544	567	572	581
7	478	467	493	495	495	478	479	478	517	530	550	537	551	545	554
8	498	489	480	467	475	493	484	498	480	515	559	551	576	559	567
9	356	484	520	493	507	517	535	537	539	537	533	535	545	566	526
10	515	507	501	489	493	517	508	523	522	537	557	559	588	579	573
11	517	517	519	520	522	529	528	532	550	545	535	537	533	555	564
12	522	523	524	524	524	528	533	537	533	542	542	541	529	537	542
13	513	508	500	502	507	511	515	515	532	545	542	542	533	539	532
14	491	497	501	504	500	508	498	508	500	513	537	537	541	551	537
15	493	497	545	493	482	497	485	532	520	507	515	537	550	581	590
16	480	460	491	502	498	495	507	515	537	532	508	545	500	508	542
17	478	467	460	438	434	456	501	507	508	504	513	523	529	537	551
18	489	495	498	497	493	485	504	506	507	513	510	517	517	544	548
19	500	493	497	502	504	506	504	501	515	519	522	526	537	535	548
20	491	501	501	500	504	504	501	510	515	513	519	526	523	559	537
21	375	396	390	432	432	444	453	471	497	537	574	608	583	599	616
22	403	414	419	471	440	471	464	523	573	563	576	634	658	683	801
23	484	491	486	460	475	541	479	506	546	533	546	557	678	683	537
24	457	497	449	473	410	449	511	502	557	568	603	564	711	625	598
25	451	471	511	507	504	523	542	557	504	548	603	611	585	612	796
26	486	418	499	504	497	488	500	511	533	564	590	629	574	621	660
27	480	398	451	456	471	484	515	537	535	557	589	629	599	605	655
28	429	522	523	501	542	544	508	510	552	561	605	625	691	620	581
29	517	520	523	523	508	493	506	515	529	573	561	576	680	702	742
30	497	403	429	456	460	506	500	548	567	542	539	547	546	568	655
31	504	508	502	506	508	506	508	520	545	537	559	559	551	559	572

S′—February, 1911.

3000γ (·03 C.G.S. Unit) +										Maximum Reading and Time.			Minimum Reading and Time.		
15 h.	16 h.	17 h.	18 h.	19 h.	20 h.	21 h.	22 h.	23 h.	24 h.						
γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	h.	m.	γ	h.	m.
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
531	597	571	452	434	403	405	429	324	355	638	16	42	264	23	15
527	478	452	486	502	434	425	461	366	368	588	7	22	256	6	13
561	508	464	461	484	476	436	452	432	423	608	14	40	251	7	9
511	522	487	518	474	483	471	418	423	433	552	15	50	342	6	33
515	544	527	515	484	520	476	464	478	440	564	17	30	317	6	48
555	605	513	471	522	487	461	383	416	440	636	15	50	320	21	58
526	522	517	506	499	502	487	482	478	467	577	15	35	403	5	32
565	513	515	527	504	509	491	483	469	476	590	14	23	388	3	20
557	557	537	518	502	509	489	455	451	469	625	13 15	20 3	392	5	25
579	599	566	571	533	518	471	449	461	414	850	13	20	271	7	6
548	559	577	608	616	543	515	487	462	473	731	9	19	370	3	33
557	584	592	559	531	511	489	487	486	483	619	16	38	411	3	57
574	586	594	566	527	524	464	495	461	454	622	17	12	361	2	44
565	634	568	513	531	518	439	484	491	500	655	16	12	396	3	37
621	590	555	548	552	531	509	495	505	499	678	14	23	374	2	42
597	586	555	539	526	520	513	505	504	502	615	15	5	445	5	39
593	630	571	527	517	544	439	477	500	469	673	15	42	394	21	12
667	662	610	544	506	476	522	513	487	425	741	14	23	234	2	21
684	680	566	559	505	499	506	443	447	430	743	15	23	326	1	30
618	610	557	522	473	447	449	427	471	469	946	14	10	352	1	24
559	586	522	500	493	467	483	447	430	344	649	12	55	324	23	44
608	587	574	495	543	491	417	458	449	394	766	12	14	348	0	0
694	579	590	511	500	477	455	432	414	471	815	14	45	366	2	33
546	619	669	571	508	504	471	442	458	423	755	12	59	314	2	34

S′—March, 1911.

661	617	605	552	564	511	529	535	473	466	708	14	15	385	2	53
574	592	625	572	519	517	515	501	498	493	642	16	45	427	1	18
554	572	557	522	530	537	506	522	476	401	598	15	52	388	23	57
570	545	545	542	520	508	502	507	511	501	594	13	47	363	0	8
603	592	581	612	563	517	510	469	486	489	671	15	43	416	21	38
598	589	579	618	594	542	497	485	491	478	639	17	55	354	3	10
554	570	586	589	548	530	515	493	517	498	627	17	45	429	5	10
563	581	592	585	570	546	493	497	454	356	610	16	25	271	23	45
566	590	594	577	537	537	508	523	515	515	610	16	47	350	0	0
579	573	579	564	548	544	533	515	520	517	605	12	20	471	3	28
563	566	559	548	533	520	522	523	522	522	570	14	10	516	0	15
542	590	576	573	563	546	522	515	510	513	601	16	7	507	23	3
537	541	557	550	542	532	524	501	480	491	559	17	3	476	23	22
537	566	614	633	605	548	491	489	482	493	667	17	24	469	6	50
589	610	607	537	500	493	491	493	491	480	658	16	23	460	6	25
535	525	542	548	541	488	491	495	475	478	576	14	40	372	6	10
573	559	533	539	520	513	504	493	473	489	586	14	57	401	3	33
564	548	532	513	506	507	504	501	493	500	574	14	50	469	7	30
532	544	541	529	524	515	511	504	497	491	573	13	40	480	1	22
585	605	572	573	535	523	448	337	352	375	689	15	45	284	22	28
621	579	589	537	530	506	482	412	405	403	680	14	50	341	23	37
627	633	728	573	502	493	508	435	485	484	870	13	37	354	1	45
572	572	572	570	511	530	495	526	485	457	777	12	20	419	3	5
649	605	572	552	548	513	520	478	463	451	762	11	42	412	2	25
720	630	617	533	504	517	473	485	523	486	900	14	5	333	21	23
651	639	607	559	537	502	493	524	515	480	689	15	54	381	0	35
598	614	673	686	574	533	441	493	464	429	845	16	47	366	23	45
581	590	649	669	636	552	532	519	510	517	715	11	55	416	0	0
629	661	660	573	542	529	517	498	488	497	765	14	0	460	6	23
611	568	561	532	544	522	508	515	507	504	692	14	2	381	1	12
617	607	564	537	517	557	520	510	515	520	661	15	11	451	2	44

S′—April, 1911.

Day.	3000γ (·03 C.G.S. Unit) +														
	0 h.	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	12 h.	13 h.	14 h.
	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
1	454	451	457	453	451	441	427	425	464	485	478	498	486	479	476
2	458	445	451	457	440	434	464	458	485	493	500	515	515	573	502
3	467	457	436	427	438	425	451	480	489	485	500	532	515	567	612
4	420	436	449	445	486	469	440	464	501	493	504	502	511	522	513
5	418	471	482	471	466	440	475	471	488	526	511	515	506	508	508
6	471	471	482	479	486	491	491	493	500	501	501	502	501	506	513
7	488	484	480	480	488	480	473	482	493	508	523	523	506	523	523
8	489	486	488	479	475	466	467	491	498	500	532	513	528	557	537
9	453	469	438	482	478	471	502	497	471	566	595	695	570	642	880
10	370	473	533	528	523	520	524	535	506	522	523	570	542	515	603
11	508	493	432	457	495	522	520	530	529	504	552	618	709	541	526
12	513	513	497	515	510	517	510	523	526	528	515	541	529	550	554
13	434	427	498	469	401	458	462	485	498	—	—	—	—	—	—
14	—	—	—	—	—	—	—	—	—	519	524	515	523	515	528
15	497	493	500	501	501	507	507	506	507	510	510	508	508	515	522
16	500	501	504	506	501	500	501	502	510	517	502	524	529	559	577
17	449	348	390	383	365	442	466	482	520	555	537	520	554	552	625
18	491	445	482	500	484	462	497	524	526	554	541	550	513	537	551
19	297	473	458	451	485	471	511	500	523	546	552	643	695	654	599
20	431	493	508	493	507	482	507	485	537	539	568	585	627	548	617
21	441	493	508	507	508	502	530	501	513	563	579	570	599	667	630
22	463	401	368	493	489	506	495	529	542	550	577	620	620	642	625
23	440	423	427	454	507	464	515	533	548	579	573	630	633	665	661
24	476	432	502	488	515	517	497	529	533	542	564	595	601	574	570
25	438	471	427	423	456	486	517	535	544	559	581	572	623	645	557
26	506	479	482	504	507	501	529	535	537	542	548	574	577	603	589
27	520	523	519	491	488	495	520	520	533	550	559	572	548	561	564
28	526	523	513	523	529	523	520	532	528	535	535	535	554	581	515
29	—	—	—	—	—	—	—	548	548	548	544	546	573	572	612
30	530	485	511	539	557	551	545	542	545	551	552	546	567	552	603

S′—May, 1911.

Day.	0 h.	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	12 h.	13 h.	14 h.
1	530	480	449	462	463	491	513	539	555	601	590	683	592	579	586
2	546	551	546	550	550	554	554	552	551	561	555	557	557	564	577
3	539	529	530	529	523	544	537	544	544	551	548	545	550	548	551
4	523	519	532	524	524	532	535	539	551	551	545	548	554	550	554
5	537	537	537	541	539	541	539	539	539	544	544	546	542	548	559
6	528	529	515	508	529	511	517	530	541	546	552	589	590	577	561
7	510	526	526	517	515	501	507	526	541	568	574	601	541	577	574
8	346	379	361	480	442	513	519	515	530	542	537	524	574	598	651
9	519	520	522	524	519	530	530	520	535	544	544	537	544	557	559
10	513	497	515	486	522	510	510	519	522	528	532	545	554	576	542
11	520	520	517	517	506	511	513	508	524	529	544	528	555	647	636
12	523	498	458	442	479	466	471	508	520	545	542	554	542	550	563
13	515	517	519	519	522	524	519	522	526	529	532	533	535	537	535
14	517	519	519	517	520	519	519	517	519	528	528	528	526	532	533
15	501	511	507	510	506	498	497	517	515	524	542	603	625	616	623
16	507	506	479	471	493	489	489	504	510	510	561	572	539	535	550
17	480	456	434	469	467	486	491	501	515	530	544	554	541	551	542
18	493	473	440	501	491	508	523	535	523	530	526	526	537	537	541
19	488	482	479	486	488	497	523	515	532	526	555	564	592	581	594
20	476	460	510	489	513	495	497	513	526	537	542	590	564	548	541
21	495	454	441	495	493	479	513	528	526	535	537	539	550	548	541
22	501	511	488	480	453	504	482	508	520	554	526	529	533	523	526
23	488	497	486	484	486	493	485	495	495	502	497	502	500	508	511
24	486	484	485	482	491	491	478	486	489	491	507	510	493	506	507
25	495	478	478	495	491	494	502	498	500	510	504	506	506	510	511
26	489	471	460	427	488	463	498	502	507	526	502	507	519	537	561
27	476	494	502	493	488	484	491	509	502	515	497	502	510	516	546
28	485	480	504	509	506	507	504	504	506	509	504	510	513	520	579
29	502	500	502	491	502	498	498	494	495	502	504	504	502	506	513
30	489	495	500	488	504	504	500	495	495	504	498	504	502	502	506
31	460	438	387	400	419	451	462	480	491	498	510	542	551	564	590

Hourly Values—*continued.*

S′—April, 1911.

3000γ (0·03 C.G.S. Unit) +										Maximum Reading and Time.			Minimum Reading and Time.		
15 h.	16 h.	17 h.	18 h.	19 h.	20 h.	21 h.	22 h.	23 h.	24 h.						
γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	h.	m.	γ	h.	m.
473	471	473	479	482	480	460	458	449	458	524	10	42	412	6	12
554	554	500	485	475	467	449	458	475	467	614	15	25	369	4	23
559	532	488	500	493	484	480	467	456	420	643	13	49	385	4	35
533	493	508	486	476	488	469	447	413	418	585	12	32	387	23	40
541	535	520	515	495	498	485	475	473	471	566	15	0	412	4	42
522	513	515	519	497	491	476	454	482	488	537	17	43	438	22	5
517	526	524	523	520	501	493	488	486	489	563	14	12	449	6	7
596	557	554	539	535	517	493	485	476	453	623	15	3	387	23	25
721	816	748	746	656	581	467	471	372	370	955	13	57	303	23	10
616	640	555	541	506	506	488	445	476	508	762	15	30	317	0	7
552	550	559	563	559	563	557	519	508	513	799	12	18	391	2	19
559	561	572	592	586	515	495	526	502	434	619	18	26	441	6	10
—	—	—	—	—	—	—	—	—	—	535	1	30	332	0	31
535	537	532	523	508	515	506	498	501	497	552	15	3	493	21	53
517	529	523	520	517	515	507	501	500	500	537	14	45	489	0	22
630	634	596	576	546	497	482	479	480	449	702	15	12	464	23	53
696	614	554	545	498	475	453	464	427	491	717	15	22	— 1	0	53
598	614	574	541	520	523	454	484	453	297	640	15	47	230	23	53
655	642	586	581	581	526	489	485	401	431	720	11	48	253	0	0
686	662	592	589	485	519	493	493	471	441	713	15	23	385	23	47
627	610	603	601	497	523	506	449	438	463	722	13	13	419	21	43
585	625	629	605	546	526	513	495	458	440	715	13	29	304	1	58
656	647	585	588	548	458	497	519	498	476	718	12	35	376	20	10
564	579	564	566	510	510	523	502	381	438	636	11	28	352	23	0
537	559	574	586	551	519	519	515	515	506	702	12	45	407	3	46
579	566	566	577	511	544	520	523	528	520	634	13	5	426	1	40
552	548	561	554	545	502	526	526	529	526	596	11	3	473	4	2
537	533	542	559	542	542	488	—	—	—	618	12	42	467	20	30
654	610	567	574	561	537	552	520	482	530	671	14	38	451	22	27
590	572	573	579	579	542	574	545	530	530	696	13	50	460	1	19

S′—May, 1911.

589	583	585	574	559	554	552	551	548	546	717	11	8	420	2	30
603	605	559	568	576	566	552	551	541	539	632	15	40	517	20	38
557	564	559	559	546	537	541	544	542	523	627	16	14	505	4	12
554	561	555	551	551	544	537	539	542	537	566	16	15	503	3	15
541	533	542	552	555	537	533	515	510	528	566	14 19	5 2	495	22	46
559	555	555	539	533	530	528	528	517	510	610	11	4	494	3	0
577	559	546	566	530	501	480	458	361	346	621	11	13	331	22	53
634	608	605	617	586	550	542	535	533	519	661	13	46	317	2	0
554	544	555	546	546	539	529	524	524	513	570	13	58	506	3	40
533	541	530	542	542	537	520	515	519	520	614	13	3	447	3	15
572	554	532	528	523	523	523	526	524	523	693	13	25	495	4	45
592	567	548	570	545	526	522	511	515	515	618	15	23	405	2	54
532	544	546	530	532	522	515	506	517	517	555	16	23	491	21	50
542	537	526	526	524	517	502	493	491	501	550	15	25	482	21	15
643	625	611	588	559	507	467	493	502	507	664	11	28	427	21	11
647	595	614	608	551	471	429	466	493	480	734	17	23	408	20	48
550	552	552	570	581	548	520	515	491	493	590	19	21	403	1	48
595	620	601	564	554	539	493	508	486	488	638	16	0	400	2	15
583	564	561	576	545	497	523	526	515	476	610	17	47	445	20	20
576	566	537	526	524	529	480	511	510	495	621	11	18	420	0	33
581	528	537	532	519	520	508	435	508	501	600	14	40	346	21	50
524	517	511	506	515	493	493	493	489	488	572	8	50	403	4	4
504	501	506	504	507	495	488	486	486	486	535	10	33	478	4	48
501	513	498	517	510	508	498	493	491	495	526	9	37	447	5	43
515	513	507	506	519	506	504	510	502	489	528	18	41	463	1	38
522	513	511	504	506	504	502	497	487	476	586	13	55	403	3	18
630	546	517	524	520	520	506	497	484	485	657	15	8	458	4	28
555	551	537	524	519	516	487	488	493	502	594	14	13	457	21	8
507	511	509	498	511	502	497	495	484	489	526	13	57	467	23	18
510	513	502	497	498	493	493	493	485	460	531	15	53	453	23	35
585	573	563	533	489	496	498	459	401	413	605	14	33	363	22	34

Hourly Values—*continued*.

S′—June, 1911.

Day.	3000γ (0·03 C.G.S. Unit) +														
	0 h.	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	12 h.	13 h.	14 h.
	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
1	412	441	441	441	448	468	478	489	507	527	544	561	573	584	595
2	441	437	448	459	489	485	524	511	531	538	547	551	556	631	577
3	496	493	487	496	505	499	499	502	509	512	514	515	522	511	531
4	499	500	500	493	499	500	500	507	515	522	527	525	524	524	524
5	505	498	500	511	507	467	474	471	480	500	522	577	537	534	—
6	576	573	576	580	575	577	565	571	585	542	551	567	553	559	542
7	533	529	541	533	541	527	512	527	559	551	563	549	581	644	604
8	527	537	530	514	517	506	515	530	541	553	546	555	557	563	568
9	535	534	527	538	534	539	535	530	539	541	541	551	545	549	545
10	539	539	537	538	541	537	520	525	546	530	571	606	640	656	644
11	495	504	484	527	525	514	530	531	551	—	—	—	—	—	—
12	—	—	—	—	—	—	—	—	—	—	555	569	606	632	565
13	478	488	517	525	514	514	534	527	541	546	561	555	589	588	603
14	488	504	462	448	465	498	551	545	547	547	543	547	567	572	580
15	503	522	537	521	518	539	533	531	547	559	588	604	652	596	588
16	537	534	539	534	537	535	533	523	553	568	553	547	555	563	563
17	531	538	537	515	503	512	499	531	557	567	584	579	573	576	587
18	523	538	527	537	533	537	537	541	541	541	545	546	549	551	555
19	525	529	541	539	545	543	535	542	541	543	545	549	559	563	555
20	535	533	537	537	534	533	534	543	535	549	543	553	549	551	563
21	521	519	512	535	535	541	535	535	534	543	545	573	559	569	565
22	454	527	539	511	491	478	523	541	545	551	565	593	580	596	626
23	499	549	546	538	534	522	526	541	525	547	546	539	555	553	557
24	535	530	442	506	525	—	—	—	—	—	—	—	557	599	608
25	522	535	527	529	538	538	534	537	539	539	541	541	545	551	555
26	538	539	537	538	535	529	534	535	537	539	537	539	541	547	551
27	534	533	537	533	541	541	538	538	537	545	541	541	542	542	545
28	533	535	537	535	534	521	529	531	534	533	535	541	538	551	567
29	507	442	522	538	538	533	538	535	530	534	537	551	569	561	541
30	518	535	538	538	534	535	534	534	533	538	541	541	541	539	542

S′—July, 1911.

1	503	514	506	526	523	527	527	530	525	533	541	557	565	555	551
2	478	496	500	457	449	456	537	522	530	538	541	549	563	571	619
3	511	482	484	510	514	504	512	507	521	534	527	539	559	565	563
4	516	502	507	504	458	476	490	476	488	520	530	520	524	537	524
5	507	515	512	512	504	499	494	502	496	510	518	514	520	530	539
6	490	496	490	488	480	470	484	490	494	506	510	496	504	504	507
7	494	488	474	465	474	460	470	494	496	494	500	496	494	498	512
8	480	519	409	431	480	503	529	543	538	539	571	575	644	712	668
9	507	504	458	494	482	494	445	519	533	542	558	601	573	558	539
10	486	499	510	514	504	526	523	510	520	527	524	538	539	545	559
11	486	473	498	543	506	498	510	504	508	515	532	585	593	558	539
12	482	494	492	500	498	484	514	507	519	526	532	531	579	591	583
13	498	510	515	482	484	486	510	515	524	528	547	550	607	587	559
14	527	524	534	528	528	531	526	538	538	541	543	542	545	545	547
15	512	531	520	542	530	520	523	535	539	540	543	545	550	558	565
16	532	534	525	531	522	522	527	537	537	545	545	549	543	558	553
17	542	542	542	538	523	527	526	545	553	554	553	559	555	562	557
18	532	518	531	530	512	(522)	(531)	541	550	563	608	609	562	601	573
19	496	510	525	508	512	508	537	553	549	571	565	597	607	612	660
20	474	512	515	520	500	500	506	535	549	580	587	589	601	563	597
21	537	529	537	541	531	554	533	537	549	563	561	581	575	569	597
22	554	546	535	522	554	531	550	545	554	580	571	577	584	577	612
23	550	541	508	530	537	529	525	547	559	559	567	571	575	592	587
24	541	545	550	547	553	546	549	551	555	557	563	565	561	569	563
25	545	542	531	529	545	514	523	554	546	557	567	563	559	567	565
26	553	553	554	553	550	547	546	550	551	559	559	563	559	559	569
27	549	545	538	537	541	541	535	546	554	559	559	579	563	565	563
28	547	549	547	547	543	534	533	527	550	553	559	563	604	571	579
29	545	472	465	496	523	535	525	545	549	563	591	579	711	658	606
30	480	515	515	510	520	531	539	537	545	559	557	577	601	634	573
31	546	525	530	510	468	527	519	533	554	550	563	563	559	611	610

S′—June, 1911.

3000γ (0·03 C.G.S. Unit) +										Maximum Reading and Time.			Minimum Reading and Time.		
15 h.	16 h.	17 h.	18 h.	19 h.	20 h.	21 h.	22 h.	23 h.	24 h.						
γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	h.	m.	γ	h.	m.
653	603	587	565	551	533	527	500	512	441	666	15	5	368	22	35
559	562	533	518	514	499	498	483	487	496	646	13	5	399	0	20
531	565	534	512	503	500	496	496	496	499	595	16	2	483	1	20
531	529	542	540	525	520	511	511	507	505	551	16	52	490	3	0
664	632	600	598	604	603	608	589	579	576	683	14	55	454	5	0
557	580	565	553	541	542	585	472	470	533	626	11	5	434	22	16
557	555	555	557	551	542	533	535	538	527	679	12	45	480	5	37
559	563	600	573	545	541	539	539	534	535	638	17	13	497	5	8
542	551	561	557	546	539	538	535	533	539	580	16	45	519	3	57
644	627	670	636	523	523	534	508	507	495	688	14	20	430	19	24
—	—	—	—	—	—	—	—	—	—	577	7	55	458	2	28
577	577	627	640	607	565	559	518	504	478	723	17	40	464	23	25
584	584	616	583	519	555	551	476	454	488	653	16	50	393	19	12
563	555	577	603	579	541	500	535	535	503	630	17	45	419	3	10
567	583	602	559	543	530	531	523	537	537	677	12	0	487	0	33
569	551	559	543	563	543	529	492	525	531	589	15	18	474	21	42
592	589	559	551	531	539	534	525	525	523	608	14	47	480	4 6	3 1
549	547	546	545	542	539	534	530	522	525	559	13	53	514	22	52
559	569	569	549	546	539	521	538	537	535	588	16	49	508	21	35
563	561	581	614	555	545	525	519	526	521	644	17	45	503	21	30
569	572	575	559	557	541	526	529	480	454	595	11	20	410	23	28
600	599	573	565	521	549	538	538	438	499	666	13	33	403	22	52
553	549	559	547	546	555	533	482	510	535	583	17	7	414	21	37
555	546	545	538	541	534	534	535	515	522	644	13	30	427	1	42
545	547	549	543	535	541	534	535	537	538	563	13	42	521	2	20
549	551	549	543	542	541	533	534	537	534	557	15	42	523	4	58
545	543	547	545	541	535	533	531	530	533	555	8	52	521	20	30
561	551	542	534	535	535	531	521	470	507	579	14	17	444	23	8
572	592	595	551	539	531	522	495	482	518	620	16	8	417	1	18
541	541	533	537	531	530	529	531	522	503	547	15	5	491	23	33

S′—July, 1911.

545	559	573	612	579	533	507	488	506	478	644	17	43	444	23	45
565	549	580	559	542	482	515	522	510	511	656	13	55	342	3	44
563	545	559	575	565	561	546	529	488	517	705	20	23	460	1	30
533	523	520	523	507	522	504	503	465	507	558	9	42	434	4	0
515	504	508	519	502	502	496	494	494	490	550	13	55	468	23	30
518	524	514	506	506	498	490	488	490	494	531	15	3	459	4	33
595	627	616	533	542	534	477	474	542	480	674	17	27	407	23	30
628	563	571	547	503	520	465	462	533	507	747	12	34	281	2	26
546	546	553	553	542	535	523	502	474	486	628	11	30	413	2	16
571	575	554	531	537	522	499	512	499	486	595	15	27	477	0	5
553	530	538	545	515	561	510	514	500	482	652	10	57	423	0	29
538	547	539	526	531	512	518	498	490	498	612	13	55	429	19	52
571	539	547	538	542	532	532	534	532	527	634	12	22	460	5	3
553	569	597	575	567	526	535	519	516	512	631	17	2	488	20	5
597	583	569	559	542	538	514	511	528	532	622	14	38	490	1	41
551	554	553	571	546	545	542	551	542	542	593	17	53	504	3	46
555	565	557	583	561	561	546	546	542	532	600	17	52	504	4	56
579	569	601	605	535	559	551	532	518	496	656	12	35	498	4	5
689	612	627	654	567	555	482	500	545	474	717	14	27	423	21	29
575	600	577	584	523	567	565	557	555	537	624	15	42	472	0	0
624	606	577	571	559	563	549	549	557	554	650	14	31	504	4	8
640	592	571	575	569	563	546	531	555	550	654	15	15	468	21	35
635	624	592	588	575	557	547	546	546	541	670	15	20	484	2	17
563	557	565	561	565	550	550	547	550	545	576	12	50	529	5	55
563	563	553	550	550	550	549	549	549	553	577	13	23	481	5	34
567	565	571	559	550	551	550	549	549	549	585	8	45	541	4	6
563	555	554	550	550	549	549	549	547	547	573	12	38	527	6	15
597	580	591	575	559	541	534	484	484	545	622	16	45	409	23	2
660	644	601	567	567	569	579	541	500	480	737	12	2	395	1	50
597	575	577	580	559	569	533	538	546	546	648	13	2	460	0	6
616	614	587	567	583	557	542	553	545	537	638	21	15	447	4	0

S′—August, 1911.

Day.	0 h.	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	12 h.	13 h.	14 h.
	3000γ (0·03 C.G.S. Unit) +														
	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
1	531	537	530	543	531	526	529	533	531	548	556	537	564	567	563
2	515	536	535	532	526	532	533	536	541	548	547	555	557	562	557
3	538	541	541	535	533	526	535	537	541	548	546	550	548	557	552
4	530	514	512	541	538	520	538	540	546	560	560	555	580	606	605
5	531	535	536	526	528	519	530	546	540	550	558	569	564	575	639
6	536	526	507	499	509	532	528	538	547	541	584	622	604	610	587
7	521	529	526	530	535	532	526	539	533	546	552	565	560	552	564
8	531	533	530	526	526	528	530	533	530	538	538	538	543	541	543
9	526	528	529	526	522	526	532	530	540	541	537	547	538	541	550
10	528	528	526	529	529	520	532	531	535	539	539	541	543	546	546
11	515	521	530	535	539	536	539	538	535	541	541	548	547	564	555
12	528	531	535	524	535	532	531	529	532	545	546	550	543	543	543
13	532	531	529	531	531	531	531	532	535	540	547	546	543	540	543
14	514	524	536	530	540	526	535	539	539	536	539	543	547	(553)	558
15	502	528	529	536	530	523	523	531	540	541	548	550	550	546	543
16	526	513	516	513	514	514	532	540	546	547	547	554	567	601	615
17	512	512	537	539	529	537	543	523	541	539	538	538	553	570	601
18	529	505	512	532	529	540	537	538	536	543	546	558	567	597	584
19	529	515	526	526	529	529	530	539	536	546	541	543	548	552	543
20	528	512	512	512	502	488	515	543	532	550	589	614	564	547	567
21	528	528	520	505	519	533	535	538	536	541	545	548	555	569	553
22	531	526	528	531	535	538	541	539	539	541	543	547	553	550	548
23	536	536	535	530	530	531	538	537	538	540	541	550	546	553	546
24	505	483	481	337	406	505	536	516	535	567	558	666	625	595	648
25	460	468	513	492	500	500	516	535	541	537	560	550	577	598	652
26	494	468	507	509	509	507	511	532	545	550	556	587	591	569	594
27	535	522	487	480	507	507	495	513	547	560	560	571	563	588	647
28	515	502	473	499	505	505	529	529	550	543	548	586	575	586	590
29	520	522	509	509	497	497	512	520	541	555	547	552	545	543	565
30	502	516	513	520	513	530	535	532	537	543	547	553	553	574	586
31	515	521	526	523	516	516	513	526	533	546	545	557	548	552	540

S′—September, 1911.

Day.	0 h.	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	12 h.	13 h.	14 h.
1	506	483	497	507	519	537	543	537	526	545	555	571	560	580	567
2	529	533	533	528	526	532	528	536	541	546	—	—	—	—	—
3	519	502	512	515	502	536	535	538	539	540	539	541	548	547	547
4	528	531	530	528	528	531	535	535	535	536	540	541	541	540	539
5	532	523	526	526	528	524	530	531	538	541	538	545	547	550	557
6	532	526	509	526	533	524	513	529	537	550	558	545	547	537	540
7	514	528	523	519	520	514	531	535	538	541	546	543	548	548	540
8	516	524	521	528	536	533	538	535	537	537	535	553	553	567	557
9	520	533	531	528	507	515	528	533	535	541	545	556	548	560	565
10	528	524	523	520	515	514	521	532	539	540	545	555	560	564	598
11	485	500	515	513	499	526	531	530	539	547	552	556	567	560	553
12	517	438	468	488	460	496	507	530	548	562	564	575	580	550	601
13	480	500	505	485	498	529	531	526	555	563	569	560	560	560	569
14	506	532	505	526	541	539	550	545	543	546	548	543	560	562	558
15	531	532	532	528	541	541	539	548	543	550	550	565	560	567	577
16	514	514	533	529	531	536	529	560	560	550	570	575	574	571	616
17	465	402	509	515	522	541	523	550	555	553	560	577	581	620	—
18	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
19	—	—	—	—	—	—	—	—	—	—	—	—	—	—	567
20	535	532	532	528	523	526	523	530	537	545	562	558	586	586	611
21	511	485	509	483	488	517	526	548	554	560	587	604	620	618	608
22	538	539	475	432	421	499	538	540	537	553	589	601	591	612	644
23	543	533	554	520	521	523	509	524	555	553	554	597	620	631	635
24	530	524	506	502	535	541	555	521	546	541	565	557	563	591	605
25	515	528	540	528	535	540	539	547	550	563	554	560	557	575	573
26	535	528	532	543	550	543	535	555	555	557	565	563	563	573	577
27	545	545	547	548	543	536	539	552	546	562	570	584	594	630	604
28	500	498	535	543	538	550	543	560	560	557	560	567	577	577	569
29	541	541	538	543	543	550	548	558	539	556	560	562	560	574	593
30	532	535	530	526	531	533	528	540	538	—	—	—	—	—	—

Hourly Values—*continued.*

S′—August, 1911.

3000γ (0·03 C.G.S. Unit) +										Maximum Reading and Time.			Minimum Reading and Time.		
15 h.	16 h.	17 h.	18 h.	19 h.	20 h.	21 h.	22 h.	23 h.	24 h.						
γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	h.	m.	γ	h.	m.
567	569	564	562	554	536	539	543	521	515	584	15	40	503	23	8
567	569	567	550	555	550	532	529	536	538	584	16	32	511	0	0
552	567	582	574	554	531	461	509	521	530	591	17	14	415	21	20
591	603	616	595	548	541	515	497	531	531	641	13	18	475	21	30
618	574	543	543	538	539	530	520	537	536	687	13	55	506	21	57
618	573	565	548	545	536	533	538	533	521	657	15	5	477	2	55
582	560	548	556	533	524	526	528	531	531	598	14	43	503	20	6
540	541	553	545	540	533	535	530	532	526	571	17	28	521	2	48
538	543	533	530	533	532	529	531	531	528	565	10	57	516	3	54
545	546	548	543	532	523	524	506	517	515	555	15	57	498	22	20
556	540	537	532	533	535	531	532	526	528	571	12	58	512	0	1
541	541	539	539	539	531	526	529	530	532	560	10	50	523	20	40
556	575	582	579	557	528	505	532	523	514	591	15	38	465	21	5
547	564	567	562	555	550	543	533	531	502	579	16	30	462	23	54
550	558	565	564	541	546	536	528	530	526	577	17	42	470	0	0
611	605	618	608	575	541	496	514	520	512	628	16	57	470	21	7
584	555	543	543	536	539	526	521	531	529	611	14	10	494	6	55
574	557	546	550	543	540	536	529	526	529	605	12	42	463	1	30
548	553	550	550	548	540	536	529	529	528	562	13	12	506	1	10
560	574	543	541	516	498	521	522	528	528	627	11	20	446	5	5
550	550	557	550	541	523	533	532	533	531	582	13	8	497	2	47
550	548	543	537	539	531	528	530	528	536	560	12	5	513	20	45
550	548	545	536	535	521	511	495	463	505	564	15	23	434	22	57
606	642	663	575	587	547	516	528	497	460	710	11	15	256	3	5
642	579	553	554	538	545	550	530	440	494	696	14	17	402	22	52
584	582	571	553	546	526	526	466	540	535	642	12	2	430	21	23
591	567	567	573	554	529	520	497	444	515	708	13	59	405	23	4
601	575	567	545	521	528	526	532	526	520	626	14	24	442	2	5
546	548	555	536	537	523	524	529	519	502	596	14	2	469	4	45
570	567	562	557	535	540	523	502	502	515	623	14	25	473	22	34
543	555	560	565	550	521	492	513	504	506	582	10	50	387	20	26

S′—September, 1911.

567	573	565	547	537	539	526	532	530	529	607	11	30	449	2	42
548	543	543	546	510	533	524	522	521	519	562	9	8	511	6	12
547	558	545	538	526	526	528	529	529	528	575	15	48	492	3	42
533	530	529	530	531	531	532	535	532	532	547	12	46	524	4	7
550	548	541	532	536	511	482	520	530	532	567	11	52	466	21	7
536	535	537	537	539	529	530	529	526	514	566	10	0	495	2	22
547	553	574	571	543	541	531	528	485	516	590	17	7	462	22	50
550	550	554	548	533	535	531	502	506	520	575	13	22	485	22	40
562	562	552	543	546	530	520	526	526	528	571	14	17	500	5	22
611	604	571	550	546	532	529	504	485	485	644	15	17	475	23	14
563	557	560	563	540	545	509	516	523	517	589	11	40	468	0	38
594	603	598	550	529	528	536	528	531	480	629	16	38	419	0	55
567	613	606	572	548	547	541	442	521	506	650	16	17	387	21	55
554	573	590	587	558	553	531	532	533	531	620	17	35	454	1	15
575	575	590	567	550	538	536	541	537	514	610	17	6	521	2	54
605	606	591	575	550	529	485	495	515	465	644	14	15	465	21	0
578	—	—	—	—	—	—	—	—	—	633	13	11	371	0	36
—	—	553	543	543	539	—	—	—	—	562	16	13	530	20	38
569	—	—	541	538	—	540	540	537	535	584	14	42	531	19	18
768	778	695	622	509	502	533	439	454	511	845	15	18	405	22	0
580	571	562	590	564	540	492	500	524	538	688	11	35	458	3	19
586	644	659	642	545	552	530	441	492	543	731	17	12	359	3	40
648	625	579	597	573	547	553	540	531	530	664	12	0	483	5	35
581	578	567	557	554	548	539	540	530	515	618	13	35	471	3	25
570	567	557	556	547	543	541	539	532	535	593	12	55	492	0	26
557	569	569	562	550	554	546	537	541	545	587	14	42	520	5	32
584	584	560	553	541	537	531	517	519	500	668	13	25	503	21	43
567	570	565	560	553	547	538	531	540	541	605	12	22	479	0	45
589	581	570	564	547	546	540	541	537	532	603	14	36	521	7	50
—	—	—	—	—	—	—	532	533	531	554	8	22	507	5	30

HOURLY VALUES—*continued.*

S′—October, 1911.

Day.	0 h.	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	12 h.	13 h.	14 h.
	3000γ (0·03 C.G.S. Unit) +														
	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
1	531	526	528	529	528	537	537	546	537	539	550	555	557	553	553
2	535	535	533	535	536	538	541	536	538	545	545	548	555	548	553
3	523	496	460	462	505	526	533	547	540	554	560	565	572	581	572
4	533	531	531	528	526	520	526	526	540	553	557	552	550	563	580
5	528	531	528	523	523	536	532	539	543	550	555	574	578	571	572
6	513	530	526	531	530	536	537	536	541	545	555	558	578	558	548
7	507	502	496	497	519	524	539	554	553	556	550	558	582	553	570
8	523	514	505	498	473	522	531	535	555	552	558	575	591	608	621
9	517	477	485	535	543	546	550	550	560	546	569	580	593	610	628
10	509	488	492	520	502	521	540	554	555	555	572	565	579	584	575
11	520	482	500	498	489	480	506	519	538	594	618	686	707	729	751
12	541	539	540	540	529	543	543	579	590	584	582	548	545	603	567
13	543	538	537	537	539	524	521	572	575	560	536	550	571	563	590
14	535	536	533	524	531	546	555	562	554	558	560	582	570	606	587
15	538	537	533	533	506	530	560	572	558	533	565	579	596	657	628
16	545	545	543	543	539	541	543	533	552	560	554	558	562	569	564
17	492	463	514	526	509	526	533	550	553	560	567	567	599	573	590
18	464	455	442	457	526	498	528	536	581	573	567	575	593	596	620
19	492	529	492	513	506	502	564	497	531	564	573	593	556	582	574
20	439	483	490	489	495	541	543	540	539	558	564	572	563	577	608
21	522	488	488	478	485	543	550	548	567	567	560	573	593	622	622
22	528	512	509	502	540	540	519	533	540	567	570	575	591	611	584
23	540	532	514	507	526	512	509	533	550	558	567	563	567	570	571
24	523	530	530	522	526	521	517	529	564	567	572	563	567	577	589
25	504	521	524	504	539	553	543	538	540	537	569	601	618	676	579
26	536	536	535	528	526	514	543	506	515	587	545	553	553	573	584
27	533	521	528	522	524	532	546	546	546	557	558	571	567	578	565
28	530	532	529	528	530	524	526	545	567	557	574	541	570	570	554
29	533	532	532	529	532	535	545	547	530	539	558	573	569	570	580
30	520	522	500	511	539	530	500	509	532	550	550	565	547	558	567
31	537	533	537	532	528	517	531	530	529	560	563	572	584	588	580

S′—November, 1911.

Day.	0 h.	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	12 h.	13 h.	14 h.
1	529	526	535	540	546	541	543	538	546	560	587	595	595	586	569
2	530	535	539	533	532	533	552	562	577	580	572	580	584	587	598
3	526	528	531	528	517	539	563	582	596	556	553	550	581	633	618
4	517	514	475	460	463	546	479	492	516	555	543	582	575	625	623
5	519	532	519	530	533	522	540	536	556	567	578	578	608	599	613
6	522	494	447	494	507	519	531	535	546	550	571	574	581	605	589
7	522	526	533	540	536	543	546	564	543	571	578	591	577	597	589
8	522	521	523	537	535	532	536	550	562	570	562	567	560	567	577
9	535	526	498	478	499	526	537	520	485	502	543	584	639	601	649
10	517	516	515	517	485	519	557	565	502	548	524	557	644	633	597
11	520	516	520	515	516	507	497	521	557	569	571	560	560	560	570
12	533	533	535	533	528	529	533	511	540	547	557	572	584	618	587
13	535	537	536	530	516	509	537	505	580	567	575	564	606	594	608
14	460	431	475	441	497	500	485	531	526	557	598	630	570	632	696
15	349	448	453	464	479	550	567	595	606	584	567	581	623	644	613
16	513	487	463	454	528	532	507	499	499	522	557	597	593	595	595
17	524	513	516	531	535	496	538	553	555	562	572	588	611	597	604
18	535	512	520	526	495	490	528	541	565	577	563	573	562	579	563
19	531	532	505	522	526	538	532	532	532	541	545	555	569	571	557
20	540	531	514	515	509	509	468	530	530	531	563	541	550	533	528
21	517	512	517	509	492	523	523	570	562	526	529	517	591	584	573
22	512	520	517	506	498	500	511	545	500	530	550	530	541	545	563
23	531	524	519	521	519	506	523	533	543	543	548	546	555	564	572
24	528	521	521	531	533	528	533	529	532	528	529	545	532	555	580
25	526	526	520	515	513	529	512	526	550	529	539	560	556	560	564
26	521	515	517	505	506	512	517	531	556	564	581	573	584	591	605
27	528	530	532	530	526	530	543	553	550	570	584	564	593	589	591
28	535	530	523	524	522	515	538	567	550	560	528	550	560	580	580
29	537	528	520	516	529	531	532	541	535	541	545	570	577	581	595
30	538	520	482	463	497	519	543	480	529	574	587	580	590	601	618

Hourly Values—*continued.*

S′—October, 1911.

3000γ (0·03 C.G.S. Unit) +										Maximum Reading and Time.			Minimum Reading and Time.		
15 h.	16 h.	17 h.	18 h.	19 h.	20 h.	21 h.	22 h.	23 h.	24 h.						
γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	h.	m.	γ	h.	m.
552	548	546	550	541	536	536	535	535	535	565	11	47	522	1	29
563	556	538	548	540	546	507	471	528	523	573	15	13	421	21	28
569	558	553	546	538	521	531	529	531	533	593	12	55	441	2	3
572	578	582	547	532	535	528	528	532	528	594	16	42	513	5	3
565	560	553	535	532	537	528	526	511	513	589	13	23	497	22	55
539	539	545	556	560	539	533	533	507	507	595	12	8	496	23	8
564	584	596	621	578	571	531	523	524	523	634	17	55	487	1	49
625	632	625	584	558	539	526	511	478	517	644	16	34	458	3	45
633	618	625	615	588	553	529	528	509	509	654	14	27	460	1	7
588	608	599	575	557	550	546	523	531	520	630	16	13	468	1	9
768	751	687	734	637	601	560	530	532	541	786	17	38	456	4	45
567	543	536	543	543	545	539	538	540	543	634	13	10	503	11	59
590	578	586	575	547	543	535	530	533	535	625	14	30	500	6	2
560	564	555	550	536	543	530	528	537	538	625	13	11	491	6	23
610	638	615	562	575	550	540	530	540	545	676	13	8	494	4	7
570	563	562	541	531	541	523	535	543	492	582	14	34	492	24	0
594	611	621	618	595	552	546	423	496	464	639	12	17	338	21	49
612	577	611	620	588	557	511	410	495	492	657	14	25	316	21	50
579	596	598	582	590	540	531	516	507	439	642	11	8	425	24	0
587	580	575	572	567	531	540	526	528	522	620	13	41	408	0	7
595	589	586	570	569	555	533	497	537	528	642	13	45	462	2	40
596	621	601	573	556	546	537	528	536	540	637	15	47	476	3	2
580	587	584	577	572	556	543	499	489	523	603	15	28	477	22	43
575	569	575	571	543	517	492	512	546	504	599	13	57	429	23	20
584	564	552	535	531	526	532	535	535	536	720	13	7	495	3	12
573	562	550	543	539	535	535	539	541	533	620	9	28	463	7	14
557	560	556	545	529	531	538	521	532	530	587	13	1	503	0	30
574	569	550	548	563	548	541	535	535	533	596	9	45	502	6	35
572	571	570	560	548	537	529	528	521	520	593	15	40	497	7	41
579	558	547	548	543	537	535	537	533	537	590	10	37	460	5	36
579	584	563	557	557	540	526	524	535	529	605	14	33	502	5	20

S′—November, 1911.

571	567	570	569	574	557	538	546	535	530	604	12	10	516	7	43
596	599	570	567	560	550	530	515	526	526	614	15	52	511	22	34
642	640	645	603	584	555	522	526	523	517	664	16	38	488	3	43
635	642	616	598	572	579	541	540	495	519	668	15	32	432	2	53
639	621	610	597	574	533	546	492	513	522	647	15	11	468	21	50
595	613	614	577	547	543	511	535	538	522	634	16	15	417	2	0
596	612	599	584	558	548	541	543	533	522	619	16	5	520	5	57
588	580	575	579	565	545	543	536	538	535	596	14	45	512	1	42
717	676	627	578	538	535	532	524	523	517	764	15	19	440	3	32
588	605	565	543	515	529	526	502	521	520	722	12	48	442	3	50
571	570	567	545	545	540	538	536	531	533	582	14	32	478	6	7
594	577	567	558	540	541	543	528	533	535	650	13	4	461	7	25
648	664	625	594	586	580	530	472	498	460	676	15	54	421	23	33
741	620	614	562	543	541	532	497	485	349	790	14	58	319	23	47
631	612	589	567	584	588	547	533	520	513	659	12	39	327	0	1
610	595	589	569	564	555	524	498	532	524	644	11	26	444	2	58
604	594	560	553	580	560	557	505	535	535	646	15	23	455	21	48
562	557	567	554	543	540	531	526	526	531	592	11	25	468	5	2
567	567	565	547	546	541	532	532	528	535	586	12	57	497	1	57
546	577	618	593	567	526	514	532	514	507	681	9	51	445	6	4
567	558	557	577	571	562	554	492	531	512	621	12	10	466	21	50
579	594	579	567	543	536	529	531	536	531	608	15	54	470	4	17
578	570	562	567	555	543	522	523	529	528	582	15	23	485	5	21
588	587	562	553	543	529	511	514	522	526	614	15	20	506	21	12
553	550	550	543	535	530	526	522	509	521	575	13	55	500	22	52
625	622	610	597	572	541	524	517	521	528	640	15	14	490	2	58
591	612	584	567	555	552	540	530	526	535	625	13	32	502	4	10
601	625	614	625	574	557	548	540	537	537	639	17	50	494	4	48
614	599	588	573	558	552	548	533	536	538	625	15	12	512	7	38
613	618	618	588	557	548	552	528	539	533	635	14	2	453	2	55

Hourly Values—*continued.*

S′—December, 1911.

Day.	3000γ (0·03 C.G.S. Unit) +														
	0 h.	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	12 h.	13 h.	14 h.
	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
1	533	531	514	500	497	522	550	555	579	571	564	586	627	596	601
2	541	512	497	543	519	509	540	558	573	594	594	596	582	612	618
3	556	547	546	554	560	553	560	564	555	507	545	597	567	597	599
4	535	539	515	520	507	488	509	541	570	553	537	620	595	607	601
5	543	545	543	543	540	539	548	546	573	584	593	584	581	570	573
6	533	541	548	537	550	522	554	572	558	565	584	571	591	608	627
7	516	500	485	498	489	439	437	478	560	573	612	639	580	630	581
8	538	541	536	531	526	523	520	535	537	553	540	556	562	578	594
9	538	538	541	537	530	528	539	539	557	532	564	569	570	579	570
10	543	546	545	541	541	541	550	563	560	560	552	565	570	571	580
11	528	533	531	528	515	530	526	562	560	552	521	557	664	618	517
12	509	422	412	420	461	498	477	516	557	554	572	590	614	640	647
13	543	545	541	550	546	538	535	543	564	545	550	584	589	604	605
14	526	540	547	548	543	554	535	558	543	538	546	564	589	596	620
15	504	502	545	526	516	532	553	608	623	601	611	616	621	631	631
16	540	545	543	531	528	526	530	557	564	589	601	604	618	608	628
17	531	530	541	546	531	526	511	509	509	554	552	573	584	584	580
18	520	487	502	489	519	494	494	512	587	537	552	560	623	647	708
19	560	546	535	536	519	500	505	593	588	570	564	550	567	603	608
20	531	539	541	526	522	512	475	496	487	477	502	522	538	560	582
21	547	543	535	520	512	528	517	505	483	477	517	526	564	595	630
22	532	537	543	536	519	502	506	505	547	556	560	573	579	563	570
23	548	546	538	537	529	537	537	519	483	504	540	547	563	572	637
24	545	543	545	541	533	535	507	513	505	489	509	554	557	562	588
25	531	540	528	519	528	532	560	543	567	565	595	595	603	596	591
26	517	535	515	471	461	516	535	478	593	593	604	605	608	628	630
27	498	514	485	487	494	492	541	591	535	545	562	653	680	676	664
28	529	529	528	526	509	494	552	630	632	603	596	584	589	664	702
29	538	530	520	523	514	529	529	533	509	570	565	587	601	587	588
30	538	543	535	535	537	543	535	541	565	582	587	586	589	581	578
31	530	504	495	516	523	530	553	521	589	526	543	529	623	659	712

S′—January, 1912.

1	523	515	500	509	516	478	526	516	573	567	560	543	550	597	557
2	523	506	501	521	498	562	541	559	562	521	540	535	574	607	576
3	549	542	535	526	524	529	544	535	535	521	544	562	598	612	603
4	537	525	530	537	539	541	546	562	552	541	552	559	572	564	573
5	549	546	539	525	533	532	535	535	550	555	572	593	619	587	627
6	554	552	526	472	505	522	499	537	569	529	518	574	594	625	617
7	545	549	542	542	545	550	544	518	532	557	569	572	586	576	576
8	549	540	541	546	552	545	540	547	562	556	586	627	617	623	653
9	550	541	545	547	554	555	554	555	518	559	567	598	604	600	624
10	557	545	535	544	513	505	498	602	617	617	613	614	610	589	571
11	552	544	538	537	529	526	550	557	544	574	596	617	634	630	627
12	548	541	537	540	550	555	518	501	491	531	562	595	634	657	688
13	480	443	460	445	471	480	470	530	503	518	524	604	659	681	665
14	505	465	455	503	515	548	557	509	518	508	559	589	607	598	600
15	532	530	520	509	470	501	509	505	496	511	567	533	544	612	627
16	520	508	514	509	506	525	522	507	496	522	516	552	586	584	569
17	539	535	521	524	528	514	515	515	509	522	554	540	559	572	588
18	504	486	463	484	511	523	532	566	651	619	623	539	602	657	606
19	515	469	479	509	514	530	537	525	539	539	566	580	581	582	578
20	538	542	535	539	533	542	541	504	541	546	582	598	597	591	589
21	545	544	540	542	532	531	544	539	562	576	579	591	604	604	603
22	545	550	552	555	549	559	567	565	588	576	586	587	603	621	653
23	522	436	490	521	514	531	546	567	535	574	578	573	588	593	623
24	547	538	537	538	540	535	530	544	557	573	584	593	603	614	620
25	514	496	496	535	545	544	556	556	547	566	552	564	578	596	605
26	544	540	542	539	538	540	552	562	572	588	591	605	608	610	608
27	556	552	549	549	535	538	533	540	555	574	590	583	582	573	581
28	552	550	552	550	550	552	559	571	550	569	571	580	576	582	593
29	548	541	528	530	539	544	554	528	516	514	567	569	564	556	567
30	545	545	542	533	542	547	554	571	579	563	569	565	559	579	593
31	531	522	523	523	518	544	555	559	566	580	583	581	587	587	587

HOURLY VALUES—*continued.*

S′—December, 1911.

3000γ (0·03 C.G.S. Unit) +										Maximum Reading and Time.			Minimum Reading and Time.		
15 h.	16 h.	17 h.	18 h.	19 h.	20 h.	21 h.	22 h.	23 h.	24 h.						
γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	h.	m.	γ	h.	m.
580	562	569	554	553	553	567	531	540	541	658	12	25	462	3	25
621	623	605	597	590	591	571	558	560	556	632	13	25	457	4	30
579	581	571	629	588	570	556	562	539	535	640	18	0	463	8	37
598	597	581	584	581	580	573	548	550	543	644	10	38	480	5	30
594	594	589	581	579	572	560	556	540	533	603	9	37	520	6	52
646	631	597	580	573	560	543	539	514	516	647	14	42	498	23	20
588	579	578	572	556	548	545	543	537	538	708	11	14	367	6	40
594	601	601	567	560	552	548	550	547	538	627	15	44	498	5	22
586	587	582	580	567	555	552	547	543	543	599	15	27	509	4	10
593	588	584	563	546	539	540	550	536	528	596	15	20	528	24	0
786	792	771	721	647	560	494	520	523	509	839	15	42	405	21	26
673	663	648	608	588	569	575	558	531	543	690	15	22	395	3	22
611	632	635	620	601	591	558	548	539	526	641	17	5	511	4	46
629	635	638	623	605	597	570	558	541	504	648	16	23	469	6	17
625	628	605	603	586	567	553	538	541	540	674	8	15	462	0	27
615	608	582	575	577	573	582	552	540	531	641	14	16	503	7	46
588	616	618	612	596	593	578	505	523	520	633	16	42	487	22	0
646	622	601	589	575	545	541	540	547	560	762	14	13	422	2	45
625	605	601	564	558	571	536	511	516	531	649	14	55	470	5	42
558	557	590	593	572	584	532	530	546	547	611	17	30	424	6	10
644	630	620	603	578	543	550	530	560	532	654	15	10	455	8	10
558	582	581	578	547	539	547	550	554	548	607	13	30	475	6	50
604	596	630	639	610	574	553	530	539	545	653	13	43	468	7	46
593	578	577	577	584	582	558	543	535	531	603	14	20	462	8	50
595	593	579	557	548	582	577	553	548	517	610	11	55	500	7	18
653	621	608	603	597	570	591	538	522	498	673	13	52	424	7	10
666	594	605	591	580	570	552	557	538	529	753	12	25	432	2	15
683	616	598	560	550	552	571	552	546	538	728	14	27	463	4	52
578	581	606	601	577	565	550	541	530	538	611	17	55	503	6	18
594	586	604	612	596	594	558	533	533	530	619	18	2	519	6	41
686	717	710	693	635	621	541	536	538	523	732	15	38	491	2	0

S′—January, 1912.

—	—	576	574	548	546	544	552	546	523	653	12	45	455	6	30
583	541	565	563	573	562	542	533	546	549	632	13	3	441	4	6
610	610	606	582	563	555	547	559	554	537	632	12	32	496	6	50
598	603	606	584	576	569	557	559	552	549	627	7	45	496	7	35
617	624	604	552	549	542	562	569	525	554	653	14	50	492	23	11
623	623	605	614	571	581	559	535	544	545	673	14	0	440	2	52
578	578	562	573	572	569	564	565	529	549	591	11	43	482	7	55
638	640	621	582	572	582	593	550	545	550	671	14	13	507	7	8
604	598	612	606	593	583	571	556	550	557	629	14	0	499	7	40
566	567	571	576	564	564	579	569	549	552	646	7	53	474	4	1
617	639	641	634	617	576	569	556	547	548	651	16	26	509	8	7
690	678	647	631	627	587	555	526	494	480	707	14	32	441	6	15
666	597	521	634	557	584	571	535	505	505	765	14	0	428	3	13
588	587	557	569	554	576	540	537	526	532	643	11	37	390	1	45
584	552	556	563	557	563	566	556	556	520	655	14	3	448	3	50
596	584	584	573	562	556	544	546	546	539	617	15	14	472	8	0
584	579	578	572	569	567	582	521	490	504	598	14	38	447	22	25
634	644	610	576	514	505	555	557	546	515	698	8	10	449	2	3
561	581	589	612	605	571	555	547	547	538	632	18	43	454	1	53
590	591	546	576	578	584	569	541	546	545	615	19	49	475	6	58
613	607	588	574	564	565	559	559	550	545	623	15	8	501	4	3
637	666	666	641	612	596	554	531	555	522	692	14	44	516	9	7
598	599	586	584	579	561	544	532	544	547	632	14	18	421	1	19
615	614	623	591	572	563	556	557	541	514	632	13	30	503	23	57
610	625	586	566	569	582	571	550	550	544	639	16	0	465	1	48
604	588	582	581	562	555	559	559	555	556	619	12	45	528	5	3
588	588	590	586	586	581	569	566	556	552	605	10	35	523	6	4
627	606	595	589	579	580	563	557	554	548	639	14	56	537	7	30
576	584	604	583	569	561	550	535	538	545	612	16	50	477	9	3
607	607	605	588	584	569	559	574	552	531	615	16	35	520	2	48
587	586	572	569	565	559	554	550	548	539	622	12	32	503	4	2

Hourly Values—*continued.*

S′—February, 1912.

Day.	3000γ (0·03 C.G.S. Unit) +														
	0 h.	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	12 h.	13 h.	14 h.
	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
1	549	545	546	546	545	549	551	537	529	546	555	573	592	504	600
2	556	553	562	562	560	558	566	569	563	593	546	559	575	590	609
3	546	555	569	563	575	552	575	576	568	581	607	602	611	619	634
4	600	605	596	604	583	605	569	621	603	617	617	579	(593)	607	624
5	561	558	538	535	549	556	578	585	515	530	538	568	575	600	604
6	566	566	564	564	564	566	558	566	569	590	604	618	609	600	588
7	563	563	564	569	564	569	570	586	585	602	583	580	588	588	595
8	555	554	555	539	547	532	537	575	522	537	556	571	604	631	637
9	545	542	543	540	537	568	554	562	578	568	564	586	587	617	620
10	555	555	554	556	558	561	569	578	578	552	555	578	589	576	621
11	527	457	485	498	513	537	537	535	553	534	560	585	619	646	581
12	535	536	508	536	549	535	545	571	607	559	598	607	607	586	624
13	558	549	554	539	488	489	519	530	525	553	585	604	573	580	576
14	525	542	530	527	530	505	498	506	508	559	560	585	560	585	594
15	555	535	538	525	540	525	519	538	578	555	558	573	583	600	613
16	535	543	537	540	542	547	549	558	544	558	577	573	576	576	580
17	549	547	530	532	537	564	551	544	578	571	593	617	630	634	670
18	544	545	547	547	544	537	598	562	512	583	569	578	590	612	639
19	549	551	543	551	543	546	549	544	573	571	566	570	573	560	579
20	515	512	525	519	532	522	525	542	540	549	559	555	569	559	576
21	528	527	517	512	511	510	512	527	512	529	525	553	559	566	571
22	517	517	517	513	517	515	517	513	523	554	544	551	558	547	562
23	512	512	519	515	512	505	513	515	510	525	537	547	543	573	600
24	498	498	478	460	405	445	464	472	487	501	503	525	539	577	590
25	505	505	508	508	519	498	500	493	496	—	578	558	554	626	609
26	503	491	485	—	—	—	506	491	498	—	—	—	—	—	—
27	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
28	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
29	—	—	—	—	—	—	—	—	—	523	534	546	551	570	558

S′—March, 1912.

Day.	0 h.	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	12 h.	13 h.	14 h.
1	526	536	536	539	536	527	517	531	546	544	558	560	589	594	587
2	538	524	523	519	524	523	548	539	564	549	567	560	553	565	570
3	526	533	526	536	534	540	541	541	550	551	567	560	565	559	555
4	531	532	532	538	536	536	524	525	534	553	541	563	602	576	567
5	539	538	540	542	540	541	546	551	553	546	563	567	561	567	566
6	519	493	497	509	515	538	553	563	559	561	566	559	555	566	546
7	536	529	519	519	523	492	542	519	542	549	553	589	591	574	631
8	524	519	505	504	500	522	544	564	563	526	546	563	597	604	676
9	536	495	495	502	495	506	492	523	551	599	564	590	570	608	615
10	524	509	516	485	519	517	532	519	529	548	553	599	585	584	573
11	522	488	456	474	495	468	469	529	526	565	572	574	577	591	623
12	538	538	539	541	540	541	549	546	551	546	549	541	560	560	575
13	504	512	500	484	510	525	517	514	527	550	557	539	553	563	570
14	514	519	516	539	536	540	540	541	525	544	544	566	567	564	568
15	525	524	521	524	538	542	549	527	560	560	561	559	565	566	572
16	533	531	527	534	534	546	553	557	559	546	553	570	568	580	570
17	517	529	533	540	542	541	543	558	565	565	560	558	567	565	561
18	544	546	544	544	546	542	542	556	555	567	564	566	560	567	565
19	541	543	544	546	544	544	551	553	550	560	564	566	568	570	564
20	540	539	534	531	541	543	546	553	563	564	570	566	556	559	572
21	542	538	541	538	543	538	553	555	563	565	563	557	561	564	560
22	536	541	539	529	536	551	551	546	531	553	570	584	633	692	747
23	533	536	540	531	529	523	522	531	540	551	—	—	—	—	—
24	—	—	—	—	—	—	—	—	—	558	566	566	568	570	576
25	540	544	544	542	541	541	542	555	557	553	561	566	561	565	570
26	538	538	538	529	538	544	542	546	542	542	558	—	623	649	638
27	567	572	570	573	575	567	566	568	577	580	598	649	635	626	638
28	575	575	568	566	567	574	570	573	587	587	594	594	594	594	589
29	570	570	566	544	548	544	544	555	559	564	570	568	570	579	570
30	525	517	512	492	499	515	546	565	570	579	576	587	572	563	577
31	546	551	546	543	546	553	556	563	567	568	566	568	572	570	575

Hourly Values—*continued.*

S′—February, 1912.

3000γ (0·03 C.G.S. Unit) +										Maximum Reading and Time.			Minimum Reading and Time.		
15 h.	16 h.	17 h.	18 h.	19 h.	20 h.	21 h.	22 h.	23 h.	24 h.						
γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	h.	m.	γ	h.	m.
622	605	583	577	568	577	579	554	553	556	639	14	54	520	7	35
605	624	583	588	600	604	583	580	571	546	648	15	49	513	23	55
621	645	663	636	696	621	607	594	600	600	678	16	39	537	4	37
646	641	626	612	590	586	570	558	563	561	660	15	22	544	5	48
609	619	614	598	590	583	573	563	564	566	639	16	17	483	7	37
581	641	613	622	600	585	576	569	571	563	667	16	7	528	7	27
602	603	607	596	595	583	570	569	563	555	611	15	29	553	23	52
653	669	646	634	615	602	573	532	539	545	692	15	23	493	8	8
631	646	624	626	613	579	563	566	563	555	653	15	42	517	4	53
699	719	627	578	624	578	562	544	546	527	763	15	55	528	8	23
603	600	600	596	587	559	560	534	521	535	662	13	4	442	1	21
596	607	609	621	607	605	549	551	559	558	643	7	30	483	2	16
612	603	621	618	594	605	571	555	528	525	643	18	7	455	4	22
619	607	592	571	576	578	571	566	556	555	633	14	34	431	6	2
634	636	604	590	566	553	549	535	523	535	669	16	7	494	5	52
594	607	610	583	583	566	553	551	555	549	626	17	19	517	2	26
692	648	585	588	569	566	562	555	551	544	714	14	3	480	6	41
656	628	603	586	578	551	546	538	542	549	691	15	21	454	7	52
597	604	604	600	570	542	532	525	525	515	628	15	20	505	23	47
560	564	583	573	561	543	532	527	529	528	592	17	8	502	0	38
580	566	558	539	536	528	525	523	518	517	588	15	0	489	8	13
558	562	544	537	527	522	528	515	510	512	590	14	15	503	6	53
566	590	561	547	528	525	498	501	470	498	619	13	57	445	22	53
558	549	566	549	529	508	498	508	506	505	605	13	37	376	3	57
561	555	556	544	537	523	517	523	503	503	660	12	45	448	6	17
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
555	566	575	574	557	551	546	539	532	526	589	17	23	507	8	55

S′—March, 1912.

587	604	604	592	560	532	550	534	538	538	613	16	51	486	5	58
565	559	557	563	553	538	521	521	536	526	587	15	37	485	4	35
553	589	592	566	555	549	534	533	532	531	606	16	38	521	1	43
559	564	553	548	551	556	534	538	536	539	619	12	0	507	6	43
563	568	570	567	553	546	538	531	516	519	579	10	10	507	23	5
566	560	556	553	542	538	539	538	529	536	589	6	49	478	1	19
623	579	556	564	550	542	534	524	516	524	656	14	43	486	2	32
662	660	651	632	594	561	555	471	468	536	752	14	27	381	22	36
606	582	570	587	566	539	539	501	502	524	633	14	8	434	3	22
587	587	590	583	566	553	542	531	523	522	638	11	12	463	2	58
631	608	601	581	553	536	522	541	533	538	660	14	33	425	2	27
575	589	575	553	546	543	531	512	495	504	609	16	13	478	23	22
566	560	555	553	570	548	533	512	523	514	585	18	45	478	2	36
563	556	563	551	542	544	536	538	531	525	575	12	6	507	2	0
577	557	555	544	540	556	551	521	529	533	599	14	15	490	21	36
585	577	582	572	565	557	534	532	515	517	599	13	14	506	22	31
577	565	558	551	555	551	544	541	544	544	590	6	44	515	0	0
565	570	564	565	565	556	540	534	531	541	576	16	30	524	5	38
566	568	563	560	557	553	543	540	541	540	579	11	39	536	22	15
570	570	565	570	558	549	542	544	544	542	592	14	25	524	2	26
558	558	550	555	555	544	540	498	522	536	572	12	50	465	21	57
623	590	591	559	546	539	538	536	527	533	832	13	40	507	7	30
—	—	—	—	—	—	—	—	—	—	565	9	50	514	5	45
576	573	570	560	551	546	548	543	546	540	584	13	10	519	20	13
575	573	570	558	551	(548)	(544)	541	541	538	585	16	45	517	8	38
613	600	624	580	579	576	573	575	572	567	662	12	43	515	8	50
631	615	591	584	583	574	568	573	573	575	666	11	18	555	5	47
600	606	599	590	594	583	560	576	556	570	614	10	2	532	22	56
574	581	579	581	570	558	555	546	536	525	592	13	10	522	5	45
574	579	561	583	592	572	558	549	553	546	616	10	58	469	2	38
568	570	566	565	563	551	553	551	556	556	582	12	0	521	2	39

S′—April, 1912.

Day.	3000γ (·03 C.G.S. Unit) +														
	0 h.	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	12 h.	13 h.	14 h.
	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
1	556	558	558	558	551	558	557	551	560	567	560	567	567	572	570
2	536	546	533	539	549	546	543	558	561	565	568	573	579	575	573
3	555	553	557	553	546	540	540	550	563	568	570	590	613	621	613
4	538	536	522	544	542	544	539	550	558	570	570	577	583	581	596
5	556	553	555	553	540	553	555	555	564	572	577	585	600	606	606
6	538	529	504	504	532	546	573	558	583	580	638	659	717	731	658
7	533	510	519	508	512	517	549	540	576	582	573	592	611	638	628
8	544	532	536	533	546	533	538	553	576	579	576	585	589	584	581
9	551	549	551	551	556	553	558	558	560	568	570	580	587	575	587
10	555	553	553	558	546	548	556	553	565	572	570	570	563	567	564
11	561	563	561	551	550	542	553	572	574	574	570	573	579	579	587
12	553	555	555	555	557	553	560	561	564	565	565	567	576	568	576
13	539	546	550	556	560	551	556	563	566	(568)	(570)	(572)	574	580	596
14	555	557	548	563	560	561	561	565	572	567	573	577	583	574	567
15	556	557	553	546	546	534	551	551	567	582	587	566	572	573	609
16	473	521	565	536	561	550	573	568	568	570	574	567	587	591	615
17	509	558	529	531	548	550	544	546	572	570	585	570	573	572	600
18	557	561	555	548	533	495	508	553	558	560	567	633	618	590	584
19	534	546	548	531	539	553	564	548	570	575	579	573	585	577	585
20	525	536	549	534	549	546	565	560	570	585	615	597	575	587	681
21	548	543	555	564	563	556	555	560	561	565	573	573	574	577	580
22	555	558	556	558	564	560	560	553	563	570	580	585	584	596	607
23	548	541	524	534	543	553	558	558	558	570	568	572	575	575	574
24	557	559	558	553	546	542	546	555	566	575	589	572	599	596	585
25	539	529	553	556	553	556	563	565	567	563	568	579	580	572	570
26	534	509	539	553	558	558	561	557	564	566	567	572	575	574	584
27	550	556	559	559	561	561	561	563	564	566	567	572	570	574	572
28	544	538	544	541	546	555	557	556	559	566	574	576	570	579	581
29	550	557	558	566	553	549	556	561	559	570	573	572	577	579	582
30	558	555	560	561	560	560	564	561	559	563	566	572	572	574	573

S′—May, 1912.

1	517	555	558	565	561	553	565	565	565	570	567	572	575	573	574
2	560	560	563	564	565	563	558	564	565	567	577	579	583	577	589
3	553	546	534	538	542	544	549	560	555	(567)	579	587	604	623	619
4	548	548	538	538	538	558	558	558	568	—	—	—	—	—	—
5	568	589	594	604	608	604	608	570	585	580	590	606	594	626	613
6	437	574	579	570	553	570	558	572	576	573	579	580	582	581	599
7	500	531	546	543	531	544	570	572	570	572	582	596	607	589	591
8	501	553	566	565	546	560	553	566	577	574	599	596	590	604	599
9	558	534	534	560	564	555	542	570	573	575	570	574	580	579	587
10	561	566	555	559	555	558	563	567	572	573	572	579	590	579	577
11	553	563	558	565	566	565	568	572	572	572	572	575	576	575	572
12	565	564	563	560	541	549	548	560	572	580	581	601	601	617	662
13	478	529	563	558	558	559	557	563	565	587	628	606	657	746	692
14	573	574	563	563	570	553	551	590	574	609	615	628	676	651	651
15	553	560	566	557	544	551	546	564	568	587	589	609	600	611	613
16	561	570	568	564	563	557	561	567	573	570	573	576	576	581	587
17	559	558	557	565	572	570	560	568	572	574	575	579	575	600	615
18	557	546	566	553	558	559	572	566	572	572	575	576	577	572	575
19	567	567	564	557	559	560	561	565	575	577	575	576	577	575	577
20	558	560	558	570	570	570	563	560	580	579	576	589	606	621	609
21	565	566	565	565	564	566	559	565	568	573	576	580	587	590	587
22	567	560	564	546	544	570	565	570	577	582	573	590	581	594	604
23	570	570	566	567	565	564	565	570	572	573	572	572	572	573	575
24	568	568	570	570	572	570	568	567	573	577	576	576	574	572	572
25	567	566	568	567	565	567	567	570	570	574	570	582	577	579	577
26	566	570	564	564	561	561	566	572	574	574	574	577	579	580	579
27	565	566	564	566	566	574	566	572	574	576	573	576	585	594	602
28	572	572	572	574	575	572	570	573	570	576	577	579	583	579	585
29	567	570	570	568	564	568	566	567	573	574	573	576	579	576	573
30	532	557	566	568	561	572	567	566	572	580	575	579	574	580	579
31	568	568	563	558	553	550	557	567	583	584	599	594	594	587	590

HOURLY VALUES—*continued.*

S′—April, 1912.

3000γ (·03 C.G.S. Unit) +										Maximum Reading and Time.			Minimum Reading and Time.		
15 h.	16 h.	17 h.	18 h.	19 h.	20 h.	21 h.	22 h.	23 h.	24 h.						
γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	h.	m.	γ	h.	m.
573	563	558	558	557	555	555	541	536	556	579	14	35	507	22	42
570	572	573	570	567	563	556	553	550	555	582	6	53	527	2	3
611	590	580	573	555	553	544	548	529	538	633	12	47	522	23	8
592	589	574	559	559	555	549	539	549	556	609	15	31	497	2	8
606	652	583	570	559	548	540	525	551	538	681	15	55	510	21	58
583	579	557	561	559	563	551	536	536	533	751	12	45	481	2	32
597	573	573	566	564	560	548	490	529	544	662	12	10	437	21	45
585	584	574	570	564	558	546	553	556	551	613	11	11	517	2	18
580	572	576	579	566	558	560	556	555	555	606	12	19	541	1	37
584	598	594	600	579	568	461	478	546	561	633	17	47	364	21	24
583	572	568	570	574	565	559	556	553	553	594	12	18	534	5	15
581	575	566	570	563	558	548	541	536	539	594	12	14	497	21	29
601	617	617	594	599	575	563	548	544	555	633	16	33	531	4	57
566	567	568	570	570	556	560	555	555	556	596	12	5	541	23	8
669	694	689	638	594	587	539	534	454	473	722	16	25	405	23	16
607	611	611	590	566	529	525	560	522	509	654	14	20	396	20	26
594	654	626	617	592	576	557	532	538	557	684	16	18	476	22	17
608	611	607	581	575	559	559	471	541	534	640	11	10	408	22	15
568	563	561	561	565	560	561	561	546	525	604	13	50	514	24	0
715	631	613	570	564	559	546	544	551	548	791	14	32	510	0	3
575	570	568	565	563	559	560	559	558	555	600	11	47	540	1	28
594	604	596	581	573	574	559	553	546	548	615	13	50	534	23	30
570	572	600	580	570	557	558	560	558	557	609	17	3	515	2	3
589	589	579	576	567	570	555	534	548	539	626	12	0	512	22	24
576	576	572	570	566	558	553	557	548	534	693	11	37	517	0	42
583	589	574	568	565	564	564	551	541	550	594	14	23	476	1	13
567	568	568	570	570	564	553	546	519	544	579	12	45	510	23	10
582	573	565	573	561	560	561	557	553	550	592	14	43	531	0	20
568	573	581	572	(568)	(564)	559	561	553	558	585	14	22	543	4	20
573	570	576	570	567	561	558	561	560	517	579	15	13	490	23	55

S′—May, 1912.

572	583	587	582	577	570	559	560	560	560	596	16	50	495	0	0
584	585	591	584	572	565	553	555	546	553	601	16	43	539	22	57
584	576	580	572	583	570	553	548	541	548	634	12	45	524	3	48
—	—	—	541	557	563	566	561	560	568	575	6	25	524	3	33
594	566	570	577	563	561	538	539	495	437	669	14	25	231	23	41
580	581	580	570	567	567	565	548	521	500	628	0	27	442	0	0
576	572	572	567	572	570	563	567	512	501	640	12	2	478	23	5
619	618	597	574	570	572	568	557	551	558	640	14	57	497	0	0
573	574	570	570	568	572	575	565	567	561	594	14	21	526	1	32
576	581	615	606	573	564	566	565	566	553	649	17	10	544	23	48
572	572	568	570	567	566	565	565	565	565	581	13	6	546	0	4
698	651	615	616	544	524	561	550	495	478	723	15	33	423	23	25
597	606	616	615	606	478	499	506	568	573	817	13	23	435	19	50
624	606	615	597	574	573	579	559	559	553	707	11	58	523	5	45
604	618	599	579	581	572	556	538	523	561	654	15	54	504	5	9
574	580	587	584	577	566	549	565	559	559	597	12	8	536	20	28
606	604	587	582	574	568	567	566	564	557	626	14	7	541	2	27
580	577	573	570	570	565	565	566	566	567	599	15	48	527	0	45
582	579	579	576	572	553	559	563	565	558	587	15	15	538	20	20
607	599	577	579	568	565	563	566	561	565	632	13	20	544	6	14
567	589	585	574	572	566	566	566	566	567	598	15	10	557	6	15
598	596	580	579	575	568	566	566	567	570	619	13	45	538	3	59
574	572	572	572	572	568	567	566	565	568	577	16	42	561	4	40
572	573	574	572	573	570	567	566	568	567	587	18	32	564	20	43
580	577	572	572	570	570	567	570	570	566	589	15	1	561	5	45
579	579	577	579	572	577	546	566	566	565	587	11	33	524	20	59
597	584	574	570	572	570	559	570	572	572	614	13	40	553	21	2
585	587	606	581	572	567	565	565	566	567	615	16	54	560	19	22
576	577	572	575	572	565	570	561	557	532	585	16	2	531	23	30
576	575	575	570	566	565	565	570	570	568	587	12	50	514	0	23
592	583	574	572	564	566	567	567	560	558	616	10	3	544	4	45

HOURLY VALUES—*continued.*

S′—June, 1912.

Day.	0 h.	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	12 h.	13 h.	14 h.
	3000γ (·03 C.G.S. Unit) +														
	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
1	558	565	560	570	577	566	587	575	568	556	576	577	574	581	584
2	536	574	570	577	576	572	568	572	573	577	575	580	583	583	583
3	567	568	556	540	542	553	574	564	582	584	587	584	606	614	625
4	556	565	570	567	572	570	574	575	575	576	587	592	581	581	594
5	567	570	574	576	573	570	572	570	577	575	576	579	582	577	582
6	574	576	576	568	570	575	776	568	576	—	—	—	—	—	—
7	—	—	—	—	—	—	—	—	—	—	—	—	569	570	568
8	562	564	567	567	570	571	571	567	567	560	564	575	599	579	588
9	564	503	472	530	529	562	571	575	592	599	578	584	595	605	682
10	509	526	519	530	522	553	548	575	575	609	605	616	648	623	665
11	554	553	532	512	562	551	551	546	577	571	588	587	587	599	599
12	538	554	554	558	560	558	555	568	568	570	568	572	582	584	582
13	551	553	553	549	562	567	548	562	569	571	571	575	578	575	577
14	561	564	564	555	548	556	558	567	569	570	571	572	578	573	582
15	560	562	555	547	552	558	567	564	570	569	572	586	594	588	599
16	567	564	563	563	567	562	561	568	569	—	—	—	—	—	—
17	—	—	—	—	—	—	—	—	—	577	578	573	572	572	570
18	554	560	570	569	564	558	567	558	570	571	571	572	571	573	579
19	563	558	565	571	562	568	569	568	571	568	568	572	567	571	569
20	565	568	569	570	570	567	569	569	570	570	570	571	570	573	571
21	567	570	567	567	567	568	570	572	570	571	569	567	567	568	572
22	561	563	562	567	561	563	567	563	569	571	575	575	580	582	571
23	558	555	546	541	543	555	560	568	569	571	573	578	579	584	582
24	551	534	569	562	565	553	558	567	570	579	589	601	586	575	586
25	558	526	541	553	573	573	571	567	575	573	577	573	586	603	585
26	569	568	571	569	570	572	570	570	573	573	572	573	584	575	584
27	563	563	553	568	570	568	569	570	572	575	572	569	573	571	569
28	572	575	573	572	571	571	571	569	569	572	577	592	633	594	569
29	560	553	552	565	575	562	546	568	575	589	571	594	612	623	580
30	536	530	543	554	571	558	565	553	578	573	573	584	585	585	579

S′—July, 1912.

Day.	0 h.	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	12 h.	13 h.	14 h.
1	554	555	546	570	564	563	570	569	573	572	579	585	590	584	584
2	561	556	545	565	565	563	567	565	567	—	—	—	—	—	—
3	—	—	—	—	—	—	—	—	—	554	553	569	567	569	570
4	539	549	546	549	545	541	538	546	563	575	582	596	613	596	622
5	551	514	505	466	554	580	558	558	578	580	585	614	698	619	590
6	524	524	519	551	547	546	552	568	592	609	573	603	587	606	578
7	497	562	564	567	548	555	558	558	578	573	585	602	587	575	590
8	567	562	561	567	561	553	562	565	569	575	584	586	601	645	597
9	567	548	537	549	545	548	565	570	568	580	582	575	580	569	575
10	536	553	565	553	547	563	564	570	570	567	569	570	569	575	582
11	558	560	563	562	565	564	560	564	567	573	573	573	577	585	601
12	562	567	567	565	564	562	567	567	567	570	573	573	570	573	573
13	562	561	564	563	558	563	564	562	563	560	565	572	573	575	572
14	561	565	567	567	567	562	563	567	568	572	567	569	569	572	569
15	564	558	558	565	564	564	561	563	567	579	575	572	575	577	582
16	562	567	569	562	562	563	563	567	571	567	571	572	573	590	577
17	565	567	571	567	568	575	572	573	568	567	565	567	567	568	568
18	561	560	558	544	522	532	547	562	570	577	584	594	603	607	631
19	567	567	567	568	567	567	563	564	570	570	572	579	592	588	604
20	558	556	565	570	569	569	568	561	571	572	575	577	592	586	586
21	548	543	562	565	570	573	565	571	571	575	582	589	587	594	616
22	548	555	562	548	551	560	562	560	561	575	575	580	579	579	582
23	558	558	554	560	568	571	567	569	565	572	573	572	573	571	577
24	568	564	562	560	564	567	572	570	570	573	573	573	575	580	575
25	569	570	570	571	571	565	569	568	569	575	579	577	580	586	575
26	561	560	561	567	568	549	552	560	567	575	570	577	575	578	592
27	548	565	567	555	551	560	571	562	579	577	592	588	611	605	648
28	569	565	565	547	526	549	554	572	579	584	573	577	579	580	582
29	563	568	564	570	568	565	567	571	572	575	578	577	578	580	580
30	564	555	561	556	569	570	573	573	573	577	575	575	578	582	582
31	(543)	529	530	534	541	554	565	567	571	580	582	587	(598)	609	620

S′—June, 1912.

3000γ (·03 C.G.S. Unit) +										Maximum Reading and Time.			Minimum Reading and Time.		
15 h.	16 h.	17 h.	18 h.	19 h.	20 h.	21 h.	22 h.	23 h.	24 h.						
γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	h.	m.	γ	h.	m.
604	597	613	615	599	580	572	550	531	536	640	18	5	495	23	13
587	611	641	611	580	608	576	567	564	567	662	16	31	531	0	0
630	601	594	611	624	581	573	568	567	556	651	18	52	521	3	39
599	602	587	576	581	576	575	576	568	567	609	15	58	544	0	29
594	583	587	587	587	574	570	570	570	574	599	14	45	555	0	25
—	—	—	—	—	—	—	—	—	—	585	8	28	563	6	45
567	567	567	568	565	565	562	563	564	562	575	13	22	560	19	30
624	685	622	594	563	575	521	546	541	564	700	16	13	505	20	53
672	616	613	594	577	562	546	558	546	509	794	14	17	382	1	57
650	589	594	594	582	567	562	562	561	554	693	14	47	464	0	20
592	616	599	578	580	572	561	563	560	538	655	15	45	498	2	30
587	633	602	579	577	563	561	562	558	551	652	16	0	526	0	7
571	569	568	570	570	563	564	558	556	561	587	13	32	536	3	26
577	578	594	585	573	560	558	551	556	560	605	16	57	536	21	35
586	573	575	572	567	565	561	567	564	567	607	13	56	529	3	20
—	—	—	—	—	—	—	—	—	—	572	5	5	555	5	17
570	573	570	572	569	567	565	563	554	554	592	10	27	538	23	15
579	577	580	573	571	567	560	564	564	563	585	16	53	547	0	3
567	575	586	589	577	575	575	567	558	565	607	17	32	549	3	32
572	575	571	570	567	568	567	567	567	567	579	3	17	560	21	52
572	572	575	577	585	565	564	564	563	561	590	18	39	560	9	5
573	575	569	569	572	565	568	560	563	558	587	12	53	553	22	0
578	582	578	572	568	568	560	562	562	551	590	13	13	522	3	36
592	601	589	612	573	573	565	565	565	558	635	17	33	519	0	50
582	571	571	567	575	570	567	568	570	569	616	13	9	505	1	12
602	603	569	571	568	567	565	567	567	563	629	15	37	560	6	16
572	569	569	570	575	586	614	590	531	572	648	21	15	495	22	55
572	564	564	578	572	592	580	569	564	560	652	11	52	556	16	35
567	565	575	573	582	575	575	563	567	536	655	13	15	530	23	48
575	573	578	572	572	568	567	553	541	554	597	7	56	509	0	31

S′—July, 1912.

573	582	597	637	587	573	560	554	554	561	655	17	40	529	21	49
—	—	—	—	—	—	—	—	—	—	579	4	35	529	1	45
571	567	567	564	565	565	558	553	545	539	575	14	25	532	23	27
638	626	627	619	577	553	534	536	537	551	663	13	53	514	21	21
584	650	701	603	562	579	546	548	507	524	751	17	0	439	2	55
577	579	584	579	573	568	561	562	521	497	644	10	40	444	23	43
599	573	578	569	568	571	564	567	563	567	614	10	42	498	0	0
607	582	567	568	565	567	565	567	565	567	651	12	57	539	5	18
584	582	594	595	575	556	551	553	556	536	607	17	43	492	2	15
585	577	572	568	563	563	562	562	567	558	589	14	37	532	0	0
575	578	573	573	567	560	565	564	564	562	621	13	58	551	2	30
569	582	575	575	570	564	560	560	561	562	584	15	43	555	22	5
567	567	567	567	562	561	561	560	560	561	577	13	0	553	3	55
569	580	571	569	567	561	564	561	563	564	590	15	43	558	5	6
573	572	575	572	575	569	558	563	561	562	594	14	12	546	1	50
585	551	592	592	589	592	599	562	563	565	623	20	32	555	8	43
(569)	(571)	572	568	567	563	556	561	561	561	579	9	46	539	21	1
631	582	575	568	564	563	567	564	563	567	643	13	45	492	4	14
589	596	580	572	567	567	567	562	555	558	616	13	39	546	23	12
588	585	573	580	589	577	578	552	552	548	607	12	18	543	21	54
604	584	590	585	577	558	562	563	545	548	622	13	50	519	23	30
582	592	588	585	586	575	568	567	561	558	601	16	19	539	2	50
575	575	578	582	585	577	562	564	568	568	594	17	28	541	2	27
577	573	575	570	568	565	567	570	569	569	587	12	55	539	2	55
575	582	573	567	567	567	567	558	553	561	592	12	36	546	22	38
580	586	599	597	592	570	569	551	549	548	609	18	45	539	22	18
648	653	643	609	573	572	551	560	564	569	667	14	23	526	4	27
582	575	579	579	573	573	569	570	563	563	590	17	48	514	4	13
580	577	580	(580)	580	580	567	568	568	564	594	10	17	553	5	28
580	582	578	579	588	584	587	(573)	(558)	(543)	598	19	8	546	1	10
(611)	602	606	604	578	562	551	507	546	551	624	14	20	498	21	47

S′—August, 1912.

Day.	0 h.	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	12 h.	13 h.	14 h.
	3000γ (·03 C.G.S. Unit) +														
	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
1	551	553	547	575	547	552	551	570	573	589	592	585	633	633	657
2	562	568	573	568	570	571	569	560	575	575	571	580	586	586	585
3	558	549	534	529	567	565	568	573	575	571	584	577	582	594	585
4	543	558	575	575	572	567	556	569	569	578	577	579	585	582	580
5	569	573	573	573	571	569	563	564	571	573	573	575	579	575	575
6	569	568	558	549	541	575	561	560	572	—	—	—	—	—	—
7	—	—	—	—	—	—	—	—	—	575	575	592	578	592	592
8	569	568	570	567	565	556	558	567	573	577	579	572	582	589	575
9	570	568	568	560	567	564	565	567	572	579	577	579	578	585	589
10	561	575	572	572	567	558	571	568	572	578	585	582	605	618	605
11	565	567	565	565	565	567	569	567	577	580	580	590	589	586	589
12	572	575	564	571	571	568	568	568	570	578	575	575	573	577	575
13	570	572	573	570	567	568	569	571	572	578	573	579	578	585	587
14	570	570	570	568	567	571	567	572	573	582	575	579	579	582	594
15	552	563	560	556	571	568	570	568	570	582	578	589	595	604	609
16	569	568	569	568	569	568	568	568	568	572	575	579	589	580	580
17	564	555	570	570	565	567	568	573	573	575	595	605	653	667	601
18	519	558	565	569	568	552	575	570	577	577	585	579	596	585	597
19	549	563	567	558	558	568	543	568	587	(599)	(612)	624	691	646	654
20	561	547	551	549	551	551	562	580	584	582	579	599	603	605	609
21	553	562	571	563	564	562	562	568	575	580	592	585	592	582	586
22	522	527	558	558	553	555	567	572	578	578	594	609	614	613	691
23	563	569	541	531	512	513	558	558	578	582	588	597	618	613	698
24	554	538	536	519	553	545	555	565	575	592	597	587	582	582	592
25	572	569	554	544	551	539	572	572	577	580	589	601	594	604	599
26	556	572	560	567	570	563	560	567	577	578	588	596	592	587	590
27	565	553	560	562	568	564	555	572	575	575	592	592	597	601	594
28	517	567	552	553	537	553	553	568	573	580	578	569	582	592	585
29	562	563	568	564	549	561	573	565	587	582	595	594	648	629	603
30	569	570	558	546	578	547	553	577	579	582	592	596	594	588	594
31	569	572	568	567	567	570	571	571	577	580	599	592	577	586	616

S′—September, 1912.

Day.	0 h.	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	12 h.	13 h.	14 h.
1	568	568	567	569	569	562	558	578	582	584	601	609	618	648	638
2	571	567	558	558	571	572	572	573	575	575	575	586	582	586	585
3	567	571	573	571	571	570	573	572	571	575	577	580	587	587	582
4	570	568	567	565	567	568	573	573	573	575	(586)	596	588	618	618
5	537	562	568	558	555	561	560	571	575	585	585	582	584	582	592
6	558	569	575	577	569	578	570	572	582	585	601	588	620	621	621
7	562	565	579	577	568	573	558	572	578	582	590	589	603	587	585
8	569	567	577	573	560	570	575	575	578	585	586	587	589	596	601
9	567	568	570	568	562	562	565	567	573	571	580	597	607	592	628
10	519	558	558	575	562	556	571	573	573	588	586	588	597	618	614
11	565	563	570	565	562	563	567	573	580	585	580	588	592	602	609
12	562	571	571	570	567	571	572	575	582	580	588	602	607	614	629
13	547	565	575	568	564	572	567	567	580	588	580	587	599	613	620
14	569	567	567	571	572	554	562	556	553	582	592	572	592	592	592
15	572	573	571	570	577	575	568	569	579	580	584	596	601	604	599
16	573	573	573	572	572	570	568	577	575	584	580	586	590	601	612
17	553	556	560	565	570	571	573	(574)	(575)	575	594	586	595	589	589
18	551	500	521	539	507	537	528	532	621	652	561	597	605	660	685
19	483	556	558	551	569	573	575	571	569	592	592	592	596	602	601
20	573	569	565	564	552	531	543	560	589	575	580	607	616	640	654
21	543	526	554	541	558	558	573	571	578	587	585	587	589	586	577
22	529	544	541	543	532	552	556	575	572	592	587	597	597	613	627
23	539	564	551	558	546	547	556	573	589	580	604	635	590	609	602
24	567	570	555	561	567	561	562	578	582	582	586	588	609	640	670
25	558	570	578	587	575	578	564	549	560	597	639	725	612	616	601
26	573	573	575	578	575	578	580	573	545	582	580	582	592	586	605
27	573	573	572	570	570	573	560	560	575	592	588	599	605	614	607
28	554	570	573	570	563	565	567	575	579	579	586	592	592	594	595
29	573	570	573	570	573	575	578	585	588	(587)	585	592	599	607	604
30	573	570	567	568	563	567	567	575	588	585	594	602	597	611	616

Hourly Values—*continued.*

S′—August, 1912.

3000γ (·03 C.G.S. Unit) +										Maximum Reading and Time.			Minimum Reading and Time.		
15 h.	16 h.	17 h.	18 h.	19 h.	20 h.	21 h.	22 h.	23 h.	24 h.						
γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	h.	m.	γ	h.	m.
653	684	721	616	569	561	561	563	568	562	749	16	51	528	1	32
585	585	599	585	575	567	569	565	560	558	611	17	18	548	23	21
589	582	588	612	586	586	565	569	561	543	628	17	47	512	2	28
580	587	573	570	571	573	570	565	572	569	601	16	4	528	0	10
572	571	569	567	569	568	565	564	572	569	585	11	13	554	22	0
—	—	—	—	—	—	—	—	—	—	584	6	19	517	3	58
595	584	579	575	577	560	568	569	567	569	626	11	20	532	20	12
580	573	573	575	573	567	568	572	571	570	605	13	16	546	5	28
594	586	596	601	589	575	565	562	556	561	611	17	45	546	23	33
603	592	575	570	563	567	567	565	567	565	628	12	45	552	4	35
585	577	579	572	571	571	564	563	568	572	601	13	45	548	4	47
5/9	579	577	572	571	570	569	565	569	570	580	12	15	556	6	8
588	586	578	575	569	563	563	567	568	570	594	15	32	549	20	10
584	607	596	575	569	568	563	545	548	552	630	16	18	528	23	38
621	607	582	570	565	565	567	565	567	569	638	15	35	546	2	18
582	587	578	580	569	570	569	567	562	564	604	16	19	560	22	30
647	650	621	633	602	569	568	505	492	519	701	12	57	444	22	12
605	601	595	582	575	571	568	571	565	549	621	14	40	514	0	0
633	623	597	582	577	565	555	543	567	561	722	12	21	479	21	14
609	613	596	589	585	572	555	558	560	553	629	15	25	532	3	30
601	601	605	609	604	585	567	554	504	522	621	15	30	478	22	59
646	643	606	578	556	568	565	558	567	563	704	14	0	512	0	27
662	619	611	601	564	556	568	552	563	554	728	14	3	455	3	50
577	578	579	584	589	558	568	567	569	572	609	11	2	498	2	36
590	605	619	605	592	585	555	547	563	556	635	17	4	500	21	33
612	603	604	582	577	577	568	564	563	565	642	15	18	551	1	28
580	588	588	592	592	575	549	541	485	517	614	12	48	468	23	16
589	596	584	577	572	564	567	564	564	562	614	9	5	505	0	3
592	587	592	579	572	565	572	567	571	569	669	11	54	521	3	48
609	602	587	584	565	569	570	570	564	569	635	15	13	537	2	45
607	628	578	575	575	572	569	570	572	568	655	15	53	563	3	55

S′—September, 1912.

609	592	587	582	575	568	567	571	572	571	657	13	10	543	5	43
585	580	579	577	580	573	561	573	575	567	591	11	18	546	20	40
582	582	579	573	573	571	570	570	569	570	594	12	2	562	0	8
639	620	601	577	573	565	568	556	504	537	678	14	52	480	23	25
599	592	584	586	579	575	577	564	502	558	605	15	10	478	23	3
606	602	595	618	588	586	555	565	560	562	642	13	35	532	21	3
580	578	582	589	590	577	573	554	571	569	614	12	10	544	21	57
599	606	616	587	584	545	562	555	555	567	633	16	55	532	19	43
623	621	606	597	582	582	568	551	537	519	655	14	11	501	23	44
631	614	602	577	573	570	570	567	547	565	648	14	53	521	5	5
618	606	614	604	594	569	567	571	571	562	642	14	18	552	2	47
639	644	621	597	599	589	553	565	519	547	659	15	43	502	22	58
620	599	597	595	592	571	571	569	571	569	631	15	5	546	3	25
603	590	589	587	585	570	564	551	568	572	628	15	20	526	21	50
595	586	579	577	573	570	572	567	573	573	624	10	45	549	6	22
623	637	605	586	577	570	563	558	545	553	648	15	55	539	23	2
587	585	584	570	568	568	571	571	567	551	604	11	53	548	0	35
665	620	596	599	564	567	551	561	547	483	708	14	21	444	3	43
614	621	622	599	584	570	562	567	573	573	660	16	25	451	0	0
670	655	639	587	594	577	582	567	561	543	676	15	2	517	5	22
577	584	582	578	578	577	572	552	552	529	603	8	48	515	23	47
627	628	613	592	594	575	572	567	565	539	644	13	28	519	3	30
601	596	595	586	573	575	558	558	554	567	647	12	57	522	0	7
708	771	723	700	655	613	567	510	546	558	819	15	23	468	21	52
603	599	582	571	572	568	568	565	570	573	777	11	7	512	7	1
597	592	596	584	578	573	560	564	573	573	620	14	5	546	20	45
595	595	587	582	577	573	572	568	561	554	628	10	43	543	23	55
596	592	588	582	575	569	568	567	570	573	602	14	42	543	0	3
592	587	586	580	573	570	569	570	571	573	619	13	14	564	3	27
624	604	595	580	575	571	558	571	558	562	638	14	57	545	23	20

Hourly Values—*continued.*

S′—October, 1912.

Day.	3000γ (·03 C.G.S. Unit) +														
	0 h.	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	12 h.	13 h.	14 h.
	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
1	562	577	575	568	569	569	570	575	580	588	596	602	618	584	599
2	494	483	507	513	—	—	—	—	—	—	588	582	590	589	599
3	578	578	575	571	564	575	580	592	597	590	587	599	618	631	645
4	563	561	570	565	563	573	569	571	575	604	599	597	604	599	—
5	—	—	—	—	—	—	—	—	—	589	589	601	611	612	609
6	570	569	568	565	564	568	571	567	577	582	595	597	595	603	602
7	558	556	564	554	558	558	563	578	580	588	594	592	596	597	590
8	568	564	544	563	567	560	571	582	569	599	592	596	620	644	645
9	562	558	556	569	572	570	582	572	582	601	588	609	624	611	616
10	558	567	569	569	570	568	572	572	577	—	—	—	—	—	—
11	—	—	—	—	—	553	564	565	584	596	613	—	—	587	599
12	548	543	531	534	524	529	547	548	556	561	556	571	587	572	567
13	532	539	539	543	544	544	548	546	548	558	560	582	651	607	647
14	552	542	556	539	548	551	(558)	(565)	(572)	579	580	579	596	615	600
15	498	482	514	516	521	501	535	535	538	573	608	607	685	626	574
16	523	478	489	501	527	522	535	576	562	576	596	600	600	586	638
17	540	557	521	540	523	532	576	589	549	583	576	607	628	639	644
18	546	559	564	554	548	531	535	553	556	576	587	589	586	604	598
19	559	561	562	559	559	564	566	572	574	576	578	578	579	593	583
20	555	542	545	547	540	548	559	566	578	583	579	576	573	581	583
21	554	554	553	547	548	555	548	531	596	583	586	586	614	583	588
22	549	536	542	542	540	559	551	566	566	576	585	587	588	586	598
23	551	554	557	553	549	559	576	561	568	516	593	588	585	591	589
24	552	547	546	548	540	556	547	555	573	569	583	576	591	596	593
25	549	551	551	552	551	551	546	576	571	573	574	587	593	613	607
26	536	549	559	556	549	564	569	579	585	566	559	580	587	606	606
27	556	559	—	—	—	—	—	—	—	573	586	593	600	598	639
28	540	535	527	515	528	511	537	548	564	572	573	573	593	585	573
29	559	561	537	532	535	540	542	540	542	593	587	583	593	613	621
30	554	557	557	559	546	548	555	553	559	554	569	583	586	587	586
31	557	546	554	552	555	521	544	549	564	568	600	604	603	605	614

S′—November, 1912.

1	547	531	529	537	547	538	573	568	564	564	593	596	605	614	628
2	545	552	537	536	542	554	545	551	562	573	589	604	591	598	597
3	544	549	540	551	553	531	523	530	555	576	564	559	566	576	563
4	556	566	551	539	542	545	516	536	557	569	578	580	597	585	598
5	544	549	551	542	545	548	555	539	539	561	562	568	564	561	563
6	548	548	551	549	508	477	484	539	578	578	—	—	—	—	—
7	—	—	—	—	—	—	—	—	—	—	580	598	596	581	605
8	530	513	563	568	566	569	576	562	554	585	591	578	606	613	624
9	551	516	498	488	518	521	532	548	562	—	—	—	—	—	—
10	—	—	—	—	—	—	—	—	—	516	540	590	617	643	643
11	516	441	480	488	505	530	501	531	535	569	610	583	600	629	661
12	478	520	518	511	497	505	576	555	573	561	(568)	(576)	585	591	617
13	557	563	562	551	552	545	557	532	574	580	579	595	596	615	634
14	559	557	554	552	547	551	562	553	566	—	—	—	—	—	—
15	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
16	542	539	539	529	525	533	537	536	545	603	516	542	591	628	641
17	542	537	546	544	549	576	562	544	510	553	576	588	—	—	—
18	—	—	—	—	—	—	—	—	—	574	562	546	569	571	583
19	535	528	527	533	480	505	539	552	520	537	563	564	566	591	—

Hourly Values—*continued.*

S′—October, 1912.

3000γ (·03 C.G.S. Unit) +										Maximum Reading and Time.			Minimum Reading and Time.		
15 h.	16 h.	17 h.	18 h.	19 h.	20 h.	21 h.	22 h.	23 h.	24 h.						
γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	h.	m.	γ	h.	m.
607	613	—	688	611	582	—	—	498	494	697	18	2	487	23	10
599	594	577	568	575	573	570	571	573	578	610	14	5	471	0	49
609	602	611	599	573	562	565	562	565	563	680	13	45	553	21	52
—	—	—	—	—	—	—	—	—	—	622	13	40	539	7	28
599	596	602	599	599	592	573	570	568	570	618	13	7	563	22	47
587	585	580	575	577	564	568	567	561	558	611	13	27	553	4	28
592	589	587	586	575	572	569	568	565	568	620	12	33	546	0	22
630	621	631	602	582	584	558	547	563	562	669	13	32	522	1	48
612	609	613	604	585	577	570	565	558	558	648	12	18	539	23	35
—	—	—	—	—	—	—	—	—	—	587	6	34	543	5	24
606	587	573	561	554	553	555	548	536	548	633	9	45	524	23	7
561	561	567	569	558	544	537	544	538	532	594	11	55	517	3	59
660	651	627	603	573	568	554	548	495	552	694	11	50	478	23	6
648	622	604	614	596	566	580	501	503	498	663	14	55	476	22	17
559	628	617	605	576	562	523	529	549	523	750	12	15	414	1	8
608	605	598	586	583	559	564	503	542	540	658	14	15	448	0	56
665	656	615	593	583	573	557	553	544	546	680	14	57	503	2	15
614	590	595	576	578	579	556	552	559	559	628	15	3	522	5	53
590	585	585	576	571	559	564	561	557	555	605	12	37	554	3	0
583	576	572	566	566	559	555	556	555	554	610	12	48	528	3	28
579	587	576	547	544	555	566	548	545	549	662	11	40	482	6	43
593	570	571	566	566	549	547	545	542	551	612	14	40	520	2	13
600	606	591	566	574	570	555	551	548	552	624	16	10	482	9	0
589	583	583	563	564	559	561	551	551	549	617	14	5	499	6	37
634	619	586	563	552	(551)	548	523	548	536	641	14	42	516	22	0
600	602	583	573	576	554	548	554	555	556	626	15	38	527	0	0
646	647	628	619	590	574	559	546	551	540	668	15	17	537	23	47
617	639	619	589	593	570	553	521	542	559	645	15	40	503	5	23
620	606	591	576	598	562	555	542	546	554	629	14	13	510	7	42
587	572	557	568	566	549	555	563	559	557	605	13	30	536	4	16
612	597	593	600	573	559	549	551	552	547	636	14	10	508	5	0

S′—November, 1912.

622	608	623	605	597	579	559	521	516	545	660	14	4	486	22	45
617	665	629	621	617	591	553	527	520	544	706	15	50	504	23	0
563	569	568	559	566	555	546	552	549	556	586	12	22	510	5	52
591	588	585	578	566	559	552	559	548	544	611	12	15	503	6	1
561	554	576	553	551	557	559	555	554	548	587	16	55	516	8	30
—	—	—	—	—	—	—	—	—	—	608	9	28	445	5	13
628	646	643	631	619	602	579	566	549	530	663	16	25	535	23	35
597	588	578	581	581	538	547	552	552	551	641	14	2	496	0	35
—	—	—	—	—	—	—	—	—	—	601	8	9	476	2	17
623	626	612	585	589	563	566	536	532	516	672	14	13	464	9	11
670	695	684	664	610	538	588	549	537	478	709	16	18	371	1	33
621	593	587	574	564	559	556	552	554	557	650	14	50	433	0	21
638	617	589	573	568	569	552	549	553	559	651	14	55	496	6	45
—	—	—	—	—	—	—	—	—	—	581	7	43	519	6	37
—	—	602	578	548	549	536	548	551	542	604	17	3	522	20	35
664	658	593	571	552	536	551	511	544	542	679	12	20	460	6	38
—	—	—	—	—	—	—	—	—	—	613	6	30	476	7	18
597	580	591	576	578	555	540	547	525	535	634	15	14	514	23	19
—	—	—	—	—	—	—	—	—	—	615	6	22	443	4	4

V—February, 1911.

Day.	0 h.	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	12 h.	13 h.	14 h.
	68000γ (·68 C.G.S. Unit) +														
	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
5	—	—	—	—	—	—	—	—	—	—	—	573	539	413	491
6	633	598	617	605	636	530	560	604	573	514	512	(516)	520	540	549
7	629	624	591	602	610	598	605	583	607	621	587	522	522	524	502
8	558	560	556	533	528	566	518	505	505	525	507	524	506	492	487
9	595	594	591	566	545	549	512	518	537	526	550	525	505	505	502
10	609	620	591	582	581	585	560	554	520	541	518	530	540	543	514
11	638	609	596	583	556	568	543	506	502	516	516	512	533	522	510
12	560	562	594	583	609	602	619	594	598	606	563	534	537	510	530
13	564	562	556	548	585	579	548	535	528	528	525	526	489	489	496
14	540	553	569	564	563	524	576	568	528	560	552	495	464	499	499
15	601	619	646	614	646	613	571	598	636	601	568	579	564	545	530
16	554	579	560	556	575	568	543	512	544	558	—	—	592	588	583
17	632	636	640	655	662	634	615	598	629	636	686	639	598	617	588
18	668	671	628	629	648	607	602	657	617	568	636	579	600	579	587
19	653	661	703	703	684	674	639	619	617	614	609	592	588	577	568
20	636	630	632	642	652	636	652	626	611	619	623	600	601	601	598
21	640	644	646	642	666	658	671	646	659	647	649	606	552	540	556
22	634	639	677	737	691	705	672	636	647	606	643	604	626	604	560
23	649	667	681	662	621	617	619	595	586	568	553	530	548	636	590
24	663	668	662	644	634	609	617	596	572	528	601	609	558	566	611
25	655	638	651	647	614	621	607	585	566	553	543	554	560	581	590
26	667	682	667	634	630	587	568	620	619	614	588	560	549	550	552
27	685	706	689	658	625	619	582	598	621	614	563	636	619	602	554
28	685	652	653	651	617	636	611	621	649	594	623	617	596	598	598

V—March, 1911.

1	345	339	335	330	325	317	298	282	240	287	220	203	179	199	217
2	338	328	321	298	288	296	250	259	235	241	229	221	218	237	244
3	296	293	300	288	316	275	255	244	252	288	324	328	302	283	300
4	345	357	387	383	366	336	307	332	315	302	282	265	288	261	249
5	301	296	301	306	305	284	252	278	303	316	328	366	305	283	279
6	378	364	344	340	370	368	335	312	302	307	338	306	303	305	292
7	370	366	358	330	332	341	332	286	322	303	344	316	309	296	288
8	331	331	321	331	359	335	359	344	283	316	338	349	334	311	300
9	491	453	405	379	366	330	317	328	328	341	331	338	311	296	284
10	328	326	339	338	349	349	355	341	338	311	312	307	309	298	300
11	326	325	328	328	328	326	324	316	319	325	334	321	306	303	296
12	320	317	317	319	316	319	319	316	307	315	313	306	293	294	298
13	324	322	326	325	331	331	332	328	326	334	328	332	311	303	300
14	334	330	331	320	325	319	320	328	341	370	374	328	315	302	286
15	317	316	317	317	315	306	288	306	345	351	349	328	320	316	300
16	358	347	360	357	335	334	335	284	353	358	344	317	343	309	320
17	334	331	341	339	341	344	347	344	340	354	362	353	316	319	321
18	338	344	332	332	330	331	326	321	320	319	313	315	302	293	293
19	321	320	324	321	322	321	315	321	328	328	313	313	307	315	311
20	328	330	328	324	326	317	315	317	316	311	315	301	269	277	271
21	453	427	411	389	370	372	340	331	321	364	364	290	294	303	305
22	386	379	364	334	343	306	311	306	286	290	307	293	297	265	351
23	373	368	343	341	322	313	282	254	284	321	370	312	296	303	298
24	351	339	341	331	328	351	319	301	280	274	277	275	309	305	316
25	360	357	347	331	339	322	328	317	311	321	290	277	279	297	368
26	373	364	370	358	349	311	317	297	305	302	287	290	284	301	294
27	345	370	391	351	359	341	328	302	277	306	301	288	306	302	319
28	425	410	373	347	336	325	309	296	290	268	252	249	286	297	298
29	324	322	326	316	313	316	302	313	328	264	279	309	256	277	324
30	338	347	372	370	347	343	306	316	305	319	309	290	293	288	297
31	345	324	319	325	315	320	309	297	321	319	309	288	293	298	284

Hourly Values—*continued.*

V—February, 1911.

68000γ (·68 C.G.S. Unit) +										Maximum Reading and Time.			Minimum Reading and Time.		
15 h.	16 h.	17 h.	18 h.	19 h.	20 h.	21 h.	22 h.	23 h.	24 h.						
γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	h.	m.	γ	h.	m.
—	—	—	—	—	—	—	—	—	—	—	—		—	—	
—	—	—	—	—	—	—	—	—	—	—	—		—	—	
—	—	—	—	—	—	—	—	—	—	—	—		—	—	
—	—	—	—	—	—	—	—	—	—	—	—		—	—	
518	522	516	524	528	520	524	537	571	633	—	—		—	—	
530	510	537	549	563	566	581	572	558	629	668	3	52	416	11	25
509	518	526	533	535	531	586	596	590	558	699	8	35	448	11	20
480	495	510	507	520	588	572	576	590	595	611	23	35	444	8	25
491	518	524	534	545	549	564	588	596	609	623	2	7	410	11	30
506	514	521	530	530	533	530	576	611	638	638	23	38	490	9	38
524	518	525	540	548	544	564	558	558	560	647	0	23	482	8	52
524	537	547	548	560	568	562	568	560	564	649	5	48	499	12	55
512	520	518	530	539	533	554	566	545	540	596	4	23	467	12	30
505	496	525	534	525	552	552	617	623	601	684	6	47	440	11	37
518	518	530	543	582	573	573	585	590	554	680	1	42	509	15	22
573	581	594	600	600	615	614	617	638	632	648	23	11	507	6	42
601	617	632	625	620	617	647	648	667	668	706	10	25	558	11	50
604	594	604	614	617	623	643	652	647	653	684	0	37	512	9	5
576	582	588	605	617	623	629	630	630	636	741	2	50	558	10	30
586	601	615	614	619	625	640	639	644	640	668	5	33	550	11	22
575	582	573	586	600	590	623	655	653	634	687	9	30	531	12	55
590	614	677	623	628	689	674	652	648	649	771	16	38	516	14	55
581	605	619	643	639	636	643	667	680	663	697	1	55	509	11	58
598	602	614	632	634	657	720	687	670	655	756	14	14	497	8	50
592	596	606	611	642	626	629	643	652	667	680	0	50	486	10	5
576	581	611	634	657	643	655	665	684	685	699	23	12	459	10	21
604	595	598	621	632	639	638	655	674	685	725	0	57	537	8	50
591	611	678	655	639	649	666	703	718	693	725	17	0	547	11	10

V—March, 1911.

233	240	259	274	282	311	366	347	339	338	377	20	42	163	12	0
268	275	274	273	298	305	311	315	305	296	341	0	0	193	10	20
298	284	290	274	283	290	328	345	328	345	359	21	48	223	7	55
258	273	280	282	288	290	292	296	300	301	402	0	50	235	10	28
279	288	290	311	324	316	317	427	405	378	484	22	15	237	12	15
302	311	309	341	359	349	351	354	368	370	410	4	19	264	10	40
284	301	317	336	345	334	336	345	335	331	382	0	55	258	9	15
294	305	301	306	321	330	338	354	368	491	551	24	0	258	7	50
312	300	311	311	320	324	340	338	326	328	605	0	9	275	13	58
292	288	300	309	309	307	316	328	325	326	364	5	48	280	16	17
307	313	316	321	325	326	326	326	325	320	345	9	55	288	13	50
296	284	297	306	315	331	328	330	326	324	334	20	0	286	15	58
305	306	212	317	320	324	331	331	332	334	341	9	4	292	13	37
280	300	307	319	343	354	351	339	334	317	395	9	22	246	14	38
297	313	335	328	322	334	330	334	338	358	393	9	10	273	6	25
298	290	328	325	335	340	355	344	347	334	387	9	13	233	11	10
316	311	309	312	326	332	353	349	339	338	382	10	5	291	12	20
292	307	311	320	319	319	321	322	326	321	355	1	18	283	12	27
317	303	303	311	320	322	324	326	326	328	334	5	52	284	12	25
280	290	275	290	331	325	331	370	551	453	615	22	50	252	13	52
322	322	330	412	360	339	340	347	377	386	465	0	40	268	11	5
315	309	368	340	341	351	340	360	351	373	417	0	10	208	10	10
306	306	316	321	343	389	386	392	364	351	417	19	28	227	6	57
315	311	309	322	328	351	355	363	373	360	402	22	53	237	10	30
339	317	328	317	344	427	387	408	372	373	497	14	5	238	11	6
307	347	357	328	335	353	364	343	344	345	402	16	26	245	7	23
317	301	440	431	400	406	392	404	392	425	581	16	50	242	7	50
303	306	307	366	397	385	351	336	334	324	468	0	22	214	10	35
306	309	355	340	326	328	325	322	331	338	387	17	17	216	11	50
298	293	300	319	322	330	360	362	347	345	395	2	15	250	10	50
280	290	294	305	322	364	339	343	338	341	376	19	40	268	11	45

V—April, 1911.

Day.	68000γ (·68 C.G.S. Unit) + 0 h.	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	12 h.	13 h.	14 h.
	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
1	343	318	319	314	326	323	332	330	356	342	328	298	282	294	292
2	319	323	326	322	319	330	332	330	328	349	343	328	292	267	284
3	319	322	328	334	324	351	338	326	323	322	240	230	275	292	284
4	336	333	324	326	326	326	336	318	332	337	349	318	307	305	314
5	375	404	371	357	360	355	357	347	333	330	333	338	346	349	349
6	357	359	353	351	356	349	349	351	357	364	364	353	343	336	338
7	353	351	353	349	343	345	346	341	332	311	322	313	317	322	324
8	340	345	342	342	343	341	342	352	352	355	365	346	332	319	322
9	378	450	389	371	343	359	361	347	318	303	299	314	322	301	333
10	541	512	436	391	379	384	385	383	359	341	336	323	317	337	349
11	380	371	380	383	378	360	343	349	359	311	311	330	336	340	365
12	365	365	365	366	366	352	360	362	371	384	372	356	356	330	345
13	384	444	429	410	399	389	372	355	387	—	—	—	—	—	—
14	—	—	—	—	—	—	—	—	—	351	357	355	352	349	338
15	365	366	365	365	365	362	362	361	362	360	356	351	349	343	336
16	366	366	365	361	359	365	365	364	361	368	357	365	323	323	336
17	382	407	406	407	407	407	395	406	388	363	376	388	383	380	351
18	417	411	408	389	382	397	393	395	382	353	376	389	418	411	392
19	536	581	521	452	408	384	399	385	376	376	336	353	364	361	378
20	430	429	420	404	401	393	383	388	374	369	382	334	353	359	350
21	425	426	397	401	407	379	370	359	360	372	357	363	372	376	368
22	418	422	477	455	395	408	385	387	374	383	370	370	372	374	378
23	431	430	440	435	401	397	388	374	374	370	366	351	361	376	370
24	429	418	421	401	380	376	378	366	361	361	353	334	350	347	350
25	503	460	448	440	430	402	389	380	382	370	355	350	349	351	379
26	395	406	398	397	392	391	383	378	382	372	364	357	368	366	369
27	389	388	392	388	402	399	382	376	374	374	364	357	357	351	357
28	391	388	388	388	387	392	391	388	384	384	389	391	376	368	359
29	—	—	—	—	—	—	—	389	393	398	395	391	370	369	365
30	426	425	414	406	399	388	398	393	382	395	391	391	370	378	372

V—May, 1911.

	67000γ (·67 C.G.S. Unit) +														
1	1056	1060	1061	1050	1041	1028	1009	1013	1002	1002	981	976	980	989	983
2	996	996	999	1000	1006	1000	996	1004	998	1000	1003	998	987	987	989
3	1008	1009	1008	1019	1003	1012	1004	1006	1003	999	991	987	990	990	999
4	1002	1014	1019	1010	1013	1002	994	984	983	991	991	993	984	987	987
5	993	994	990	993	993	991	993	993	994	991	993	993	989	990	985
6	1017	1000	1004	1002	993	984	979	984	981	980	981	968	962	962	971
7	1000	995	994	1000	997	995	989	991	985	974	957	966	964	960	966
8	1150	1111	1127	1141	1097	1074	1054	1046	1029	1029	1027	1013	1008	993	998
9	1025	1019	1017	1018	1010	1010	1010	1010	1013	1008	1004	995	1006	1002	1004
10	1018	1023	1029	1022	1037	1048	1027	1025	1008	1010	1004	1012	995	1003	1006
11	1016	1003	1010	1006	1019	1014	1003	1014	1013	1008	1003	997	1010	1006	1004
12	1006	1019	1046	1079	1057	1035	1052	1031	1038	1016	1000	1002	1012	1013	1008
13	1017	1016	1019	1029	1017	1017	1021	1013	1008	1008	1004	1000	1004	1000	1002
14	1016	1008	1008	1008	1006	1003	1006	1008	1006	1006	1003	999	1004	1003	1000
15	1048	1025	1019	1013	1012	1013	1036	1036	984	1013	993	998	989	975	993
16	1067	1056	1038	1038	1032	1019	1008	1008	1008	1014	1010	1023	1019	1006	1012
17	1098	1089	1099	1092	1078	1041	1031	1035	1019	1010	1014	1012	1016	1018	1019
18	1065	1070	1067	1080	1061	1035	1025	1013	1008	1012	1023	1018	1018	1013	1014
19	1046	1046	1059	1052	1042	1018	1010	1008	1004	1010	999	994	1002	1006	1014
20	1048	1076	1092	1048	1045	1019	1014	1017	1004	1012	998	1000	1012	1010	1003
21	1076	1070	1097	1071	1040	1041	1029	1029	1027	1027	1010	1014	1010	1006	1010
22	1111	1079	1060	1052	1061	1059	1025	1023	1021	1013	1029	1023	1029	1023	1029
23	1040	1040	1035	1033	1025	1025	1023	1021	1025	1021	1027	1016	1027	1022	1017
24	1036	1037	1038	1027	1022	1017	1014	1022	1027	1018	1017	1025	1017	1014	1013
25	1025	1029	1040	1038	1013	1006	1003	1016	1022	1022	1019	1021	1016	1013	1014
26	1027	1061	1083	1082	1084	1051	1048	1048	1038	1040	1060	1013	1010	1000	997
27	1018	1019	1000	1006	990	1002	1002	993	989	990	987	985	981	979	980
28	1033	1013	1016	1013	989	995	994	990	997	989	987	989	981	987	995
29	1013	1000	995	995	999	998	1006	1006	999	994	995	995	994	991	991
30	998	998	999	994	999	994	985	995	989	997	993	993	991	990	985
31	1004	1023	1054	1069	1054	1044	1025	1017	1010	1004	995	983	975	975	980

Hourly Values—*continued.*

V—April, 1911.

68000γ (·68 C.G.S. Unit) + 15 h.	16 h.	17 h.	18 h.	19 h.	20 h.	21 h.	22 h.	23 h.	24 h.	Maximum Reading and Time. γ	h.	m.	Minimum Reading and Time. γ	h.	m.
γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	h.	m.	γ	h.	m.
288	292	296	301	311	313	322	322	320	319	392	7	57	267	11	22
294	311	311	215	318	320	230	336	324	319	362	7	15	248	13	7
292	295	292	309	319	320	327	330	342	336	362	5	12	254	11	35
318	324	340	341	349	347	352	368	376	375	378	23	10	294	12	43
343	338	343	351	352	355	353	353	352	357	419	1	9	309	9	5
326	326	338	343	343	346	349	359	364	353	368	22	38	313	15	5
326	327	336	341	343	347	351	343	343	340	359	1	53	290	9	35
326	332	337	345	349	355	357	349	346	378	381	23	59	298	23	25
334	356	372	425	448	437	431	497	527	541	553	23	20	282	9	43
333	364	393	391	372	368	364	378	390	380	556	0	30	279	11	30
365	357	352	356	359	361	366	365	368	365	391	0	10	295	9	26
352	349	349	359	387	383	406	402	374	384	433	21	3	322	13	0
—	—	—	—	—	—	—	—	—	—	490	1	10	345	7	1
328	330	334	352	360	361	366	361	365	365	370	20	39	323	15	19
336	352	349	356	365	365	366	366	366	366	374	2	15	326	14	32
342	352	368	378	381	397	395	387	381	385	404	20	20	317	12	7
411	406	391	385	445	490	509	433	430	417	519	20	40	340	13	45
368	370	389	392	388	378	414	479	471	536	568	24	0	317	8	35
391	410	417	418	441	421	418	410	429	430	713	0	32	319	9	38
360	411	425	431	440	459	459	433	433	425	469	20	15	309	10	40
385	376	449	433	407	433	421	411	411	418	465	20	13	340	7	48
374	399	433	455	431	426	414	423	420	431	532	2	23	344	10	45
410	378	379	412	412	420	448	440	437	429	454	2	9	336	10	52
350	353	363	382	383	401	376	403	450	503	510	23	55	327	10	30
395	388	383	416	416	406	397	397	393	395	525	0	10	325	10	10
384	378	380	398	402	420	403	393	391	389	426	19	38	347	10	51
372	372	379	385	385	399	414	403	395	391	421	4	7	340	11	13
372	383	384	376	387	395	431	—	—	—	515	21	27	340	12	30
395	398	387	382	389	452	423	416	422	426	490	19	57	355	13	23
369	374	387	385	382	459	540	464	446	446	667	20	28	357	12	2

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67000γ (·67 C.G.S. Unit) +															
1009	1008	1004	1006	1004	1004	1004	1003	1003	996	1073	1	5	961	11	28
995	1006	995	994	1010	1013	1073	1031	1013	1008	1107	20	53	977	13	23
994	989	989	994	996	1014	1015	1009	1003	1002	1027	3	12	978	10	2
987	991	991	993	998	997	993	991	993	993	1027	2	3	964	8	9
987	990	989	989	1008	1002	994	997	1004	1017	1027	23	55	979	8	50
975	981	989	993	997	995	993	991	998	1000	1023	0	0	955	11	15
978	983	990	1003	1031	1045	1084	1069	1090	1150	1160	24	0	952	10	1
1006	1010	1018	1052	1046	1041	1067	1040	1029	1025	1177	0	7	988	13	3
1008	1006	1006	1013	1023	1025	1023	1021	1017	1018	1032	0	37	988	10	35
1008	1006	1008	1010	1017	1022	1022	1023	1025	1016	1061	3	47	987	11	38
1010	1006	1004	1004	1004	1006	1006	1006	1080	1006	1029	9	43	983	10	5
1013	1029	1025	1082	1060	1035	1029	1017	1016	1017	1120	3	7	989	9	50
1003	1002	1006	1006	1010	1018	1027	1031	1025	1016	1037	20	43	998	11	20
1000	1002	999	997	999	1002	1006	1035	1052	1048	1059	23	27	993	10	43
1010	1029	1076	1131	1120	1071	1078	1097	1071	1067	1187	18	37	951	12	33
1150	1093	1149	1204	1121	1079	1132	1141	1121	1098	1421	17	22	994	8	30
1016	1029	1033	1067	1118	1101	1094	1086	1086	1065	1137	18	42	990	11	28
1014	1086	1055	1045	1079	1051	1063	1046	1037	1046	1112	16	0	993	8	50
1022	1004	1022	1099	1031	1059	1146	1054	1038	1048	1197	20	48	972	9	58
1016	1037	1023	1027	1027	1029	1045	1083	1059	1076	1102	1	57	985	9	13
1031	1025	1025	1027	1029	1031	1037	1162	1236	1111	1414	22	22	995	10	3
1029	1029	1037	1042	1063	1042	1040	1038	1038	1040	1109	0	1	1006	7	28
1023	1025	1027	1031	1038	1036	1031	1031	1035	1036	1055	19	2	1010	7	55
1021	1019	1023	1029	1032	1035	1035	1031	1032	1025	1041	20	0	998	12	52
1014	1018	1019	1021	1029	1023	1025	1023	1022	1027	1048	2	0	995	5	53
1000	990	987	987	990	990	991	991	997	1018	1099	3	26	975	16	43
1022	1010	991	989	990	1032	1057	1041	1040	1033	1078	15	18	970	12	8
997	998	994	1016	1029	1016	1021	1029	1019	1013	1046	18	53	978	12	20
994	993	995	997	1017	1006	999	995	999	998	1023	18	35	981	13	7
979	980	983	987	990	987	985	991	990	1004	1008	24	0	972	15	32
987	1000	1004	1006	1023	1031	1014	1017	1046	1086	1086	23	57	962	12	14

Hourly Values—*continued.*

V—June, 1911.

Day.	68000γ (·68 C.G.S. Unit) +														
	0 h.	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	12 h.	13 h.	14 h.
	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
1	272	265	245	228	217	203	192	189	173	165	164	158	156	162	165
2	213	242	250	243	204	196	185	177	170	161	173	162	156	185	175
3	196	192	196	195	198	195	194	190	192	191	178	178	180	186	186
4	191	192	194	196	201	203	194	181	181	177	178	166	166	172	177
5	192	198	196	198	194	199	191	194	200	201	200	188	176	180	181
6	200	198	186	188	205	190	173	176	185	196	188	194	186	181	178
7	327	252	264	242	218	203	185	181	181	186	188	188	188	205	213
8	200	199	199	199	196	195	198	182	188	188	180	184	184	186	191
9	196	196	195	198	194	190	195	188	186	185	182	176	181	180	185
10	186	188	191	190	186	180	185	178	169	162	167	163	161	154	182
11	214	207	210	213	178	177	182	180	177	—	—	—	—	—	—
12	—	—	—	—	—	—	—	—	—	181	181	192	195	199	203
13	252	252	238	209	203	199	188	194	185	178	171	175	172	184	192
14	308	284	270	261	275	249	226	207	210	207	204	192	200	194	198
15	233	226	223	207	211	200	194	188	196	199	186	196	205	205	198
16	209	209	209	200	204	201	196	194	192	182	188	200	200	200	200
17	207	205	198	200	207	207	198	194	188	181	186	184	188	195	194
18	218	210	207	204	201	198	194	194	196	198	199	195	195	192	194
19	219	215	207	200	199	196	198	194	194	188	188	191	190	191	200
20	218	210	207	211	207	204	201	201	199	184	185	186	191	186	188
21	219	223	229	226	214	218	211	213	211	201	213	204	205	210	204
22	260	242	243	237	232	247	249	224	223	226	220	218	213	205	234
23	310	284	245	242	233	232	233	230	232	224	220	217	215	218	218
24	306	284	299	318	257	243	237	224	—	—	—	—	218	226	232
25	229	228	226	226	224	224	226	224	224	219	220	222	224	224	224
26	226	226	230	228	228	232	228	226	226	222	224	219	218	220	224
27	224	224	226	229	230	226	226	224	223	224	226	224	224	224	224
28	233	230	229	232	232	236	234	229	228	224	224	218	220	222	217
29	264	255	271	245	236	228	232	226	222	219	224	217	219	209	222
30	260	253	237	232	228	232	230	229	229	226	228	224	224	228	232

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1	207	218	220	211	198	192	189	190	186	182	175	171	171	171	179
2	253	258	228	236	245	266	245	217	211	197	203	199	202	194	224
3	224	221	245	221	203	205	215	198	199	186	193	202	198	193	192
4	274	249	245	235	226	238	230	224	225	213	197	203	205	198	202
5	240	224	213	207	216	216	211	215	205	202	200	203	202	202	207
6	213	207	215	219	217	216	215	207	207	209	201	194	201	202	203
7	217	213	215	216	213	209	197	190	194	205	192	198	211	202	200
8	270	243	225	238	230	203	183	174	162	171	154	156	152	201	194
9	236	213	200	207	201	186	174	187	190	184	162	171	179	165	173
10	228	228	203	203	190	174	171	164	165	167	160	165	162	165	171
11	190	222	226	213	194	165	179	190	173	165	150	164	150	150	173
12	197	194	188	177	177	173	171	156	158	165	152	162	159	174	178
13	206	194	182	183	183	181	163	152	152	149	145	152	160	167	160
14	169	169	165	162	162	159	159	158	155	162	162	163	155	159	159
15	187	179	177	167	160	158	154	146	155	159	155	150	154	154	154
16	179	183	178	175	171	171	167	162	152	155	160	155	158	165	168
17	—	—	—	—	—	—	160	159	159	152	154	155	158	160	158
18	175	179	178	179	175	(171)	(166)	162	156	158	162	155	158	159	159
19	165	177	179	160	168	146	141	130	122	141	118	114	117	117	116
20	168	188	192	174	183	183	194	141	139	141	126	130	133	135	129
21	164	154	152	150	154	141	133	127	145	133	133	133	139	139	137
22	152	150	152	165	168	159	136	130	127	126	130	121	122	129	129
23	169	163	160	182	163	162	156	155	141	125	130	133	129	131	133
24	148	146	150	152	155	154	143	145	141	144	139	135	133	133	129
25	137	145	144	146	155	156	152	144	141	143	141	135	143	148	140
26	145	145	144	143	152	152	146	152	146	135	139	146	143	139	137
27	146	148	150	156	154	154	154	149	144	149	144	140	137	133	133
28	144	144	143	143	143	144	144	143	137	133	136	133	131	123	123
29	278	220	232	213	186	160	160	154	163	162	165	152	164	148	162
30	216	211	187	205	182	165	162	156	144	140	149	158	148	152	152
31	171	169	167	174	186	194	182	162	149	149	150	146	149	145	141

V—June, 1911.

68000γ (·68 C.G.S. Unit) +										Maximum Reading and Time.			Minimum Reading and Time.		
15 h.	16 h.	17 h.	18 h.	19 h.	20 h.	21 h.	22 h.	23 h.	24 h.						
γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	h.	m.	γ	h.	m.
202	189	198	196	208	215	228	230	215	213	296	0	23	151	11	53
161	170	171	176	173	181	190	194	189	196	256	1	22	150	8	50
186	204	207	201	200	198	194	194	191	191	228	16	8	176	10	45
186	188	192	198	198	199	194	194	192	192	206	5	0	163	11	22
165	188	186	191	192	226	312	243	209	200	424	20	35	163	13	19
186	188	192	191	190	194	201	242	281	327	361	23	38	153	7	48
207	209	210	217	219	220	229	209	204	200	323	0	0	171	7	50
190	186	222	228	210	205	201	200	198	196	255	17	20	171	7	0
186	185	182	192	192	194	192	191	188	186	204	4	30	166	11	15
207	195	277	291	243	280	255	236	218	214	317	17	58	133	8	35
—	—	—	—	—	—	—	—	—	—	242	2	46	157	7	35
199	201	241	371	304	287	256	222	233	252	460	17	43	161	9	36
194	201	230	219	226	274	255	249	264	308	310	19	43	158	7	47
205	203	210	275	285	256	270	281	262	233	323	0	20	188	10	42
203	218	228	226	217	223	229	226	214	209	249	17	30	173	7	17
198	199	198	201	219	217	209	220	218	207	232	18	41	180	9	10
204	211	205	207	215	220	214	218	220	218	226	19	47	171	9	33
192	199	198	198	201	200	199	207	214	219	226	0	32	190	12	55
199	203	213	209	209	213	220	232	218	218	239	22	2	186	9	15
190	192	199	239	218	214	211	228	224	219	256	17	55	177	9	45
210	203	209	207	224	226	219	230	234	260	252	24	0	194	10	47
226	242	245	239	233	258	264	261	270	310	323	24	0	194	10	30
220	223	226	228	245	266	251	285	300	306	361	0	5	209	12	10
224	223	224	224	228	229	233	232	233	229	354	2	32	209	11	43
224	220	224	228	228	234	232	228	226	226	245	19	45	213	8	55
223	217	217	219	224	228	224	224	224	224	236	5	7	214	16	55
224	226	226	228	226	226	232	233	232	233	238	8	55	215	9	10
219	222	220	224	226	232	232	233	242	264	266	24	0	215	13	55
223	220	245	242	242	249	252	256	264	260	284	1	45	209	12	50
230	232	232	230	233	226	226	228	232	245	261	0	0	221	7	59

V—July, 1911.

186	182	189	207	245	230	209	224	266	253	298	18	38	164	10	47
228	203	211	224	228	231	262	258	236	224	297	5	2	170	8	59
205	209	217	240	234	292	326	282	268	274	626	20	25	173	8	57
207	207	209	209	213	217	221	228	228	240	272	0	3	186	9	56
209	203	203	216	224	221	216	211	215	213	245	0	13	187	9	8
205	206	207	207	207	207	215	228	222	217	230	22	15	186	10	40
187	171	209	184	178	178	200	311	276	270	330	22	3	171	20	30
201	188	203	190	197	248	247	329	289	236	391	22	10	139	11	30
177	178	182	187	186	190	187	206	215	228	249	0	0	146	10	0
177	192	182	188	186	183	187	177	183	190	241	0	43	154	7	28
171	177	181	178	276	282	229	213	200	197	442	19	5	129	11	50
179	178	184	179	179	224	249	240	228	206	279	20	19	146	9	53
167	163	169	168	164	168	168	167	168	169	207	0	35	133	10	27
160	162	175	182	186	182	192	192	186	187	198	21	45	150	8	0
164	167	167	171	167	162	168	171	178	179	197	1	53	144	7	20
169	171	169	178	173	171	171	171	173	173	192	17	55	147	8	20
162	162	162	173	169	181	186	184	177	175	199	21	9	138	8	57
159	160	158	165	179	213	169	159	158	165	238	19	45	146	10	5
141	137	167	229	173	160	167	216	187	168	270	17	44	101	9	43
133	158	148	154	186	257	220	177	162	164	302	19	41	111	9	13
143	137	146	140	145	154	149	152	152	152	171	19	30	117	10	10
146	139	141	143	159	165	162	221	184	169	251	22	0	112	10	35
139	145	146	154	162	173	158	152	154	148	188	3	22	118	9	20
135	136	137	140	144	137	137	135	133	137	158	3	40	126	13	40
141	145	146	148	149	146	146	146	146	145	165	4	25	130	10	17
139	139	136	146	144	146	146	146	145	146	158	8	48	126	9	10
136	139	139	139	139	139	143	146	143	144	162	3	43	129	13	12
129	137	141	141	143	150	152	154	247	278	402	23	21	116	13	50
154	162	150	167	168	211	238	213	192	216	271	0	23	131	10	39
154	159	158	158	175	173	196	229	192	171	251	21	39	123	8	1
154	171	162	160	141	178	263	251	220	201	390	21	19	126	8	5

Hourly Values—*continued.*

V—August, 1911.

Day.	0 h.	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	12 h.	13 h.	14 h.
	68000γ (·68 C.G.S. Unit) +														
	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
1	201	187	181	167	160	158	164	156	141	149	146	133	123	121	116
2	130	139	144	135	144	133	136	130	133	131	133	139	133	131	136
3	152	152	152	150	150	149	152	154	152	149	152	144	143	145	136
4	169	171	174	159	149	146	146	145	143	135	130	131	123	133	150
5	182	168	163	158	163	171	171	165	135	129	141	140	120	133	144
6	156	150	164	182	171	152	140	136	141	140	127	137	136	139	144
7	158	155	154	158	159	154	152	145	140	139	139	141	133	135	136
8	150	149	148	152	148	143	140	143	145	144	148	146	140	143	143
9	148	152	154	152	149	141	140	141	144	145	140	144	139	141	144
10	146	146	146	152	152	143	144	136	141	143	141	143	141	143	141
11	165	162	152	150	146	145	146	144	140	145	143	139	139	141	139
12	154	154	154	150	148	145	143	137	139	139	137	133	143	143	145
13	152	150	150	146	149	146	137	141	140	145	140	136	139	145	145
14	169	164	158	158	152	150	149	144	140	143	148	149	139	(138)	137
15	175	174	169	165	156	160	155	152	155	148	148	145	144	136	137
16	158	162	174	171	164	156	150	143	143	139	140	141	133	143	144
17	175	175	173	159	158	152	150	156	159	163	163	169	154	144	143
18	168	171	173	168	162	156	152	154	154	152	144	136	146	136	148
19	163	164	164	165	164	162	159	155	150	146	152	150	143	152	143
20	163	179	183	183	179	178	152	148	143	136	131	121	129	130	137
21	171	165	167	175	178	165	160	158	150	146	149	154	145	140	145
22	143	145	155	149	140	135	135	133	131	129	123	127	131	131	127
23	146	144	140	139	140	137	137	133	139	136	135	129	120	133	126
24	209	177	187	255	306	221	187	186	202	173	163	148	155	159	133
25	239	232	215	186	160	158	171	173	159	160	146	152	146	148	152
26	255	248	221	200	175	162	152	164	152	136	169	163	162	159	152
27	198	174	194	179	177	159	174	186	178	175	152	159	167	164	165
28	207	192	253	213	179	183	167	162	154	152	148	148	145	145	143
29	164	163	156	160	164	155	149	141	152	136	140	152	140	150	152
30	164	162	168	169	162	168	162	149	144	146	136	139	139	140	139
31	183	183	182	168	179	175	162	150	146	149	145	140	130	133	144

V—September, 1911.

1	183	182	182	171	156	150	144	146	137	130	144	139	123	131	136
2	154	156	152	150	148	145	146	141	154	154	141	—	—	—	—
3	160	158	250	156	156	149	146	146	148	135	127	120	117	117	114
4	131	131	131	129	127	126	127	131	131	127	123	123	121	118	125
5	131	131	137	137	133	131	127	127	123	123	121	121	122	114	118
6	141	136	140	140	130	127	123	121	116	107	102	120	136	127	123
7	139	143	143	141	139	131	131	135	133	135	126	126	129	127	125
8	148	143	149	146	139	136	135	133	135	126	133	120	118	121	120
9	150	148	146	141	145	143	144	133	129	139	133	131	127	122	121
10	141	141	140	139	141	136	131	127	133	121	131	126	126	125	118
11	167	163	158	158	155	152	149	144	140	139	133	129	120	117	120
12	146	159	175	163	160	154	144	152	154	121	103	92	95	107	106
13	165	182	173	190	177	173	164	168	150	141	145	131	127	131	136
14	203	221	216	197	167	150	148	148	145	149	149	140	149	139	131
15	158	162	164	165	155	152	154	154	143	162	169	171	164	155	155
16	178	184	187	177	164	159	156	169	169	136	159	158	144	145	156
17	213	228	238	201	194	175	167	169	182	165	192	143	136	141	143
18	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
19	—	—	—	—	—	—	—	—	—	—	—	—	—	143	154
20	171	171	169	173	169	158	173	152	169	211	183	190	155	155	152
21	304	253	243	222	213	211	196	194	181	169	173	186	177	165	175
22	247	217	253	244	277	251	222	222	217	207	224	194	188	213	197
23	270	224	215	209	205	205	198	187	179	201	181	190	169	167	160
24	194	198	213	202	209	203	190	202	202	200	187	181	200	187	188
25	198	198	188	184	179	177	165	162	167	183	175	171	163	155	156
26	194	192	186	179	178	171	174	173	169	160	155	154	156	148	159
27	181	177	178	178	175	175	177	181	168	173	171	168	192	171	164
28	192	184	183	179	171	169	159	141	167	169	165	149	154	152	159
29	177	175	177	174	171	173	164	155	144	122	160	141	152	152	154
30	175	175	171	168	163	162	160	163	169	—	—	—	—	—	—

Hourly Values—*continued.*

V—August, 1911.

68000γ (·68 C.G.S. Unit) +										Maximum Reading and Time.			Minimum Reading and Time.		
15 h.	16 h.	17 h.	18 h.	19 h.	20 h.	21 h.	22 h.	23 h.	24 h.						
γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	h.	m.	γ	h.	m.
122	120	117	131	127	116	125	123	122	130	202	0	22	111	12	54
141	143	149	149	154	155	150	155	154	152	159	22	40	118	8	15
136	139	141	155	160	162	171	205	188	169	215	21	45	125	9	2
145	146	177	187	188	183	171	200	200	182	211	22	27	117	12	0
158	152	145	144	154	155	154	160	158	156	183	0	20	103	11	32
178	173	162	156	164	169	160	156	164	158	211	15	30	116	10	8
152	146	139	164	160	167	162	149	152	150	189	18	5	123	11	37
144	144	146	150	152	154	154	150	152	148	157	19	7	137	5	55
143	141	144	144	143	143	145	143	145	146	156	9	53	133	10	1
141	143	144	144	146	148	162	175	178	165	187	22	53	133	6	55
141	143	146	146	146	146	146	146	152	154	168	0	10	131	11	10
146	145	146	146	146	154	158	156	154	152	162	21	15	129	11	5
139	140	145	150	155	154	200	192	174	169	221	21	23	131	11	10
145	149	154	155	156	169	171	165	163	175	181	20	35	133	12	42
139	145	148	152	156	169	162	160	158	158	192	0	20	131	13	25
146	150	160	181	205	211	205	200	184	175	215	20	3	123	11	47
140	144	152	154	158	160	162	167	164	168	179	1	45	126	12	55
141	141	148	152	155	159	159	158	162	163	177	1	40	131	13	0
150	150	152	154	160	163	163	162	169	163	171	22	50	139	14	14
137	155	155	156	162	174	186	177	174	171	194	20	51	108	11	10
152	150	154	141	137	145	149	144	143	143	179	3	34	127	18	32
130	135	137	136	133	137	152	144	148	146	167	2	22	122	9	40
127	129	129	133	133	130	143	196	213	209	235	23	27	116	11	35
148	173	229	196	197	187	276	299	249	239	458	21	5	120	14	5
171	177	168	159	202	248	234	240	217	255	268	19	25	120	10	35
149	152	156	155	169	175	171	211	232	198	266	0	12	133	6	2
171	160	158	177	194	175	174	175	194	207	219	23	37	133	10	5
144	165	168	160	190	201	188	173	169	164	276	2	17	121	8	43
144	146	150	154	156	159	155	155	158	164	171	1	12	116	10	47
145	145	150	154	160	164	165	167	187	183	192	23	0	125	11	25
150	143	145	155	169	168	244	209	202	183	254	20	54	108	10	55

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139	155	158	163	159	163	158	158	154	154	200	0	27	114	11	48
139	144	144	146	146	164	160	159	159	160	169	20	3	108	10	12
118	125	126	130	131	131	131	131	131	131	164	0	25	110	14	30
125	126	127	126	127	127	127	129	130	131	133	9	2	116	13	0
118	123	123	123	127	131	154	152	140	141	164	21	12	114	13	0
125	131	136	135	136	136	136	139	140	139	144	23	30	95	10	4
129	129	133	139	144	152	143	139	152	148	163	23	25	116	12	20
120	126	133	141	139	136	137	143	154	150	159	23	16	107	12	15
123	122	130	131	140	141	144	145	141	141	152	0	23	118	7	39
116	118	123	131	131	127	145	149	160	167	169	24	0	111	14	13
126	121	131	146	144	150	152	149	148	146	173	1	2	108	11	50
103	122	—	—	—	—	—	—	—	165	179	1	52	89	11	30
127	140	152	164	163	160	165	194	219	203	234	22	30	108	12	15
141	149	145	159	159	160	160	164	159	158	238	1	37	123	11	20
152	154	165	174	174	174	171	171	171	178	183	23	50	135	8	20
143	183	167	154	268	235	229	225	209	213	291	18	50	126	9	17
150	177	—	—	—	—	—	—	—	—	260	1	39	121	11	45
—	—	154	169	181	183	—	—	—	—	186	19	45	152	16	38
159	—	168	168	169	—	169	175	174	171	181	22	30	136	13	10
156	217	215	211	213	245	274	266	356	304	375	22	53	118	14	33
171	177	177	177	207	247	281	329	293	247	362	22	12	143	8	50
177	167	222	222	220	232	216	249	344	270	365	22	39	150	16	25
164	177	179	213	202	209	209	200	197	194	260	0	0	150	14	23
175	177	182	187	184	184	186	190	192	198	234	9	17	146	10	20
162	164	171	179	178	179	181	182	187	194	207	0	15	146	12	30
156	156	165	169	175	150	150	146	179	181	198	0	15	141	10	20
150	156	162	165	171	171	175	181	181	192	200	11	40	146	15	0
155	160	165	165	168	174	177	178	174	177	196	0	35	131	7	5
154	154	149	167	179	177	173	175	175	175	187	10	7	112	9	0
—	—	—	—	—	—	—	175	171	174	180	0	55	120	6	23

Hourly Values—*continued.*

V—October, 1911.

Day.	68000γ (·68 C.G.S. Unit) +														
	0 h.	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	12 h.	13 h.	14 h.
	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
1	174	177	175	175	169	167	163	165	162	154	150	155	165	165	158
2	169	169	171	171	171	165	169	165	163	164	162	178	150	156	158
3	194	194	198	213	235	209	174	178	158	167	158	158	152	150	158
4	171	171	173	177	175	173	168	163	158	154	149	149	149	154	164
5	167	168	169	171	173	171	184	177	179	175	173	154	137	139	141
6	190	190	186	184	178	171	169	168	163	152	152	148	140	136	139
7	183	187	187	190	179	164	159	169	175	181	164	144	139	149	158
8	190	177	186	183	202	205	196	181	177	171	188	175	159	162	140
9	222	209	213	196	190	181	165	165	171	154	133	—	—	—	—
10	192	178	179	184	177	190	167	152	149	140	141	129	127	127	123
11	196	196	194	165	152	146	145	149	149	145	143	150	143	148	154
12	215	198	188	181	162	174	202	171	187	192	181	139	137	111	116
13	167	165	162	158	152	141	126	149	168	171	135	108	150	139	129
14	164	164	155	152	150	148	148	154	141	159	149	111	117	111	122
15	164	159	158	158	156	152	146	160	167	129	156	136	116	110	114
16	167	162	162	162	160	156	155	155	148	148	137	131	136	140	133
17	171	192	209	207	201	188	211	205	200	178	194	194	184	162	162
18	238	249	235	234	228	209	205	183	186	186	173	152	155	155	156
19	209	201	194	202	205	192	213	230	197	202	167	171	177	158	150
20	209	251	267	245	251	209	196	203	184	158	182	167	163	156	140
21	209	205	219	206	215	182	175	183	177	179	150	148	114	114	129
22	196	190	207	206	197	188	188	186	162	152	178	139	130	152	156
23	164	181	174	169	190	194	175	167	159	129	123	139	137	123	143
24	177	164	156	155	168	183	194	164	171	156	152	139	125	110	114
25	201	171	190	181	181	139	144	140	121	102	85	80	97	106	89
26	163	164	160	159	144	140	141	190	152	92	—	—	—	—	—
27	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
28	187	190	184	181	177	183	171	171	194	182	196	182	144	133	150
29	190	188	188	190	188	178	178	181	187	150	152	165	152	155	165
30	181	183	190	184	164	135	155	140	133	129	165	173	116	152	177
31	181	181	181	182	181	173	160	168	158	164	155	144	148	140	152

V—November, 1911.

1	98	103	97	106	101	97	96	97	87	68	71	74	84	86	64
2	111	128	109	100	103	103	90	78	100	84	79	73	68	68	78
3	135	136	113	107	120	86	67	83	125	101	97	78	79	33	23
4	125	113	122	109	113	149	125	109	122	113	65	—	—	—	—
5	135	147	143	130	130	140	132	122	122	115	122	103	82	56	56
6	168	177	178	186	181	151	151	154	149	149	134	120	86	106	115
7	132	141	147	154	147	154	128	126	109	119	105	94	94	105	96
8	132	136	140	132	138	128	117	103	111	113	100	84	60	83	77
9	126	124	141	134	159	128	79	77	78	41	6	1	25	22	−8
10	113	103	101	98	69	46	73	75	132	130	134	56	39	56	84
11	134	113	119	94	86	81	136	151	139	92	44	64	62	60	73
12	113	121	117	111	103	117	90	97	94	83	81	75	69	37	52
13	113	107	115	97	87	83	75	141	182	167	119	60	88	86	94
14	214	208	225	177	151	119	117	107	116	134	122	124	116	122	98
15	210	216	201	210	143	138	105	151	176	147	134	134	126	117	97
16	149	162	143	147	125	117	132	121	124	139	125	125	96	84	73
17	157	153	151	151	128	128	92	93	109	90	111	109	90	100	86
18	154	135	138	109	141	135	151	132	117	100	87	90	82	77	71
19	106	128	132	132	135	136	109	97	88	69	55	60	82	78	73
20	111	109	119	128	121	132	113	84	68	88	30	107	30	86	74
21	122	121	113	106	79	67	81	79	107	132	111	31	87	100	45
22	157	132	117	113	105	84	71	75	58	67	73	55	52	56	48
23	98	105	97	97	100	78	93	71	96	102	83	77	65	73	67
24	96	96	109	122	71	74	71	94	116	109	84	67	41	56	45
25	101	97	98	93	88	92	90	86	93	64	45	37	50	60	58
26	101	102	101	78	67	46	46	62	92	128	109	79	67	68	71
27	109	106	102	97	96	96	74	77	73	83	71	71	58	39	18
28	102	109	105	98	107	111	92	81	100	56	30	33	62	48	33
29	113	116	105	109	113	111	98	90	71	59	41	30	11	21	2
30	96	94	103	125	182	145	103	96	109	96	75	73	74	78	77

Hourly Values—*continued.*

V—October, 1911.

68000γ (·68 C.G.S. Unit) +										Maximum Reading and Time.			Minimum Reading and Time.		
15 h.	16 h.	17 h.	18 h.	19 h.	20 h.	21 h.	22 h.	23 h.	24 h.						
γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	h.	m.	γ	h.	m.
154	158	159	163	165	169	171	171	171	169	182	2	55	146	9	20
158	156	169	156	162	168	179	196	207	194	216	23	2	141	9	21
150	159	162	167	171	179	181	175	175	171	251	3	57	143	7	45
162	164	171	169	169	168	169	169	169	167	181	3	18	133	9	50
164	164	165	164	165	165	171	171	181	190	196	24	0	133	11	35
154	158	155	155	168	174	178	175	173	183	196	0	0	127	12	50
150	152	154	171	181	201	194	190	183	190	203	20	20	118	12	13
140	140	152	159	177	188	187	196	205	222	228	23	45	131	15	27
—	—	—	159	169	169	173	194	196	192	226	0	10	—	—	
123	135	146	154	159	169	171	178	188	196	202	23	52	108	9	25
163	178	186	229	232	267	268	254	241	215	276	20	38	133	11	28
154	167	182	163	160	164	163	162	163	167	215	9	25	93	13	30
126	133	143	152	165	162	163	160	160	164	194	9	23	95	11	3
131	137	129	145	149	145	154	162	164	164	187	9	5	89	11	12
129	137	136	149	168	168	173	171	171	167	179	10	32	104	13	25
133	141	139	150	145	146	146	149	158	171	173	24	0	121	14	20
154	152	145	167	175	177	181	220	235	238	251	22	24	142	16	33
140	150	155	162	168	183	186	221	241	209	253	0	54	123	9	10
152	152	154	165	171	188	203	201	201	209	253	9	5	123	10	21
144	152	162	160	160	194	207	209	207	209	279	1	22	131	14	0
133	135	152	165	173	174	181	192	205	196	227	2	3	103	12	15
160	149	152	155	162	164	165	169	168	164	222	3	42	103	12	5
150	148	155	150	163	175	174	186	182	177	200	4	43	108	9	42
125	129	133	136	149	155	162	169	186	201	220	6	0	95	13	15
102	110	122	139	137	150	171	165	162	163	207	0	3	59	9	8
—	—	—	—	—	—	—	—	—	—	207	6	19	44	9	42
—	152	156	167	177	177	187	192	192	187	209	23	15	143	15	30
148	149	163	171	175	181	194	194	190	190	221	7	32	125	12	48
171	169	164	169	179	186	192	184	184	181	200	7	35	133	9	35
159	169	160	173	177	171	171	184	178	181	207	1	54	102	8	33
152	156	158	163	169	175	181	183	181	179	194	4	47	130	11	25

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49	50	58	73	77	83	106	111	111	111	117	24	0	38	15	25
82	90	79	77	74	81	83	96	122	135	136	1	17	54	6	51
37	44	83	83	90	107	113	115	109	125	141	0	47	11	13	18
77	101	117	117	119	134	136	132	144	135	195	5	33	42	13	38
63	84	88	106	117	126	143	148	155	168	178	24	0	45	13	28
103	90	90	105	105	119	139	143	139	132	202	2	16	64	11	38
93	94	101	116	124	122	124	132	136	132	166	2	53	79	11	33
97	106	109	109	111	115	120	121	124	126	151	2	10	50	12	19
31	73	68	96	100	96	107	113	106	113	186	3	48	−24	13	37
88	88	94	93	90	90	120	139	147	134	235	8	27	4	10	44
81	88	90	96	90	96	103	113	121	113	179	5	57	49	12	35
62	75	90	103	103	106	111	116	107	113	157	7	38	27	12	40
79	78	90	96	134	143	135	162	173	214	234	23	47	27	11	0
98	96	97	98	103	102	116	128	151	210	256	1	21	68	7	27
101	107	101	113	145	151	148	153	166	149	288	0	28	71	6	23
78	90	88	96	119	125	128	139	163	157	184	1	17	64	13	25
73	68	78	90	106	120	128	157	155	154	179	22	15	48	9	15
81	75	88	97	103	101	105	107	109	106	170	6	12	59	11	52
71	83	84	90	97	92	117	117	111	111	149	5	0	37	10	27
84	71	62	78	101	106	106	111	116	122	172	9	52	−22	10	18
46	56	64	78	105	115	119	(146)	174	157	187	22	22	12	11	3
35	36	50	67	88	103	111	113	94	98	157	0	0	25	9	5
73	74	79	77	87	93	97	92	101	96	119	8	13	40	7	13
50	50	64	75	81	92	98	96	98	101	134	8	55	18	11	35
77	71	67	75	75	77	84	86	100	101	119	8	8	14	8	47
56	71	79	84	90	103	109	109	117	109	151	8	47	35	5	35
26	58	81	90	92	94	96	100	102	102	119	{0 1}	{10 6}	10	13	55
31	45	59	90	90	94	106	109	106	113	124	5	4	17	10	11
16	33	46	55	69	74	84	88	73	96	121	0	59	−1	14	2
71	75	81	97	96	103	107	109	117	116	205	4	9	52	10	7

V—December, 1911.

Day.	67000γ (·67 C.G.S. Unit) +														
	0 h.	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	12 h.	13 h.	14 h.
	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
1	1132	1146	1160	1159	1144	1141	1127	1099	1085	1089	1049	1079	1036	1047	1053
2	1125	1129	1142	1161	1123	1154	1137	1123	1100	1093	1068	1061	1047	1079	1079
3	1140	1140	1137	1117	1121	1119	1084	1097	1091	1049	1055	1041	980	979	1019
4	1125	1116	1163	1180	1205	1169	1127	1097	1099	1084	1049	1083	1095	1114	1090
5	1136	1129	1113	1110	1114	1109	1103	1087	1080	1074	1068	1081	1089	1068	1079
6	1125	1118	1116	1129	1113	1129	1127	1090	1085	1081	1071	1062	1015	998	1022
7	1089	1076	1053	1046	992	1102	1135	1081	1003	916	1003	1000	960	976	979
8	1093	1095	1106	1118	1087	1087	1071	1061	1071	1068	1068	1057	1026	1041	1071
9	1095	1087	1095	1097	1094	1099	1085	1076	1072	1071	1046	1024	1039	1039	1049
10	1091	1102	1100	1087	1083	1071	1079	1112	1113	1102	1083	1062	1046	1036	1026
11	1104	1099	1098	1090	1071	1036	1061	1042	1061	1117	1076	990	1018	1020	1089
12	1212	1228	1249	1188	1186	1170	1163	1178	1078	1071	1118	1081	1049	1039	1030
13	1118	1125	1117	1127	1099	1108	1091	1081	1083	1032	1030	1047	1047	1060	1080
14	1138	1119	1112	1113	1102	1109	1089	1106	1066	1061	1037	1032	1032	1018	1068
15	1188	1207	1192	1205	1214	1195	1114	1087	1090	1119	1117	1114	1103	1085	1071
16	1094	1104	1103	1095	1087	1104	1094	1087	1079	1093	1071	1076	1065	1051	1051
17	1129	1121	1112	1095	1087	1098	1079	1095	1064	1074	1066	1061	1049	1030	1034
18	1216	1163	1109	1079	1041	998	1011	979	1011	1041	1008	1023	1056	1024	1009
19	1095	1102	1089	1087	1076	1084	1068	1056	1057	1068	1065	1090	1066	1039	1065
20	1064	1066	1087	1072	1053	1049	1055	1000	1030	1033	1007	996	998	1003	1013
21	1089	1089	1085	1085	1072	1064	1065	1041	1043	1042	1093	1033	1042	1057	1043
22	1087	1087	1104	1091	1091	1068	1037	1043	1053	1093	1080	1060	1036	1027	995
23	1085	1089	1091	1087	1071	1083	1068	1087	1030	995	981	986	988	1009	999
24	1090	1093	1087	1083	1061	1068	1084	1081	1075	1053	957	962	998	1020	986
25	1090	1083	1085	1091	1084	1079	1075	1070	1078	1076	1055	1051	1052	1052	1047
26	1122	1136	1142	1132	1133	1142	1103	1110	1099	1108	1084	1064	1074	1074	1057
27	1148	1106	1119	1119	1137	1159	1179	1133	1135	1108	1121	1125	1053	1033	1017
28	1097	1118	1112	1117	1131	1109	1148	1114	1103	1148	1122	1068	1068	1049	1023
29	1104	1097	1087	1103	1109	1103	1087	1078	1079	1058	1032	1057	1049	1030	1034
30	1095	1098	1099	1114	1112	1095	1083	1087	1075	1064	1051	1061	1053	1042	1036
31	1116	1125	1127	1106	1087	1074	1070	1041	1079	1071	1140	950	946	963	975

V—January, 1912.

1	1156	1140	1173	1180	1178	1170	1165	1175	1080	1081	1078	1098	1019	1049	1071
2	1093	1093	1078	1081	1051	1056	1041	1053	1076	1068	1036	999	998	1004	1011
3	1071	1083	1087	1093	1084	1087	1076	1079	1058	1049	1023	1028	1081	1083	1074
4	1091	1097	1090	1065	1072	1068	1072	1066	1064	1072	1083	1038	1011	1008	1018
5	1079	1076	1078	1055	1046	1049	1056	1068	1068	1071	1051	1019	1011	979	954
6	1094	1116	1104	1075	1081	1028	1018	995	1018	1083	1020	1058	969	985	988
7	1078	1079	1084	1070	1062	1047	1055	1064	1052	1085	1068	1049	1041	1036	1030
8	1095	1093	1094	1091	1100	1087	1081	1064	1064	1052	1045	1043	1046	1068	1079
9	1083	1093	1095	1102	1091	1079	1058	1056	1038	1043	1038	1045	1043	1017	1039
10	1090	1097	1099	1113	1027	1110	1121	1093	1072	1108	1099	1078	1066	1049	1045
11	1103	1103	1121	1140	1133	1144	1098	1068	1068	1079	1070	1085	1094	1089	1076
12	1104	1121	1112	1125	1094	1079	1094	1097	1075	1102	1057	1058	1075	1027	1022
13	1097	1112	1116	1108	1090	1066	1053	1011	1023	954	980	973	971	941	947
14	1071	1079	1106	1106	1117	1068	1039	1024	969	979	996	982	1003	1028	1003
15	1076	1075	1072	1072	1099	1047	1061	1061	1011	1000	1099	1071	967	960	985
16	1083	1099	1091	1079	1074	1064	1065	1075	1037	1068	988	985	969	979	1001
17	1072	1084	1080	1068	1074	1087	1072	1060	1057	1043	1039	998	1022	1039	1033
18	1118	1085	1071	1058	1046	1028	1014	998	1068	1131	1117	1036	1104	1062	1030
19	1079	1084	1093	1094	1076	1094	1087	1091	1076	1083	1041	1033	1027	1015	1032
20	1084	1072	1072	1066	1064	1061	1075	1049	1032	1068	1042	1023	1023	1026	1026
21	1102	1087	1087	1085	1081	1074	1064	1055	1064	1049	1030	1051	1056	1049	1056
22	1090	1085	1100	1083	1097	1085	1061	1060	1066	1065	1045	1046	1046	1039	1037
23	1104	1117	1170	1114	1093	1095	1087	1068	1109	1123	1108	1008	1045	992	1099
24	1087	1087	1085	1091	1090	1098	1097	1091	1076	1079	1076	1065	1045	1056	1034
25	1099	1125	1174	1161	1106	1060	1043	1068	1075	1091	1087	1064	1033	1042	1049
26	1087	1079	1083	1094	1094	1094	1094	1068	1062	1066	1060	1062	1058	1042	1034
27	1084	1076	1080	1084	1081	1085	1076	1047	1041	1045	1056	1071	1055	1039	1045
28	1078	1068	1068	1071	1068	1062	1053	1047	1049	1049	1051	1068	1027	1003	1015
29	1058	1064	1053	1049	1043	1049	1020	1026	988	988	986	916	975	984	1024
30	1083	1079	1084	1090	1070	1053	1052	1051	1060	1071	1070	1028	1014	998	1005
31	1066	1075	1074	1089	1068	1055	1042	1053	1056	1081	1075	1074	1061	990	998

V—December, 1911.

67000γ (·67 C.G.S. Unit) +										Maximum Reading and Time.			Minimum Reading and Time.		
15 h.	16 h.	17 h.	18 h.	19 h.	20 h.	21 h.	22 h.	23 h.	24 h.						
γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	h.	m.	γ	h.	m.
1045	1085	1121	1122	1121	1127	1125	1136	1127	1125	1188	2	48	1015	12	1
1091	1097	1109	1106	1121	1119	1131	1131	1136	1140	1192	2	40	1016	11	43
1037	1071	1074	1085	1090	1093	1097	1104	1123	1125	1148	0	4	960	12	13
1081	1094	1090	1099	1104	1108	1117	1125	1140	1136	1228	4	19	1001	9	57
1078	1083	1094	1093	1089	1087	1098	1116	1125	1125	1142	0	0	1042	0	12
1027	1033	1045	1053	1060	1071	1083	1093	1099	1089	1148	5	45	992	12	56
1041	1060	1061	1060	1062	1074	1074	1090	1104	1093	1170	9	52	853	9	10
1065	1052	1068	1068	1076	1080	1087	1099	1109	1095	1156	3	15	1009	12	2
1051	1062	1056	1066	1083	1087	1094	1095	1093	1091	1119	4	25	992	11	30
1020	1030	1046	1062	1064	1057	1064	1080	1097	1104	1123	8	0	1015	13	26
1053	1049	1066	1080	1102	1131	1151	1195	1203	1212	1230	23	39	899	10	48
1051	1068	1085	1097	1097	1098	1099	1114	1114	1118	1281	1	48	1017	3	33
1075	1076	1083	1089	1100	1112	1116	1125	1136	1138	1153	1	45	998	8	59
1083	1080	1090	1098	1108	1113	1136	1159	1173	1188	1193	23	49	1005	12	55
1068	1087	1094	1094	1099	1098	1103	1098	1095	1094	1249	1	15	1039	7	25
1042	1055	1064	1072	1087	1099	1106	1103	1117	1129	1133	23	35	1034	14 14	35 50
1030	1033	1045	1068	1085	1104	1119	1146	1217	1216	1249	23	10	1019	15	28
1020	1037	1062	1068	1087	1091	1085	1097	1089	1095	1237	0	24	876	7	29
1094	1085	1076	1080	1068	1066	1071	1084	1074	1064	1142	11	7	982	10	44
982	1001	1024	1030	1053	1061	1072	1075	1087	1089	1107	23	25	953	11	10
1034	1036	1046	1055	1061	1063	1068	1078	1080	1087	1112	10	15	979	10	47
1023	1049	1064	1062	1079	1068	1066	1065	1102	1085	1116	2	20	990	14	5
1036	1045	1061	1095	1104	1098	1108	1108	1087	1090	1119	21	26	923	9	14
1007	1037	1046	1057	1061	1071	1085	1091	1089	1090	1103	0	37	944	11	47
1046	1042	1060	1076	1075	1072	1097	1109	1122	1122	1127	23 23	15 31	1038	15	55
1057	1079	1079	1085	1083	1085	1131	1148	1161	1148	1195	7	20	1005	7	11
1008	1047	1072	1078	1080	1087	1095	1106	1113	1097	1203	6	25	990	14 14	35 50
1022	1030	1038	1057	1066	1070	1087	1097	1108	1104	1173	5	47	1004	14	50
1027	1034	1049	1062	1080	1087	1095	1097	1097	1095	1131	4	5	996	10	27
1039	1053	1070	1079	1087	1094	1100	1100	1103	1116	1127	3	35	1030	14	32
1053	1060	1074	1103	1109	1109	1119	1129	1154	1156	1180	10	10	905	11	0

V—January, 1912.

15 h.	16 h.	17 h.	18 h.	19 h.	20 h.	21 h.	22 h.	23 h.	24 h.	Max. γ	h.	m.	Min. γ	h.	m.
—	—	—	—	1039	1051	1081	1097	1100	1093	1237	5	39	—	—	
1009	1028	1034	1052	1049	1056	1060	1064	1060	1071	1104	8	39	960	10	44
1071	1079	1074	1075	1064	1057	1058	1068	1083	1091	1103	11	41	975	9	32
992	1022	1026	1039	1046	1057	1060	1065	1072	1079	1112	9	50	979	14	42
979	980	1011	1045	1030	1034	1033	1058	1080	1094	1117	9	28	939	13	48
996	1013	1028	1028	1056	1075	1090	1084	1076	1078	1127	1	0	960	10	13
1030	1047	1062	1055	1061	1070	1071	1076	1087	1095	1107	8	47	1022	14	30
1078	1071	1055	1064	1065	1070	1078	1087	1076	1083	1112	3	53	962	11	32
1043	1058	1064	1061	1065	1074	1083	1085	1081	1090	1113	3	42	998	12	53
1046	1058	1057	1066	1075	1072	1076	1084	1095	1103	1148	4	7	1038	13	28
1087	1081	1074	1081	1095	1099	1097	1095	1090	1104	1160	4	52	1028	10	25
1019	1011	1023	1038	1055	1058	1064	1079	1085	1097	1170	6	34	1005	14	5
994	1007	1068	1008	1058	1026	1084	1081	1080	1071	1125	19	22	899	13	9
982	1018	1033	1033	1043	1071	1072	1064	1066	1076	1132	3	40	915	8	55
1005	1023	1042	1045	1049	1046	1051	1066	1081	1083	1131	9	58	937	11	58
998	1017	1034	1037	1043	1049	1051	1049	1062	1072	1106	1	30	947	10	5
1036	1049	1053	1066	1070	1081	1099	1108	1131	1118	1138	22	50	971	11	30
1028	1015	1043	1039	1042	1038	1043	1060	1070	1079	1142	9	25	977	6	43
1033	1022	1032	1033	1055	1061	1076	1076	1085	1084	1124	2	37	994	10	50
1027	1034	1026	1034	1053	1070	1081	1097	1102	1102	1106	23	20	1005	7	51
1066	1072	1075	1076	1074	1075	1074	1080	1083	1090	1127	4	12	1017	9	33
1030	1036	1045	1053	1065	1074	1076	1085	1083	1104	1118	4	39	982	9	11
1093	1083	1060	1047	1066	1071	1083	1081	1076	1087	1188	2	5	960	10	48
1027	1036	1053	1068	1079	1083	1079	1087	1095	1099	1119	23	32	1022	15	10
1055	1045	1043	1046	1049	1058	1078	1083	1080	1087	1202	2	21	1018	11	57
1024	1023	1032	1038	1042	1057	1049	1061	1076	1084	1103	5	33	1019	15	23
1042	1053	1056	1062	1065	1064	1068	1078	1081	1078	1089	0	10	1017	10	45
1005	1011	1028	1039	1053	1053	1062	1064	1060	1058	1083	0	20	998	12	20
1020	1034	1022	1030	1037	1045	1051	1052	1061	1083	1097	9	39	868	10	33
1011	1024	1026	1041	1049	1071	1076	1071	1070	1066	1099	3	9	982	11	53
1037	1034	1047	1039	1046	1051	1058	1061	1061	1072	1110	2	48	975	13	15

Hourly Values—*continued.*

V—February, 1912.

Day.	67000γ (0·67 C.G.S. Unit) +														
	0 h.	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	12 h.	13 h.	14 h.
	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
1	1095	1082	1082	1078	1071	1095	1087	1092	1064	1059	1007	1043	1037	995	1003
2	1087	1088	1088	1087	1080	1088	1075	1074	1066	1080	1031	1026	1055	1047	1011
3	1088	1084	1086	1102	1086	1104	1087	1058	1043	1025	1017	965	1011	980	1035
4	1079	1090	1095	1096	1075	1055	1064	1076	1083	1067	1047	1049	1027	991	1007
5	1084	1086	1094	1078	1066	1055	1050	1066	1064	1027	993	1023	1003	987	1007
6	1071	1082	1079	1086	1087	1084	1064	1058	1063	1055	1070	1068	1067	1058	1043
7	1102	1090	1087	1088	1083	1078	1078	1075	1088	1098	1064	1031	1021	1015	1034
8	1096	1090	1084	1086	1075	1071	1086	1051	1063	1045	1049	988	961	976	980
9	1112	1086	1087	1076	1086	1086	1078	1075	1082	1058	1031	1027	1023	1019	1017
10	1084	1086	1082	1079	1072	1063	1058	1059	1079	1063	1030	1045	1049	1033	1023
11	1088	1100	1132	1116	1124	1088	1078	1041	1026	1009	999	1007	964	948	976
12	1094	1088	1088	1080	1083	1096	1070	1075	1075	1076	1057	1067	1050	1059	1042
13	1098	1091	1076	1075	1082	1086	1062	1047	1033	1001	1098	1071	961	1011	1060
14	1100	1110	1102	1104	1084	1106	1082	1055	1033	1013	991	1003	1037	1019	1021
15	1083	1079	1084	1086	1070	1062	1058	1029	1046	1062	1042	1015	1038	1045	1021
16	1106	1114	1106	1098	1098	1094	1084	1075	1074	1045	1078	1043	1033	1045	1046
17	1083	1087	1090	1104	1110	1095	1098	1092	1071	1095	1084	1095	1082	1072	1057
18	1080	1091	1086	1082	1080	1116	1084	1108	1064	1094	1149	1118	—	—	—
19	1086	1090	1100	1087	1102	1086	1086	1083	1080	1110	1095	1066	1070	1049	1043
20	1095	1094	1108	1114	1110	1104	1098	1091	1078	1092	1102	1074	1046	1055	1070
21	1100	1102	1098	1108	1096	1086	1082	1064	1062	1072	1035	1015	1041	1038	1026
22	1096	1090	1095	1102	1100	1098	1098	1090	1079	1086	1072	1066	1080	1068	1055
23	1092	1087	1088	1094	1090	1094	1087	1084	1084	1074	1066	1042	1041	1031	1031
24	1094	1102	1098	1114	1120	1114	1094	1059	1025	1025	999	1027	996	1003	1015
25	1095	1092	1092	1098	1090	1088	1092	1087	1067	—	—	—	—	—	—
26	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
27	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
28	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
29	—	—	—	—	—	—	—	—	—	1058	1054	1059	1063	1072	1051

V—March, 1912.

1	980	980	977	982	982	988	988	976	965	950	936	916	908	913	920
2	977	982	984	982	984	982	966	958	976	962	962	976	972	958	954
3	992	1000	1000	992	994	998	988	984	978	977	970	966	949	942	946
4	980	980	980	980	978	974	980	990	994	1014	953	919	901	929	953
5	978	978	978	978	978	976	970	972	984	976	984	964	949	949	948
6	996	998	1007	1004	1008	1000	988	984	980	1004	1008	1010	998	992	945
7	982	984	984	996	988	986	974	970	958	965	949	932	921	929	924
8	990	992	994	992	990	982	988	992	984	952	936	932	925	931	949
9	1055	1032	1003	988	1010	992	988	969	931	901	924	957	928	935	944
10	1006	1019	1000	1000	992	978	972	957	956	945	931	949	941	936	949
11	1007	1016	1023	1051	1026	1006	992	982	973	944	956	968	948	953	950
12	992	992	990	992	988	984	976	977	988	988	984	941	952	956	950
13	1018	1015	1010	1011	1008	992	970	973	960	962	988	954	961	984	969
14	1007	1011	1010	1003	994	988	984	978	980	964	956	965	950	954	956
15	990	996	1000	986	986	976	994	1010	1007	1000	994	1012	1000	984	973
16	1003	994	998	992	1000	996	992	992	990	982	950	964	977	978	974
17	1022	1027	1004	1002	1002	998	994	996	1000	1018	1011	994	970	978	988
18	998	996	996	998	1002	998	1000	996	996	1003	1003	996	986	977	972
19	1004	1002	1002	998	998	994	994	994	996	996	994	988	988	988	992
20	996	1000	1002	1007	1016	1004	1003	1000	1004	1004	996	1004	994	990	977
21	1002	1002	1002	1004	1010	1012	1008	1002	1000	1006	1007	996	992	980	974
22	1027	1018	1008	1006	1006	1000	992	992	970	953	973	960	954	950	960
23	1002	1003	1003	1003	1006	1007	1015	1016	1018	1006	—	—	—	—	—
24	—	—	—	—	—	—	—	—	—	994	994	992	994	992	980
25	1007	1008	1010	1012	1014	1006	1000	1000	996	986	978	988	978	984	984
26	1010	1010	1014	1010	1008	1007	1004	1002	992	—	1000	—	931	944	946
27	990	990	992	994	990	994	996	996	980	969	958	950	940	941	949
28	994	994	996	1000	1003	996	992	994	990	996	988	986	986	986	977
29	1007	1002	1000	1016	1004	1000	994	992	992	992	996	998	974	969	973
30	1002	998	1003	1018	1007	992	1014	984	980	1007	990	984	1003	994	986
31	1003	996	994	1000	998	992	988	996	998	1003	1000	990	982	980	974

V—February, 1912.

67000γ (·67 C.G.S. Unit) +										Maximum Reading and Time.			Minimum Reading and Time.		
15 h.	16 h.	17 h.	18 h.	19 h.	20 h.	21 h.	22 h.	23 h.	24 h.						
γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	h.	m.	γ	h.	m.
1003	1034	1049	1064	1067	1064	1074	1094	1095	1087	1114	4	48	961	9	54
1015	1029	1037	1046	1058	1067	1074	1094	1091	1088	1114	9	8	997	9	53
1027	1025	1021	1039	1067	1067	1075	1066	1064	1079	1116	5	10	934	10	56
1019	1026	1050	1064	1064	1068	1078	1082	1086	1084	1116	3	2	981	12	43
1003	1022	1030	1045	1055	1066	1086	1086	1075	1071	1102	1	43	976	13	38
1051	1059	1070	1078	1091	1096	1098	1098	1100	1102	1104	24	0	1033	6	40
1047	1055	1054	1055	1057	1072	1074	1078	1092	1096	1106	0	8	1005	12	55
997	1009	1039	1046	1054	1068	1079	1094	1112	1112	1120	24	0	950	11	58
1027	1035	1057	1064	1064	1068	1079	1090	1079	1084	1120	0	0	1005	13	35
1022	1030	1037	1042	1046	1071	1090	1090	1090	1088	1098	23	10	1011	9	58
1011	1026	1037	1041	1053	1068	1087	1092	1092	1094	1148	4	28	942	12	50
1043	1045	1050	1064	1075	1098	1104	1118	1106	1098	1124	21	55	1017	9	50
1094	1086	1076	1062	1076	1102	1114	1110	1102	1100	1137	10	10	946	11	58
1030	1025	1055	1060	1070	1072	1076	1090	1090	1083	1122	3	22	969	10	23
1022	1035	1058	1076	1076	1076	1080	1083	1102	1106	1110	23	45	988	10	33
1053	1045	1054	1071	1078	1084	1083	1080	1080	1083	1122	1	35	993	11	2
1033	1038	1051	1057	1075	1082	1086	1087	1087	1080	1136	3	23	1017	15	10
1060	1067	1078	1086	1088	1087	1091	1083	1084	1086	1182	9	51	1009	8	3
1035	1046	1058	1078	1083	1088	1092	1098	1098	1095	1130	9	25	1025	14	53
1063	1067	1050	1086	1084	1098	1102	1086	1102	1100	1122	10	0	1029	12	23
1035	1046	1060	1070	1078	1080	1084	1096	1096	1096	1112	3	0	1001	10	57
1055	1072	1083	1088	1088	1088	1088	1095	1088	1092	1107	5	25	1043	10	43
1035	1046	1060	1074	1072	1072	1080	1092	1092	1094	1102	4	35	1015	11	8
1027	1045	1047	1058	1066	1070	1086	1092	1096	1095	1137	4	10	969	10	15
—	1053	—	1074	1091	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1064	1074	1079	1087	1098	1093	1093	1096	1098	1098	—	—	—	—	—	—

V—March, 1912.

920	932	942	952	966	988	992	986	992	977	998	6	0	901	11	35
953	957	968	968	970	984	992	998	994	992	1002	21	30	941	9	55
952	968	972	976	978	980	984	986	980	980	1008	1	22	935	12	28
949	952	956	960	973	977	984	980	978	978	1034	8	57	883	11	45
954	950	973	974	980	982	982	986	986	996	998	24	0	944	13	35
980	974	980	984	984	980	978	978	980	982	1022	10	5	932	14	2
933	949	953	964	974	982	980	984	988	990	1007	8	50	911	11	4
944	949	970	976	996	1007	1004	1004	1065	1055	1092	23	10	909	12	5
950	954	957	974	984	994	1000	996	1006	1006	1060	0	15	887	9	10
961	966	977	984	988	988	1000	1004	1010	1007	1034	0	37	911	10	3
966	966	982	980	986	986	1000	1000	994	992	1075	2	50	931	9	23
956	960	970	973	978	982	988	1000	1007	1018	1018	23	45	915	11	13
960	966	972	978	988	1004	994	996	1002	1007	1026	0	22	936	11	20
957	968	972	977	978	986	988	988	992	990	1018	0	32	939	9	48
974	982	988	992	990	984	996	1002	996	1003	1038	8	35	967	5	15
980	984	994	992	994	996	1000	1007	1012	1022	1026	23	57	944	10	14
973	980	994	998	998	1002	1002	1002	1000	998	1035	10	12	962	12	28
976	988	980	994	994	996	1004	1004	1002	1004	1012	9	45	968	14	10
992	992	996	996	996	998	1002	1002	998	996	1010	0	0	984	11	15
969	980	994	992	994	996	1000	996	1000	1002	1020	4	10	964	15	22
986	992	992	994	994	994	996	1019	1031	1027	1044	22	22	968	13	58
950	970	990	996	1000	1002	1000	1000	1002	1002	1026	0	5	923	11	15
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
986	994	996	1000	1002	1010	1010	1002	1004	1007	—	—	—	—	—	—
980	994	994	998	1002	1004	1007	1010	1010	1010	—	—	—	—	—	—
956	968	980	982	988	996	996	994	992	990	1020	10	25	925	12	13
961	973	986	992	994	988	992	996	994	994	1006	6	55	933	12	2
978	984	984	990	994	996	1006	1016	1012	1007	1026	22	0	970	13	37
974	980	984	992	998	996	1000	996	996	1002	1023	3	3	960	13	25
974	982	1052	992	1003	1016	1019	1018	1011	1003	1027	3	5	954	11	12
976	984	988	988	988	996	992	992	990	990	1011	3	0	965	14	13

V—April, 1912.

Day.	67000γ (·67 C.G.S. Unit) +														
	0 h.	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	12 h.	13 h.	14 h.
	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
1	990	990	990	994	994	992	994	990	994	1002	992	990	986	977	984
2	1000	1003	1006	1012	1002	994	984	986	980	978	978	978	992	982	984
3	996	996	994	996	1000	1002	1010	1004	1003	996	986	972	964	962	956
4	1007	1006	1018	1014	1010	1002	992	990	982	957	968	972	956	968	974
5	994	992	988	996	996	994	990	988	986	977	974	982	990	974	969
6	1022	1014	1015	1007	1002	998	1002	990	984	953	945	965	965	972	978
7	1022	1012	1019	1024	1030	1018	1010	1002	1000	992	990	986	977	969	974
8	1044	1038	1034	1023	1015	1003	1003	998	984	990	978	980	973	982	982
9	1012	1016	1011	1018	1008	1002	1000	1002	996	992	988	986	988	977	988
10	1002	1002	1002	1002	1002	1000	998	1000	996	996	998	1004	1011	1020	1000
11	1049	1022	1023	1027	1022	1018	1018	1018	1020	1015	1018	1004	994	984	1000
12	1014	1014	1010	1007	1006	1002	1002	1002	1006	1008	1007	1000	996	990	996
13	1020	1027	1019	1012	1010	1008	1010	1008	1007	(1003)	(999)	(994)	990	992	990
14	1030	1023	1014	1015	1007	1008	1008	1006	1008	1012	1000	976	984	994	996
15	1008	1003	1002	1003	1002	1008	1000	1000	984	982	980	994	984	1003	1002
16	1083	1101	1081	1048	1032	1024	1020	1026	1041	1041	1034	1032	1016	1000	1011
17	1143	1093	1072	1075	1055	1035	1026	1022	1003	1016	1038	1047	1028	1034	1007
18	1073	1043	1044	1039	1044	1051	1063	1043	1036	1019	1023	1000	1000	1012	1018
19	1083	1081	1079	1075	1053	1039	1028	1026	1024	1019	1007	994	1003	1016	1010
20	1041	1044	1052	1048	1044	1031	1024	1012	1007	1007	1000	994	996	996	1002
21	1032	1030	1026	1026	1026	1020	1026	1008	1014	1020	1018	1014	1008	1015	1012
22	1019	1018	1018	1018	1014	1016	1018	1018	1014	1014	1014	1012	992	988	996
23	1044	1044	1048	1053	1040	1028	1019	1018	1012	1014	1016	1014	1020	1015	1019
24	1020	1023	1020	1026	1027	1027	1024	1012	1015	1007	1003	1004	1000	1006	1006
25	1040	1043	1041	1038	1032	1028	1030	1024	1023	1019	1020	1006	992	1006	1010
26	1030	1036	1044	1043	1035	1030	1022	1016	1022	1023	1026	1014	1002	1014	1000
27	1032	1032	1026	1024	1022	1020	1019	1020	1022	1023	1023	1019	1020	1014	1022
28	1049	1035	1038	1026	1026	1018	1011	1012	1010	1003	1004	1002	1006	1007	1004
29	1026	1028	1028	1023	1022	1019	1018	1018	1012	1011	1008	1010	1015	1012	1015
30	1018	1016	1020	1015	1010	1012	1010	1012	1012	1015	1007	1010	1006	1010	1012

V—May, 1912.

	68000γ (·68 C.G.S. Unit) +														
1	28	35	27	31	18	20	18	18	18	18	11	10	2	3	10
2	26	24	20	26	24	24	24	23	22	18	16	8	8	12	18
3	43	44	40	49	47	32	19	12	10	(16)	22	7	3	2	3
4	34	36	35	30	34	23	19	12	11	—	—	—	—	—	—
5	18	14	11	6	−6	−8	−14	−4	2	10	2	0	0	14	16
6	261	109	93	47	63	56	40	49	44	51	51	40	32	38	35
7	91	69	103	73	51	79	60	44	41	40	27	26	26	36	24
8	79	71	63	47	34	27	43	34	16	38	49	38	20	23	30
9	69	59	56	47	34	34	44	38	41	36	32	30	32	28	34
10	38	41	39	47	41	38	38	39	36	32	35	31	22	22	30
11	35	38	35	39	35	31	30	31	28	26	27	26	26	26	30
12	30	30	30	31	36	38	32	30	23	18	12	14	11	18	14
13	81	85	67	47	43	38	36	32	16	14	22	19	6	24	77
14	127	77	65	56	44	41	43	44	38	35	35	32	35	65	48
15	57	57	60	64	56	53	38	30	39	30	28	34	30	28	43
16	68	57	55	56	45	43	38	34	39	35	43	38	34	32	35
17	45	51	45	53	48	38	35	31	30	18	30	28	28	30	30
18	43	48	44	49	48	38	35	36	41	41	35	36	32	34	35
19	35	34	38	38	39	31	31	27	28	23	27	32	32	36	31
20	48	44	45	40	35	34	34	30	28	18	22	32	11	22	26
21	39	36	40	38	35	34	35	32	30	26	26	27	26	26	27
22	40	41	43	43	47	55	45	36	38	38	36	31	28	31	32
23	39	36	38	38	36	34	36	30	30	34	34	32	36	35	34
24	38	38	35	36	38	35	34	35	35	34	35	36	36	35	34
25	38	40	35	34	34	32	34	34	32	32	36	28	30	30	31
26	36	38	39	44	44	39	36	38	35	31	34	30	28	28	34
27	47	47	44	40	41	36	34	34	36	35	27	30	27	26	27
28	38	38	36	38	38	35	34	36	35	39	34	34	34	34	31
29	40	41	39	40	38	35	35	34	35	34	30	34	34	34	34
30	49	59	51	40	44	36	32	28	32	30	30	34	35	34	35
31	41	41	41	45	41	41	38	34	34	14	10	16	18	30	32

Hourly Values—*continued.*

V—April, 1912.

67000γ (·67 C.G.S. Unit) +										Maximum Reading and Time.			Minimum Reading and Time.		
15 h.	16 h.	17 h.	18 h.	19 h.	20 h.	21 h.	22 h.	23 h.	24 h.						
γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	h.	m.	γ	h.	m.
988	992	994	994	992	992	994	998	1007	1000	1011	23	0	973	12	52
980	982	984	986	992	994	996	996	996	996	1018	2	45	969	10	40
962	973	980	988	996	994	994	996	1000	1007	1012	6	43	950	13	48
973	984	980	986	990	994	1006	1002	1000	994	1030	2	25	949	12	0
970	1000	1000	996	996	998	1007	1019	1019	1022	1035	22	45	962	15	35
990	1004	1000	1002	1003	1003	1003	1000	1018	1022	1034	0	12	917	9	29
988	988	1000	1000	1000	998	1006	1038	1041	1044	1057	22	30	949	12	23
988	992	996	1000	1002	1002	1006	1010	1008	1012	1043	0	0	962	11	55
992	998	996	1004	1006	1007	1002	1002	1002	1002	1026	2	50	954	12	8
988	994	998	996	1015	1012	1038	1115	1064	1049	1130	22	3	964	15	10
996	992	992	998	1002	1014	1015	1016	1014	1014	1061	0	17	972	12	30
990	996	1002	1003	1004	1002	1006	1019	1022	1020	1030	23	12	986	12	32
990	996	1000	1004	1019	1022	1038	1041	1041	1030	1045	23	10	980	11	50
996	1002	1000	1004	1007	1012	1023	1016	1014	1008	1030	0	0	970	10	42
1000	1026	1069	1064	1093	1117	1093	1077	1069	1083	1125	20	0	962	9	49
1011	1014	1056	1061	1055	1051	1184	1102	1089	1143	1332	20	47	976	13	13
992	1011	1043	1032	1083	1057	1040	1040	1119	1073	1178	0	8	986	14	22
1015	1020	1035	1039	1051	1056	1059	1063	1106	1083	1122	22	40	992	11	55
1015	1027	1035	1026	1027	1028	1030	1023	1030	1041	1093	0	55	974	10	35
1047	1036	1032	1034	1036	1039	1035	1036	1035	1032	1065	1	35	986	10	40
1016	1022	1026	1024	1026	1026	1022	1019	1020	1019	1034	0	0	998	12	12
1004	1016	1019	1022	1032	1064	1060	1049	1041	1044	1073	19	57	980	12	25
1020	1020	1020	1032	1031	1030	1026	1026	1026	1020	1065	3	2	1002	10	28
1011	1016	1018	1020	1024	1034	1030	1035	1045	1040	1048	23	3	994	11	13
1015	1010	1011	1018	1016	1022	1036	1031	1031	1030	1049	1	30	973	11	53
1011	1016	1020	1022	1023	1026	1022	1024	1028	1032	1049	2	22	994	12	5
1018	1019	1018	1018	1022	1026	1022	1031	1036	1049	1060	23	45	1010	12	50
1011	1016	1018	1019	1023	1022	1024	1026	1026	1026	1049	0	0	996	11	14
1018	1018	1018	1018	(1018)	(1018)	1018	1018	1019	1018	1032	2	23	965	10	36
1011	1014	1014	1016	1018	1016	1022	1026	1024	1028	1031	23	45	1006	11	45

V—May, 1912.

68000γ (·68 C.G.S. Unit) +															
12	14	15	24	35	36	30	26	24	26	41	0	42	2	12	25
18	23	22	24	45	55	44	40	40	43	67	19	20	5	11	22
7	19	22	24	41	55	43	41	40	34	68	20	2	—4	8	13
—	—	—	32	28	26	24	26	18	18	45	1	15	7	6	47
12	12	10	16	22	28	64	138	99	261	352	24	0	—20	5	35
28	28	34	32	31	32	34	40	60	91	352	0	0	24	15	12
34	35	34	34	32	43	41	39	56	79	119	2	18	10	11	10
35	38	38	35	35	38	44	83	76	69	107	22	13	—2	7	50
31	34	34	34	35	39	43	41	38	38	76	0	5	20	12	43
32	28	40	64	53	38	34	35	36	35	69	17	39	18	12	43
30	30	30	30	30	30	30	30	28	30	44	2	30	21	11	55
26	28	35	51	67	107	73	61	65	81	121	20	5	2	11	35
49	48	48	146	113	115	228	258	200	127	313	21	10	2	9	12
52	55	51	97	95	168	119	91	69	57	212	19	57	14	11	27
38	63	53	51	57	53	52	53	71	68	83	23	33	18	9	45
36	39	39	41	44	49	47	49	47	45	67	0	0	28	13	20
31	35	38	40	41	45	52	44	43	43	61	3	20	10	8	46
34	32	31	38	38	36	35	34	34	35	59	3	25	26	12	10
35	36	36	36	40	40	53	51	47	48	57	21	0	18	9	5
31	36	38	39	43	43	40	39	40	39	53	0	20	10	12	20
28	34	39	38	39	38	38	38	36	40	44	16	41	22	9	10
35	40	41	41	43	44	41	40	38	39	65	4	38	30	10	45
34	36	34	36	36	38	38	35	36	38	41	2	20	26	7	14
35	35	38	36	41	38	40	41	38	38	43	18	50	26	9	50
34	34	35	36	38	38	38	38	36	36	43	10	30	18	9	20
34	34	36	39	40	41	52	63	51	47	75	21	32	26	11	45
27	28	35	34	38	39	44	45	40	38	52	21	45	23	9	30
34	32	49	49	51	49	41	38	40	40	57	17	0	28	9	35
34	38	38	38	40	35	40	39	43	49	53	23	57	28	10	22
34	34	38	41	40	41	39	39	38	41	65	0	50	23	9	30
35	40	41	40	40	38	38	43	41	44	49	3	12	2	9	23

Hourly Values—*continued*.

V—June, 1912.

Day.	68000γ (·68 C.G.S. Unit) +														
	0 h.	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	12 h.	13 h.	14 h.
	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
1	109	108	116	113	109	104	108	104	108	108	112	101	97	103	99
2	148	141	124	124	114	109	112	114	114	109	108	109	101	103	103
3	126	122	117	132	124	109	108	100	101	95	88	83	96	92	101
4	120	117	114	118	113	106	112	116	112	106	109	112	110	113	108
5	121	118	112	108	110	118	114	117	113	113	113	108	109	109	110
6	110	112	118	120	118	113	117	108	108	112	116	116	117	117	118
7	118	121	121	118	120	121	122	122	118	114	114	114	110	109	114
8	118	120	118	120	118	116	116	117	117	106	100	104	103	99	103
9	148	146	203	182	156	134	126	117	114	110	95	109	106	110	134
10	150	167	182	182	186	144	121	134	112	112	113	110	122	124	136
11	138	130	141	154	148	132	124	116	110	125	133	116	122	114	117
12	141	144	136	138	122	124	121	122	122	118	113	118	117	121	117
13	136	142	137	133	128	124	120	117	120	120	110	116	118	117	118
14	136	132	132	128	133	130	122	113	116	110	110	114	114	116	116
15	141	134	142	136	136	134	122	136	118	113	118	110	110	108	110
16	122	126	125	122	118	120	120	114	117	—	—	—	—	—	—
17	—	—	—	—	—	—	—	—	—	104	99	105	109	114	118
18	130	130	124	122	116	114	112	108	110	110	106	106	108	109	112
19	122	125	129	125	121	118	122	116	118	114	114	106	114	106	108
20	116	114	116	116	117	114	118	116	114	116	114	114	114	114	114
21	114	114	114	118	116	118	117	114	113	114	114	109	114	114	114
22	116	117	117	121	117	114	113	110	105	103	101	106	96	96	104
23	122	121	122	137	132	116	110	108	113	114	112	106	106	105	105
24	126	129	126	124	120	117	117	114	104	110	108	96	96	101	101
25	124	134	152	148	136	122	117	116	117	116	114	112	109	108	108
26	117	117	118	117	118	118	118	117	117	116	114	116	114	110	109
27	120	122	117	130	126	121	122	120	118	112	113	105	113	112	114
28	160	137	120	120	116	117	126	126	124	122	117	100	104	99	112
29	130	133	140	133	125	121	130	126	118	122	114	117	105	109	112
30	158	152	164	154	122	140	130	130	122	120	116	112	114	121	118

V—July, 1912.

Day.	0 h.	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	12 h.	13 h.	14 h.
1	140	142	154	144	140	138	125	122	122	118	108	110	112	109	110
2	134	130	133	133	117	117	114	117	122	—	—	—	—	—	—
3	—	—	—	—	—	—	—	—	—	121	116	114	112	114	114
4	136	142	138	140	126	122	117	110	125	91	112	103	103	110	104
5	140	138	160	167	160	138	133	124	112	114	114	108	136	174	128
6	175	174	164	148	138	138	130	118	122	118	114	121	130	130	122
7	191	174	162	142	136	125	124	118	118	117	116	112	109	117	120
8	122	122	122	120	118	116	118	124	116	120	105	106	108	125	118
9	130	130	133	137	134	133	121	117	108	109	112	113	118	116	118
10	137	140	141	136	126	121	117	117	117	114	114	116	114	114	114
11	122	122	121	132	122	118	114	113	106	114	109	112	113	110	113
12	118	118	117	116	116	114	114	114	114	112	110	114	112	112	114
13	114	116	114	112	114	113	114	109	106	109	110	106	106	110	106
14	114	114	114	114	114	114	110	112	108	109	114	114	114	113	110
15	114	114	120	114	114	110	106	108	108	105	108	106	108	106	106
16	114	114	112	116	114	114	114	114	112	112	113	106	109	106	110
17	129	122	122	120	121	117	114	114	117	116	113	114	114	114	114
18	122	121	121	124	134	140	128	116	112	106	103	100	100	103	106
19	114	114	114	114	114	114	114	114	110	109	109	108	108	108	108
20	122	124	122	118	116	116	114	114	113	113	113	114	113	108	105
21	142	148	148	129	120	114	108	113	118	118	113	109	116	110	113
22	134	129	126	133	130	117	120	120	116	122	120	117	114	113	113
23	125	130	130	134	129	120	117	118	112	114	116	113	110	106	109
24	122	122	126	128	132	129	121	118	122	120	117	114	117	116	114
25	124	125	121	124	121	124	121	122	120	116	109	106	110	110	113
26	132	134	133	126	128	128	126	137	130	122	120	113	113	117	113
27	144	146	130	136	140	137	120	126	125	118	114	116	110	104	117
28	130	136	132	137	148	141	132	125	128	125	122	122	118	121	120
29	130	130	132	126	128	130	128	124	122	117	122	118	122	120	116
30	129	130	130	136	140	130	132	122	121	122	122	121	120	117	118
31	(147)	146	152	156	152	148	136	126	124	124	122	122	(118)	113	110

V—June, 1912.

68000γ (·68 C.G.S. Unit) +										Maximum Reading and Time.			Minimum Reading and Time.		
15 h.	16 h.	17 h.	18 h.	19 h.	20 h.	21 h.	22 h.	23 h.	24 h.						
γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	h.	m.	γ	h.	m.
99	104	109	136	144	134	175	194	168	148	228	21	55	91	12	25
105	106	136	136	156	188	148	137	126	126	267	19	28	99	11	50
109	110	109	152	199	156	142	134	122	120	217	18	52	72	10	38
109	112	114	113	114	114	116	120	121	121	124	23	0	100	9	7
109	110	114	114	122	114	116	116	109	110	129	18	45	99	11	52
118	120	121	132	132	124	122	121	122	118	138	18	0	103	8	45
116	116	118	118	117	117	118	117	118	118	126	1	15	106	12	5
106	126	154	154	152	192	190	176	160	148	217	19	30	91	13	20
180	138	148	141	160	152	142	144	148	150	261	2	12	91	9	40
167	148	141	150	152	154	144	136	133	138	211	3	52	101	7	42
122	138	148	142	148	154	167	164	148	141	183	20	45	101	10	35
118	150	152	136	138	134	136	138	140	136	186	16	3	106	9	20
120	122	122	122	133	126	132	130	133	136	146	1	25	106	9	48
117	118	132	138	141	142	142	146	146	141	150	22	20	103	9	43
116	121	117	120	122	128	130	129	126	122	150	1	42	106	12	0
—	—	—	—	—	—	—	—	—	—	129	0	15	114	8	0
117	118	114	114	114	118	118	118	122	130	132	23	50	97	9	53
113	114	114	114	117	118	118	122	121	122	133	0	32	93	7	30
108	110	114	122	122	126	129	121	121	116	138	20	37	103	13	50
113	114	114	114	118	117	116	116	117	114	121	18	55	109	3	25
110	114	114	116	125	122	122	118	118	116	130	19	2	103	7	30
108	109	114	113	110	114	116	117	121	122	126	23	18	91	12	40
106	109	114	116	117	117	116	122	124	126	144	2	47	103	13	30
106	113	114	129	124	125	132	129	121	124	140	21	20	87	11	5
112	114	114	118	118	120	125	122	116	117	160	1	50	102	11	50
112	121	121	122	121	118	118	118	116	120	130	15	45	106	8	57
106	110	114	114	116	141	213	191	170	160	261	21	15	99	11	20
112	116	114	113	125	148	175	158	134	130	190	21	9	95	13	5
120	118	122	121	124	130	142	175	164	158	186	22	0	103	11	55
117	116	120	122	122	122	122	122	138	140	178	3	20	105	4	20

V—July, 1912.

109	114	120	162	158	137	130	140	134	134	178	17	57	99	10	35
—	—	—	—	—	—	—	—	—	—	138	0	0	110	6	18
120	116	118	118	116	116	118	122	118	136	140	24	0	112	12	2
113	114	148	178	144	156	175	160	144	140	209	17	22	75	9	15
118	144	249	178	160	160	202	243	174	175	392	17	3	87	10	50
130	134	133	140	130	130	130	128	140	191	207	24	0	101	9	45
122	126	129	124	128	137	138	130	136	122	216	0	15	105	12	12
132	126	124	124	122	117	122	122	122	130	138	14	55	99	10	3
113	121	122	130	128	129	141	134	134	137	146	2	48	93	8	23
114	114	117	121	118	122	121	118	120	122	146	1	28	106	9	0
114	114	116	118	121	118	116	118	121	118	134	2	40	103	9	55
114	114	114	118	121	117	118	118	118	114	122	19	15	106	9	50
110	110	110	114	114	114	114	114	113	114	120	1	25	103	3	21
113	110	112	113	113	113	114	114	114	114	116	19	0	106	8	50
110	113	114	120	122	122	126	122	114	114	129	21	20	99	8	50
114	114	114	118	130	168	184	154	141	129	205	20	30	101	11	5
(115)	(117)	118	118	117	118	121	124	122	122	134	21	23	106	9	58
109	114	117	120	118	118	118	114	114	114	154	4	32	93	10	32
109	114	114	114	114	117	117	116	119	122	125	23	48	101	13	3
105	113	113	114	126	150	148	146	146	142	166	20	20	99	14	22
114	117	121	124	134	124	120	118	126	134	162	1	20	100	6	8
113	117	122	122	125	130	126	122	124	125	142	3	10	103	7	25
116	118	122	110	132	142	124	113	121	122	148	19	40	105	13	17
116	117	118	118	120	118	122	122	122	124	138	4	5	112	10	38
117	118	118	118	118	118	121	122	129	132	134	23	7	104	10	30
112	114	122	122	129	126	128	144	152	144	156	22	37	101	10	55
122	130	144	144	137	138	132	132	134	130	158	0	50	95	12	45
120	121	122	125	122	126	126	128	129	130	162	4	8	110	9	15
120	118	122	(122)	122	138	130	125	124	129	142	20	10	112	10	35
117	118	118	118	124	133	150	(149)	(148)	(147)	152	20	45	114	13	8
(110)	110	117	125	132	138	140	144	150	144	162	3	0	106	15	25

V—August, 1912.

Day.	68000γ (·68 C.G.S. Unit) +														
	0 h.	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	12 h.	13 h.	14 h.
	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
1	144	148	142	132	124	117	116	112	99	83	95	122	113	113	130
2	136	137	137	130	133	126	126	116	122	133	124	118	114	117	118
3	134	136	141	142	140	126	125	126	122	116	120	109	120	120	122
4	138	137	132	132	128	125	118	117	116	106	114	112	110	105	110
5	121	124	122	121	121	122	120	118	117	114	116	113	110	114	116
6	128	125	122	122	130	122	106	113	104	—	—	—	—	—	—
7	—	—	—	—	—	—	—	—	—	146	138	138	125	112	120
8	134	133	134	132	132	136	140	141	138	125	121	125	124	118	120
9	133	130	133	130	130	132	126	126	122	122	120	117	118	122	125
10	144	138	132	129	130	128	126	124	126	121	117	110	110	103	105
11	124	122	124	128	125	126	130	124	124	117	120	114	106	114	104
12	124	125	122	122	121	122	125	121	122	122	122	120	122	122	122
13	124	122	122	121	120	122	125	124	122	122	120	116	114	114	114
14	122	120	122	122	118	118	114	114	114	114	112	112	112	114	108
15	144	134	132	136	132	128	121	122	114	121	114	109	108	106	106
16	118	117	120	120	118	118	114	114	114	110	108	117	106	108	112
17	122	122	122	120	122	118	117	118	120	120	124	109	106	99	104
18	182	164	148	144	130	130	130	126	133	124	124	117	112	112	112
19	130	133	140	141	146	136	129	116	118	(111)	(104)	96	109	103	113
20	164	156	156	146	154	160	144	130	124	130	122	121	112	110	110
21	140	144	140	138	134	130	134	128	130	113	116	114	114	126	105
22	168	166	160	162	156	144	134	125	120	116	116	121	129	116	103
23	146	137	124	142	160	164	148	137	133	141	130	137	128	116	117
24	162	152	162	156	156	144	144	133	141	144	128	114	106	106	113
25	144	144	148	148	150	154	134	132	133	117	103	108	106	116	113
26	134	130	134	142	132	124	114	114	110	112	105	104	110	114	109
27	125	130	129	129	128	126	121	118	122	120	112	109	112	99	101
28	179	171	146	138	134	122	146	138	118	(131)	144	138	122	113	118
29	121	120	121	122	126	117	117	100	121	109	107	109	110	110	108
30	122	122	120	128	122	117	122	110	105	97	99	100	110	103	105
31	118	117	116	116	116	114	110	110	106	104	96	95	108	106	96

V—September, 1912.

Day.	0 h.	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	12 h.	13 h.	14 h.
1	120	116	120	118	117	114	113	109	106	97	103	89	93	97	99
2	116	118	121	121	121	114	114	114	117	125	113	103	104	105	113
3	120	117	114	114	114	114	114	114	112	101	96	100	103	99	104
4	114	114	114	117	114	113	114	114	114	114	(110)	106	101	104	95
5	150	137	130	134	130	121	114	112	112	106	104	110	97	105	112
6	162	152	133	128	125	122	129	121	124	136	122	112	103	99	110
7	144	132	122	121	117	116	121	114	120	121	108	106	116	109	106
8	126	126	136	118	128	121	116	117	120	116	112	104	101	106	106
9	136	136	124	128	121	116	113	106	106	110	100	95	101	106	114
10	138	136	124	125	114	117	118	114	117	112	114	114	117	106	109
11	132	130	133	138	130	132	130	128	125	126	120	101	91	91	104
12	128	120	121	118	121	116	117	117	118	109	113	114	109	96	93
13	148	154	138	125	126	128	122	125	121	120	130	125	99	100	101
14	124	125	120	120	117	118	126	132	118	133	81	104	126	104	105
15	136	126	125	130	125	122	121	125	120	112	116	96	105	97	105
16	122	121	122	120	121	118	114	114	112	104	101	97	103	104	103
17	133	132	136	126	122	117	114	(108)	(101)	95	95	96	99	105	103
18	132	144	171	160	146	144	152	152	118	99	95	136	132	116	112
19	160	179	152	144	122	124	125	128	129	138	118	120	120	109	105
20	124	122	126	129	134	148	162	141	148	146	124	118	106	108	97
21	138	140	144	148	144	138	120	120	110	121	117	117	106	110	110
22	148	156	160	156	148	144	140	128	132	136	113	96	113	121	117
23	134	133	138	150	144	148	122	93	133	112	65	79	83	95	101
24	125	118	121	120	113	113	109	114	113	124	129	110	99	88	95
25	207	175	152	144	133	137	152	158	162	117	89	83	79	85	96
26	129	126	126	125	124	122	113	118	126	125	125	136	148	126	112
27	128	129	128	125	126	121	117	117	109	120	121	109	108	101	112
28	130	129	126	124	124	118	120	108	112	110	97	96	93	95	104
29	124	124	122	126	124	118	116	117	(116)	(115)	114	96	101	93	92
30	122	121	121	120	125	124	122	118	130	134	120	117	93	103	105

V—August, 1912.

68000γ (·68 C.G.S. Unit) +										Maximum Reading and Time.			Minimum Reading and Time.		
15 h.	16 h.	17 h.	18 h.	19 h.	20 h.	21 h.	22 h.	23 h.	24 h.						
γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	h.	m.	γ	h.	m.
172	146	339	205	164	150	144	138	137	136	392	16	56	68	8	47
120	121	126	132	132	126	128	128	128	134	146	1	4	113	12	30
122	122	121	146	162	162	158	146	140	138	174	19	25	95	10	45
117	120	122	121	125	124	125	122	118	121	142	0	7	103	12	40
120	118	120	121	122	122	120	128	129	128	132	22	20	106	12	13
—	—	—	—	—	—	—	—	—	—	146	4	12	91	7	25
124	130	133	133	137	144	148	146	134	134	160	20	25	101	13	20
114	126	130	128	133	130	130	132	133	133	146	9	45	109	10	43
124	124	126	132	136	136	133	134	137	144	146	24	0	106	9	53
108	117	121	122	122	121	122	124	125	124	146	0	0	100	13	20
108	114	120	120	120	121	128	129	122	124	134	21	15	96	14	12
122	122	122	122	122	122	124	126	126	124	130	1	0	117	5	55
114	114	116	118	118	120	125	124	122	122	133	8	40	110	12	50
109	113	120	122	118	117	128	126	134	144	146	24	0	104	14	12
113	117	116	120	117	122	118	120	118	118	148	0	4	104	12	30
114	121	122	122	120	121	120	122	122	122	124	18	0	99	12	18
103	113	122	146	148	156	156	156	171	182	183	24	0	88	14	17
114	117	120	122	124	125	126	130	129	130	186	0	20	106	12	32
126	137	137	137	136	141	146	176	179	164	191	21	35	85	10	48
106	109	120	122	124	122	126	133	138	140	164	0	0	99	12	25
101	100	112	117	130	134	132	130	148	168	175	23	22	85	15	45
97	130	152	133	136	164	154	148	144	146	182	20	2	87	14	33
124	125	133	134	152	160	168	170	174	162	208	4	23	103	12	47
105	121	118	122	130	154	182	164	150	144	188	20	43	96	12	50
122	117	124	128	138	148	132	144	134	134	164	4	45	95	9	50
114	121	130	126	125	126	126	128	125	125	148	2	43	83	10	50
103	112	110	117	130	129	124	129	146	179	182	24	0	93	13	0
126	124	125	125	122	121	114	114	116	121	190	0	30	91	9	12
106	110	116	121	122	124	124	120	122	122	138	3	56	85	6	54
103	113	117	124	116	136	122	120	121	118	140	19	55	84	10	42
103	120	116	114	117	122	116	114	118	120	126	16	5	85	10	52

V—September, 1912.

100	109	110	116	122	120	116	117	118	116	128	18	39	85	10	55
114	113	114	114	117	118	128	122	120	120	132	21	0	88	10	22
112	114	113	114	114	114	114	118	116	114	129	8	56	91	10	5
100	99	101	113	114	117	122	124	138	150	156	23	50	75	11	15
110	116	114	117	117	124	130	134	148	162	170	23	40	93	12	17
105	108	110	137	134	137	137	158	144	144	170	0	0	91	12	35
109	110	109	110	126	133	134	133	134	126	146	0	0	99	12	5
109	114	120	118	114	130	142	138	137	136	150	20	25	99	11	33
103	110	109	117	118	121	129	136	136	138	140	24	0	79	11	0
114	106	101	112	114	114	114	120	125	132	142	0	5	96	12	50
106	110	114	129	126	136	140	133	133	128	146	20	47	77	11	50
92	99	106	118	152	146	150	158	148	148	166	21	27	83	14	30
100	106	110	114	122	122	122	122	118	124	156	0	40	91	11	43
124	118	109	121	122	122	133	141	140	136	162	8	32	71	9	38
112	114	114	114	118	120	120	121	122	122	138	0	0	83	11	30
100	108	110	114	121	124	130	136	136	133	138	23	0	95	11	15
116	112	113	120	122	118	120	122	121	132	141	2	3	85	10	35
114	120	128	132	137	164	148	148	158	160	182	2	18	63	9	43
113	116	129	128	126	126	128	130	124	124	191	0	40	99	10	5
95	100	113	121	125	138	141	137	136	138	171	8	35	91	15	35
122	125	125	128	122	118	124	130	134	148	164	3	25	101	12	15
108	106	109	106	118	122	130	136	136	134	164	0	25	83	11	15
101	95	110	112	122	126	130	122	126	125	162	2	35	53	10	0
101	152	150	160	183	207	243	259	263	207	293	22	17	83	13	20
108	124	121	117	129	132	130	132	130	129	209	0	2	71	12	10
104	122	116	118	124	125	129	130	130	128	152	11	52	85	10	12
112	113	114	117	118	122	122	122	128	130	144	9	55	88	8	32
103	110	114	116	118	120	124	122	124	124	130	0	0	85	10	3
96	106	109	114	120	122	122	122	122	122	129	0	35	77	11	13
106	109	113	120	122	122	126	126	129	134	150	8	57	91	11	58

V—October, 1912.

Day.	68000γ (·68 C.G.S. Unit) +														
	0 h.	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	12 h.	13 h.	14 h.
	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
1	134	133	130	137	132	125	118	116	110	109	103	93	85	92	109
2	237	239	216	205	—	—	—	—	—	—	136	126	117	109	108
3	126	121	129	126	122	120	117	121	130	142	136	113	101	101	100
4	124	124	129	122	117	114	120	110	116	117	118	104	88	105	—
5	—	—	—	—	—	—	—	—	—	125	122	120	105	104	99
6	132	129	128	125	122	118	114	117	112	(112)	(111)	110	93	80	87
7	122	129	130	130	137	125	118	112	106	109	120	106	91	83	99
8	122	121	137	128	116	114	114	116	116	129	128	129	133	100	99
9	136	132	137	144	134	124	116	125	122	126	121	117	109	95	110
10	125	129	124	120	122	118	121	114	105	—	—	—	—	—	—
11	—	—	—	—	—	154	148	128	117	137	130	—	—	57	59
12	136	112	146	125	114	120	84	93	93	89	101	104	67	49	53
13	148	150	140	137	125	117	110	120	128	124	114	104	81	84	76
14	158	144	142	128	129	114	(114)	(114)	(114)	114	95	83	91	84	91
15	200	198	211	172	144	138	134	144	132	12[illegible]	136	118	110	106	97
16	126	136	140	144	125	114	101	164	128	144	117	121	108	100	103
17	140	134	130	129	134	132	104	87	126	134	132	117	101	99	83
18	126	122	122	113	109	110	117	130	84	83	85	103	97	96	97
19	117	114	112	110	113	108	110	109	103	96	91	83	72	75	85
20	112	121	120	133	122	106	100	95	95	101	104	84	67	63	85
21	103	104	104	103	99	95	72	47	65	69	53	110	33	77	80
22	103	109	121	116	103	89	84	71	75	69	79	80	77	79	92
23	101	100	106	97	95	81	80	79	93	39	10	17	53	43	49
24	103	106	108	101	93	87	95	100	84	79	77	69	68	73	76
25	105	101	100	97	96	97	68	75	87	99	80	71	87	99	93
26	113	118	112	105	100	92	79	89	105	96	67	59	67	75	77
27	103	106	—	—	—	—	—	—	—	69	65	69	65	55	61
28	125	130	126	128	132	134	122	106	85	85	80	80	75	68	68
29	122	125	114	116	110	113	103	73	59	101	88	95	91	92	89
30	101	103	101	100	109	101	87	73	83	79	73	76	63	51	47
31	96	112	120	106	104	117	100	96	95	65	79	83	88	77	51

V—November, 1912.

1	104	99	109	118	110	121	108	88	75	76	69	73	79	81	63
2	158	134	133	136	133	121	116	101	95	91	93	95	87	85	84
3	132	113	109	96	88	92	92	96	89	91	85	34	49	45	55
4	106	93	99	95	92	81	72	69	53	76	95	77	84	72	57
5	97	110	104	108	91	88	87	96	76	83	49	45	51	45	49
6	105	101	113	117	132	113	125	148	110	92	—	—	—	—	—
7	—	—	—	—	—	—	—	—	—	—	142	130	96	71	81
8	154	183	171	121	116	97	80	95	101	122	105	89	80	84	71
9	120	125	136	48	171	154	126	117	106	—	—	—	—	—	—
10	—	—	—	—	—	—	—	—	—	39	31	19	6	4	21
11	164	172	263	232	191	148	109	150	129	76	116	59	65	75	77
12	180	236	219	176	150	138	152	116	120	100	(93)	(86)	79	97	88
13	106	106	106	105	110	89	85	91	106	80	79	77	75	69	65
14	103	106	105	100	97	108	104	89	80	—	—	—	—	—	—
15	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
16	109	100	96	88	63	49	22	80	77	112	172	47	77	53	73
17	105	100	114	96	55	51	65	91	61	75	33	27	—	—	—
18	—	—	—	—	—	—	—	—	—	79	113	57	2	47	57
19	99	95	92	110	109	73	71	51	42	35	63	77	79	97	—

V—October, 1912.

68000γ (·68 C.G.S. Unit) +										Maximum Reading and Time.			Minimum Reading and Time.		
15 h.	16 h.	17 h.	18 h.	19 h.	20 h.	21 h.	22 h.	23 h.	24 h.						
γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	h.	m.	γ	h.	m.
101	85	—	162	164	183	—	—	120	237	241	23	35	69	10	10
114	121	116	121	117	122	124	124	126	126	249	1	10	101	14	15
100	106	109	113	125	124	124	126	124	124	148	9	2	87	11	35
—	—	—	—	—	—	—	—	—	—	140	8	40	55	11	37
95	99	100	110	114	140	134	130	130	132	146	19	53	88	15	10
95	103	104	106	110	117	114	122	120	122	134	0	15	77	12	33
99	100	104	110	114	114	116	122	122	122	140	3	57	78	12	42
99	101	106	106	113	120	129	134	140	136	156	8	55	93	14	15
114	105	103	114	116	118	126	130	130	125	162	9	4	83	12	45
—	—	—	—	—	—	—	—	—	—	137	1	28	91	8	18
65	88	85	89	85	108	103	106	121	136	164	7	55	—	—	
67	79	80	103	110	116	132	138	142	148	156	1	58	43	12	40
85	80	83	87	104	110	117	126	137	158	170	23	50	61	12	2
81	84	92	85	100	144	174	164	203	200	214	23	0	65	10	45
87	109	106	118	122	117	122	129	126	126	233	1	47	71	14	33
101	99	89	104	114	120	132	133	152	140	186	7	5	87	17	0
69	79	92	103	113	121	129	137	138	126	166	8	17	63	15	2
95	92	96	99	108	110	118	129	126	117	146	7	2	61	10	15
87	91	93	100	105	108	110	120	110	112	120	0	28	68	12	20
87	85	92	97	101	105	104	105	106	103	138	2	42	55	12	40
79	109	112	112	99	96	100	100	103	103	126	11	3	4	12	2
88	91	93	93	97	99	97	101	100	101	129	1	30	42	10	42
59	75	89	88	96	99	113	100	99	103	120	20	57	−20	9	32
79	76	85	85	88	95	99	104	101	105	112	22	0	55	12	8
92	92	92	99	99	(99)	99	110	116	113	121	23	23	35	10	50
77	81	85	91	91	100	109	99	100	103	128	1	8	45	10	52
57	68	75	87	93	101	106	110	114	125	127	24	0	51	12	55
65	81	84	92	95	108	110	118	126	122	142	4	52	42	13	40
89	87	79	87	91	88	100	104	103	101	134	4	47	43	7	40
61	67	67	91	113	103	99	100	103	96	122	19	20	39	14	0
49	59	77	99	96	100	104	99	99	104	129	4	48	35	14	38

V—November, 1912.

72	79	87	92	91	121	109	129	146	158	162	23	42	51	10	15
79	81	91	87	95	104	110	129	130	132	162	0	5	71	15	39
65	72	72	85	89	97	104	91	96	106	134	0	0	22	10	43
63	67	72	81	84	93	101	92	91	97	113	0	5	42	7	42
49	51	68	81	83	84	97	103	100	105	118	3	27	27	11	15
—	—	—	—	—	—	—	—	—	—	187	6	28	69	8	37
89	100	100	106	109	110	120	125	150	154	162	23	57	55	13	20
71	76	89	93	93	100	122	124	120	120	198	1	17	63	14	12
—	—	—	—	—	—	—	—	—	—	182	4	2	95	8	5
35	49	61	77	91	137	152	162	179	164	191	23	18	−32	9	37
73	95	105	106	118	148	164	166	175	180	298	1	50	23	9	5
89	95	96	93	96	96	104	105	113	106	259	1	25	69	11	55
73	80	89	95	103	104	109	109	99	103	133	8	52	25	10	35
—	—	—	—	—	—	—	—	—	—	114	5	25	67	8	25
—	—	83	95	109	104	99	106	106	109	117	23	55	85	17	8
87	68	87	103	97	99	95	99	114	105	251	9	7	−57	10	47
—	—	—	—	—	—	—	—	—	—	146	2	18	6	10	10
65	80	71	84	91	92	89	97	97	99	154	9	26	−20	12	10
—	—	—	—	—	—	—	—	—	—	142	7	35	−34	6	35

—		May 29, 1911.			June 2, 1911.			June 26, 1911.			June 30, 1911.			July 24, 1911.			July 28, 1911.		
		H	D	V	H	D	V	H	D	V	H	D	V	H	D	V	H	D	V
h.	m.	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
8	0	6	1	3	37	0	8	4	6	0	4	3	1	2	4	2	7	5	46
	5	5	1	4	24	1	4	2	5	0	4	3	0	4	4	2	11	3	45
	10	6	0	4	19	5	3	4	4	1	4	2	0	4	4	1	10	0	45
	15	2	1	3	18	4	1	3	4	0	5	1	1	6	2	1	8	1	44
	20	1	5	3	10	9	0	4	3	0	5	1	1	7	2	1	6	3	43
	25	1	5	3	7	12	1	3	3	0	5	2	0	8	2	1	4	5	42
	30	0	6	3	8	13	3	1	1	0	5	1	1	8	0	1	4	15	40
	35	0	6	3	5	12	6	2	5	0	4	1	1	8	0	1	2	14	37
	40	2	5	3	0	14	8	1	6	0	4	1	0	8	0	1	13	17	35
	45	6	0	4	0	22	9	1	6	0	4	0	0	7	1	1	15	20	34
	50	6	1	4	11	22	10	1	6	0	4	0	0	5	3	1	21	14	34
	55	6	2	3	7	14	12	1	4	0	4	0	0	2	3	0	20	14	33
9	0	5	4	3	4	7	13	1	5	0	2	0	0	3	4	0	28	16	32
	5	6	2	2	1	10	12	1	5	0	1	1	0	5	3	1	27	15	32
	10	4	4	1	0	8	12	0	5	0	1	1	0	5	0	1	29	18	30
	15	5	3	1	5	9	12	1	4	0	0	0	0	5	2	1	29	18	30
	20	5	3	1	6	11	11	1	3	1	1	0	0	4	4	1	22	19	28
	25	9	1	0	7	10	10	1	2	0	2	0	0	0	7	0	25	19	27
	30	7	0	0	7	14	8	2	1	1	2	1	0	1	7	0	23	16	24
	35	7	0	0	10	9	10	2	0	1	2	1	0	4	6	0	23	17	18
	40	9	1	0	7	8	8	2	1	1	3	3	0	3	6	0	16	19	10
	45	9	1	0	11	8	7	2	3	0	2	3	0	4	5	0	2	31	3
	50	10	0	0	10	6	7	2	4	0	2	5	1	2	6	0	4	46	0
	55	10	1	0	4	13	4	1	5	0	3	4	1	3	8	0	0	51	3
10	0	9	1	1	6	20	4	3	6	1	4	4	1	0	6	0	37	62	21

—		May 22, 1911.			May 26, 1911.			June 19, 1911.			June 23, 1911.			July 17, 1911.			July 21, 1911.		
		H	D	V	H	D	V	H	D	V	H	D	V	H	D	V	H	D	V
h.	m.	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
17	0	10	3	9	1	18	5	10	2	0	20	16	2	42	54	3	20	22	4
	5	10	6	10	0	18	4	11	1	2	22	17	1	39	46	5	25	25	3
	10	9	6	9	0	23	3	10	1	2	22	15	1	42	42	5	27	23	3
	15	6	7	9	4	25	1	9	0	2	21	13	2	45	39	6	28	22	4
	20	6	9	8	3	23	0	9	3	1	21	10	3	51	35	3	25	23	4
	25	4	6	7	4	21	0	9	0	0	19	10	3	41	42	2	24	23	2
	30	5	0	8	4	25	0	6	0	1	20	9	3	39	40	2	22	28	3
	35	4	2	9	7	22	1	6	2	1	15	10	3	34	45	0	21	23	4
	40	3	6	7	12	18	3	6	3	1	19	8	3	34	37	4	20	28	4
	45	5	8	5	11	14	4	5	0	1	16	3	3	28	47	1	21	22	4
	50	5	7	7	11	14	4	6	1	1	15	1	3	25	55	1	18	21	5
	55	9	1	8	11	10	4	5	0	1	11	4	2	27	50	2	18	16	5
18	0	3	5	6	8	10	4	4	3	2	8	10	0	27	42	4	17	13	7
	5	1	8	5	9	11	3	3	1	1	6	9	1	17	47	4	16	15	6
	10	1	8	4	14	10	2	2	1	2	5	10	2	6	52	3	10	18	5
	15	0	8	2	21	6	4	1	4	1	2	11	1	0	70	0	8	23	2
	20	1	6	4	22	3	5	3	5	1	1	11	1	12	62	1	8	18	3
	25	1	0	4	15	3	4	2	4	2	1	11	1	5	55	6	10	13	4
	30	1	0	4	6	0	4	4	4	3	2	8	2	16	42	9	5	11	4
	35	0	5	1	15	8	1	2	4	3	2	16	0	25	37	11	6	7	4
	40	1	6	1	15	10	4	4	4	2	4	7	3	45	23	14	4	5	3
	45	3	6	0	17	7	4	2	5	2	5	13	0	58	8	17	4	7	2
	50	4	5	1	16	6	4	1	5	2	2	9	1	55	1	17	2	8	0
	55	1	3	0	20	6	4	0	5	3	1	0	5	51	0	14	2	5	1
19	0	1	1	0	22	7	3	0	6	3	0	4	4	38	8	11	0	0	1

Term Hour Data. Sitka—*continued.*

—		Nov. 20, 1911.			Nov. 24, 1911.			Dec. 18, 1911.			Dec. 22, 1911.			Jan. 22, 1912.			Jan. 26, 1912.		
		H	D	V	H	D	V	H	D	V	H	D	V	H	D	V	H	D	V
h.	m.	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
18	0	11	11	0	7	9	0	—	—	—	2	5	0	11	16	0	—	5	1
	5	11	11	1	5	6	2	—	—	—	1	5	0	12	11	2	—	4	0
	10	10	7	1	5	7	2	0	15	0	2	6	0	8	12	2	—	5	1
	15	10	7	1	4	6	2	1	14	0	3	6	0	8	12	2	—	4	1
	20	8	9	1	6	9	1	0	15	0	3	6	0	7	16	2	3	4	1
	25	8	8	0	8	8	1	0	12	0	4	3	1	8	12	2	2	5	1
	30	7	8	1	5	6	1	2	11	0	1	2	2	6	15	2	3	4	1
	35	7	7	2	6	8	0	2	10	0	1	4	2	8	11	3	3	3	0
	40	7	10	1	5	9	1	2	8	0	2	1	2	6	9	4	3	3	1
	45	6	4	2	5	6	2	1	8	1	2	1	2	6	8	4	4	3	1
	50	5	3	2	5	6	2	0	9	0	2	3	2	4	8	4	4	2	1
	55	4	4	2	4	5	1	2	7	1	2	3	3	8	8	4	3	3	0
19	0	4	2	3	4	1	2	1	6	2	2	4	3	4	3	6	2	4	0
	5	1	5	3	1	4	2	0	5	1	0	4	3	0	11	4	2	2	1
	10	1	5	3	0	2	2	0	5	1	2	1	3	2	9	4	1	2	1
	15	1	4	3	0	4	2	1	5	1	2	2	3	7	4	5	0	4	0
	20	1	3	4	0	1	2	2	4	1	2	3	3	6	6	5	1	4	0
	25	2	3	4	0	1	2	2	4	2	2	1	3	6	8	4	1	2	0
	30	1	3	4	1	1	3	2	4	2	1	1	3	5	2	6	1	1	1
	35	2	2	5	3	1	3	3	3	1	3	1	3	8	1	6	0	1	1
	40	0	0	6	2	2	3	3	1	1	2	0	3	6	6	4	0	2	1
	45	1	3	6	4	1	3	3	1	1	0	1	2	7	2	8	0	2	1
	50	2	0	7	3	1	3	1	0	1	2	0	2	6	3	5	3	2	1
	55	2	0	7	5	2	3	3	0	1	0	0	2	5	4	4	2	0	1
20	0	1	1	6	4	0	3	1	0	1	1	0	2	5	0	4	0	2	1

Term Hour Data. Eskdalemuir.

—		May 29, 1911.			June 2, 1911.			June 26, 1911.			June 30, 1911.			July 24, 1911.			July 28, 1911.		
		N	E	V	N	E	V	N	E	V	N	E	V	N	E	V	N	E	V
h.	m.	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
8	0	—	—	—	—	—	—	11	5	15	10	6	12	6	14	8	41	24	17
	5	18	12	14	—	—	—	11	6	15	10	3	11	6	12	8	39	29	17
	10	17	11	13	—	—	—	10	7	15	11	3	10	9	12	8	38	28	17
	15	16	10	13	—	—	—	10	4	15	11	4	10	10	15	8	35	26	15
	20	15	10	12	—	—	—	10	8	13	11	4	10	10	13	7	34	26	14
	25	16	10	12	—	—	—	10	6	12	10	4	9	11	13	7	37	26	13
	30	14	10	12	—	—	—	10	5	11	10	2	9	11	12	7	38	19	11
	35	13	10	12	—	—	—	10	6	9	9	3	9	12	11	6	27	22	12
	40	10	10	12	—	—	—	9	6	8	9	3	9	10	11	6	19	17	13
	45	9	10	11	—	—	—	10	3	7	8	3	8	8	9	6	22	9	12
	50	9	9	9	—	—	—	10	4	6	7	3	8	10	9	5	27	16	10
	55	9	8	8	—	—	—	8	7	6	6	3	8	8	6	5	30	9	9
9	0	4	9	8	—	—	—	6	8	6	5	2	7	6	8	5	24	16	7
	5	6	10	8	—	—	—	4	7	6	5	3	8	9	10	4	29	9	5
	10	6	10	7	—	—	—	4	6	5	5	1	8	8	8	3	27	6	4
	15	6	10	7	—	—	—	4	8	5	4	2	7	5	10	2	26	11	3
	20	5	9	6	—	—	—	3	8	5	3	2	6	6	5	2	24	0	4
	25	5	6	5	—	—	—	1	7	5	3	1	5	3	3	2	17	5	3
	30	4	7	4	—	—	—	1	7	3	3	0	4	0	6	1	17	7	2
	35	3	5	3	—	—	—	2	5	2	2	0	4	2	3	2	17	9	1
	40	3	5	2	—	—	—	2	5	1	0	0	3	2	4	2	15	9	0
	45	2	3	1	—	—	—	2	3	0	1	0	2	3	3	2	17	10	0
	50	1	3	0	—	—	—	2	3	0	0	0	1	3	3	1	16	3	0
	55	1	1	0	—	—	—	0	2	0	0	0	0	3	2	0	4	0	1
10	0	0	0	0	—	—	—	2	0	0	1	0	0	6	0	0	0	2	0

—		May 22, 1911.			May 26, 1911.			June 19, 1911.			June 23, 1911.			July 17, 1911.			July 21, 1911.		
		N	E	V	N	E	V	N	E	V	N	E	V	N	E	V	N	E	V
h.	m.	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
17	0	3	2	0	3	8	3	—	—	—	9	10	3	14	10	0	11	3	0
	5	1	4	2	3	11	4	—	—	—	11	6	2	15	13	2	13	0	1
	10	0	4	0	1	17	5	—	—	—	7	10	3	9	15	3	9	1	1
	15	3	3	2	0	23	6	—	—	—	10	7	2	5	16	3	4	5	1
	20	8	2	2	8	25	7	—	—	—	7	10	1	0	21	4	7	4	1
	25	7	3	2	22	21	7	—	—	—	10	6	1	20	11	2	6	6	1
	30	3	6	3	26	17	7	—	—	—	10	7	1	23	10	2	6	5	1
	35	6	3	3	27	11	7	—	—	—	10	7	1	36	4	2	2	5	1
	40	8	2	3	22	9	6	—	—	—	0	11	1	26	11	3	0	6	1
	45	11	1	3	16	7	7	—	—	—	1	10	1	38	3	3	5	6	0
	50	10	0	3	17	8	7	—	—	—	4	11	1	42	0	2	1	7	0
	55	9	3	4	22	7	6	—	—	—	10	10	1	35	5	2	2	9	0
18	0	10	2	5	22	7	5	—	—	—	17	7	1	27	9	4	6	9	0
	5	10	2	6	22	3	5	—	—	—	18	7	1	36	7	5	2	11	0
	10	8	2	6	18	7	4	—	—	—	20	5	1	45	1	4	13	6	0
	15	12	2	5	13	7	4	—	—	—	23	5	2	52	0	5	16	5	0
	20	10	2	5	14	8	3	—	—	—	23	6	0	38	5	5	14	5	0
	25	12	2	6	18	5	3	—	—	—	24	5	1	47	9	5	10	4	0
	30	13	3	7	22	2	1	—	—	—	25	5	1	49	7	5	11	5	1
	35	10	3	7	27	0	1	—	—	—	34	0	0	42	13	7	9	8	0
	40	10	4	7	24	2	1	—	—	—	31	5	1	19	24	10	10	8	0
	45	9	3	7	24	3	1	—	—	—	32	4	1	7	35	13	12	6	1
	50	6	3	7	23	2	1	—	—	—	23	4	1	10	33	13	17	6	2
	55	9	5	6	23	1	0	—	—	—	18	11	2	16	22	12	10	8	2
19	0	10	2	6	22	1	0	—	—	—	24	7	1	17	20	11	6	8	2

—		Nov. 20, 1911.			Nov. 24, 1911.			Dec. 18, 1911.			Dec. 22, 1911.			Jan. 22, 1912.			Jan. 26, 1912.		
		N	E	V	N	E	V	N	E	V	N	E	V	N	E	V	N	E	V
h.	m.	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
18	0	2	1	5	2	0	2	6	1	0	5	1	2	2	0	4	1	3	3
	5	3	0	3	2	0	2	4	1	1	6	1	3	0	0	4	0	4	3
	10	3	1	3	3	1	3	4	0	1	6	1	2	3	1	4	1	5	3
	15	1	1	3	3	0	2	3	1	0	5	0	2	3	0	4	2	5	3
	20	3	2	3	3	0	2	3	3	0	5	1	2	4	2	3	1	5	3
	25	3	2	3	4	0	2	2	4	0	4	2	2	6	1	3	1	3	2
	30	2	2	3	4	0	1	3	5	0	4	2	2	6	0	3	3	3	2
	35	1	3	3	4	0	1	3	5	0	5	2	2	6	1	3	6	2	2
	40	0	3	3	4	0	1	3	5	0	5	2	1	6	1	3	4	2	2
	45	0	3	2	3	0	1	4	5	0	5	3	1	7	1	3	4	2	2
	50	2	3	3	3	0	0	3	7	0	7	3	0	8	3	3	5	0	1
	55	2	3	3	3	0	0	2	7	0	8	2	0	9	3	3	4	0	0
19	0	2	3	3	3	0	0	0	7	0	8	2	0	9	3	3	5	0	0
	5	2	4	2	3	0	0	0	7	0	7	2	0	10	1	2	3	0	0
	10	2	4	2	3	0	0	1	7	0	3	2	0	10	2	2	4	0	0
	15	2	5	2	3	0	0	2	7	0	5	3	0	8	3	0	4	0	0
	20	2	5	1	1	1	0	2	7	0	5	2	0	4	3	0	4	2	0
	25	2	5	1	0	2	0	3	7	0	5	3	0	9	3	2	3	3	0
	30	0	5	1	0	2	1	4	7	0	5	2	0	4	5	2	4	4	0
	35	2	6	0	1	2	1	4	7	0	3	3	0	3	4	2	6	4	0
	40	2	5	1	2	2	1	3	7	0	3	3	0	6	3	2	4	3	0
	45	1	5	1	3	2	0	3	7	0	2	3	0	2	3	2	3	2	0
	50	0	6	1	1	2	0	2	7	0	3	5	0	0	3	2	4	2	0
	55	3	5	1	0	2	0	2	7	0	0	5	0	3	3	3	3	2	0
20	0	3	5	1	1	2	0	2	7	0	0	5	0	2	3	3	4	2	0

—		May 29, 1911.			June 2, 1911.			June 26, 1911.			June 30, 1911.			July 24, 1911.			July 28, 1911.		
		H	D	V	H	D	V	H	D	V	H	D	V	H	D	V	H	D	V
h.	m.	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
8	0	8	46	8	5	38	3	1	53	9	6	38	8	4	45	9	24	62	12
	5	8	48	8	4	38	4	0	52	10	7	37	10	1	45	9	21	67	14
	10	10	46	10	3	40	5	1	52	10	7	36	11	5	42	9	22	65	14
	15	9	45	11	5	40	5	1	52	10	8	36	11	5	46	9	21	63	12
	20	8	44	11	5	40	5	2	51	8	7	35	11	6	45	9	23	64	12
	25	9	43	11	4	39	5	3	50	8	7	35	9	7	44	8	19	64	11
	30	8	40	11	4	39	5	3	48	6	6	33	9	6	42	8	16	57	11
	35	10	39	10	4	38	5	4	47	5	6	32	9	8	41	7	13	57	10
	40	6	38	10	5	34	5	4	44	4	6	31	8	7	38	7	9	50	10
	45	4	36	9	4	32	4	5	41	3	6	30	8	5	35	6	12	41	9
	50	5	32	8	2	29	3	6	39	2	6	27	7	7	32	5	14	47	7
	55	5	28	7	3	27	3	6	34	1	5	26	7	5	28	5	19	37	5
9	0	3	27	6	3	25	3	6	30	0	4	21	6	5	25	4	13	41	3
	5	2	26	6	3	23	2	7	27	0	3	18	5	6	24	4	16	34	3
	10	3	22	5	1	19	1	6	24	0	5	15	5	6	22	4	16	29	2
	15	3	21	5	4	17	1	7	22	0	4	12	4	4	18	3	17	23	2
	20	2	16	4	2	15	1	5	17	0	3	9	4	5	14	2	20	16	2
	25	2	14	4	2	11	1	6	14	0	3	7	3	3	9	2	13	17	2
	30	2	11	3	5	10	1	6	11	0	2	4	3	1	9	2	13	14	2
	35	2	10	3	3	8	1	6	7	1	2	3	3	3	7	1	12	20	1
	40	1	8	2	2	6	1	6	6	0	1	2	2	2	5	1	11	18	1
	45	1	5	2	1	6	1	6	4	1	1	1	2	1	5	1	11	13	0
	50	0	3	1	0	5	0	5	2	3	0	1	1	0	2	0	12	6	1
	55	1	2	1	2	0	1	6	0	4	0	0	1	1	1	0	7	0	2
10	0	0	0	0	1	0	1	6	0	4	0	0	0	4	0	0	0	0	2

—		May 22, 1911.			May 26, 1911.			June 19, 1911.			June 23, 1911.			July 17, 1911.			July 21, 1911.		
		H	D	V	H	D	V	H	D	V	H	D	V	H	D	V	H	D	V
h.	m.	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
17	0	1	17	3	6	34	3	6	29	1	—	—	—	11	18	1	12	25	4
	5	1	19	4	5	37	4	8	29	0	—	—	—	11	22	2	13	25	5
	10	0	21	4	0	44	6	7	30	0	—	—	—	12	23	2	10	22	5
	15	2	21	4	2	49	8	10	30	1	—	—	—	4	23	2	8	26	5
	20	7	21	4	13	49	8	9	30	1	—	—	—	0	24	2	9	26	5
	25	6	25	4	22	44	8	8	30	1	—	—	—	12	23	2	8	25	5
	30	2	26	4	25	43	7	8	31	1	—	—	—	15	23	1	3	25	5
	35	4	22	4	25	39	7	10	30	2	—	—	—	29	17	1	4	24	5
	40	7	21	4	20	35	7	10	29	3	—	—	—	19	19	1	0	22	3
	45	10	21	4	20	35	6	8	26	3	—	—	—	28	14	1	6	20	3
	50	8	21	4	23	33	5	10	24	3	—	—	—	38	13	0	5	20	2
	55	3	20	4	25	31	4	7	23	4	—	—	—	28	10	0	2	19	2
18	0	9	22	3	25	28	4	7	23	3	—	—	—	24	11	0	4	14	2
	5	8	17	3	25	25	4	6	17	4	—	—	—	24	7	1	5	14	0
	10	10	14	3	22	23	4	4	17	5	—	—	—	35	6	0	11	11	1
	15	12	11	3	19	22	3	7	11	5	—	—	—	44	1	0	12	9	2
	20	11	9	3	19	17	3	6	10	5	—	—	—	41	0	1	15	7	1
	25	12	8	3	23	15	2	5	7	5	—	—	—	36	0	0	11	6	1
	30	6	7	3	32	11	2	2	6	5	—	—	—	40	2	1	12	3	2
	35	6	3	3	30	9	2	1	6	5	—	—	—	36	0	2	11	3	2
	40	2	2	3	29	6	2	0	3	5	—	—	—	22	6	3	10	3	2
	45	8	0	3	28	5	1	2	2	4	—	—	—	6	7	4	8	3	2
	50	6	1	3	28	3	1	2	1	4	—	—	—	0	7	4	12	1	2
	55	7	1	2	28	2	1	2	0	4	—	—	—	3	6	4	11	0	2
19	0	6	1	0	25	0	0	0	1	4	—	—	—	3	6	4	5	1	2

Term Hour Data. Stonyhurst—*continued.*

—		Nov. 20, 1911.			Nov. 24, 1911.			Dec. 18, 1911.			Dec. 22, 1911.			Jan. 22, 1912.			Jan. 26, 1912.		
		H	D	V	H	D	V	H	D	V	H	D	V	H	D	V	H	D	V
h.	m.	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
18	0	1	21	0	3	25	2	6	26	13	5	26	0	0	20	0	2	24	2
	5	2	20	1	2	25	3	4	25	12	2	27	0	1	21	3	2	25	2
	10	1	19	2	3	25	3	5	25	12	3	27	1	2	22	4	0	26	2
	15	1	21	1	3	25	4	4	24	11	4	27	1	2	23	5	0	25	2
	20	1	20	2	4	25	4	4	25	11	2	27	2	4	23	5	1	24	2
	25	2	21	2	5	25	4	3	26	10	1	27	2	4	23	6	2	22	2
	30	1	21	2	5	24	3	3	26	10	2	27	3	4	23	6	2	23	2
	35	1	22	1	5	24	3	4	26	9	2	27	3	5	23	6	—	—	—
	40	0	23	1	5	22	3	4	25	9	2	26	4	5	22	7	—	—	—
	45	0	23	1	4	22	2	4	23	9	3	25	4	5	22	8	—	—	—
	50	0	21	1	3	21	2	4	22	9	4	23	4	5	21	8	—	—	—
	55	1	20	1	3	21	2	3	19	8	4	21	5	5	20	8	—	—	—
19	0	1	17	1	3	19	1	1	17	8	6	19	5	6	18	9	4	23	0
	5	1	14	1	3	15	0	0	15	8	5	15	5	7	17	10	3	20	1
	10	1	11	1	2	13	1	0	13	7	3	12	5	7	16	10	3	19	3
	15	1	10	1	2	9	1	0	11	7	3	11	6	5	14	10	3	17	3
	20	1	9	1	3	7	1	0	10	6	4	10	6	5	10	11	3	15	3
	25	1	9	2	2	5	1	0	9	5	3	9	6	6	10	11	3	14	3
	30	0	7	2	1	4	1	0	5	5	3	6	7	2	9	11	3	13	3
	35	1	3	2	1	4	1	2	3	4	2	5	7	2	7	11	3	11	3
	40	0	1	2	1	4	1	2	0	4	2	3	7	4	5	12	3	9	3
	45	1	0	3	1	3	1	1	1	3	1	2	7	1	3	12	3	6	3
	50	0	0	3	1	3	1	1	2	3	1	0	8	1	0	14	3	3	4
	55	0	1	3	0	2	1	1	1	2	1	0	8	2	1	14	3	1	5
20	0	0	1	3	1	0	1	1	2	0	0	0	9	0	0	14	3	0	7

Term Hour Data. Seddin.

—		May 29, 1911.			June 2, 1911.			June 26, 1911.			June 30, 1911.			July 24, 1911.			July 28, 1911.		
		N	E	V	N	E	V	N	E	V	N	E	V	N	E	V	N	E	V
h.	m.	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
8	0	0	30	11	0	12	4	9	24	24	6	18	11	—	—	—	—	40	—
	5	0	30	10	2	12	4	10	24	24	6	17	11	7	16	9	—	43	—
	10	1	29	10	3	13	4	11	23	24	5	15	11	4	15	8	—	41	—
	15	4	28	10	1	12	3	11	21	24	4	15	10	2	15	7	—	38	—
	20	5	27	10	0	11	2	11	20	24	4	14	10	1	13	6	—	37	—
	25	4	25	9	2	10	2	11	18	24	4	13	10	1	12	5	—	36	—
	30	6	24	8	2	10	3	12	16	24	4	13	10	0	10	5	—	32	—
	35	4	22	8	3	10	2	13	15	23	2	11	9	0	10	4	—	34	—
	40	6	22	7	4	8	2	13	14	23	2	11	9	2	9	3	—	29	—
	45	6	22	6	4	8	2	13	12	22	2	10	9	4	9	3	—	26	—
	50	8	20	7	6	8	2	12	10	20	1	9	8	2	7	3	—	26	—
	55	8	18	6	5	7	2	13	10	19	1	8	8	6	7	3	—	20	—
9	0	10	19	6	5	6	2	13	10	17	0	7	8	4	9	2	—	18	—
	5	9	18	6	6	6	2	13	8	15	0	6	7	1	8	1	—	15	—
	10	9	16	5	6	6	1	11	7	12	1	5	5	2	7	1	—	12	—
	15	9	15	4	7	5	1	6	7	10	2	4	5	4	7	0	—	10	—
	20	9	13	4	7	5	1	9	7	9	2	4	5	5	6	1	—	7	—
	25	9	11	4	7	6	0	9	7	7	4	4	5	9	5	1	—	10	—
	30	9	9	4	5	4	0	7	7	5	4	3	5	8	6	1	—	7	—
	35	9	8	4	7	3	0	5	6	4	5	2	4	6	5	1	—	5	—
	40	10	7	3	7	3	1	5	5	3	4	3	3	6	5	1	—	3	—
	45	10	5	2	8	3	0	4	4	2	7	2	2	4	4	0	—	1	—
	50	9	3	1	7	1	0	2	2	1	6	2	1	5	2	1	—	0	—
	55	9	1	1	8	0	0	2	2	0	7	1	1	4	2	1	—	1	—
10	0	10	0	0	10	1	0	0	0	0	6	0	0	1	0	1	—	3	—

—		May 22, 1911.			May 26, 1911.			June 19, 1911.			June 23, 1911.			July 17, 1911.			July 21, 1911.		
		N	E	V	N	E	V	N	E	V	N	E	V	N	E	V	N	E	V
h.	m.	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
17	0	4	1	0	2	12	8	8	1	0	13	1	3	31	7	7	1	0	2
	5	2	2	1	0	18	6	8	0	1	13	1	2	30	7	6	3	0	2
	10	2	2	1	4	22	6	8	1	2	16	1	2	34	9	5	8	1	4
	15	3	2	1	6	25	6	8	0	1	15	1	2	37	9	5	9	2	4
	20	6	1	0	16	26	4	8	1	2	16	2	2	38	10	5	8	1	4
	25	5	2	0	24	24	2	8	1	3	12	1	1	25	7	1	8	3	3
	30	3	3	1	23	17	3	13	2	2	14	1	1	20	7	0	8	2	3
	35	4	2	1	18	12	5	10	1	3	14	1	2	15	5	0	12	3	3
	40	7	1	1	10	8	7	10	1	3	22	3	3	24	7	2	10	3	2
	45	7	1	1	7	12	8	8	2	3	21	4	2	13	3	1	7	4	1
	50	5	2	2	9	11	6	10	2	3	19	5	2	8	4	0	8	6	1
	55	5	2	2	9	10	5	7	2	3	15	5	1	17	5	3	8	8	1
18	0	5	2	3	10	9	5	8	2	3	12	4	0	19	7	5	6	9	0
	5	5	1	3	10	7	4	5	2	3	11	4	0	12	7	3	9	10	1
	10	6	0	2	8	8	5	4	2	3	9	4	1	5	5	2	3	10	0
	15	7	0	2	4	8	5	6	0	2	8	3	1	0	3	2	0	9	0
	20	6	0	2	4	6	4	5	1	2	8	3	2	11	2	5	2	9	1
	25	6	1	2	6	5	2	3	2	3	7	3	2	3	3	5	4	10	2
	30	0	1	3	10	3	2	1	2	3	6	3	2	8	1	6	3	9	2
	35	2	3	3	14	2	0	0	3	2	0	2	0	16	1	9	6	11	3
	40	0	3	3	12	2	1	1	4	2	8	2	4	30	4	11	6	11	2
	45	5	2	1	12	3	0	2	3	1	6	0	2	39	4	12	5	10	2
	50	4	2	1	13	2	0	1	1	0	8	1	2	44	2	12	2	10	1
	55	6	2	1	11	1	0	1	2	0	11	4	2	43	0	12	8	10	3
19	0	5	1	2	10	0	0	2	2	0	6	4	0	35	0	10	9	9	3

—		Nov. 20, 1911.			Nov. 24, 1911.			Dec. 18, 1911.			Dec. 22, 1911.			Jan. 22, 1912.			Jan. 26, 1912.		
		N	E	V	N	E	V	N	E	V	N	E	V	N	E	V	N	E	V
h.	m.	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
18	0	1	1	0	1	1	1	5	2	2	5	0	1	2	0	2	1	5	0
	5	1	0	0	0	1	1	1	1	3	6	0	1	0	1	2	0	6	0
	10	0	0	0	0	1	1	0	0	3	7	0	1	3	2	1	0	6	0
	15	1	0	0	1	1	1	0	0	2	6	0	1	5	2	1	1	6	1
	20	1	0	0	3	1	0	1	1	2	5	0	1	6	2	1	0	6	1
	25	2	0	0	4	1	0	1	3	2	5	0	1	7	1	1	0	5	1
	30	1	0	1	4	1	0	2	3	1	5	1	1	7	1	1	2	4	1
	35	0	2	1	4	0	0	1	3	1	6	2	1	7	2	1	3	4	0
	40	0	3	1	4	0	1	1	4	2	7	2	1	7	2	1	2	2	0
	45	0	3	1	3	0	1	3	5	1	7	2	1	7	1	1	2	2	1
	50	1	3	1	2	0	2	3	5	1	7	2	1	7	2	1	2	0	1
	55	2	4	1	2	1	2	1	6	1	9	2	0	8	3	1	2	0	1
19	0	2	4	1	2	2	1	1	7	1	8	2	0	9	2	1	2	1	2
	5	2	4	1	2	2	1	1	6	2	7	1	0	10	2	0	1	1	2
	10	2	4	1	1	2	1	1	7	2	4	1	1	11	2	0	2	1	2
	15	2	4	2	2	2	1	1	6	1	5	2	1	7	4	1	2	2	1
	20	2	4	2	1	2	1	1	6	1	6	2	1	5	3	1	3	4	1
	25	2	5	2	0	2	2	2	5	1	4	2	0	7	4	1	4	4	1
	30	2	5	2	1	3	2	3	4	1	5	2	0	5	6	1	4	4	0
	35	2	5	2	1	4	1	2	3	1	3	2	1	3	6	1	4	4	0
	40	2	5	2	1	4	1	1	3	1	2	3	1	5	4	1	3	4	0
	45	2	6	1	2	4	0	1	4	0	2	4	0	2	5	1	2	3	0
	50	2	6	1	1	3	0	1	5	0	3	4	0	0	5	2	2	2	0
	55	2	6	1	0	4	1	1	6	0	2	5	0	3	6	1	0	4	0
20	0	3	6	1	0	3	0	1	6	0	0	4	0	1	6	1	2	4	0

Term Hour Data. De Bilt.

h.	m.	May 29, 1911. H	D	V	June 2, 1911. H	D	V	June 26, 1911. H	D	V	June 30, 1911. H	D	V	July 24, 1911. H	D	V	July 28, 1911. H	D	V
		γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
8	0																		
	5	10	30	—	0	10	—	3	20	—	4	9	—	1	16	—	21	46	—
	10	10	29	—	2	12	—	4	20	—	5	8	—	3	15	—	24	42	—
	15	8	28	—	3	12	—	3	19	—	6	8	—	4	17	—	20	36	—
	20	7	27	—	4	11	—	4	19	—	5	9	—	4	17	—	19	35	—
	25	7	25	—	4	8	—	3	18	—	6	7	—	6	14	—	20	36	—
	30	6	23	—	4	7	—	3	19	—	6	7	—	6	14	—	13	29	—
	35	5	22	—	4	8	—	3	18	—	5	7	—	7	14	—	11	27	—
	40	4	21	—	4	5	—	2	18	—	5	7	—	6	13	—	6	23	—
	45	3	22	—	3	3	—	2	17	—	5	7	—	3	11	—	3	18	—
	50	2	19	—	3	3	—	2	18	—	6	6	—	4	10	—	14	22	—
	55	1	18	—	3	4	—	0	19	—	6	6	—	0	9	—	14	13	—
9	0	0	17	—	6	2	—	0	19	—	6	6	—	2	10	—	15	17	—
	5	0	17	—	6	2	—	1	19	—	6	5	—	7	9	—	17	10	—
	10	1	16	—	5	3	—	2	18	—	5	3	—	6	9	—	17	7	—
	15	0	15	—	4	4	—	3	18	—	4	3	—	4	9	—	16	6	—
	20	0	14	—	3	4	—	3	15	—	3	2	—	4	7	—	14	0	—
	25	1	13	—	3	6	—	2	15	—	4	3	—	1	6	—	9	9	—
	30	1	11	—	3	2	—	3	14	—	3	1	—	0	7	—	14	7	—
	35	1	10	—	2	2	—	4	10	—	4	1	—	3	6	—	17	7	—
	40	1	9	—	1	2	—	8	9	—	3	1	—	3	6	—	18	7	—
	45	1	7	—	0	3	—	8	7	—	2	0	—	4	6	—	20	5	—
	50	1	6	—	1	2	—	11	4	—	0	1	—	4	3	—	12	2	—
	55	2	3	—	1	1	—	11	3	—	1	1	—	5	1	—	3	3	—
10	0	3	0	—	0	0	—	13	0	—	2	1	—	7	0	—	0	3	—

h.	m.	May 22, 1911. H	D	V	May 26, 1911. H	D	V	June 19, 1911. H	D	V	June 23, 1911. H	D	V	July 17, 1911. H	D	V	July 21, 1911. H	D	V
		γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
17	0																		
	5	2	1	—	0	20	—	8	1	—	9	1	—	16	6	—	8	0	—
	10	1	1	—	0	24	—	8	1	—	7	1	—	12	7	—	6	2	—
	15	2	1	—	1	30	—	9	0	—	7	3	—	8	6	—	3	3	—
	20	5	0	—	6	32	—	8	1	—	4	2	—	5	7	—	4	5	—
	25	5	1	—	17	30	—	9	1	—	9	1	—	20	6	—	3	3	—
	30	2	2	—	21	22	—	9	2	—	8	1	—	23	4	—	0	5	—
	35	3	1	—	17	13	—	8	2	—	8	1	—	32	0	—	2	6	—
	40	5	1	—	13	10	—	9	1	—	1	3	—	23	6	—	0	5	—
	45	7	1	—	9	10	—	7	2	—	0	4	—	34	1	—	5	6	—
	50	6	1	—	11	7	—	8	3	—	3	5	—	40	0	—	4	7	—
	55	5	2	—	15	6	—	5	3	—	7	5	—	31	0	—	3	9	—
18	0	4	1	—	14	6	—	7	3	—	12	2	—	26	6	—	5	12	—
	5	4	1	—	14	6	—	4	3	—	13	1	—	32	7	—	3	12	—
	10	5	1	—	11	6	—	2	3	—	13	1	—	40	6	—	9	11	—
	15	6	1	—	8	7	—	6	2	—	17	2	—	47	6	—	12	9	—
	20	5	2	—	9	5	—	4	3	—	18	2	—	35	7	—	12	9	—
	25	6	2	—	12	3	—	3	2	—	18	2	—	41	11	—	8	11	—
	30	1	2	—	19	0	—	1	2	—	19	2	—	40	11	—	9	10	—
	35	1	3	—	20	0	—	0	4	—	28	0	—	30	13	—	6	13	—
	40	0	3	—	19	2	—	0	3	—	17	2	—	15	19	—	7	13	—
	45	5	4	—	19	3	—	2	3	—	18	0	—	2	23	—	6	12	—
	50	4	4	—	20	2	—	2	2	—	17	1	—	0	18	—	9	11	—
	55	5	5	—	18	1	—	1	3	—	14	6	—	2	13	—	5	11	—
19	0	7	3	—	17	1	—	3	2	—	17	6	—	7	11	—	4	10	—

Term Hour Data. De Bilt—*continued.*

—		Nov. 20, 1911.			Nov. 24, 1911.			Dec. 18, 1911.			Dec. 22, 1911.			Jan. 22, 1912.			Jan. 26, 1912.		
		H	D	V	H	D	V	H	D	V	H	D	V	H	D	V	H	D	V
h.	m.	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
18	0	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	5	4	0	—	3	2	—	4	1	—	8	0	—	3	0	—	0	6	—
	10	3	0	—	3	0	—	4	0	—	8	0	—	6	2	—	1	8	—
	15	2	0	—	3	1	—	3	1	—	8	0	—	7	2	—	1	6	—
	20	3	1	—	4	0	—	3	2	—	7	0	—	7	2	—	0	5	—
	25	3	1	—	6	0	—	2	3	—	6	1	—	7	2	—	0	3	—
	30	2	1	—	6	0	—	3	5	—	7	1	—	9	2	—	1	3	—
	35	1	1	—	6	0	—	2	6	—	7	1	—	8	2	—	3	3	—
	40	1	1	—	6	0	—	2	6	—	7	2	—	7	2	—	3	2	—
	45	3	2	—	4	0	—	3	6	—	7	2	—	7	2	—	3	2	—
	50	3	3	—	3	0	—	3	7	—	9	3	—	7	2	—	3	2	—
	55	3	4	—	3	1	—	1	7	—	10	3	—	9	2	—	3	1	—
19	0	2	3	—	3	1	—	0	7	—	10	3	—	10	2	—	3	1	—
	5	3	5	—	3	2	—	0	7	—	9	3	—	11	2	—	2	1	—
	10	1	5	—	2	2	—	0	7	—	5	3	—	12	3	—	2	0	—
	15	1	6	—	2	3	—	0	7	—	6	3	—	7	3	—	3	2	—
	20	1	6	—	1	3	—	0	6	—	7	3	—	7	3	—	3	3	—
	25	1	6	—	0	3	—	1	6	—	6	3	—	9	3	—	3	3	—
	30	2	5	—	0	4	—	2	5	—	6	3	—	5	3	—	3	5	—
	35	2	5	—	0	5	—	2	3	—	4	3	—	3	4	—	3	3	—
	40	2	6	—	1	5	—	2	3	—	3	3	—	7	3	—	3	3	—
	45	1	6	—	0	5	—	1	5	—	3	4	—	2	3	—	3	2	—
	50	0	7	—	1	3	—	1	6	—	3	6	—	0	3	—	3	2	—
	55	2	7	—	0	4	—	0	6	—	1	6	—	3	4	—	1	3	—
20	0	3	6	—	0	2	—	0	6	—	0	6	—	0	5	—	2	3	—

Term Hour Data. Uccle.

—		May 29, 1911.			June 2, 1911.			June 26, 1911.			June 30, 1911.			July 24, 1911.			July 28, 1911.		
		H	D	V	H	D	V	H	D	V	H	D	V	H	D	V	H	D	V
h.	m.	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
8	0	10	23	—	6	6	—	2	15	—	0	9	—	0	13	—	15	38	—
	5	10	22	—	5	6	—	2	14	—	0	9	—	2	13	—	15	35	—
	10	10	22	—	4	7	—	2	15	—	0	9	—	2	14	—	16	34	—
	15	10	23	—	4	8	—	2	15	—	0	8	—	2	13	—	14	31	—
	20	9	22	—	3	7	—	2	15	—	0	7	—	3	12	—	13	30	—
	25	8	20	—	3	6	—	2	14	—	0	6	—	4	12	—	14	29	—
	30	6	19	—	4	5	—	1	13	—	1	6	—	5	12	—	13	27	—
	35	5	17	—	5	5	—	1	13	—	1	6	—	6	11	—	7	28	—
	40	4	15	—	3	4	—	1	13	—	2	7	—	6	11	—	6	23	—
	45	3	16	—	3	4	—	1	13	—	2	5	—	6	11	—	4	21	—
	50	3	17	—	3	3	—	1	13	—	3	4	—	6	9	—	9	23	—
	55	2	15	—	3	3	—	1	14	—	3	4	—	5	8	—	10	19	—
9	0	1	13	—	3	2	—	1	13	—	3	4	—	4	7	—	11	18	—
	5	1	12	—	3	1	—	1	13	—	3	3	—	4	6	—	13	18	—
	10	1	11	—	3	2	—	0	13	—	3	3	—	5	6	—	13	13	—
	15	0	11	—	3	3	—	2	12	—	3	3	—	6	6	—	13	11	—
	20	0	11	—	2	3	—	2	11	—	3	3	—	6	4	—	13	7	—
	25	1	9	—	2	3	—	2	11	—	2	2	—	5	4	—	9	8	—
	30	1	8	—	2	3	—	3	10	—	1	2	—	5	4	—	11	8	—
	35	1	7	—	2	2	—	4	8	—	1	2	—	5	3	—	13	7	—
	40	1	7	—	1	2	—	5	6	—	1	2	—	5	3	—	13	6	—
	45	0	6	—	1	2	—	6	5	—	1	1	—	5	2	—	13	4	—
	50	0	4	—	0	1	—	8	3	—	0	1	—	5	2	—	10	3	—
	55	1	2	—	1	1	—	9	2	—	0	0	—	6	1	—	3	1	—
10	0	1	0	—	0	0	—	11	0	—	0	0	—	6	0	—	0	0	—

—	May 22, 1911.			May 26, 1911.			June 19, 1911.			June 23, 1911.			July 17, 1911.			July 21, 1911.		
	H	D	V	H	D	V	H	D	V	H	D	V	H	D	V	H	D	V
h. m.	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
17 0	0	0	—	2	3	—	5	1	—	6	0	—	8	—	—	7	1	—
5	1	2	—	0	6	—	5	0	—	7	1	—	6	—	—	6	1	—
10	2	2	—	0	9	—	5	0	—	7	2	—	4	—	—	5	1	—
15	3	2	—	3	13	—	6	1	—	6	3	—	2	—	—	4	0	—
20	4	2	—	11	15	—	6	1	—	6	3	—	1	—	—	4	1	—
25	3	2	—	15	15	—	6	1	—	6	3	—	5	—	—	3	1	—
30	3	3	—	18	13	—	6	2	—	7	2	—	13	—	—	2	2	—
35	6	3	—	14	10	—	7	2	—	5	3	—	15	—	—	0	2	—
40	7	3	—	13	7	—	7	2	—	2	3	—	19	—	—	2	3	—
45	6	4	—	13	6	—	6	1	—	0	4	—	25	—	—	4	4	—
50	6	4	—	13	4	—	6	1	—	3	4	—	27	—	—	3	5	—
55	7	4	—	15	4	—	5	2	—	5	6	—	20	—	—	1	5	—
18 0	8	4	—	15	4	—	5	2	—	9	6	—	18	—	—	3	7	—
5	9	6	—	13	4	—	5	2	—	11	5	—	21	—	—	4	7	—
10	9	6	—	12	4	—	4	2	—	13	4	—	28	—	—	6	7	—
15	11	6	—	12	4	—	4	1	—	14	4	—	31	—	—	7	8	—
20	6	6	—	11	4	—	3	1	—	16	4	—	30	—	—	8	8	—
25	5	6	—	15	3	—	2	1	—	18	4	—	28	—	—	8	8	—
30	5	4	—	21	3	—	1	1	—	21	4	—	25	—	—	7	8	—
35	5	4	—	19	3	—	1	1	—	23	4	—	15	—	—	6	8	—
40	8	6	—	19	3	—	0	1	—	16	3	—	8	—	—	5	8	—
45	6	6	—	19	3	—	1	1	—	17	3	—	1	—	—	6	8	—
50	8	6	—	19	3	—	4	1	—	16	4	—	0	—	—	8	8	—
55	11	5	—	18	2	—	4	3	—	15	4	—	2	—	—	6	7	—
19 0	8	6	—	18	0	—	4	4	—	14	6	—	5	—	—	6	7	—

—	Nov. 20, 1911.			Nov. 24, 1911.			Dec. 18, 1911.			Dec. 22, 1911.			Jan. 22, 1912.			Jan. 26, 1912.		
	H	D	V	H	D	V	H	D	V	H	D	V	H	D	V	H	D	V
h. m.	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
18 0	0	0	—	2	0	—	1	1	—	2	0	—	3	0	—	2	2	—
5	1	1	—	2	1	—	1	0	—	3	0	—	3	1	—	1	3	—
10	2	2	—	3	1	—	2	0	—	5	0	—	3	2	—	1	3	—
15	2	2	—	3	1	—	1	1	—	5	0	—	3	2	—	0	3	—
20	2	2	—	2	0	—	1	1	—	5	0	—	3	2	—	1	3	—
25	1	2	—	2	0	—	1	1	—	5	0	—	5	2	—	2	2	—
30	1	2	—	4	0	—	1	2	—	5	1	—	5	2	—	4	2	—
35	2	2	—	5	1	—	1	3	—	5	1	—	5	2	—	5	2	—
40	2	2	—	4	1	—	2	4	—	6	2	—	5	2	—	5	1	—
45	2	2	—	4	1	—	2	4	—	6	2	—	5	2	—	5	1	—
50	2	2	—	4	1	—	2	4	—	6	2	—	5	2	—	4	1	—
55	2	3	—	3	2	—	1	4	—	6	1	—	6	3	—	5	0	—
19 0	2	3	—	2	2	—	1	4	—	6	1	—	7	3	—	5	0	—
5	2	3	—	2	2	—	1	4	—	6	2	—	8	3	—	4	0	—
10	2	3	—	2	2	—	1	4	—	6	2	—	6	3	—	4	0	—
15	2	3	—	2	2	—	1	4	—	6	2	—	6	3	—	5	1	—
20	2	3	—	1	2	—	0	3	—	6	1	—	6	4	—	5	1	—
25	2	3	—	1	2	—	0	3	—	6	1	—	5	4	—	6	1	—
30	2	4	—	0	2	—	0	2	—	6	2	—	5	4	—	5	2	—
35	2	4	—	2	2	—	1	1	—	5	2	—	4	4	—	5	2	—
40	2	3	—	2	2	—	1	1	—	4	3	—	5	5	—	5	2	—
45	2	3	—	2	2	—	1	2	—	2	3	—	3	5	—	4	1	—
50	2	3	—	1	1	—	1	2	—	2	3	—	1	5	—	4	0	—
55	2	3	—	2	2	—	1	2	—	1	4	—	1	5	—	4	0	—
20 0	3	3	—	2	2	—	1	2	—	0	4	—	0	6	—	6	0	—

Term Hour Data. Val Joyeux.

h.	m.	May 29, 1911. H	D	V	June 2, 1911. H	D	V	June 26, 1911. H	D	V	June 30, 1911. H	D	V	July 24, 1911. H	D	V	July 28, 1911. H	D	V
		γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
8	0	14	18	—	10	7	—	—	—	—	0	13	—	5	17	—	20	36	—
	5	14	19	—	8	8	—	—	—	—	1	12	—	5	15	—	18	39	—
	10	13	19	—	7	8	—	—	—	—	1	13	—	7	15	—	19	38	—
	15	11	19	—	8	9	—	—	—	—	2	12	—	7	16	—	18	33	—
	20	10	18	—	8	7	—	—	—	—	2	12	—	8	15	—	16	30	—
	25	10	18	—	7	7	—	—	—	—	2	10	—	8	17	—	17	34	—
	30	9	17	—	6	6	—	—	—	—	2	9	—	8	15	—	11	27	—
	35	8	17	—	5	5	—	—	—	—	1	9	—	7	14	—	12	30	—
	40	6	17	—	5	3	—	—	—	—	2	8	—	7	11	—	9	23	—
	45	5	17	—	5	2	—	2	12	—	1	8	—	5	10	—	6	20	—
	50	5	15	—	4	1	—	2	12	—	2	8	—	5	10	—	12	21	—
	55	3	14	—	3	3	—	2	13	—	2	4	—	3	8	—	12	18	—
9	0	2	13	—	2	3	—	0	12	—	2	4	—	4	9	—	12	22	—
	5	2	12	—	1	4	—	0	13	—	2	4	—	5	9	—	14	16	—
	10	2	12	—	1	3	—	2	12	—	2	3	—	5	9	—	13	14	—
	15	0	11	—	2	4	—	3	12	—	2	3	—	3	7	—	12	13	—
	20	1	11	—	1	5	—	2	9	—	1	3	—	2	7	—	11	9	—
	25	1	10	—	1	6	—	2	9	—	0	3	—	1	5	—	9	9	—
	30	2	9	—	2	4	—	3	9	—	1	2	—	0	6	—	10	9	—
	35	2	9	—	2	5	—	4	8	—	1	3	—	0	5	—	11	9	—
	40	2	8	—	1	5	—	6	6	—	0	3	—	0	5	—	10	7	—
	45	1	6	—	1	4	—	6	4	—	2	0	—	0	4	—	11	7	—
	50	2	4	—	1	4	—	6	3	—	2	2	—	2	2	—	6	1	—
	55	1	1	—	1	2	—	7	1	—	2	1	—	2	1	—	3	0	—
10	0	2	0	—	0	0	—	7	0	—	2	2	—	4	0	—	0	0	—

h.	m.	May 22, 1911. H	D	V	May 26, 1911. H	D	V	June 19, 1911. H	D	V	June 23, 1911. H	D	V	July 17, 1911. H	D	V	July 21, 1911. H	D	V
		γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
17	0	4	0	—	—	—	—	8	3	—	4	1	—	18	2	—	11	1	—
	5	2	0	—	4	3	—	8	0	—	5	2	—	16	3	—	11	0	—
	10	3	0	—	2	6	—	8	1	—	3	2	—	12	3	—	8	0	—
	15	3	1	—	0	9	—	10	0	—	5	1	—	10	2	—	5	1	—
	20	5	0	—	4	13	—	9	2	—	3	1	—	8	4	—	6	0	—
	25	5	2	—	11	12	—	7	0	—	7	1	—	16	4	—	4	3	—
	30	3	2	—	15	8	—	8	2	—	6	0	—	21	2	—	4	0	—
	35	3	3	—	16	7	—	8	1	—	7	0	—	25	2	—	3	0	—
	40	4	3	—	14	5	—	7	2	—	0	1	—	20	2	—	2	1	—
	45	4	4	—	14	6	—	7	4	—	1	2	—	27	0	—	4	3	—
	50	3	5	—	15	5	—	—	—	—	2	4	—	31	2	—	3	2	—
	55	3	4	—	17	4	—	—	—	—	7	3	—	27	3	—	2	4	—
18	0	2	3	—	—	4	—	7	—	—	10	4	—	23	4	—	2	5	—
	5	—	—	—	—	2	—	4	0	—	10	5	—	27	4	—	0	6	—
	10	—	—	—	—	—	—	4	1	—	12	4	—	32	6	—	6	6	—
	15	—	—	—	14	—	—	6	0	—	14	6	—	—	—	—	7	6	—
	20	—	—	—	12	—	—	5	2	—	14	6	—	—	—	—	8	5	—
	25	—	—	—	14	—	—	4	1	—	15	6	—	—	—	—	4	6	—
	30	—	—	—	18	—	—	2	0	—	16	6	—	28	9	—	6	6	—
	35	3	0	—	20	3	—	1	0	—	21	6	—	23	10	—	4	8	—
	40	2	1	—	20	2	—	0	1	—	15	6	—	13	13	—	5	9	—
	45	0	0	—	19	2	—	0	1	—	16	5	—	3	14	—	6	6	—
	50	0	1	—	21	2	—	0	0	—	15	5	—	0	12	—	8	7	—
	55	1	1	—	21	1	—	1	1	—	11	7	—	2	11	—	5	5	—
19	0	0	0	—	20	0	—	3	1	—	14	7	—	7	10	—	4	5	—

Term Hour Data. Val Joyeux—*continued*.

		Nov. 20, 1911.			Nov. 24, 1911.			Dec. 18, 1911.			Dec. 22, 1911.			Jan. 22, 1912.			Jan. 26, 1912.		
		H	D	V	H	D	V	H	D	V	H	D	V	H	D	V	H	D	V
h.	m.	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
18	0	5	0	—	1	1	—	5	3	—	8	1	—	5	0	—	1	4	—
	5	5	0	—	0	0	—	4	1	—	7	1	—	4	1	—	0	4	—
	10	4	0	—	2	2	—	4	1	—	6	1	—	4	2	—	0	5	—
	15	4	0	—	2	2	—	2	0	—	7	0	—	4	1	—	0	5	—
	20	3	0	—	3	3	—	2	3	—	6	1	—	6	3	—	0	4	—
	25	4	1	—	4	3	—	2	3	—	4	1	—	7	3	—	1	4	—
	30	3	1	—	5	3	—	2	3	—	6	1	—	7	3	—	2	4	—
	35	2	0	—	6	1	—	1	2	—	6	2	—	8	4	—	2	4	—
	40	2	3	—	5	1	—	1	3	—	6	2	—	8	4	—	2	4	—
	45	1	2	—	5	3	—	0	3	—	6	1	—	8	4	—	2	1	—
	50	2	4	—	3	3	—	1	4	—	7	3	—	7	5	—	3	0	—
	55	1	3	—	1	3	—	1	5	—	7	4	—	8	6	—	3	2	—
19	0	0	—	—	3	2	—	1	5	—	8	2	—	8	7	—	3	3	—
	5	—	—	—	5	3	—	0	5	—	7	0	—	11	4	—	2	2	—
	10	—	—	—	5	2	—	0	7	—	4	2	—	11	6	—	3	2	—
	15	—	—	—	4	4	—	0	6	—	4	3	—	6	5	—	3	2	—
	20	—	—	—	3	1	—	1	5	—	3	4	—	8	4	—	2	4	—
	25	—	—	—	1	2	—	2	5	—	4	3	—	7	4	—	2	5	—
	30	—	—	—	2	3	—	2	6	—	4	3	—	4	8	—	2	4	—
	35	—	—	—	2	5	—	1	3	—	2	4	—	3	5	—	2	4	—
	40	—	—	—	4	4	—	0	3	—	2	4	—	4	4	—	3	2	—
	45	—	—	—	4	3	—	0	4	—	2	3	—	2	5	—	3	3	—
	50	—	—	—	3	2	—	1	5	—	2	4	—	1	3	—	2	1	—
	55	—	—	—	2	3	—	0	5	—	0	3	—	2	5	—	2	2	—
20	0	—	—	—	1	0	—	1	5	—	0	4	—	0	5	—	3	3	—

Term Hour Data. Agincourt.

		May 29, 1911.			June 2, 1911.			June 26, 1911.			June 30, 1911.			July 24, 1911.			July 28, 1911.		
—		H	D	V	H	D	V	H	D	V	H	D	V	H	D	V	H	D	V
h.	m.	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
8	0	1	2	—	0	4	—	2	1	—	1	1	—	2	0	—	9	18	—
	5	1	3	—	1	4	—	3	1	—	2	1	—	5	1	—	11	18	—
	10	1	2	—	2	0	—	3	2	—	1	1	—	6	4	—	12	19	—
	15	1	2	—	4	1	—	4	1	—	2	1	—	7	0	—	11	18	—
	20	1	1	—	7	3	—	2	2	—	1	0	—	6	4	—	9	18	—
	25	1	0	—	7	4	—	1	1	—	1	1	—	6	5	—	8	12	—
	30	1	0	—	8	2	—	0	2	—	1	1	—	6	6	—	4	18	—
	35	1	0	—	8	2	—	0	2	—	0	2	—	7	7	—	0	18	—
	40	1	4	—	8	4	—	0	4	—	0	2	—	6	11	—	9	23	—
	45	1	5	—	7	5	—	2	2	—	0	2	—	6	11	—	9	12	—
	50	1	5	—	7	8	—	2	1	—	1	2	—	2	8	—	12	7	—
	55	1	5	—	7	10	—	2	1	—	1	2	—	1	11	—	18	13	—
9	0	0	5	—	6	10	—	4	3	—	1	2	—	4	11	—	18	13	—
	5	0	4	—	5	10	—	4	4	—	1	2	—	6	6	—	18	12	—
	10	0	4	—	4	10	—	4	4	—	2	1	—	5	7	—	18	14	—
	15	0	5	—	4	10	—	4	0	—	2	2	—	4	11	—	17	18	—
	20	0	8	—	5	15	—	5	1	—	2	4	—	2	11	—	14	23	—
	25	1	8	—	7	15	—	5	5	—	2	5	—	1	12	—	18	27	—
	30	1	8	—	5	16	—	7	7	—	1	5	—	3	11	—	22	18	—
	35	1	8	—	4	16	—	9	8	—	2	5	—	2	11	—	21	12	—
	40	1	10	—	4	19	—	9	9	—	2	5	—	2	11	—	20	10	—
	45	1	10	—	4	15	—	8	10	—	2	5	—	2	11	—	18	6	—
	50	2	10	—	4	15	—	9	11	—	2	7	—	0	11	—	18	16	—
	55	2	10	—	5	15	—	9	13	—	3	8	—	0	11	—	13	14	—
10	0	3	10	—	5	15	—	10	14	—	3	8	—	2	11	—	9	0	—

Term Hour Data. Agincourt—*continued.*

h.	m.	May 22, 1911. H	D	V	May 26, 1911. H	D	V	June 19, 1911. H	D	V	June 23, 1911. H	D	V	July 17, 1911. H	D	V	July 21, 1911. H	D	V
		γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
17	0	0	8	—	4	13	—	2	24	—	12	10	—	10	32	—	0	11	—
	5	0	7	—	0	8	—	0	19	—	12	8	—	8	27	—	3	10	—
	10	1	7	—	4	5	—	0	18	—	10	7	—	5	24	—	2	10	—
	15	2	7	—	8	2	—	3	18	—	7	4	—	5	19	—	4	5	—
	20	2	8	—	13	0	—	4	16	—	6	4	—	3	22	—	7	5	—
	25	1	5	—	16	5	—	2	12	—	5	4	—	7	25	—	7	1	—
	30	0	6	—	24	5	—	3	11	—	4	4	—	12	31	—	12	5	—
	35	1	7	—	26	3	—	3	11	—	6	4	—	14	31	—	12	4	—
	40	2	7	—	29	4	—	4	11	—	4	0	—	12	29	—	11	3	—
	45	4	6	—	31	5	—	6	11	—	0	0	—	25	37	—	10	2	—
	50	5	6	—	34	9	—	8	10	—	0	1	—	28	34	—	9	1	—
	55	0	3	—	34	11	—	7	10	—	1	1	—	23	30	—	8	2	—
18	0	3	2	—	34	11	—	8	10	—	2	1	—	19	28	—	7	2	—
	5	6	2	—	38	10	—	8	6	—	2	1	—	23	31	—	10	5	—
	10	5	2	—	38	5	—	10	5	—	2	1	—	32	36	—	16	5	—
	15	7	2	—	40	5	—	15	6	—	4	1	—	43	37	—	18	5	—
	20	7	2	—	41	5	—	16	6	—	5	2	—	32	37	—	16	5	—
	25	0	2	—	43	10	—	14	5	—	4	4	—	28	32	—	16	5	—
	30	2	2	—	47	11	—	13	4	—	6	6	—	16	27	—	16	6	—
	35	5	2	—	47	10	—	16	3	—	8	8	—	13	13	—	14	5	—
	40	9	0	—	44	7	—	16	2	—	6	4	—	10	5	—	12	7	—
	45	10	1	—	44	7	—	17	2	—	11	5	—	3	0	—	12	5	—
	50	10	0	—	44	6	—	20	3	—	10	7	—	0	0	—	13	4	—
	55	11	1	—	47	6	—	20	2	—	6	2	—	1	2	—	12	0	—
19	0	13	1	—	48	6	—	18	0	—	10	4	—	10	7	—	14	5	—

h.	m.	Nov. 20, 1911. H	D	V	Nov. 24, 1911. H	D	V	Dec. 18, 1911. H	D	V	Dec. 22, 1911. H	D	V	Jan. 22, 1912. H	D	V	Jan. 26, 1912. H	D	V
		γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
18	0	0	0	—	0	0	—	—	—	—	0	1	—	1	1	—	0	0	—
	5	3	1	—	1	1	—	—	—	—	2	1	—	2	0	—	1	0	—
	10	2	1	—	1	1	—	—	—	—	3	1	—	0	1	—	1	0	—
	15	3	1	—	5	3	—	—	—	—	3	0	—	2	2	—	2	1	—
	20	4	1	—	6	2	—	—	—	—	4	0	—	2	2	—	3	0	—
	25	3	1	—	8	1	—	—	—	—	4	1	—	2	3	—	2	0	—
	30	3	1	—	9	2	—	—	—	—	4	2	—	3	4	—	3	0	—
	35	3	1	—	9	1	—	—	—	—	5	2	—	3	1	—	4	1	—
	40	5	1	—	5	2	—	—	—	—	6	2	—	2	3	—	4	1	—
	45	4	1	—	5	1	—	—	—	—	6	2	—	2	3	—	3	3	—
	50	6	2	—	4	4	—	—	—	—	9	2	—	3	5	—	4	4	—
	55	7	2	—	8	5	—	—	—	—	11	2	—	2	2	—	4	4	—
19	0	9	2	—	8	5	—	—	—	—	11	5	—	2	7	—	4	3	—
	5	9	1	—	9	5	—	—	—	—	9	5	—	7	7	—	4	2	—
	10	10	5	—	6	5	—	—	—	—	8	6	—	4	7	—	3	2	—
	15	9	5	—	9	6	—	—	—	—	9	7	—	4	4	—	4	4	—
	20	11	6	—	8	7	—	—	—	—	10	7	—	6	5	—	4	4	—
	25	12	7	—	9	7	—	—	—	—	11	8	—	8	5	—	4	5	—
	30	11	7	—	9	8	—	—	—	—	11	8	—	7	3	—	4	5	—
	35	12	7	—	10	10	—	—	—	—	12	9	—	5	7	—	4	6	—
	40	12	7	—	11	9	—	—	—	—	13	10	—	7	8	—	4	6	—
	45	12	7	—	13	11	—	—	—	—	11	10	—	3	5	—	4	6	—
	50	12	9	—	14	10	—	—	—	—	12	11	—	3	7	—	4	6	—
	55	13	10	—	14	11	—	—	—	—	13	11	—	7	7	—	4	7	—
20	0	14	10	—	14	11	—	—	—	—	12	11	—	2	7	—	5	7	—

—		May 29, 1911.			June 2, 1911.			June 26, 1911.			June 30, 1911.			July 24, 1911.			July 28, 1911.		
		H	D	V	H	D	V	H	D	V	H	D	V	H	D	V	H	D	V
h.	m.	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
8	0	2	2	0	0	2	4	3	0	1	3	1	2	3	0	2	7	13	0
	5	2	3	0	1	2	4	2	0	1	3	1	2	7	1	2	6	13	1
	10	2	2	0	1	0	4	2	1	1	2	1	2	7	2	2	9	13	1
	15	2	2	0	2	1	4	3	0	1	2	0	1	7	3	2	8	15	2
	20	2	1	0	4	1	3	2	1	1	2	1	2	7	1	2	6	15	2
	25	2	0	0	6	2	3	1	2	1	2	1	1	7	2	1	3	10	3
	30	2	1	0	5	1	2	0	2	1	1	2	1	8	6	1	2	15	3
	35	2	2	0	5	2	1	0	3	0	1	2	0	8	6	1	0	15	2
	40	2	2	0	6	5	1	1	2	1	0	2	0	7	7	1	7	15	2
	45	2	3	0	5	6	0	0	2	1	1	2	1	6	8	0	8	12	3
	50	2	4	0	4	6	1	1	0	1	0	1	1	4	8	1	9	6	4
	55	1	5	0	4	6	1	1	0	2	0	2	1	2	8	1	13	10	4
9	0	0	6	0	3	8	2	2	1	2	1	2	2	4	9	1	17	9	4
	5	0	6	0	3	9	3	2	3	3	1	3	2	5	8	1	16	12	4
	10	0	6	0	2	8	3	3	3	3	0	2	1	6	10	1	17	12	4
	15	0	7	0	1	9	3	4	0	4	0	3	1	6	11	1	17	14	4
	20	1	8	1	1	11	4	4	2	3	1	4	1	3	11	1	15	19	4
	25	2	8	1	2	12	4	5	5	4	1	5	1	1	10	1	17	19	5
	30	3	8	1	1	12	4	5	5	4	1	6	2	2	10	1	19	13	5
	35	3	9	1	1	12	6	6	5	5	2	6	2	1	9	1	20	9	5
	40	3	10	1	0	13	5	7	5	5	3	6	3	1	9	1	21	8	4
	45	4	11	1	0	12	6	8	7	6	3	6	3	2	9	1	18	6	4
	50	5	11	1	1	12	5	8	8	6	4	6	4	0	9	1	15	12	4
	55	5	13	1	2	12	5	8	11	6	4	7	3	0	9	2	13	12	4
10	0	5	15	1	2	12	5	9	11	5	5	8	4	0	10	2	12	0	4

—		May 22, 1911.			May 26, 1911.			June 19, 1911.			June 23, 1911.			July 17, 1911.			July 21, 1911.		
		H	D	V	H	D	V	H	D	V	H	D	V	H	D	V	H	D	V
h.	m.	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
17	0	0	8	4	2	4	1	0	17	3	10	9	8	16	29	0	0	9	0
	5	1	6	6	0	5	0	0	16	2	10	9	9	12	29	1	2	9	1
	10	2	5	6	4	2	1	0	15	2	9	8	9	9	23	0	2	8	1
	15	3	4	6	7	1	1	1	13	1	8	6	8	8	21	0	3	6	2
	20	5	4	4	10	0	1	1	12	1	6	6	6	8	19	0	5	5	2
	25	4	3	4	11	2	1	1	11	1	6	4	6	11	22	1	5	4	2
	30	2	3	3	17	2	2	2	10	0	5	2	4	14	23	0	10	5	1
	35	3	3	2	19	2	2	4	9	0	5	2	3	20	25	0	9	2	2
	40	4	3	0	21	2	2	5	9	0	3	1	2	15	23	1	9	1	2
	45	7	3	1	26	2	3	6	9	1	0	0	2	21	25	3	8	1	2
	50	8	2	1	29	5	3	6	8	1	0	1	1	26	25	4	7	0	2
	55	4	2	1	29	4	4	6	6	2	3	1	1	23	25	5	6	0	3
18	0	6	3	2	30	5	6	6	5	3	4	3	1	17	22	6	6	1	2
	5	8	3	4	32	4	6	6	5	4	4	3	1	20	23	6	8	1	4
	10	8	2	4	34	3	7	6	4	5	5	3	1	28	24	7	9	2	4
	15	9	3	6	35	3	6	9	5	4	6	4	0	40	25	9	14	5	5
	20	8	3	6	37	2	7	10	4	5	7	4	0	31	23	9	12	5	6
	25	6	2	7	39	3	8	9	4	6	8	4	1	29	21	11	10	3	6
	30	5	2	7	42	4	8	8	3	8	8	4	1	19	19	11	12	2	7
	35	6	2	7	42	3	8	8	2	7	11	4	1	13	13	11	8	2	3
	40	7	2	6	42	3	8	9	1	6	7	4	1	10	7	9	8	3	7
	45	10	1	6	42	4	9	13	1	8	13	4	2	2	1	9	8	2	9
	50	9	1	6	43	4	8	13	1	9	11	3	3	0	0	9	10	2	9
	55	8	1	5	43	4	7	13	0	9	4	3	3	0	1	8	6	1	10
19	0	9	0	8	43	4	5	13	1	9	9	3	2	9	3	11	7	1	10

Term Hour Data. Cheltenham—*continued.*

—		Nov. 20, 1911.			Nov. 24, 1911.			Dec. 18, 1911.			Dec. 22, 1911.			Jan. 22, 1912.			Jan. 26, 1912.		
		H	D	V	H	D	V	H	D	V	H	D	V	H	D	V	H	D	V
h.	m.	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
18	0	0	1	0	0	0	0	1	0	3	0	0	1	3	0	0	1	0	0
	5	6	1	0	0	0	0	0	1	3	1	0	1	1	0	0	0	1	1
	10	3	0	3	0	0	0	0	2	3	2	1	1	1	0	1	0	1	2
	15	3	1	2	2	0	0	0	4	3	1	2	1	2	1	1	0	1	2
	20	6	1	2	3	2	0	0	3	1	1	2	1	2	1	1	1	2	2
	25	4	1	2	6	1	0	0	4	1	1	4	1	3	2	2	2	2	3
	30	4	1	2	6	2	0	2	4	0	0	4	1	4	2	2	2	2	2
	35	4	2	2	7	2	1	1	5	0	3	5	0	3	3	2	2	3	3
	40	6	2	1	7	3	1	2	6	0	2	5	0	3	4	2	4	3	3
	45	6	4	2	7	4	1	5	7	0	3	6	0	3	3	4	2	3	3
	50	7	2	3	6	4	2	4	7	1	6	6	0	2	3	4	5	4	3
	55	8	4	3	7	5	2	3	8	3	6	6	0	3	4	4	4	5	3
19	0	9	7	4	7	5	2	4	8	4	6	8	0	2	4	4	4	5	3
	5	9	8	4	7	6	3	4	8	4	6	8	0	6	5	4	4	5	3
	10	9	8	4	7	6	3	5	9	4	5	9	1	5	5	5	2	5	3
	15	10	8	4	8	6	3	6	10	3	6	9	1	3	5	5	3	6	3
	20	12	9	4	7	7	3	7	11	3	6	10	1	4	5	5	3	6	3
	25	12	10	5	7	8	3	7	11	3	6	11	1	7	5	6	2	6	3
	30	11	9	6	8	9	4	8	12	3	6	11	1	4	5	6	2	8	3
	35	12	10	6	9	10	4	8	12	3	5	11	1	2	5	7	3	9	3
	40	14	11	6	10	11	4	8	12	3	6	11	2	3	6	7	2	9	3
	45	13	10	7	10	10	4	8	12	3	6	12	2	0	6	7	3	9	4
	50	13	12	6	10	11	4	7	12	1	7	12	2	3	8	6	3	8	3
	55	14	14	6	10	11	4	8	13	1	6	13	1	2	6	8	3	9	3
20	0	15	13	6	11	11	4	7	13	1	6	13	1	0	6	8	3	9	3

Term Hour Data. Tucson.

—		May 29, 1911.			June 2, 1911.			June 26, 1911.			June 30, 1911.			July 24, 1911.			July 28, 1911.		
		H	D	V	H	D	V	H	D	V	H	D	V	H	D	V	H	D	V
h.	m.	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
8	0	1	0	2	6	0	2	1	0	0	0	0	0	1	2	1	2	6	0
	5	0	1	1	4	0	1	1	1	1	0	0	0	3	2	1	4	6	0
	10	0	0	1	5	1	1	1	2	1	0	0	0	4	1	1	2	5	1
	15	1	0	1	4	2	1	1	2	1	0	0	0	5	0	1	2	6	1
	20	1	1	1	5	5	0	1	2	0	1	1	0	5	0	1	5	6	1
	25	2	1	1	5	7	0	1	1	0	1	1	0	6	1	1	4	6	1
	30	2	1	1	4	10	0	1	1	0	1	1	0	6	2	1	3	8	1
	35	2	1	1	4	10	0	0	2	0	1	1	0	7	2	1	0	6	1
	40	2	1	1	4	12	0	0	2	0	1	1	0	6	1	1	4	6	1
	45	3	0	1	4	13	0	1	2	0	1	1	0	6	2	1	4	5	1
	50	3	1	0	4	11	0	1	2	0	1	1	0	5	3	1	6	1	1
	55	2	1	0	3	12	0	1	2	0	1	1	0	2	5	1	7	3	1
9	0	2	1	0	2	11	0	1	2	0	1	1	0	4	6	1	11	0	1
	5	2	1	0	2	11	0	2	2	0	2	1	0	7	6	1	11	1	1
	10	2	1	0	2	10	0	3	2	0	2	1	0	7	5	2	14	3	1
	15	2	1	0	1	9	0	4	1	0	1	1	0	7	6	2	14	5	2
	20	2	1	0	1	9	0	4	2	0	1	1	1	5	6	1	11	7	2
	25	3	1	0	2	9	0	4	2	0	1	1	0	2	6	1	11	10	1
	30	4	1	0	1	8	0	5	2	0	1	1	0	3	8	1	12	5	1
	35	4	0	0	0	9	0	5	2	0	1	1	0	3	6	1	13	6	2
	40	4	0	1	1	7	0	6	2	1	2	1	1	2	6	1	17	2	2
	45	4	0	1	2	4	0	7	2	1	1	1	1	2	7	1	15	4	2
	50	4	0	1	3	4	0	7	2	1	2	2	1	1	7	1	14	10	2
	55	4	0	1	4	5	0	7	2	1	2	2	1	1	8	0	14	14	2
10	0	4	0	1	5	6	0	7	2	0	2	2	1	0	8	0	20	9	1

—		May 22, 1911.			May 26, 1911.			June 19, 1911.			June 23, 1911.			July 17, 1911.			July 21, 1911.		
		H	D	V	H	D	V	H	D	V	H	D	V	H	D	V	H	D	V
h.	m.	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
17	0	0	21	2	1	43	2	1	36	12	8	24	11	18	30	6	8	22	3
	5	1	21	2	0	41	2	1	33	11	7	22	9	15	26	6	8	21	2
	10	1	20	2	3	39	1	1	31	10	8	21	9	15	23	6	8	17	1
	15	2	18	2	5	36	1	1	30	9	7	20	8	15	21	6	8	14	0
	20	3	18	2	5	32	0	1	29	8	5	18	6	17	19	6	9	14	0
	25	3	16	2	5	33	0	1	26	8	5	17	6	15	22	6	8	14	0
	30	3	15	1	8	31	0	0	25	8	5	16	5	15	23	6	8	12	0
	35	4	15	1	11	27	0	1	22	5	5	16	5	11	24	6	9	8	0
	40	6	14	1	13	24	0	1	21	3	4	15	5	10	22	6	8	6	0
	45	7	14	1	15	22	0	1	20	2	2	14	5	9	23	5	8	6	0
	50	8	14	1	15	21	0	1	17	1	1	12	4	8	23	4	7	6	0
	55	8	14	0	14	18	0	1	15	1	1	11	3	7	20	3	6	6	0
18	0	8	13	0	16	18	0	2	15	0	1	10	2	5	17	3	6	6	0
	5	8	10	0	18	14	0	3	14	0	0	10	3	2	16	3	6	6	0
	10	9	10	0	20	11	0	3	13	0	0	9	2	4	16	2	5	6	0
	15	9	8	0	21	9	0	6	10	0	0	8	2	7	16	2	6	6	0
	20	9	8	0	21	7	0	8	8	0	0	8	2	5	16	1	5	5	0
	25	8	7	0	21	6	0	9	7	0	0	7	1	2	15	1	5	5	0
	30	7	6	0	20	8	0	9	6	0	1	7	1	0	15	0	4	4	0
	35	8	6	1	22	6	1	9	4	0	2	6	0	2	10	0	3	2	0
	40	10	5	1	23	4	1	12	2	0	2	6	0	5	6	0	3	2	0
	45	11	4	2	24	3	2	14	2	0	5	5	0	6	1	0	2	2	0
	50	11	3	3	26	3	3	15	1	0	4	2	1	6	0	1	2	2	0
	55	11	2	3	28	2	4	16	1	0	2	0	1	5	2	1	1	1	0
19	0	10	0	3	28	0	4	16	0	1	3	0	2	6	2	2	0	0	0

—		Nov. 20, 1911.			Nov. 24, 1911.			Dec. 18, 1911.			Dec. 22, 1911.			Jan. 22, 1912.			Jan. 26, 1912.		
		H	D	V	H	D	V	H	D	V	H	D	V	H	D	V	H	D	V
h.	m.	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
18	0	—	—	—	—	—	—	3	6	1	3	18	0	6	7	1	2	3	6
	5	1	10	2	—	—	—	—	—	—	—	—	—	6	6	1	1	2	5
	10	0	6	1	—	—	—	—	—	—	2	14	0	5	6	0	0	3	5
	15	1	3	1	—	—	—	—	—	—	3	13	0	5	7	0	0	4	5
	20	2	2	0	—	—	—	1	6	0	1	14	0	5	6	0	0	4	4
	25	1	2	0	—	—	—	1	5	0	0	12	1	5	6	0	0	3	4
	30	1	2	0	—	—	—	1	3	0	1	12	1	5	6	0	0	3	4
	35	2	2	0	—	—	—	1	2	0	3	11	1	4	6	0	1	4	4
	40	2	0	0	—	—	—	1	2	1	3	10	1	4	5	0	1	4	4
	45	2	0	0	—	—	—	2	1	1	3	9	1	4	5	0	1	3	4
	50	4	0	0	—	—	—	1	1	2	4	7	1	4	6	0	1	4	4
	55	4	0	0	—	—	—	1	1	2	5	6	1	3	4	0	1	4	4
19	0	4	0	0	—	—	—	0	0	3	6	6	2	3	5	0	1	2	4
	5	5	0	0	—	—	—	0	0	3	3	6	1	5	4	0	1	2	4
	10	5	0	0	—	—	—	0	0	4	3	6	2	4	4	0	0	2	4
	15	6	2	0	—	—	—	0	0	4	3	4	2	3	3	0	0	2	4
	20	6	2	1	—	—	—	1	0	5	3	3	3	3	3	0	0	1	3
	25	7	2	1	—	—	—	1	0	6	4	3	3	6	2	1	0	1	3
	30	7	3	1	—	—	—	1	0	7	3	2	3	4	2	1	0	0	3
	35	8	4	1	—	—	—	1	1	8	5	2	4	3	2	1	0	0	3
	40	8	4	2	—	—	—	2	1	8	5	1	4	3	2	1	0	0	2
	45	9	5	2	—	—	—	2	2	10	6	1	4	2	2	1	1	0	1
	50	9	6	3	—	—	—	1	2	10	6	1	5	1	2	2	1	0	1
	55	10	4	4	—	—	—	1	2	11	6	0	5	2	0	2	0	1	0
20	0	10	3	4	—	—	—	1	2	11	6	0	5	0	2	3	0	2	0

Term Hour Data. Lukiapang.

—	May 29, 1911.			June 2, 1911.			June 26, 1911.			June 30, 1911.			July 24, 1911.			July 28, 1911.		
	H	D	V	H	D	V	H	D	V	H	D	V	H	D	V	H	D	V
h. m.	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
8 0	13	0	1	19	0	0	3	0	0	7	0	0	5	0	0	26	—	0
5	13	1	1	19	1	0	2	0	0	7	1	0	6	0	1	21	—	0
10	12	1	2	19	2	0	2	0	0	7	2	0	6	0	2	22	—	0
15	12	1	2	18	2	1	1	0	0	7	3	0	6	1	3	20	—	0
20	11	2	2	17	2	1	1	1	0	6	5	0	5	1	3	17	—	1
25	10	2	2	15	2	1	1	1	1	5	5	1	4	1	3	15	—	2
30	10	2	2	14	2	2	0	0	1	4	6	1	5	1	4	11	—	3
35	8	2	2	14	2	2	0	1	1	3	6	1	6	1	4	12	—	4
40	8	2	2	12	2	2	0	1	1	3	7	1	5	0	4	2	—	6
45	7	2	2	10	2	2	0	1	1	3	8	1	4	1	6	5	—	4
50	6	3	1	10	2	3	0	2	1	3	8	1	1	1	7	9	—	4
55	5	3	1	11	2	3	0	2	2	3	9	2	0	1	7	9	—	3
9 0	4	4	1	12	3	3	1	2	2	2	9	2	0	0	7	5	—	3
5	4	4	1	16	4	3	1	1	2	2	10	2	—	0	—	6	—	—
10	—	4	1	17	4	3	1	2	2	2	10	2	—	1	—	7	—	—
15	—	4	1	16	5	4	2	3	2	1	10	2	—	0	8	8	—	—
20	—	5	1	14	5	4	1	4	2	1	10	3	—	0	8	5	—	—
25	—	5	0	11	5	4	1	3	3	0	10	3	—	0	8	5	—	—
30	—	5	0	0	6	4	1	3	3	0	11	3	—	0	8	3	—	—
35	2	—	0	11	6	4	—	2	3	—	—	—	—	0	8	3	—	—
40	1	—	0	16	6	4	—	2	3	—	—	—	—	0	8	0	—	—
45	0	—	1	13	6	3	—	1	—	—	—	—	—	—	—	—	—	—
50	0	—	1	6	6	3	—	1	—	—	—	—	—	—	—	—	—	—
55	0	—	1	2	7	3	—	1	—	—	—	—	—	—	—	—	—	—
10 0	—	—	1	0	7	3	—	1	—	—	—	—	—	—	—	—	—	—

—	May 22, 1911.			May 26, 1911.			June 19, 1911.			June 23, 1911.			July 17, 1911.			July 21, 1911.		
	H	D	V	H	D	V	H	D	V	H	D	V	H	D	V	H	D	V
h. m.	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
17 0	3	—	1	8	1	0	6	0	2	5	0	0	8	1	2	5	0	6
5	2	—	2	9	0	0	6	0	2	6	0	0	6	4	2	4	1	5
10	1	—	2	8	0	1	5	1	2	5	1	0	6	7	1	4	1	5
15	0	—	0	7	1	2	5	1	2	6	1	1	7	6	1	4	2	4
20	0	—	2	10	2	1	5	1	2	6	2	1	8	7	2	5	3	4
25	0	—	2	11	4	1	4	1	2	5	1	1	11	5	3	3	4	4
30	1	—	1	10	5	1	3	0	2	8	0	1	10	4	3	4	5	3
35	3	—	2	9	6	1	3	0	2	7	0	1	12	5	4	4	6	3
40	5	—	1	7	5	0	3	0	2	5	1	0	7	4	4	5	8	3
45	4	—	0	9	5	0	2	0	2	2	1	0	8	2	3	4	8	3
50	4	—	0	8	6	0	2	0	1	1	0	0	9	2	3	3	8	3
55	5	—	0	6	6	0	2	0	1	0	0	0	7	4	4	2	7	3
18 0	4	—	1	10	6	0	2	0	1	0	0	0	2	5	2	3	6	3
5	4	—	0	6	8	0	2	1	0	1	0	0	4	6	1	3	6	2
10	3	—	0	5	9	0	3	1	0	1	0	0	2	1	2	2	5	2
15	3	—	1	2	10	0	2	1	0	1	0	0	6	0	2	2	6	2
20	1	—	1	0	11	0	3	2	0	1	0	1	4	4	2	2	6	2
25	1	—	1	0	11	0	2	2	0	1	0	1	7	5	2	1	8	2
30	0	—	0	6	11	0	1	2	0	0	0	1	4	6	2	2	8	2
35	2	—	0	2	11	0	0	2	0	0	3	1	5	8	3	1	8	1
40	3	—	0	2	10	1	1	2	0	2	5	1	4	10	2	0	7	1
45	4	—	0	3	9	1	1	2	0	0	6	1	0	11	2	0	7	1
50	—	—	0	2	8	1	2	3	0	0	6	3	0	10	0	1	8	1
55	—	—	0	1	8	1	2	3	0	2	6	3	1	8	1	2	9	0
19 0	—	—	0	1	9	1	1	2	0	3	6	3	0	8	1	1	9	0

TERM HOUR DATA. LUKIAPANG—*continued.*

—		Nov. 20, 1911.			Nov. 24, 1911.			Dec. 18, 1911.			Dec. 22, 1911.			Jan. 22, 1912.			Jan. 26, 1912.		
		H	D	V	H	D	V	H	D	V	H	D	V	H	D	V	H	D	V
h.	m.	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
18	0	0	1	0	0	1	0	5	5	—	0	0	0	1	1	1	0	1	0
	5	0	2	0	1	1	0	4	5	—	1	1	0	0	1	1	2	1	0
	10	0	1	0	1	1	0	0	5	—	2	1	0	0	0	1	3	0	0
	15	0	1	0	2	1	0	—	5	—	2	1	1	1	1	1	4	0	0
	20	0	1	0	4	1	0	—	4	—	2	1	1	3	2	1	3	0	0
	25	0	1	0	5	1	0	—	4	—	1	1	1	4	2	1	3	1	0
	30	1	1	0	5	1	0	—	4	—	0	0	1	4	2	1	2	1	0
	35	1	0	1	6	1	0	—	3	—	2	0	1	4	2	1	3	2	0
	40	0	0	1	5	1	0	—	2	—	3	0	1	3	2	1	2	2	1
	45	0	0	1	4	1	1	—	1	—	3	0	1	3	2	1	2	2	1
	50	1	0	1	4	1	1	—	0	—	4	0	1	3	2	1	2	2	1
	55	1	0	2	5	1	1	—	0	—	5	1	1	4	3	1	3	2	1
19	0	1	0	2	5	1	1	—	0	—	6	1	1	3	2	0	3	2	2
	5	2	0	2	5	1	2	—	0	—	6	1	1	5	2	0	2	2	2
	10	2	0	2	5	0	2	—	0	—	4	1	1	6	1	0	3	2	2
	15	2	0	2	4	0	2	—	0	—	3	1	2	4	2	0	4	2	2
	20	2	1	2	3	0	2	—	0	—	2	1	2	2	2	0	3	1	2
	25	3	1	3	2	0	3	—	1	—	2	1	2	5	2	0	3	1	1
	30	3	0	2	2	0	3	5	2	—	1	1	2	5	0	0	4	0	1
	35	3	0	2	3	0	3	3	3	—	1	1	2	5	1	0	4	0	1
	40	3	1	2	4	0	3	2	3	—	1	1	3	4	2	0	4	1	1
	45	3	1	2	5	0	3	1	3	—	2	1	3	1	2	0	4	1	1
	50	2	1	2	6	0	3	0	3	—	2	1	3	0	1	0	4	2	1
	55	3	1	2	6	0	4	0	4	—	2	0	3	1	0	0	4	2	1
20	0	3	1	3	5	0	4	0	4	—	2	0	3	1	0	0	5	2	1

TERM HOUR DATA. DEHRA DUN.

—		May 29, 1911.			June 2, 1911.			June 26, 1911.			June 30, 1911.			July 24, 1911.			July 28, 1911.		
		H	D	V	H	D	V	H	D	V	H	D	V	H	D	V	H	D	V
h.	m.	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
8	0	9	0	0	2	2	—	2	2	0	13	2	0	12	0	5	18	0	0
	5	8	0	0	2	1	—	2	0	0	12	1	0	14	0	5	22	0	3
	10	7	1	0	1	2	—	2	1	0	13	2	0	14	1	5	24	2	4
	15	6	2	1	2	2	0	2	2	1	13	2	0	15	1	5	23	3	6
	20	5	4	1	2	1	1	2	2	1	12	2	0	14	1	6	20	4	6
	25	4	5	2	1	1	2	2	2	2	12	1	0	14	1	6	20	7	6
	30	4	7	2	1	1	2	2	2	3	11	1	0	15	2	6	17	8	6
	35	3	7	3	0	1	2	3	2	4	10	0	0	15	2	4	13	10	6
	40	4	8	4	0	0	2	4	4	4	9	1	0	14	2	4	8	11	5
	45	4	8	4	1	1	3	5	6	5	9	2	0	11	4	3	9	16	6
	50	4	9	5	0	0	4	6	7	6	8	3	1	9	4	2	13	17	7
	55	3	10	5	1	1	4	6	8	6	7	3	2	6	7	0	13	18	9
9	0	3	10	5	2	1	5	6	9	6	5	4	3	10	7	1	12	18	8
	5	3	11	6	2	1	6	7	9	7	5	4	4	11	7	2	12	19	9
	10	3	11	7	2	2	8	7	10	8	4	5	5	11	6	2	15	20	9
	15	2	12	7	2	2	8	7	9	9	3	6	5	9	6	2	15	20	10
	20	2	13	7	2	3	9	6	10	8	2	7	5	6	8	1	14	20	11
	25	1	13	7	4	4	10	5	10	8	1	7	5	2	10	0	13	22	11
	30	1	13	8	4	5	11	4	11	9	1	10	6	4	10	0	13	25	12
	35	2	14	8	3	5	11	3	11	9	1	10	7	2	11	1	12	27	13
	40	1	15	8	2	7	11	2	11	9	1	11	7	2	12	1	10	28	13
	45	0	16	8	3	8	11	1	12	9	0	12	8	2	12	1	8	29	13
	50	0	17	8	4	9	11	1	12	9	0	13	9	0	15	0	8	29	15
	55	0	17	7	5	10	11	0	14	9	0	13	9	0	12	1	4	30	15
10	0	0	18	7	6	11	12	0	16	10	0	14	9	2	13	1	0	32	14

—		May 22, 1911.			May 26, 1911.			June 19, 1911.			June 23, 1911.			July 17, 1911.			July 21, 1911.		
		H	D	V	H	D	V	H	D	V	H	D	V	Ḣ	D	V	H	D	V
h.	m.	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
17	0	1	0	—	5	4	—	4	2	—	7	0	0	13	0	0	4	1	1
	5	1	0	—	6	3	3	4	2	—	6	0	0	11	1	—	4	0	1
	10	0	0	0	7	1	3	5	2	—	6	0	0	11	3	—	2	0	0
	15	1	0	1	8	0	3	6	1	—	6	0	0	11	3	1	1	1	0
	20	1	0	2	9	0	2	5	1	—	6	1	0	11	2	1	2	1	0
	25	0	1	2	9	0	4	4	1	—	8	0	0	11	2	2	1	1	0
	30	0	2	2	10	0	3	4	1	—	7	0	—	15	1	2	2	2	0
	35	2	1	3	8	2	2	5	1	—	6	0	—	13	1	4	2	2	1
	40	4	0	4	6	4	1	5	1	—	3	0	—	12	2	3	4	2	1
	45	3	0	4	6	4	1	5	2	—	1	0	—	15	1	3	4	2	1
	50	3	1	4	5	3	2	4	2	—	0	1	—	16	0	4	4	3	1
	55	3	2	3	5	5	1	3	2	—	1	1	—	10	1	3	4	3	1
18	0	4	2	3	5	5	1	3	2	—	2	1	—	8	3	3	4	3	1
	5	4	2	3	5	5	1	2	1	—	1	2	0	12	3	4	2	3	1
	10	4	2	3	4	4	1	2	1	—	2	2	0	15	4	4	3	4	0
	15	4	2	4	1	6	0	3	1	—	2	2	0	15	2	5	4	5	0
	20	2	2	3	0	6	0	2	0	—	1	2	0	15	3	4	3	5	0
	25	1	3	3	0	7	0	2	0	—	0	2	0	13	3	4	1	6	0
	30	0	3	3	4	6	1	0	0	—	2	3	0	9	5	4	2	6	0
	35	3	3	4	5	6	2	0	2	—	4	2	0	7	7	3	1	7	0
	40	4	3	4	4	6	2	0	2	—	0	3	0	3	9	2	0	8	0
	45	5	3	5	4	6	2	1	2	—	2	2	1	0	10	2	1	8	0
	50	6	3	5	6	5	2	2	2	—	4	4	1	0	11	1	2	8	0
	55	7	3	5	4	5	2	2	2	—	2	9	1	2	11	2	1	8	0
19	0	4	3	5	4	5	2	3	2	—	3	9	1	6	10	3	1	9	0

—		Nov. 20, 1911.			Nov. 24, 1911.			Dec. 18, 1911.			Dec. 22, 1911.			Jan. 22, 1912.			Jan. 26, 1912.		
		H	D	V	H	D	V	H	D	V	H	D	V	H	D	V	H	D	V
h.	m.	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
18	0	0	0	0	0	1	0	4	4	1	1	1	2	1	5	0	1	4	1
	5	0	1	0	0	1	0	1	5	0	4	0	2	0	5	0	1	3	1
	10	0	0	0	1	2	0	0	5	0	3	0	2	1	4	0	2	3	1
	15	0	0	0	3	1	1	0	5	0	2	0	2	2	4	0	2	3	1
	20	1	0	0	4	1	1	1	4	1	1	2	1	4	3	1	2	2	1
	25	1	0	0	6	1	1	2	4	1	1	1	1	4	3	1	1	2	1
	30	2	0	0	6	1	2	4	4	1	1	1	1	4	3	1	1	2	1
	35	1	0	0	8	1	2	2	4	1	2	0	1	4	2	1	1	1	1
	40	2	0	0	7	1	2	3	5	1	2	0	1	4	2	1	0	1	0
	45	2	1	1	6	1	2	4	2	1	4	0	1	4	2	1	0	1	0
	50	3	1	1	6	1	2	4	1	1	4	0	1	4	2	1	0	1	0
	55	4	1	1	6	1	2	4	1	2	5	0	1	4	3	1	0	1	0
19	0	4	0	1	6	1	2	4	1	2	4	0	1	4	2	1	1	1	0
	5	4	1	1	6	1	2	4	1	2	1	2	1	7	2	1	0	1	0
	10	4	1	1	5	1	2	4	1	2	1	1	1	6	1	1	0	1	0
	15	4	0	0	5	1	2	4	0	2	1	1	0	4	1	1	1	1	1
	20	4	0	1	4	2	2	4	0	2	1	1	0	3	2	1	1	1	1
	25	4	0	0	4	2	2	4	0	2	1	1	0	4	1	1	1	1	1
	30	4	0	0	4	1	1	4	1	1	1	1	0	4	1	1	1	0	1
	35	4	1	0	4	1	1	4	1	1	0	1	0	2	2	1	1	0	1
	40	3	1	0	4	0	2	3	0	1	1	1	0	1	2	1	1	0	1
	45	3	1	0	4	0	2	3	0	1	1	0	0	1	3	0	1	2	0
	50	4	0	0	6	0	2	3	0	1	1	0	0	0	2	0	0	1	0
	55	4	0	0	7	0	3	2	1	0	1	0	0	1	0	0	0	1	0
20	0	5	0	0	6	0	3	2	1	1	0	3	0	0	0	0	1	1	0

—		May 29, 1911.			June 2, 1911.			June 26, 1911.			June 30, 1911.			July 24, 1911.			July 28, 1911		
		H	D	V	H	D	V	H	D	V	H	D	V	H	D	V	H	D	V
h.	m.	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
8	0	0	24	2	1	18	12	0	30	1	0	23	3	—	—	—	—	—	—
	5	1	23	1	1	19	11	1	29	1	1	21	3	—	—	—	—	—	—
	10	0	23	1	0	20	10	1	26	0	3	20	1	—	—	—	—	—	—
	15	1	21	0	3	15	9	3	26	1	3	19	2	—	—	—	—	—	—
	20	2	19	0	3	14	8	5	24	1	4	18	1	—	—	—	—	—	—
	25	4	16	0	4	13	7	5	22	2	5	16	1	—	—	—	—	—	—
	30	5	14	1	5	11	6	6	21	3	5	16	0	—	—	—	—	—	—
	35	7	11	1	5	11	6	7	19	3	5	14	0	—	—	—	—	—	—
	40	9	10	1	5	10	4	8	18	3	7	13	0	—	—	—	—	—	—
	45	11	9	2	5	9	4	11	15	4	8	12	0	—	—	—	—	—	—
	50	13	7	4	5	9	3	13	13	4	9	11	0	—	—	—	—	—	—
	55	13	5	5	6	7	3	14	11	4	10	11	0	—	—	—	—	—	—
9	0	13	5	6	8	5	2	15	9	6	10	11	0	—	—	—	—	—	—
	5	16	5	6	10	5	1	18	7	6	10	10	1	—	—	—	—	—	—
	10	18	5	7	12	4	1	20	6	8	11	7	1	—	—	—	—	—	—
	15	19	4	7	12	4	1	23	4	8	12	7	3	—	—	—	—	—	—
	20	20	4	7	13	4	1	24	4	9	12	7	3	—	—	—	—	—	—
	25	22	3	7	14	4	1	25	4	11	12	6	4	—	—	—	—	—	—
	30	22	3	7	16	4	1	26	4	11	13	5	4	—	—	—	—	—	—
	35	24	3	8	18	4	0	27	4	11	14	4	5	—	—	—	—	—	—
	40	24	2	9	18	3	0	27	3	11	14	4	5	—	—	—	—	—	—
	45	24	1	9	18	2	0	27	3	12	15	3	5	—	—	—	—	—	—
	50	26	0	9	18	0	1	27	1	14	17	3	5	—	—	—	—	—	—
	55	25	0	9	20	0	1	27	2	14	17	2	6	—	—	—	—	—	—
10	0	—	—	10	—	—	1	27	0	14	18	0	6	—	—	—	—	—	—

—		May 22, 1911.			May 26, 1911.			June 19, 1911.			June 23, 1911.			July 17, 1911.			July 21, 1911.		
		H	D	V	H	D	V	H	D	V	H	D	V	H	D	V	H	D	V
h.	m.	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
17	0	3	1	1	—	—	—	4	0	1	1	0	1	—	—	—	—	—	—
	5	3	2	1	—	—	—	5	1	1	3	0	0	—	—	—	—	—	—
	10	3	0	1	—	—	—	4	1	1	3	2	0	—	—	—	—	—	—
	15	3	0	1	0	0	—	5	2	0	3	1	0	—	—	—	—	—	—
	20	3	1	1	3	0	—	3	2	0	2	2	1	—	—	—	—	—	—
	25	3	2	1	5	0	—	3	1	0	5	1	0	—	—	—	—	—	—
	30	3	2	1	7	0	2	5	1	0	5	1	1	—	—	—	—	—	—
	35	4	2	1	7	0	1	5	1	0	3	2	1	—	—	—	—	—	—
	40	5	1	0	4	0	2	5	2	1	0	2	3	—	—	—	—	—	—
	45	5	2	1	3	1	2	5	2	1	0	3	3	—	—	—	—	—	—
	50	5	3	1	3	2	2	3	2	1	0	4	3	—	—	—	—	—	—
	55	4	4	0	5	2	2	3	2	1	1	5	3	—	—	—	—	—	—
18	0	3	3	0	5	1	2	3	2	2	2	6	3	—	—	—	—	—	—
	5	3	3	1	6	0	2	1	2	2	3	6	3	—	—	—	—	—	—
	10	3	3	1	6	0	2	1	2	2	1	6	3	—	—	—	—	—	—
	15	3	2	0	6	0	2	3	2	2	3	6	3	—	—	—	—	—	—
	20	2	3	0	—	0	3	1	2	2	3	6	4	—	—	—	—	—	—
	25	1	4	2	—	0	2	1	2	2	3	6	3	—	—	—	—	—	—
	30	0	4	2	—	0	1	1	3	2	3	6	3	—	—	—	—	—	—
	35	1	4	1	—	0	0	0	4	2	3	6	3	—	—	—	—	—	—
	40	1	5	2	—	1	0	1	4	2	3	6	4	—	—	—	—	—	—
	45	3	5	1	—	2	1	1	3	1	5	6	5	—	—	—	—	—	—
	50	3	5	0	—	1	1	2	2	1	3	6	5	—	—	—	—	—	—
	55	3	5	0	—	0	2	3	2	1	2	8	6	—	—	—	—	—	—
19	0	—	7	1	—	0	2	3	3	1	3	8	4	—	—	—	—	—	—

TERM HOUR DATA. HELWAN—*continued*.

—		Nov. 20, 1911.			Nov. 24, 1911.			Dec. 18, 1911.			Dec. 22, 1911.			Jan. 22, 1912.			Jan. 26, 1912.		
		H	D	V	H	D	V	H	D	V	H	D	V	H	D	V	H	D	V
h.	m.	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
18	0	—	—	—	1	3	—	3	1	1	3	0	2	3	1	2	0	4	0
	5	—	—	—	1	3	—	1	1	1	4	0	1	2	2	2	1	4	0
	10	—	—	—	2	3	—	0	0	2	4	0	1	3	2	2	1	4	1
	15	—	—	—	4	3	—	0	0	2	3	0	1	4	2	1	0	4	0
	20	—	—	—	4	3	—	1	3	1	3	0	1	5	2	0	1	4	1
	25	—	—	—	5	3	—	1	5	1	3	0	1	5	0	0	0	4	1
	30	—	—	—	6	4	—	1	3	1	3	0	2	5	0	0	1	2	1
	35	—	—	—	6	3	—	1	3	1	5	0	1	5	0	1	2	2	1
	40	—	—	—	5	3	—	0	3	1	5	2	1	5	1	1	1	1	1
	45	—	—	—	4	3	1	1	3	1	5	2	1	5	1	1	1	0	1
	50	—	—	—	3	3	0	1	4	1	6	2	1	5	2	1	1	0	1
	55	—	—	—	4	3	1	1	4	1	7	0	1	6	2	1	1	0	1
19	0	—	—	—	3	3	1	1	3	1	7	2	0	7	2	1	2	0	1
	5	—	—	—	3	4	1	1	4	1	5	1	1	9	2	0	1	2	1
	10	—	—	—	2	3	1	0	4	1	3	0	2	10	2	0	2	1	·1
	15	—	—	—	1	3	1	0	4	2	3	0	2	7	2	2	3	1	1
	20	—	—	—	1	2	1	1	4	1	3	0	2	5	2	2	2	2	1
	25	—	—	—	0	3	1	1	3	2	3	0	2	6	2	2	2	2	1
	30	—	—	—	0	3	1	2	3	1	2	2	2	3	2	2	3	3	1
	35	—	—	—	1	3	1	2	3	1	1	3	2	3	2	2	4	2	1
	40	—	—	—	2	3	1	2	3	1	3	2	2	4	2	2	3	2	1
	45	—	—	—	4	3	1	2	3	1	2	1	2	1	2	2	3	3	1
	50	—	—	—	3	3	1	2	3	0	1	3	2	0	2	3	2	2	1
	55	—	—	—	1	2	1	3	3	1	2	4	2	1	2	3	2	2	1
20	0	—	—	—	3	0	1	2	3	1	0	4	2	1	2	3	3	1	1

TERM HOUR DATA. BARRACKPORE.

—		May 29, 1911.			June 2, 1911.			June 26, 1911.			June 30, 1911.			July 24, 1911.			July 28, 1911.		
		H	D	V	H	D	V	H	D	V	H	D	V	H	D	V	H	D	V
h.	m.	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
8	0	22	0	3	15	0	5	26	0	0	14	1	0	9	4	4	36	0	6
	5	21	1	4	15	0	6	25	0	0	14	0	1	12	3	3	37	1	5
	10	19	1	4	14	0	5	23	1	1	14	0	1	12	2	3	38	2	5
	15	19	2	4	14	1	5	23	1	1	14	0	1	13	2	2	35	4	5
	20	16	2	4	13	1	5	22	2	1	14	0	1	12	1	3	32	8	5
	25	15	2	3	11	1	4	21	3	1	14	0	1	13	1	2	31	12	4
	30	14	2	4	10	3	5	19	4	1	13	2	1	13	1	3	26	12	4
	35	14	4	3	9	4	5	19	7	2	12	2	2	13	1	3	27	13	3
	40	14	3	2	8	5	5	18	9	3	12	3	2	13	1	3	20	14	2
	45	13	3	3	7	5	4	18	10	3	12	4	2	10	0	3	21	23	0
	50	11	5	3	6	7	5	17	11	3	11	5	3	9	1	3	24	24	0
	55	10	5	1	5	7	5	16	12	5	11	7	3	8	0	3	22	24	0
9	0	10	5	0	5	8	5	15	12	5	10	8	3	10	1	3	21	24	1
	5	9	5	0	5	8	4	14	12	6	10	8	4	12	1	3	20	26	2
	10	8	8	0	5	9	4	15	12	6	8	9	4	10	0	3	21	24	2
	15	7	10	0	5	10	3	13	14	6	7	9	4	10	0	4	21	24	3
	20	6	11	0	4	11	3	12	15	6	5	9	4	5	1	5	17	24	3
	25	5	12	0	4	11	2	10	16	5	5	10	4	4	1	4	16	24	3
	30	5	11	1	3	11	2	9	18	5	4	10	5	4	2	3	15	25	3
	35	4	13	1	2	12	1	9	19	6	3	10	5	2	3	2	12	27	3
	40	4	14	1	1	12	1	7	20	5	2	11	5	3	4	2	11	27	3
	45	3	14	2	0	12	1	4	20	5	0	11	7	1	5	2	7	27	4
	50	1	15	3	0	12	0	3	20	5	0	11	7	0	8	1	7	26	5
	55	0	15	2	0	14	0	2	20	6	0	11	9	0	9	0	3	25	5
10	0	0	15	1	0	16	0	0	20	6	0	12	9	1	9	0	0	30	5

—		May 22, 1911.			May 26, 1911.			June 19, 1911.			June 23, 1911.			July 17, 1911.			July 21, 1911.		
		H	D	V	H	D	V	H	D	V	H	D	V	H	D	V	H	D	V
h.	m.	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
17	0	1	3	0	0	4	0	5	0	1	4	0	3	11	0	0	2	0	2
	5	1	3	1	2	2	1	4	0	1	4	0	2	10	0	1	1	0	2
	10	0	2	0	3	0	2	4	1	1	4	0	2	10	3	0	0	0	3
	15	0	3	1	4	0	2	5	1	1	4	0	1	10	3	0	0	1	2
	20	1	0	1	5	0	2	4	1	1	4	0	1	11	3	0	1	2	2
	25	0	0	2	8	1	1	4	2	2	6	1	1	14	3	0	1	2	2
	30	0	1	2	8	1	1	5	1	2	6	0	0	14	1	0	3	2	1
	35	1	2	2	6	2	2	4	2	2	4	0	1	12	0	2	3	2	2
	40	4	0	3	6	4	1	4	1	2	2	0	1	10	2	1	4	3	2
	45	3	1	3	6	7	1	3	0	1	1	2	0	12	1	0	4	3	3
	50	2	0	2	6	5	1	3	2	1	0	3	0	12	0	2	4	3	2
	55	3	1	3	5	5	1	2	2	0	2	3	0	9	0	3	4	5	2
18	0	3	1	4	6	4	1	3	1	0	1	2	0	6	1	2	4	4	2
	5	2	1	4	6	5	1	1	2	0	2	2	0	9	1	1	3	5	2
	10	3	1	4	5	5	2	2	2	0	2	3	0	11	3	1	4	3	2
	15	3	1	4	3	7	2	3	1	0	2	2	0	10	0	2	4	3	2
	20	2	2	4	3	8	1	3	1	0	0	3	0	9	0	3	4	3	2
	25	1	1	3	3	8	1	1	2	1	0	3	1	9	0	3	2	5	2
	30	1	2	4	6	8	1	1	3	0	1	3	1	5	2	3	4	7	1
	35	4	0	4	8	8	1	0	3	0	2	3	1	5	5	2	3	8	1
	40	4	1	4	7	8	1	0	3	0	0	4	1	3	8	1	2	8	0
	45	6	3	4	7	8	2	1	2	0	1	4	2	0	10	1	3	7	0
	50	7	3	5	8	8	2	1	3	1	3	9	2	0	10	0	4	8	0
	55	7	2	5	8	8	2	2	3	1	2	10	1	3	9	0	4	9	1
19	0	6	2	5	8	8	3	2	3	1	4	10	0	5	7	1	4	10	1

—		Nov. 20, 1911.			Nov. 24, 1911.			Dec. 18, 1911.			Dec. 22, 1911.			Jan. 22, 1912.			Jan. 26, 1912.		
		H	D	V	H	D	V	H	D	V	H	D	V	H	D	V	H	D	V
h.	m.	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
18	0	1	1	0	1	1	1	4	4	1	0	1	0	2	4	2	0	4	0
	5	1	1	1	1	1	0	0	4	0	1	1	0	0	4	1	1	4	0
	10	1	0	1	0	1	0	0	2	1	1	1	0	1	3	1	1	2	0
	15	1	0	1	0	1	1	0	3	1	1	1	1	2	2	2	2	2	0
	20	1	0	0	3	1	2	1	2	0	1	1	1	3	2	2	2	2	0
	25	1	0	1	4	1	2	2	2	0	0	1	1	3	2	2	2	2	0
	30	0	1	1	5	1	2	3	2	1	1	1	1	3	3	3	1	2	0
	35	0	1	1	5	1	2	2	2	2	3	1	1	3	3	2	2	2	0
	40	0	0	1	5	1	2	3	2	1	2	1	1	3	3	1	0	2	0
	45	0	0	1	3	1	2	4	2	2	3	1	2	3	3	2	0	1	0
	50	0	0	1	3	1	1	4	1	2	5	1	1	3	3	1	0	1	0
	55	1	1	1	3	1	1	5	1	2	6	0	1	3	3	1	1	1	1
19	0	0	1	1	3	1	2	5	0	2	6	0	2	5	3	1	1	1	1
	5	1	1	1	3	1	2	4	0	2	4	0	1	7	3	2	0	1	2
	10	0	0	1	3	1	2	5	0	3	3	1	1	7	3	1	1	1	1
	15	0	0	1	2	1	2	5	0	3	3	1	1	5	2	1	1	1	2
	20	0	0	1	2	1	3	5	0	2	3	1	1	3	2	0	1	0	1
	25	1	0	1	1	1	3	5	0	2	3	0	1	5	2	0	2	0	1
	30	1	0	1	2	1	3	4	0	2	3	1	1	3	1	0	2	0	1
	35	1	0	1	3	1	3	4	0	2	3	1	1	3	1	0	2	0	1
	40	1	0	1	3	1	3	4	0	1	4	1	1	3	1	0	2	0	1
	45	1	0	2	5	1	3	4	1	1	4	0	1	2	1	0	2	0	1
	50	1	0	2	5	1	3	4	1	1	6	0	2	1	0	0	2	0	0
	55	1	1	1	4	0	4	4	1	1	5	0	2	2	1	1	1	0	1
20	0	1	0	1	5	0	4	4	1	1	3	0	2	2	0	1	2	0	0

—		May 29, 1911.			June 2, 1911.			June 26, 1911.			June 30, 1911.			July 24, 1911.			July 28, 1911.		
		H	D	V	H	D	V	H	D	V	H	D	V	H	D	V	H	D	V
h.	m.	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
8	0	2	4	0	7	2	2	2	1	1	0	1	6	1	3	2	5	0	—
	5	2	3	0	7	0	1	2	0	1	0	1	5	1	3	2	6	0	—
	10	2	2	0	7	0	1	2	0	0	0	1	4	2	3	2	8	0	—
	15	1	2	0	6	0	0	2	1	0	1	1	4	2	3	2	8	0	—
	20	1	2	0	4	1	0	2	1	0	1	1	4	3	3	2	6	0	—
	25	0	2	1	4	1	1	1	2	0	1	1	3	3	3	2	6	0	—
	30	0	1	1	2	2	1	1	3	0	1	1	3	4	2	2	5	1	—
	35	1	2	2	2	3	1	0	3	1	1	1	3	3	2	1	3	2	—
	40	1	2	2	1	3	1	0	3	1	1	1	3	2	2	1	4	3	—
	45	2	2	2	0	3	2	0	1	1	1	1	2	1	1	1	4	3	—
	50	2	3	2	1	3	2	1	2	1	1	1	2	1	1	0	5	3	—
	55	2	3	2	0	3	2	1	3	1	1	1	2	3	1	1	6	3	—
9	0	1	2	2	0	2	2	2	2	2	1	1	1	4	1	2	8	2	—
	5	2	2	2	0	1	2	2	3	2	1	1	1	4	1	2	7	3	—
	10	2	2	2	1	1	2	2	3	2	2	1	1	4	1	2	7	3	—
	15	2	2	2	0	1	1	2	3	2	1	0	1	2	0	2	8	3	—
	20	2	2	2	1	2	1	2	2	2	1	1	1	1	0	1	6	3	—
	25	2	2	2	1	2	1	2	2	1	1	0	1	1	1	1	6	4	—
	30	3	2	2	1	2	1	3	2	1	1	0	1	1	0	2	7	6	—
	35	3	0	2	1	3	1	3	3	1	1	1	1	1	1	2	8	6	—
	40	3	0	2	2	2	1	3	2	1	1	1	0	1	1	2	8	7	—
	45	4	0	2	2	3	1	3	0	1	2	1	0	0	1	3	5	7	—
	50	4	0	2	4	3	1	4	0	1	2	1	0	0	2	2	2	8	—
	55	4	0	2	3	3	1	4	1	1	2	1	1	1	2	3	0	8	—
10	0	4	0	2	2	3	1	4	1	2	2	1	1	3	3	3	1	8	—

—		May 22, 1911.			May 26, 1911.			June 19, 1911.			June 23, 1911.			July 17, 1911.			July 21, 1911.		
		H	D	V	H	D	V	H	D	V	H	D	V	H	D	V	H	D	V
h.	m.	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
17	0	2	0	0	2	0	9	0	0	3	3	6	15	1	17	13	0	14	17
	5	1	0	0	1	2	9	0	1	3	3	8	15	0	17	12	0	14	17
	10	0	1	0	1	4	9	0	1	3	3	8	14	1	17	11	0	14	17
	15	0	2	0	0	6	10	1	1	3	3	8	14	2	17	10	1	15	16
	20	0	2	1	0	8	10	1	2	3	3	7	12	4	15	10	1	16	16
	25	0	3	1	1	10	10	0	3	3	3	8	12	4	17	11	0	19	15
	30	0	4	0	1	14	10	0	5	3	3	11	11	5	17	12	2	17	15
	35	1	6	1	2	14	10	1	7	4	3	9	10	3	20	12	0	19	14
	40	1	8	1	2	13	10	1	8	5	3	8	9	3	17	11	1	17	13
	45	2	8	2	3	12	9	2	8	5	3	8	8	3	19	11	2	16	13
	50	3	8	2	4	11	8	3	10	5	3	6	7	3	23	12	2	16	12
	55	3	8	2	4	12	8	3	8	5	3	5	7	3	23	11	2	14	10
18	0	3	10	2	4	11	8	3	10	5	2	6	7	2	19	10	2	12	10
	5	3	10	1	5	12	7	3	10	5	2	6	7	2	17	10	2	10	8
	10	3	11	2	6	11	6	4	10	5	1	5	7	2	17	10	4	10	8
	15	2	12	2	6	10	5	5	12	4	1	6	7	2	20	10	4	12	7
	20	3	12	2	5	8	3	5	11	4	1	4	6	2	19	9	4	10	7
	25	3	12	2	5	8	3	5	12	3	1	3	5	3	17	8	5	10	5
	30	2	11	1	5	8	3	5	13	3	1	5	5	3	15	6	5	8	4
	35	2	13	1	5	9	3	6	12	2	1	3	4	4	11	5	5	5	3
	40	2	14	1	5	9	2	7	12	1	1	3	4	5	8	3	6	3	2
	45	3	14	1	5	10	2	8	10	1	1	2	3	7	4	1	7	2	1
	50	3	14	0	5	10	2	9	10	1	0	0	1	7	2	0	7	2	2
	55	2	14	0	5	8	1	10	12	1	0	0	0	7	0	1	7	1	1
19	0	0	13	0	5	8	0	10	12	0	—	—	—	7	2	3	7	0	0

TERM HOUR DATA. HONOLULU—*continued*.

—		Nov. 20, 1911.			Nov. 24, 1911.			Dec. 18, 1911.			Dec. 22, 1911.			Jan. 22, 1912.			Jan. 26, 1912.		
		H	D	V	H	D	V	H	D	V	H	D	V	H	D	V	H	D	V
h.	m.	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
18	0	0	6	8	0	2	3	3	0	4	—	—	—	0	0	0	4	3	1
	5	1	7	8	0	2	2	3	0	4	—	—	—	0	0	0	4	3	0
	10	1	8	8	1	2	3	2	1	4	3	5	7	0	1	1	4	3	0
	15	1	7	8	1	0	3	3	3	4	3	4	7	1	1	2	4	3	0
	20	1	7	8	2	2	5	3	3	4	3	5	6	1	2	2	3	1	1
	25	2	8	8	3	2	5	3	3	4	3	5	6	2	3	3	3	0	1
	30	1	8	8	3	2	5	3	3	4	3	5	6	2	3	3	3	0	1
	35	2	8	8	4	2	5	3	2	4	4	5	6	2	3	3	3	0	1
	40	2	7	8	4	2	5	3	3	3	4	5	6	2	3	3	3	0	1
	45	2	7	8	3	2	5	3	3	3	3	5	5	2	3	3	3	0	1
	50	3	7	7	3	2	4	3	3	3	5	5	5	2	3	3	3	0	1
	55	3	7	7	3	2	4	3	3	3	5	5	5	3	3	3	2	1	1
19	0	4	7	7	4	2	3	3	3	3	4	5	5	3	3	4	2	1	1
	5	5	7	7	4	2	2	3	3	3	3	5	5	4	3	4	2	2	1
	10	6	7	7	3	2	2	3	3	3	3	4	4	5	3	4	2	2	1
	15	6	8	7	2	2	2	3	3	3	2	5	4	4	3	3	2	1	1
	20	7	8	7	2	2	2	3	3	3	2	5	3	4	3	3	2	1	1
	25	7	8	6	1	2	2	3	3	3	1	5	3	7	3	4	2	1	1
	30	8	8	5	1	3	2	3	3	3	0	5	3	6	3	3	2	0	1
	35	8	7	5	1	3	2	3	3	3	0	5	2	6	3	4	2	1	1
	40	9	7	5	1	4	2	3	3	2	0	4	2	7	3	3	1	1	1
	45	9	7	4	1	4	2	2	3	1	0	3	2	6	3	3	1	3	1
	50	10	5	3	1	4	1	1	3	1	0	2	1	6	3	3	0	3	1
	55	11	3	2	1	5	0	1	3	0	0	2	1	6	3	4	0	3	1
20	0	11	0	0	1	5	0	0	3	0	0	0	0	6	3	4	0	3	1

TERM HOUR DATA. TOUNGOO.

—		May 29, 1911.			June 2, 1911.			June 26, 1911.			June 30, 1911.			July 24, 1911.			July 28, 1911.		
		H	D	V	H	D	V	H	D	V	H	D	V	H	D	V	H	D	V
h.	m.	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
8	0	14	0	0	21	0	0	28	0	0	17	0	0	6	0	0	40	0	0
	5	12	2	0	21	0	0	27	0	0	16	1	0	10	0	0	40	0	0
	10	12	2	0	20	0	0	27	0	0	16	1	0	10	0	0	40	1	0
	15	12	4	0	19	0	0	26	1	0	16	1	0	10	0	0	40	1	0
	20	11	8	0	16	0	1	23	1	4	16	1	1	10	1	0	35	2	0
	25	10	8	1	16	0	1	21	2	4	15	1	1	11	1	0	34	6	0
	30	7	9	1	15	0	2	21	2	5	12	2	3	11	1	0	32	6	0
	35	7	9	1	15	1	2	21	2	5	11	2	3	11	0	3	29	6	0
	40	6	9	1	11	1	3	18	4	5	11	2	4	11	0	4	24	8	0
	45	6	9	1	11	0	3	17	6	5	11	2	4	11	0	4	23	12	0
	50	6	9	1	10	0	4	16	8	5	10	2	4	9	1	5	24	12	0
	55	5	10	2	10	0	4	16	9	5	9	3	5	6	2	5	24	12	0
9	0	4	10	2	10	0	4	13	8	5	7	3	5	10	3	5	23	12	0
	5	2	10	2	10	1	5	12	8	5	6	4	7	11	5	5	20	12	0
	10	2	10	2	10	1	6	12	9	5	6	5	9	11	5	5	21	12	0
	15	1	10	2	9	1	7	11	10	5	5	7	9	10	6	5	21	12	0
	20	1	10	3	8	1	7	10	10	5	5	10	9	5	9	6	18	12	0
	25	1	10	3	6	1	7	8	10	5	5	13	9	5	10	7	18	12	0
	30	1	10	3	5	1	7	6	10	5	3	13	9	5	10	8	14	12	0
	35	1	10	4	5	2	8	6	10	5	1	13	10	3	10	9	13	14	0
	40	1	10	4	5	2	8	5	10	5	1	14	11	3	10	9	12	15	0
	45	1	10	5	4	2	8	5	11	5	0	14	11	2	11	9	8	17	0
	50	1	10	5	4	2	8	2	11	4	0	14	12	0	11	10	8	13	0
	55	0	10	5	3	7	7	1	11	4	0	14	13	0	13	10	2	12	0
10	0	1	10	5	0	10	7	0	12	4	0	14	13	1	12	10	0	14	0

Term Hour Data. Toungoo—*continued.*

—		May 22, 1911.			May 26, 1911.			June 19, 1911.			June 23, 1911.			July 17, 1911.			July 21, 1911.		
		H	D	V	H	D	V	H	D	V	H	D	V	H	D	V	H	D	V
h.	m.	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
17	0	5	1	0	1	1	0	5	0	0	5	0	2	7	16	0	0	0	0
	5	5	0	0	1	1	0	5	1	0	5	0	2	5	11	0	0	0	0
	10	4	1	0	2	0	0	5	2	0	5	0	2	5	11	0	0	0	0
	15	3	2	0	6	0	0	5	3	0	5	0	2	8	17	0	0	0	0
	20	3	2	0	6	0	0	5	2	0	5	0	3	9	20	0	0	1	0
	25	2	2	0	6	1	0	5	2	0	6	0	3	10	22	0	0	4	0
	30	1	2	0	6	1	0	5	2	0	6	1	3	10	22	0	0	4	0
	35	3	2	0	6	2	0	5	2	0	5	1	2	10	21	1	0	6	0
	40	5	2	0	4	6	0	5	2	0	2	1	2	7	16	1	1	9	0
	45	5	2	1	4	9	0	5	2	0	1	2	2	10	21	1	1	9	0
	50	4	2	1	2	8	0	5	3	0	0	2	2	10	21	1	1	10	0
	55	4	2	2	2	10	0	5	3	0	0	3	1	5	11	1	1	10	0
18	0	5	2	2	1	10	1	5	4	0	0	2	1	5	10	1	1	10	0
	5	4	2	3	1	9	1	4	5	0	0	2	1	7	16	1	1	10	1
	10	4	2	4	1	9	1	4	5	0	1	2	1	10	21	1	1	9	1
	15	4	2	4	0	10	1	5	4	0	0	2	1	10	21	0	1	9	1
	20	3	2	5	0	10	1	4	4	0	0	2	0	8	18	0	1	9	1
	25	2	2	5	0	11	2	2	8	0	0	5	0	9	20	0	0	10	1
	30	0	2	5	1	11	2	0	9	0	0	5	0	5	10	0	1	10	1
	35	4	2	5	1	11	2	0	9	0	0	3	0	5	10	0	1	10	1
	40	4	2	5	1	11	2	0	9	1	0	8	0	4	9	0	0	10	1
	45	5	2	6	1	11	3	0	8	1	0	8	1	0	0	0	1	10	1
	50	5	3	6	1	11	3	1	9	1	1	10	1	0	1	0	1	10	1
	55	5	2	6	1	11	3	2	9	1	0	10	2	4	9	0	1	10	1
19	0	5	2	6	1	11	3	2	10	1	0	10	2	5	11	0	1	10	1

—		Nov. 20, 1911.			Nov. 24, 1911.			Dec. 18, 1911.			Dec. 22, 1911.			Jan. 22, 1912.			Jan. 26, 1912.		
		H	D	V	H	D	V	H	D	V	H	D	V	H	D	V	H	D	V
h.	m.	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
18	0	0	2	7	1	0	2	5	2	1	0	0	5	—	—	—	0	2	1
	5	1	2	5	1	0	2	1	2	0	1	0	5	0	0	2	0	2	1
	10	2	2	5	1	0	2	0	2	0	1	1	5	0	0	2	1	1	1
	15	1	2	5	2	0	1	0	2	0	1	1	5	1	0	2	1	1	1
	20	2	3	5	4	0	1	1	2	0	1	1	5	2	1	2	1	1	1
	25	3	2	5	5	1	1	1	1	0	1	1	5	2	1	2	1	1	1
	30	3	1	5	6	0	1	2	1	0	2	1	5	3	1	2	1	1	1
	35	3	2	5	6	0	1	2	0	0	4	1	5	4	1	2	1	1	1
	40	4	2	5	6	0	1	2	0	0	4	0	5	4	1	2	1	1	1
	45	5	1	5	4	1	1	4	0	0	5	0	5	5	1	2	1	1	1
	50	5	2	5	4	1	1	5	0	0	6	0	5	6	1	2	1	1	1
	55	5	3	5	4	2	0	5	0	1	8	0	5	6	1	2	2	1	1
19	0	6	2	5	3	1	1	5	0	1	8	0	4	7	1	1	2	2	1
	5	6	3	5	2	1	1	5	0	1	6	0	4	9	1	1	2	2	1
	10	6	3	5	2	0	1	5	0	2	6	0	3	10	0	1	2	2	1
	15	7	3	5	2	0	1	5	0	2	6	0	3	9	0	1	4	1	0
	20	8	2	4	1	0	1	4	0	2	6	0	3	8	1	1	5	1	0
	25	9	0	5	1	0	1	5	0	2	6	0	3	10	0	1	5	1	0
	30	10	2	4	1	0	0	5	0	3	6	0	3	9	0	1	6	1	0
	35	10	1	2	1	0	2	4	0	3	6	0	1	8	0	1	6	0	0
	40	10	1	2	0	0	1	2	0	4	7	0	1	8	0	1	6	1	0
	45	9	2	1	1	0	2	2	0	5	7	0	1	7	0	1	6	1	0
	50	9	1	1	1	0	2	2	0	5	9	0	1	7	0	0	7	1	0
	55	9	1	1	2	0	2	1	0	5	8	0	0	7	0	0	7	1	0
20	0	10	1	0	2	0	2	1	0	4	7	0	0	8	0	0	8	0	0

—		May 29, 1911.			June 2, 1911.			June 26, 1911.			June 30, 1911.			July 24, 1911.			July 28, 1911.		
		H	D	V	H	D	V	H	D	V	H	D	V	H	D	V	H	D	V
h.	m.	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
8	0	14	0	0	7	0	1	25	0	0	17	0	0	18	0	1	43	1	0
	5	14	2	2	7	0	2	24	0	1	17	2	1	19	1	2	42	0	2
	10	14	3	3	6	0	1	25	1	5	17	1	1	19	1	1	42	0	2
	15	13	4	4	6	0	1	24	1	5	17	1	2	19	2	4	40	0	4
	20	12	7	5	6	0	1	24	1	6	17	3	3	19	2	4	38	0	5
	25	11	8	5	5	0	0	22	2	7	17	3	4	19	2	4	37	1	7
	30	10	8	5	5	1	0	20	2	8	17	5	5	20	2	4	33	2	7
	35	11	8	7	5	1	2	19	5	9	16	5	7	20	2	4	31	2	10
	40	11	9	7	4	1	2	20	7	10	16	7	7	20	3	4	24	4	13
	45	10	10	7	4	1	2	19	9	12	16	7	6	20	3	4	24	9	16
	50	10	12	8	2	0	3	18	10	13	16	8	6	17	4	4	25	11	16
	55	9	13	8	1	1	4	17	11	14	16	8	6	14	5	4	24	12	16
9	0	9	15	8	1	1	6	16	11	14	15	8	6	17	8	4	21	12	20
	5	8	16	7	1	1	6	15	11	14	13	9	7	18	8	2	20	13	21
	10	8	18	7	1	1	6	15	12	14	12	10	7	18	8	1	20	14	21
	15	8	19	10	1	2	6	14	13	16	11	10	7	15	8	0	20	16	23
	20	6	19	11	1	2	7	12	14	17	10	10	6	12	9	1	17	16	23
	25	6	20	11	1	2	7	11	14	17	8	10	5	8	10	2	15	18	23
	30	6	20	11	1	2	7	9	15	18	6	11	6	7	10	2	13	20	25
	35	5	20	11	1	3	8	8	15	19	6	11	5	6	11	1	10	21	25
	40	5	22	11	1	3	9	7	18	20	3	12	6	5	12	2	7	22	25
	45	3	22	11	1	5	10	6	18	20	2	12	5	5	12	2	6	23	26
	50	1	24	11	0	7	10	4	19	20	2	12	3	1	13	4	5	23	26
	55	0	24	11	0	8	12	1	20	19	1	12	4	1	13	4	0	23	25
10	0	1	24	11	0	11	13	0	20	20	0	12	4	0	12	1	—	—	25

—		May 22, 1911.			May 26, 1911.			June 19, 1911.			June 23, 1911.			July 17, 1911.			July 21, 1911.		
		H	D	V	H	D	V	H	D	V	H	D	V	H	D	V	H	D	V
h.	m.	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
17	0	3	0	0	0	2	3	5	0	3	3	0	0	12	0	3	2	0	0
	5	2	2	0	1	2	2	5	2	1	3	1	0	11	0	2	1	2	1
	10	1	0	1	2	1	1	5	3	2	3	1	1	11	2	2	0	2	0
	15	1	2	1	4	1	0	5	4	0	3	2	2	10	1	2	1	0	0
	20	1	2	1	6	0	0	3	1	4	3	2	3	11	1	1	1	2	0
	25	1	2	1	8	0	3	3	2	3	5	2	3	13	1	1	0	2	2
	30	1	2	0	7	1	4	4	1	3	5	2	3	13	0	1	1	2	3
	35	1	2	0	6	1	5	4	2	2	4	2	3	12	1	2	2	2	3
	40	3	2	0	5	3	5	4	3	2	2	2	4	10	1	3	3	3	1
	45	4	2	0	4	4	5	3	3	2	1	2	4	11	1	1	3	3	3
	50	3	2	0	4	4	5	2	4	4	1	3	3	14	1	0	4	3	7
	55	2	2	0	4	5	4	1	4	4	1	3	3	10	0	2	4	3	5
18	0	3	2	0	4	5	4	1	4	2	2	3	3	7	1	4	4	2	5
	5	2	2	0	3	5	4	1	4	2	1	4	3	9	2	3	3	3	6
	10	2	2	1	2	5	3	1	4	2	2	4	3	10	5	3	3	3	6
	15	2	2	1	2	7	5	1	3	2	1	5	3	12	3	3	3	3	3
	20	2	2	1	2	7	5	1	4	3	0	5	3	9	3	2	3	4	5
	25	1	2	1	2	8	5	0	4	3	0	7	3	10	3	3	3	5	7
	30	0	2	1	2	8	4	0	5	2	1	4	1	7	3	2	3	5	6
	35	1	2	0	6	8	4	0	7	2	6	5	0	5	5	3	3	8	6
	40	2	2	0	4	8	4	0	4	2	0	5	1	2	7	5	2	9	6
	45	3	2	0	4	8	5	0	3	0	1	5	2	1	9	5	2	5	5
	50	6	2	0	4	7	3	1	3	0	2	8	3	0	7	5	3	7	5
	55	5	2	0	5	7	4	1	4	0	0	8	4	1	8	2	2	7	4
19	0	4	2	0	2	7	5	1	4	1	1	8	5	5	7	0	2	7	6

Term Hour Data. Alibag (Bombay)—*continued.*

—		Nov. 20, 1911.			Nov. 24, 1911.			Dec. 18, 1911.			Dec. 22, 1911.			Jan. 22, 1912.			Jan. 26, 1912.		
		H	D	V	H	D	V	H	D	V	H	D	V	H	D	V	H	D	V
h.	m.	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
18	0	0	2	3	0	0	5	4	3	6	0	2	2	1	2	5	0	3	0
	5	0	0	2	0	1	5	3	5	6	1	2	2	0	2	4	0	3	2
	10	1	1	3	0	1	3	1	5	6	1	2	2	1	1	4	1	3	1
	15	1	3	3	2	2	3	0	5	6	1	2	5	1	0	3	1	2	2
	20	1	2	3	3	2	3	2	5	4	1	1	5	3	1	3	2	2	2
	25	1	1	4	4	3	3	1	5	3	0	2	5	4	1	2	1	2	2
	30	0	2	5	4	3	3	2	5	3	0	0	5	3	1	3	1	2	2
	35	0	2	5	5	3	3	2	5	3	1	0	5	3	2	3	1	2	2
	40	0	3	5	5	2	4	2	5	5	1	0	3	4	2	3	1	1	0
	45	0	2	3	5	2	5	4	3	3	2	1	5	4	2	3	0	1	0
	50	0	2	3	4	1	5	3	2	2	3	1	3	5	2	3	0	1	0
	55	1	2	3	4	3	5	4	3	2	4	2	3	5	3	1	1	2	0
19	0	2	2	2	4	3	3	5	2	1	5	2	5	5	3	1	2	2	0
	5	1	3	2	4	3	3	5	1	1	2	2	5	5	2	1	1	1	0
	10	2	3	2	4	2	3	5	1	1	1	3	5	7	2	1	1	1	0
	15	3	3	1	3	2	3	5	1	1	2	4	3	5	2	3	2	1	0
	20	2	3	2	3	3	3	5	0	1	1	4	2	5	2	3	2	1	2
	25	3	1	2	3	3	3	5	0	2	1	3	2	6	3	0	2	1	3
	30	3	1	2	2	3	3	5	0	0	0	4	2	5	3	0	3	0	1
	35	3	2	2	2	2	3	5	2	1	0	4	1	5	3	1	3	0	0
	40	3	2	3	3	1	3	5	2	1	0	3	1	5	2	1	2	0	0
	45	3	2	3	4	1	2	5	3	1	1	3	1	3	2	1	2	0	0
	50	3	2	2	4	1	1	4	3	1	1	3	0	1	2	1	2	0	0
	55	4	1	1	4	0	0	3	2	0	1	3	1	3	1	1	2	0	0
20	0	4	3	0	3	1	0	3	2	1	0	3	1	1	1	1	3	0	0

Term Hour Data. Vieques (Porto Rico).

—		May 29, 1911.			June 2, 1911.			June 26, 1911.			June 30, 1911.			July 24, 1911.			July 28, 1911.		
		H	D	V	H	D	V	H	D	V	H	D	V	H	D	V	H	D	V
h.	m.	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
8	0	1	0	0	1	1	3	2	0	0	0	0	1	0	0	5	3	3	0
	5	1	1	1	1	0	3	2	0	0	0	0	0	2	0	5	4	3	1
	10	1	1	1	1	0	3	2	0	0	1	0	0	3	0	5	4	4	0
	15	1	1	2	1	0	3	2	0	0	1	0	0	3	0	6	4	4	1
	20	1	1	2	1	0	3	1	1	0	1	0	0	4	1	6	5	4	1
	25	1	1	2	2	1	3	1	2	0	1	1	0	5	2	6	4	3	3
	30	1	2	2	3	0	3	1	2	0	1	1	0	6	3	6	2	3	2
	35	1	3	2	3	0	3	0	2	0	0	1	0	6	4	6	0	5	1
	40	1	3	2	3	1	2	0	2	1	0	1	0	6	5	5	4	3	3
	45	1	4	2	3	2	2	0	2	1	1	1	1	6	6	4	5	1	3
	50	1	5	2	3	3	2	0	2	1	1	1	1	5	8	3	4	1	6
	55	1	5	2	3	4	1	0	2	1	1	2	1	4	8	2	6	2	6
9	0	0	6	2	2	4	1	0	2	2	1	2	1	6	7	2	8	0	8
	5	0	6	2	2	4	1	1	2	3	1	2	1	6	7	3	8	1	9
	10	0	6	2	1	4	1	1	2	3	0	2	1	6	8	3	9	3	8
	15	0	7	2	1	5	1	1	2	4	0	3	1	6	9	3	10	4	7
	20	0	7	2	1	5	1	1	3	4	0	3	1	5	9	2	9	4	6
	25	0	7	3	1	6	0	2	4	4	0	3	1	3	9	0	9	3	8
	30	1	8	3	1	6	0	2	5	4	0	3	1	4	8	1	11	2	9
	35	1	8	3	0	6	0	2	6	5	0	3	1	4	8	2	11	1	10
	40	1	8	3	0	7	0	3	8	5	0	3	1	3	9	1	12	0	10
	45	1	9	3	0	8	1	4	9	5	0	3	1	3	9	1	9	1	11
	50	1	9	4	0	9	1	4	10	4	0	5	2	2	9	2	9	4	7
	55	2	11	4	1	9	1	5	14	4	1	6	2	2	9	1	9	5	7
10	0	2	12	4	1	9	1	5	15	3	1	7	2	2	9	1	11	8	10

—		May 22, 1911.			May 26, 1911.			June 19, 1911.			June 23, 1911.			July 17, 1911.			July 21, 1911.		
		H	D	V	H	D	V	H	D	V	H	D	V	H	D	V	H	D	V
h.	m.	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
17	0	1	5	1	4	0	1	2	17	3	11	9	0	12	19	1	—	—	—
	5	1	6	2	1	1	0	1	17	3	11	9	1	10	19	1	—	—	—
	10	1	5	2	1	2	0	1	17	2	10	9	1	9	18	0	—	—	—
	15	0	3	2	0	2	0	2	17	1	11	9	2	7	17	0	—	—	—
	20	0	3	2	0	2	1	1	16	1	9	9	3	7	15	0	—	—	—
	25	0	3	1	1	2	2	1	15	1	10	9	3	8	13	1	—	—	—
	30	0	3	0	3	2	3	2	15	0	10	9	3	9	13	1	—	—	—
	35	0	5	1	3	2	3	1	15	0	9	9	3	10	12	3	—	—	—
	40	2	3	2	5	2	5	2	15	0	7	9	4	8	10	3	—	—	—
	45	2	3	2	6	2	6	1	14	0	7	9	3	11	9	6	—	—	—
	50	2	2	2	7	2	7	1	10	0	5	8	3	12	6	7	—	—	—
	55	1	2	2	7	2	7	1	10	0	6	7	4	10	4	8	—	—	—
18	0	2	2	2	7	2	9	0	9	0	6	7	4	9	3	7	—	—	—
	5	2	2	2	7	2	9	0	9	0	5	7	5	9	3	9	—	—	—
	10	2	2	2	7	2	9	0	9	1	5	7	5	14	2	10	—	—	—
	15	2	2	2	8	2	10	1	8	1	4	5	5	17	2	13	—	—	—
	20	2	2	1	8	2	11	1	8	1	4	5	5	14	0	13	—	—	—
	25	1	1	1	8	2	12	1	7	1	4	5	5	13	0	13	—	—	—
	30	0	1	1	10	2	13	1	6	1	5	5	5	10	0	10	—	—	—
	35	0	1	1	10	2	13	1	3	2	5	3	7	9	0	7	—	—	—
	40	1	1	1	10	2	14	0	3	2	3	3	7	6	0	6	—	—	—
	45	1	1	2	10	2	14	1	3	3	5	2	8	3	0	2	—	—	—
	50	1	0	2	10	3	14	2	2	3	3	1	7	1	0	1	—	—	—
	55	1	0	2	11	3	15	2	1	3	0	0	6	0	2	0	—	—	—
19	0	0	0	2	11	3	16	1	0	3	1	0	7	—	—	—	—	—	—

—		Nov. 20, 1911.			Nov. 24, 1911.			Dec. 18, 1911.			Dec. 22, 1911.			Jan. 22, 1912.			Jan. 26, 1912.		
		H	D	V	H	D	V	H	D	V	H	D	V	H	D	V	H	D	V
h.	m.	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
18	0	2	0	0	0	2	1	7	0	0	4	0	7	13	0	1	2	1	2
	5	3	0	1	1	3	1	5	0	0	5	0	8	12	0	0	1	1	2
	10	2	0	2	2	2	1	4	0	0	6	1	8	10	0	0	1	0	1
	15	2	0	1	2	1	1	3	0	0	5	2	8	9	0	0	1	1	1
	20	2	1	1	3	0	1	3	2	0	5	2	8	9	0	0	0	2	1
	25	2	2	1	4	0	1	2	3	0	3	3	7	8	1	0	0	3	1
	30	1	3	0	5	0	1	2	1	0	3	3	7	7	1	0	0	3	1
	35	1	3	0	5	0	0	1	2	0	4	3	7	6	3	1	1	3	1
	40	1	4	0	4	2	0	2	2	1	5	3	7	6	5	1	1	3	1
	45	1	6	0	4	2	1	2	3	1	5	4	7	6	6	1	1	3	1
	50	1	8	1	4	1	1	1	3	1	6	4	7	5	4	2	1	3	1
	55	1	9	1	5	0	1	1	3	1	6	4	7	5	3	3	1	4	1
19	0	1	9	1	5	0	1	0	3	2	6	5	7	5	3	3	1	5	1
	5	0	9	1	5	0	1	—	—	—	5	5	7	6	3	4	1	7	1
	10	0	9	0	5	0	1	—	—	—	3	6	6	6	4	4	1	8	0
	15	0	9	0	5	1	1	—	—	—	3	7	4	5	6	4	1	8	0
	20	0	9	0	5	0	1	—	—	—	3	7	4	4	5	4	1	8	0
	25	0	10	0	5	0	0	—	—	—	3	8	3	5	4	4	1	8	0
	30	1	11	0	5	0	0	—	—	—	2	8	3	3	3	4	1	8	0
	35	2	11	0	5	1	0	—	—	—	2	9	3	3	4	4	1	8	0
	40	2	12	0	6	2	0	—	—	—	1	10	2	3	5	5	1	9	0
	45	2	12	1	7	2	1	—	—	—	1	11	2	2	6	5	1	9	0
	50	2	13	1	7	3	1	—	—	—	1	13	1	2	7	5	2	9	0
	55	2	14	2	7	3	1	0	9	—	0	14	0	1	7	5	2	9	0
20	0	2	15	2	8	3	1	1	9	—	0	14	0	0	7	5	2	9	0

Term Hour Data. Kodaikanal.

—		May 29, 1911.			June 2, 1911.			June 26, 1911.			June 30, 1911.			July 24, 1911.			July 28, 1911.		
		H	D	V	H	D	V	H	D	V	H	D	V	H	D	V	H	D	V
h.	m.	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
8	0	37	0	0	18	0	1	45	0	0	27	0	0	21	0	17	54	0	0
	5	35	1	1	18	0	1	44	1	1	25	0	1	22	1	17	54	1	2
	10	31	2	3	18	1	0	43	2	1	25	2	2	25	3	17	54	4	5
	15	31	2	5	18	3	1	39	3	1	25	3	3	26	3	17	48	7	5
	20	27	2	6	17	4	0	38	4	1	25	4	3	25	3	17	43	9	5
	25	26	3	7	16	4	0	34	4	0	25	5	3	26	3	13	42	9	5
	30	25	4	9	15	5	0	32	4	0	24	5	1	26	3	12	36	10	5
	35	23	7	11	14	7	0	31	4	0	23	5	1	25	3	12	32	10	5
	40	21	9	11	13	7	0	27	4	1	20	5	0	23	3	12	29	10	1
	45	21	10	12	12	8	1	26	5	1	19	5	0	21	3	9	26	12	3
	50	19	13	12	12	8	1	26	7	3	19	5	0	16	3	7	29	15	5
	55	15	13	13	12	8	1	24	8	3	19	7	0	15	3	6	24	16	5
9	0	13	13	15	11	8	1	20	11	5	18	7	0	17	3	6	29	18	5
	5	13	13	16	11	9	1	20	14	5	18	7	0	17	4	6	24	21	5
	10	13	15	16	10	9	1	19	14	6	14	7	0	15	4	6	24	21	7
	15	9	15	16	10	11	2	15	15	6	13	7	0	15	4	6	19	21	9
	20	8	16	16	9	12	2	14	15	6	13	7	0	10	4	3	17	21	10
	25	7	19	17	8	14	2	11	15	8	11	7	0	8	4	2	18	22	8
	30	7	20	17	7	16	3	8	15	10	7	7	1	8	4	2	18	23	6
	35	6	20	17	6	18	3	8	15	11	7	7	1	6	4	2	18	26	5
	40	5	20	18	6	19	5	6	15	11	6	7	1	4	3	1	18	29	5
	45	2	20	17	5	19	5	2	18	11	5	7	1	3	3	1	13	31	1
	50	1	20	19	4	19	6	2	18	11	1	7	1	2	3	1	13	31	5
	55	1	20	20	2	19	6	1	20	11	1	7	1	0	3	0	11	32	5
10	0	0	19	21	0	20	6	0	21	12	0	7	2	2	3	0	0	32	2

—		May 22, 1911.			May 26, 1911.			June 19, 1911.			June 23, 1911.			July 17, 1911.			July 21, 1911.		
		H	D	V	H	D	V	H	D	V	H	D	V	H	D	V	H	D	V
h.	m.	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
17	0	4	3	1	0	1	0	5	0	2	2	0	1	9	0	2	2	0	0
	5	4	2	1	3	1	0	5	0	2	2	2	2	7	0	2	2	0	0
	10	4	0	0	5	1	0	5	0	2	2	2	2	7	1	2	1	0	0
	15	4	2	1	5	0	1	5	0	2	2	3	3	7	1	2	1	0	0
	20	4	0	1	6	1	1	5	0	2	2	3	2	10	1	3	1	0	0
	25	4	2	1	9	0	2	5	0	2	4	4	3	12	1	5	0	1	0
	30	1	2	1	8	1	2	5	0	2	5	4	3	12	1	5	1	1	0
	35	1	1	1	7	1	1	5	0	2	2	3	2	11	1	5	1	1	0
	40	4	1	2	5	1	1	5	0	2	1	3	1	7	1	5	2	1	1
	45	5	2	2	5	1	1	5	0	2	1	3	1	10	1	5	2	2	2
	50	4	2	2	5	1	1	5	0	2	1	5	0	11	1	5	2	3	2
	55	5	2	1	5	1	0	5	0	2	1	5	0	6	1	5	2	4	2
18	0	4	2	1	5	1	1	5	0	1	1	5	0	6	2	2	2	5	3
	5	4	2	1	5	1	1	5	0	1	1	5	0	6	2	4	2	5	3
	10	4	3	1	5	1	1	4	0	1	1	5	0	7	3	5	2	5	3
	15	2	3	1	4	2	0	4	0	1	1	5	1	7	3	5	2	7	3
	20	1	2	1	3	2	0	4	0	1	1	5	1	6	3	5	2	7	4
	25	0	3	1	4	4	0	4	0	1	1	5	0	6	3	5	1	8	4
	30	0	4	0	5	4	1	2	0	0	1	5	0	5	3	3	2	9	4
	35	1	3	1	5	4	2	1	0	0	1	7	1	4	3	4	1	10	3
	40	0	3	1	5	5	2	0	0	0	0	7	1	0	8	1	1	10	3
	45	4	4	2	5	4	1	1	0	0	1	7	1	0	8	0	1	10	0
	50	5	5	2	5	3	1	2	0	1	1	7	1	0	8	1	1	10	0
	55	6	4	2	5	4	1	3	0	2	1	7	1	0	8	1	1	9	0
19	0	5	4	2	5	4	1	4	0	2	1	7	1	3	8	3	1	10	1

Term Hour Data. Kodaikanal—*continued.*

—		Nov. 20, 1911.			Nov. 24, 1911.			Dec. 18, 1911.			Dec. 22, 1911.			Jan. 22, 1912.			Jan. 26, 1912.		
		H	D	V	H	D	V	H	D	V	H	D	V	H	D	V	H	D	V
h.	m.	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
18	0	2	3	0	3	3	0	5	5	2	1	0	0	2	0	5	0	3	3
	5	2	4	1	3	3	1	4	7	2	2	0	2	0	0	5	0	3	3
	10	2	3	1	3	3	1	1	7	1	2	0	2	4	0	5	0	4	3
	15	1	3	1	3	4	1	0	5	0	1	0	3	4	0	5	1	5	3
	20	2	3	1	5	2	2	1	4	1	1	1	3	5	0	5	1	5	3
	25	1	1	1	5	2	2	2	7	1	1	1	3	5	0	5	0	4	3
	30	1	2	1	6	2	3	3	5	2	1	0	3	5	0	5	0	3	2
	35	1	1	1	6	2	3	3	3	2	2	0	3	5	0	5	1	3	2
	40	1	1	1	5	2	3	3	2	2	2	0	3	5	0	5	1	3	2
	45	0	1	1	4	2	3	4	2	3	2	0	3	5	0	5	0	2	2
	50	0	1	1	4	2	3	4	2	3	5	0	3	5	0	5	1	2	2
	55	1	2	2	4	2	3	4	2	3	5	0	4	5	0	5	1	2	1
19	0	1	2	3	4	2	3	3	2	3	6	0	3	5	0	5	1	2	1
	5	1	2	3	3	2	4	3	2	3	2	1	3	8	0	5	1	2	1
	10	0	2	3	2	2	3	4	3	3	1	1	3	9	0	5	1	1	3
	15	0	2	3	2	1	3	4	2	3	1	1	3	7	0	5	1	1	3
	20	1	2	3	1	2	3	4	1	3	1	1	3	5	0	3	0	1	3
	25	1	2	3	0	2	3	4	1	3	1	1	3	5	0	4	0	0	2
	30	1	3	3	0	2	4	4	1	3	1	1	1	6	0	4	0	0	3
	35	1	3	3	1	1	5	4	0	3	1	1	1	6	0	2	0	0	3
	40	1	0	4	2	1	5	4	0	3	0	1	2	5	0	2	0	0	3
	45	0	1	4	3	1	6	3	0	3	1	1	2	5	0	1	0	0	2
	50	1	1	4	3	0	6	2	0	3	1	1	3	5	0	0	0	0	1
	55	1	1	4	3	1	6	1	0	3	1	1	3	5	0	0	0	0	1
20	0	2	1	4	3	0	6	1	0	3	1	0	3	5	0	0	0	0	0

Term Hour Data. Mauritius.

—		May 29, 1911.			June 2, 1911.			June 26, 1911.			June 30, 1911.			July 24, 1911.			July 28, 1911.		
		H	D	V	H	D	V	H	D	V	H	D	V	H	D	V	H	D	V
h.	m.	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
8	0	—	—	—	19	0	1	14	2	0	18	0	0	1	0	0	7	0	0
	5	—	—	—	16	0	1	13	0	1	16	0	1	3	2	1	7	1	1
	10	—	—	—	17	0	1	13	2	1	18	1	2	5	4	3	8	1	1
	15	—	—	—	16	0	0	12	4	1	16	1	4	7	6	5	8	1	2
	20	—	—	—	17	0	1	12	5	2	14	2	5	10	7	6	7	2	2
	25	—	0	—	14	0	1	10	5	3	15	2	6	12	8	7	7	3	3
	30	8	0	0	13	1	1	8	6	4	13	2	7	12	10	9	5	4	4
	35	10	2	1	12	1	1	7	6	5	13	4	9	12	11	9	6	5	4
	40	11	3	1	12	0	1	6	7	7	13	6	9	12	11	9	4	7	4
	45	10	4	0	8	0	1	5	8	7	15	8	10	12	12	8	4	8	4
	50	10	5	2	8	1	1	4	8	7	13	9	11	11	12	9	6	11	4
	55	8	4	2	7	1	1	4	8	8	11	11	13	12	13	9	6	13	4
9	0	8	4	3	6	1	1	3	9	9	11	11	15	13	16	9	6	16	4
	5	8	2	5	4	2	1	2	9	9	8	13	16	11	17	12	7	17	4
	10	7	2	6	5	2	1	1	11	9	6	14	16	10	17	12	7	15	4
	15	8	3	5	6	2	1	1	14	9	7	14	16	10	19	13	7	14	4
	20	6	4	7	6	2	1	1	14	7	7	15	17	10	20	13	6	14	4
	25	7	5	7	4	4	1	1	15	7	5	17	16	8	22	13	6	16	4
	30	6	4	7	5	4	1	1	17	7	4	17	16	7	24	13	6	19	4
	35	4	5	6	2	6	1	1	18	7	4	18	16	7	22	13	6	20	4
	40	2	4	7	2	6	1	1	20	8	4	19	16	6	22	13	7	22	5
	45	0	4	6	2	7	1	0	21	9	4	20	17	4	22	14	6	22	6
	50	3	5	6	2	8	1	1	21	9	4	21	17	3	23	13	5	20	4
	55	1	4	3	1	9	1	1	16	8	2	22	18	1	24	14	3	17	4
10	0	0	4	3	0	9	1	2	18	9	0	23	18	0	26	13	0	19	4

—		May 22, 1911.			May 26, 1911.			June 19, 1911.			June 23, 1911.			July 17, 1911.			July 21, 1911.		
		H	D	V	H	D	V	H	D	V	H	D	V	H	D	V	H	D	V
h.	m.	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
17	0	5	1	—	0	6	2	7	0	0	10	5	0	16	2	3	5	2	0
	5	5	2	—	1	4	1	7	0	2	8	6	0	15	2	1	4	2	1
	10	5	2	—	3	2	0	7	2	1	9	5	0	14	2	2	5	0	1
	15	4	2	—	5	2	0	6	2	2	8	7	0	14	1	1	2	0	1
	20	4	0	—	7	1	1	7	3	1	7	6	0	15	0	1	3	0	1
	25	3	0	—	8	0	2	4	2	1	8	5	0	15	0	1	3	0	1
	30	3	0	—	10	2	3	5	2	1	8	8	0	14	1	1	3	0	1
	35	2	0	—	10	4	3	4	2	1	8	8	0	14	1	2	4	0	1
	40	4	0	—	8	7	4	6	3	1	7	8	0	13	1	2	4	0	1
	45	5	1	—	7	8	4	5	3	2	7	6	0	13	1	3	5	0	1
	50	5	0	—	7	9	4	4	3	1	6	8	0	14	2	1	5	0	1
	55	4	0	—	7	9	4	4	3	1	6	8	1	11	2	2	5	2	1
18	0	4	1	—	8	10	4	3	2	1	6	9	1	8	2	3	4	3	1
	5	4	2	—	7	11	4	4	2	1	7	8	1	9	1	1	5	3	1
	10	4	2	—	7	11	4	5	0	1	7	7	1	10	2	1	6	2	2
	15	4	2	—	6	11	4	4	0	1	6	5	1	11	2	1	5	2	2
	20	3	2	—	6	11	5	5	0	1	5	2	1	8	2	1	6	4	2
	25	2	2	—	6	10	5	4	0	0	4	3	1	7	1	1	3	5	3
	30	1	2	—	7	11	4	4	0	1	5	0	1	6	1	1	2	4	3
	35	0	2	—	10	11	4	0	0	1	6	3	1	4	1	1	1	5	3
	40	1	1	—	11	12	4	1	0	1	2	3	1	2	1	1	0	5	3
	45	2	0	—	11	13	4	2	0	1	3	4	1	0	1	1	1	5	3
	50	3	2	—	11	13	4	4	1	1	3	4	1	0	1	1	2	5	3
	55	4	2	—	11	12	4	2	2	3	2	4	1	0	1	0	3	5	3
19	0	4	1	—	12	11	4	5	2	4	0	5	1	3	1	1	3	5	3

—		Nov. 20, 1911.			Nov. 24, 1911.			Dec. 18, 1911.			Dec. 22, 1911.			Jan. 22, 1912.			Jan. 26, 1912.		
		H	D	V	H	D	V	H	D	V	H	D	V	H	D	V	H	D	V
h.	m.	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
18	0	1	1	—	0	—	—	5	2	1	0	0	1	—	—	—	—	—	—
	5	0	2	—	1	—	—	3	2	0	0	0	1	—	—	—	—	—	—
	10	0	2	—	3	2	—	3	2	1	1	0	1	—	—	—	—	—	—
	15	1	2	—	4	2	—	1	1	1	1	0	1	—	—	—	—	—	—
	20	1	2	—	5	2	—	1	1	1	1	0	0	—	—	—	—	—	—
	25	1	2	—	8	2	—	1	1	1	0	0	1	—	—	—	—	—	—
	30	1	2	—	6	3	—	1	1	1	1	0	2	—	—	—	—	—	—
	35	2	2	—	7	3	—	0	1	1	1	0	2	—	—	—	—	—	—
	40	2	2	—	6	3	—	1	1	1	1	0	1	—	—	—	—	—	—
	45	3	2	—	5	3	—	1	1	0	2	1	1	—	—	—	—	—	—
	50	3	2	—	5	2	—	2	1	1	3	1	1	—	—	—	—	—	—
	55	3	3	—	5	2	—	2	0	1	4	1	1	—	—	—	—	—	—
19	0	4	2	—	4	2	—	2	0	1	4	1	1	—	—	—	—	—	—
	5	4	2	—	5	2	—	1	0	1	4	1	1	—	—	—	—	—	—
	10	4	3	—	4	2	—	3	0	1	3	1	1	—	—	—	—	—	—
	15	4	2	—	3	2	—	2	0	1	3	2	1	—	—	—	—	—	—
	20	4	2	—	2	2	—	2	0	1	3	2	1	—	—	—	—	—	—
	25	4	1	—	4	2	—	1	0	1	3	2	1	—	—	—	—	—	—
	30	5	1	—	2	1	—	4	0	1	3	2	1	—	—	—	—	—	—
	35	5	1	—	4	1	—	3	0	1	2	2	1	—	—	—	—	—	—
	40	6	2	—	4	0	—	3	0	1	3	2	1	—	—	—	—	—	—
	45	7	2	—	6	0	—	1	0	1	3	1	1	—	—	—	—	—	—
	50	7	2	—	5	0	—	3	0	1	3	1	1	—	—	—	—	—	—
	55	7	2	—	6	0	—	2	0	1	3	0	0	—	—	—	—	—	—
20	0	7	0	—	5	0	—	2	0	1	2	0	0	—	—	—	—	—	—

Term Hour Data. Pilar.

—		May 29, 1911.			June 2, 1911.			June 26, 1911.			June 30, 1911.			July 24, 1911.			July 28, 1911.		
		H	D	V	H	D	V	H	D	V	H	D	V	H	D	V	H	D	V
h.	m.	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
8	0	1	0	0	2	2	0	2	1	0	0	2	0	0	1	0	1	4	0
	5	0	0	0	1	2	0	1	1	0	1	2	0	2	1	0	1	5	0
	10	0	0	1	1	1	0	1	2	0	1	1	0	3	1	0	3	4	0
	15	1	0	1	1	1	0	1	1	0	1	0	1	3	0	0	4	4	0
	20	1	0	1	2	1	0	1	1	1	2	1	1	4	0	0	3	3	0
	25	1	0	2	3	3	0	0	1	1	2	1	1	4	0	0	3	3	0
	30	1	0	2	3	2	0	0	2	1	2	1	2	5	0	0	3	3	0
	35	1	1	2	3	1	0	1	2	1	2	1	2	5	0	0	2	4	1
	40	2	1	2	3	0	1	1	2	1	2	2	2	6	0	0	0	1	1
	45	2	2	2	3	2	0	1	2	1	2	2	3	5	0	0	1	1	1
	50	2	2	2	4	3	1	2	1	1	3	2	3	4	0	0	1	1	1
	55	2	2	2	3	3	0	2	1	1	3	2	3	3	0	0	3	1	1
9	0	2	2	2	3	2	0	2	2	1	3	2	3	6	0	0	3	1	1
	5	2	2	2	2	1	1	3	2	1	3	2	3	6	0	0	4	0	1
	10	2	3	2	2	2	1	4	1	1	3	2	3	6	1	0	5	1	1
	15	2	2	3	1	2	1	3	0	1	3	2	3	7	1	0	6	1	1
	20	3	4	3	2	1	1	4	1	1	4	2	3	5	2	0	5	1	1
	25	3	3	3	1	0	1	4	1	2	5	2	4	4	4	0	6	1	1
	30	3	3	3	1	2	1	4	1	3	5	2	4	4	3	0	7	1	1
	35	4	2	3	0	2	1	4	0	3	5	3	5	4	2	0	5	1	1
	40	4	4	3	0	3	2	5	0	2	5	3	5	3	4	0	5	1	1
	45	4	4	3	0	2	1	5	1	2	5	2	5	3	4	0	2	1	1
	50	5	4	3	0	2	1	5	2	3	5	2	5	2	5	0	3	1	1
	55	4	2	4	2	3	1	5	2	3	5	3	5	3	5	0	3	1	1
10	0	4	2	4	2	1	1	5	2	3	5	4	5	4	5	0	6	1	1

—		May 22, 1911.			May 26, 1911.			June 19, 1911.			June 23, 1911.			July 17, 1911.			July 21, 1911.		
		H	D	V	H	D	V	H	D	V	H	D	V	H	D	V	H	D	V
h.	m.	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
17	0	6	9	12	6	0	7	6	3	6	4	5	2	18	7	13	6	3	2
	5	5	7	11	6	1	8	6	4	6	4	7	2	16	7	13	6	4	2
	10	5	5	11	3	1	8	6	4	6	3	6	2	15	5	12	5	4	2
	15	5	6	10	1	2	7	7	4	6	4	7	2	14	4	12	4	4	2
	20	4	7	10	0	4	7	6	4	6	3	7	1	14	4	11	4	3	3
	25	4	7	8	1	5	7	6	4	6	5	7	1	14	4	10	2	2	3
	30	3	7	8	3	5	7	6	6	7	5	7	1	15	6	10	4	1	3
	35	4	7	8	4	1	7	6	6	6	5	7	0	14	6	10	3	1	3
	40	6	7	7	5	2	6	6	6	7	3	9	0	11	6	8	1	1	3
	45	6	6	6	6	4	5	6	6	7	2	7	0	12	6	8	1	0	3
	50	5	6	6	8	4	5	5	6	7	3	7	0	11	7	6	1	0	3
	55	5	5	6	8	5	4	4	7	6	2	7	0	8	6	5	0	0	3
18	0	5	4	5	9	3	4	3	7	5	2	9	0	5	4	4	1	1	3
	5	4	6	5	10	3	4	2	7	5	2	7	0	3	4	2	0	1	2
	10	4	7	4	10	4	3	2	7	4	2	7	1	6	4	3	0	2	2
	15	4	7	4	10	2	3	2	6	4	3	6	0	6	6	3	1	2	2
	20	4	7	4	9	1	3	2	6	3	3	7	1	5	5	3	1	2	2
	25	3	6	4	9	0	2	2	5	2	2	6	1	2	5	3	1	3	2
	30	1	4	4	11	0	2	1	4	2	3	4	1	1	3	3	2	3	2
	35	1	4	2	12	0	2	0	4	1	4	3	2	2	1	2	1	4	1
	40	0	2	2	12	0	2	0	4	0	3	2	2	1	1	2	2	3	1
	45	1	0	2	12	0	1	1	3	0	3	1	2	0	0	2	2	3	0
	50	1	0	1	13	0	1	2	2	0	2	1	2	0	1	1	2	3	0
	55	1	0	1	14	0	0	2	1	0	0	1	1	0	1	0	2	3	0
19	0	1	0	0	15	0	0	1	0	0	1	0	1	2	1	0	2	1	0

Term Hour Data. Pilar—*continued.*

h.	m.	Nov. 20, 1911. H	D	V	Nov. 24, 1911. H	D	V	Dec. 18, 1911. H	D	V	Dec. 22, 1911. H	D	V	Jan. 22, 1912. H	D	V	Jan. 26, 1912. H	D	V
h.	m.	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
18	0	7	20	6	0	12	5	5	28	5	1	14	6	7	0	7	11	15	10
	5	8	20	6	0	13	5	3	28	5	2	14	5	5	0	7	11	16	10
	10	8	19	5	0	13	5	2	28	5	2	13	4	5	1	5	11	16	9
	15	7	17	5	1	10	4	1	27	5	2	9	4	6	1	5	12	17	9
	20	7	16	5	2	13	3	2	26	5	1	10	3	6	2	4	11	16	8
	25	6	15	4	3	12	3	1	25	5	0	7	3	7	2	4	11	16	8
	30	6	13	4	4	10	3	2	26	6	1	7	2	7	3	3	12	16	8
	35	5	13	4	4	10	2	1	25	5	3	7	2	5	5	3	12	18	8
	40	5	13	3	3	10	2	2	25	4	2	4	2	5	5	2	11	18	7
	45	4	13	3	3	9	1	3	25	3	3	4	2	5	6	2	11	16	7
	50	4	11	3	2	7	1	3	24	3	4	3	2	4	5	1	11	18	7
	55	4	10	3	2	7	1	2	24	2	6	4	3	3	6	1	10	16	7
19	0	4	10	3	2	6	1	2	23	2	6	1	3	4	6	1	8	15	6
	5	4	8	3	2	6	1	2	21	0	4	1	3	5	5	0	7	13	6
	10	4	7	3	1	4	1	3	21	0	4	0	3	6	6	0	6	13	6
	15	3	6	3	1	3	1	3	19	0	4	1	3	3	5	0	6	13	5
	20	2	7	3	0	3	1	3	16	0	4	1	3	3	5	0	5	11	4
	25	2	5	3	0	2	1	3	13	0	4	1	3	6	4	0	4	10	4
	30	2	4	3	0	1	1	4	10	0	4	1	3	3	3	1	3	8	3
	35	1	4	2	0	1	1	4	9	0	3	1	2	3	1	1	3	7	3
	40	1	3	2	0	1	1	3	7	0	4	1	2	4	1	1	2	6	2
	45	0	1	2	1	1	1	2	4	0	4	1	1	1	1	1	2	5	1
	50	0	1	1	1	0	1	1	1	0	4	1	1	1	0	1	1	4	1
	55	0	1	1	1	0	0	0	0	0	3	1	0	1	0	1	0	1	0
20	0	0	0	0	1	0	0	0	0	0	3	1	0	0	0	1	0	0	0

Term Hour Data. Antarctic.

h.	m.	May 29, 1911. N′	E′	V	June 2, 1911. N′	E′	V	June 26, 1911. N′	E′	V	June 30, 1911. N′	E′	V	July 24, 1911. N′	E′	V	July 28, 1911. N′	E′	V
h.	m.	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
8	0	0	8	0	5	23	13	0	0	0	1	6	0	4	13	0	—	—	—
	5	4	6	3	6	17	14	8	2	5	2	4	1	1	13	2	—	—	—
	10	6	6	4	16	23	16	8	1	5	2	3	2	1	12	4	—	—	—
	15	8	10	5	16	23	14	7	2	6	4	5	3	4	13	5	—	—	—
	20	10	13	5	13	23	11	8	8	8	5	6	3	4	19	8	—	—	—
	25	9	13	3	12	28	11	8	8	6	4	6	3	2	19	6	—	—	—
	30	9	15	3	9	28	8	8	4	6	4	5	3	4	19	6	16	5	9
	35	7	9	0	5	26	8	8	5	7	4	5	3	3	19	5	13	0	9
	40	11	6	2	0	19	6	11	7	6	3	2	3	1	17	3	20	12	14
	45	12	10	4	11	23	8	14	8	6	4	5	3	0	15	2	0	12	2
	50	8	10	3	13	21	7	13	11	6	4	5	4	6	12	2	19	14	5
	55	8	5	1	12	19	4	13	8	6	5	5	2	6	10	3	24	3	8
9	0	11	3	3	14	17	3	18	6	6	5	3	2	4	4	2	19	17	9
	5	12	3	4	11	16	2	11	2	5	4	0	2	6	5	4	16	15	5
	10	13	3	5	10	14	3	11	3	6	3	2	2	6	6	4	15	6	4
	15	15	0	5	8	9	2	10	10	7	3	3	3	8	13	5	15	7	5
	20	15	3	6	7	8	2	15	8	6	2	5	5	6	8	5	23	16	5
	25	17	1	7	9	6	2	11	8	6	0	6	6	0	6	4	20	18	5
	30	15	3	8	12	6	3	16	6	6	5	6	6	1	5	3	23	22	4
	35	15	5	9	16	5	2	16	4	6	4	6	5	6	1	2	26	21	0
	40	12	5	10	19	2	2	16	3	5	3	8	7	5	0	2	22	25	1
	45	15	6	11	17	1	1	16	1	5	5	9	6	7	5	5	23	25	1
	50	14	11	8	22	8	7	12	2	6	2	9	2	6	6	3	19	23	2
	55	11	10	7	21	0	0	14	3	5	7	5	2	6	8	4	26	19	5
10	0	11	5	7	20	3	1	11	3	4	7	6	2	11	6	4	75	52	11

Term Hour Data. Antarctic—*continued.*

—		May 22, 1911.			May 26, 1911.			June 19, 1911.			June 23, 1911.			July 17, 1911.			July 21, 1911.		
		N'	E'	V	N'	E'	V	N'	E'	V	N'	E'	V	N'	E'	V	N'	E'	V
h.	m.	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
17	0	11	23	8	12	19	6	21	7	6	7	43	5	—	—	—	53	19	2
	5	11	19	9	21	10	6	21	3	6	17	33	0	—	—	—	49	18	1
	10	8	18	11	20	13	8	21	8	8	0	23	0	—	—	—	38	23	0
	15	11	16	11	18	11	8	23	10	9	22	37	14	—	—	—	28	26	1
	20	11	19	14	19	0	2	21	8	8	21	31	13	—	—	—	16	19	2
	25	18	24	20	18	8	6	19	8	8	24	32	13	—	—	—	23	12	4
	30	9	15	17	23	9	4	20	5	8	27	30	14	—	—	—	6	27	16
	35	12	19	15	22	19	4	19	6	8	35	34	14	—	—	—	10	27	15
	40	6	19	13	16	28	3	16	6	8	19	23	4	—	—	—	0	23	16
	45	13	15	9	16	32	3	17	5	8	22	26	5	—	—	—	9	34	29
	50	16	10	9	16	35	2	19	4	8	35	32	8	—	—	—	7	39	30
	55	10	13	7	18	23	0	13	5	8	48	25	11	—	—	—	0	30	27
18	0	13	19	6	26	36	5	17	6	8	52	13	8	—	—	—	6	30	28
	5	11	12	3	24	49	5	13	6	8	52	13	8	—	—	—	11	22	28
	10	12	8	7	16	50	4	11	8	8	49	5	14	—	—	—	31	13	27
	15	11	8	9	12	70	6	11	5	8	53	2	17	—	—	—	24	5	25
	20	15	7	9	6	66	2	11	4	7	47	1	17	—	—	—	33	0	33
	25	15	2	5	0	66	5	9	3	6	45	5	19	—	—	—	37	18	37
	30	11	7	4	5	81	18	6	3	6	45	7	23	—	—	—	30	10	34
	35	8	0	0	4	78	18	9	6	8	43	0	21	—	—	—	36	6	39
	40	10	6	3	7	72	19	10	5	8	33	12	23	—	—	—	29	17	39
	45	2	8	6	5	70	19	9	5	3	27	5	21	—	—	—	22	13	36
	50	4	11	9	7	78	17	5	17	5	32	5	24	—	—	—	27	21	37
	55	6	6	9	11	87	14	11	0	0	29	14	29	—	—	—	18	25	33
19	0	0	8	14	6	90	8	0	19	4	19	5	23	—	—	—	6	29	30

—		Nov. 20, 1911.			Nov. 24, 1911.			Dec. 18, 1911.			Dec. 22, 1911.			Jan. 22, 1912.			Jan. 26, 1912.		
		N'	E'	V	N'	E'	V	N'	E'	V	N'	E'	V	N'	E'	V	N'	E'	V
h.	m.	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
18	0	49	53	32	42	59	8	163	263	27	12	72	30	34	71	18	49	12	0
	5	58	63	45	41	37	2	121	220	10	20	90	40	25	48	24	38	22	18
	10	60	57	47	42	41	4	120	208	20	28	94	47	35	49	46	44	22	16
	15	53	53	50	44	90	21	106	204	25	18	87	40	35	83	49	43	30	27
	20	39	37	50	53	87	12	83	173	18	26	102	44	33	98	49	38	39	27
	25	32	37	55	50	66	2	42	125	5	3	49	24	28	102	48	33	31	20
	30	21	23	55	42	74	9	20	97	2	1	47	27	29	103	53	38	41	27
	35	12	28	59	40	72	11	9	52	0	9	78	38	0	63	34	35	10	14
	40	18	33	56	56	81	17	0	14	5	0	90	38	15	129	60	28	22	25
	45	20	36	46	68	67	7	6	19	18	8	102	34	20	119	61	26	30	45
	50	17	25	40	59	72	8	8	5	20	38	127	28	17	127	60	22	46	47
	55	12	21	46	57	70	9	24	0	33	47	129	17	20	109	57	28	39	40
19	0	21	23	43	42	68	8	20	6	27	57	94	7	8	110	63	31	23	35
	5	12	21	38	40	62	3	28	16	40	68	83	27	30	126	68	35	43	46
	10	6	0	33	34	64	7	23	10	43	71	78	24	30	90	43	26	15	33
	15	10	8	40	30	45	2	7	6	37	59	13	0	48	110	50	35	0	49
	20	4	12	30	39	54	9	21	8	54	63	0	17	47	99	49	38	3	46
	25	0	8	26	33	54	9	26	40	55	71	8	30	51	5	15	29	18	49
	30	15	23	24	17	43	4	23	45	48	70	15	38	48	14	28	23	21	40
	35	16	38	19	5	13	0	20	90	62	72	15	42	61	67	50	20	11	43
	40	17	66	30	0	0	2	20	111	62	74	37	57	59	41	38	25	17	45
	45	27	48	6	24	20	11	12	109	52	86	37	63	70	23	23	27	18	43
	50	1	26	0	27	14	13	31	129	45	76	27	51	65	54	46	27	30	46
	55	17	26	7	29	25	13	59	180	40	69	45	59	91	44	49	12	26	35
20	0	17	41	3	36	45	13	67	209	12	79	58	72	76	0	0	0	17	31

Diagrams and Magnetic Curves.

Diurnal Inequalities.

Quick Runs (on Term Hours).

Sudden Commencements.

Short Storms and Longer Storms.

EXPLANATION OF PLATES.

The diagrams in Plates I to XIV were plotted from the diurnal inequality tables in Chapter IV. The remaining plates, with the exception of Nos. LVI and LVII, are reproduced from tracings of the magnetic curves, very carefully made. Even original magnetic curves all suffer from two defects. There is a variability, usually slight, in the length of hour intervals. This may arise from imperfection in the clock, or from stretching or bagging of the paper. The Antarctic curves did not suffer much from this defect; but, as it so happened, it was specially prominent on April 9, 1911, during one of the storms that has been reproduced. The second defect is that known as "parallax"; the line joining corresponding positions of the dots of light which answer to the curve and the base line is not strictly perpendicular to the latter. As explained on p. 265, there was a difference in the parallax errors of the three Antarctic curves. If we suppose the hour mark to show the correct time for the N′ trace, the points answering to the true hour in the E′ and V traces were on the average respectively 0·6 mm. and 0·9 mm. to the right of the mark. In the ordinary curves 0·6 mm. represented 1·8 and 0·9 mm. represented 2·7 minutes of time.

In the reproductions of the term-hour curves, the Sc.s and the shorter storms in Plates XV to XLI, the difference in parallax error has been corrected, at least approximately, and points on the three Antarctic curves, having a common abscissa, represent the same time. But the reproductions of the longer storms show the same relative errors of parallax as the originals. In some cases, where a short storm is included, corresponding points in the three traces are indicated by short vertical lines with numerals 1, 2 . . . attached.

The parallax and clock errors in the curves from the co-operating stations were only sometimes known. Some of these curves were very faint and the definition was not always good. Thus the accuracy of reproduction in their case is probably less satisfactory.

The great majority of the short breaks in the longer storms represent the loss of trace during the time taken to change the sheet, an operation usually performed between 20 h. and 21 h. G.M.T.

The hours shown in the Plates are G.M.T., except in the case of Plates I to XI where the time shown is that of 180° E.

Plate I.

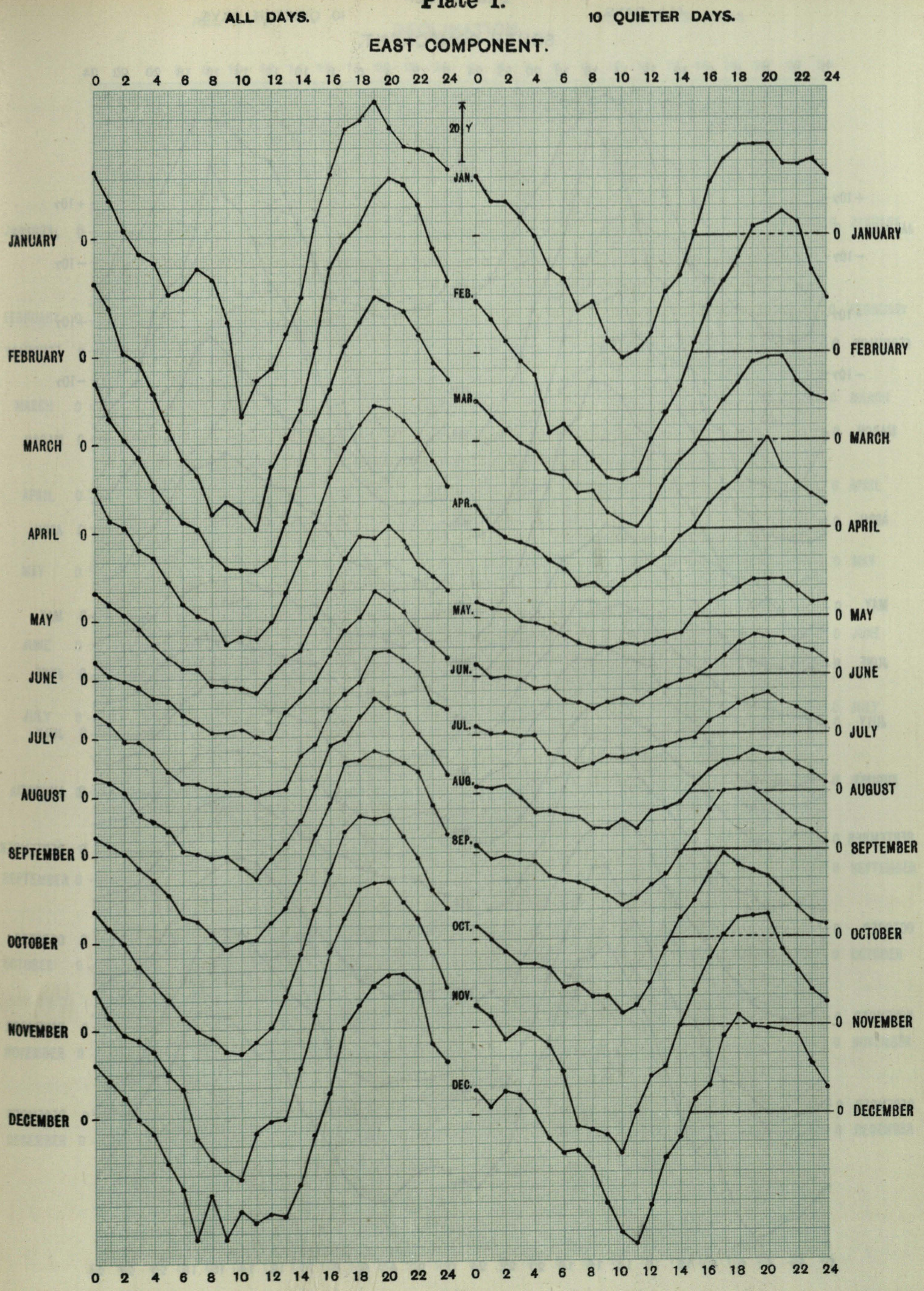
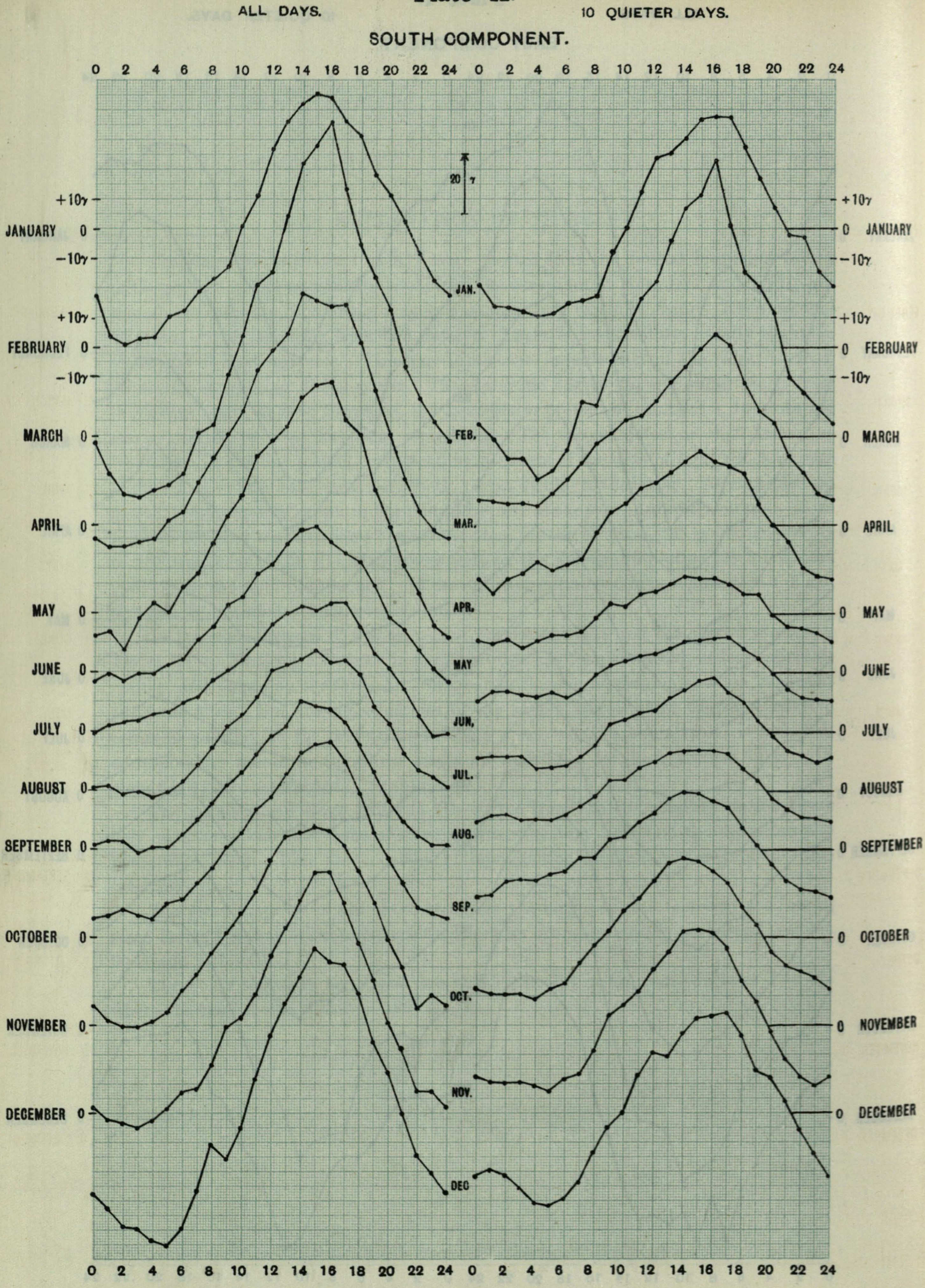

ALL DAYS.
10 QUIETER DAYS.
EAST COMPONENT.
0 2 4 6 8 10 12 14 16 18 20 22 24
20 γ
JANUARY 0
FEBRUARY 0
MARCH 0
APRIL 0
MAY 0
JUNE 0
JULY 0
AUGUST 0
SEPTEMBER 0
OCTOBER 0
NOVEMBER 0
DECEMBER 0
JAN.
FEB.
MAR.
APR.
MAY.
JUN.
JUL.
AUG.
SEP.
OCT.
NOV.
DEC.
0 JANUARY
0 FEBRUARY
0 MARCH
0 APRIL
0 MAY
0 JUNE
0 JULY
0 AUGUST
0 SEPTEMBER
0 OCTOBER
0 NOVEMBER
0 DECEMBER

Plate II.



ALL DAYS.
10 QUIETER DAYS.
SOUTH COMPONENT.
0 2 4 6 8 10 12 14 16 18 20 22 24
+10γ
JANUARY 0
−10γ
+10γ
FEBRUARY 0
−10γ
MARCH 0
APRIL 0
MAY 0
JUNE 0
JULY 0
AUGUST 0
SEPTEMBER 0
OCTOBER 0
NOVEMBER 0
DECEMBER 0
20 γ
JAN.
FEB.
MAR.
APR.
MAY
JUN.
JUL.
AUG.
SEP.
OCT.
NOV.
DEC

Plate III.

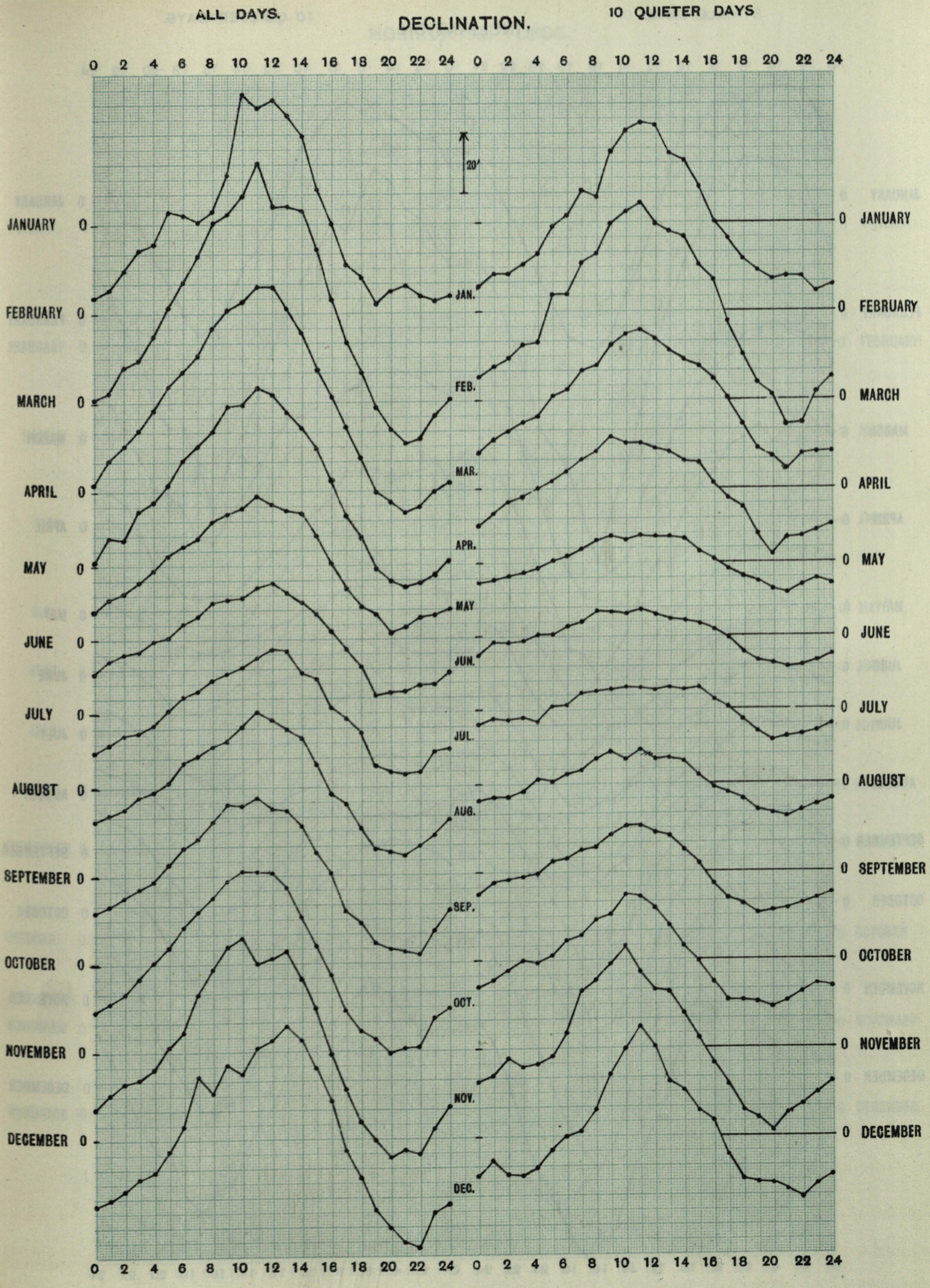

ALL DAYS.
DECLINATION.
10 QUIETER DAYS
0 2 4 6 8 10 12 14 16 18 20 22 24
20′
JANUARY 0
FEBRUARY 0
MARCH 0
APRIL 0
MAY 0
JUNE 0
JULY 0
AUGUST 0
SEPTEMBER 0
OCTOBER 0
NOVEMBER 0
DECEMBER 0
JAN.
FEB.
MAR.
APR.
MAY
JUN.
JUL.
AUG.
SEP.
OCT.
NOV.
DEC.
0 JANUARY
0 FEBRUARY
0 MARCH
0 APRIL
0 MAY
0 JUNE
0 JULY
0 AUGUST
0 SEPTEMBER
0 OCTOBER
0 NOVEMBER
0 DECEMBER

Plate IV.

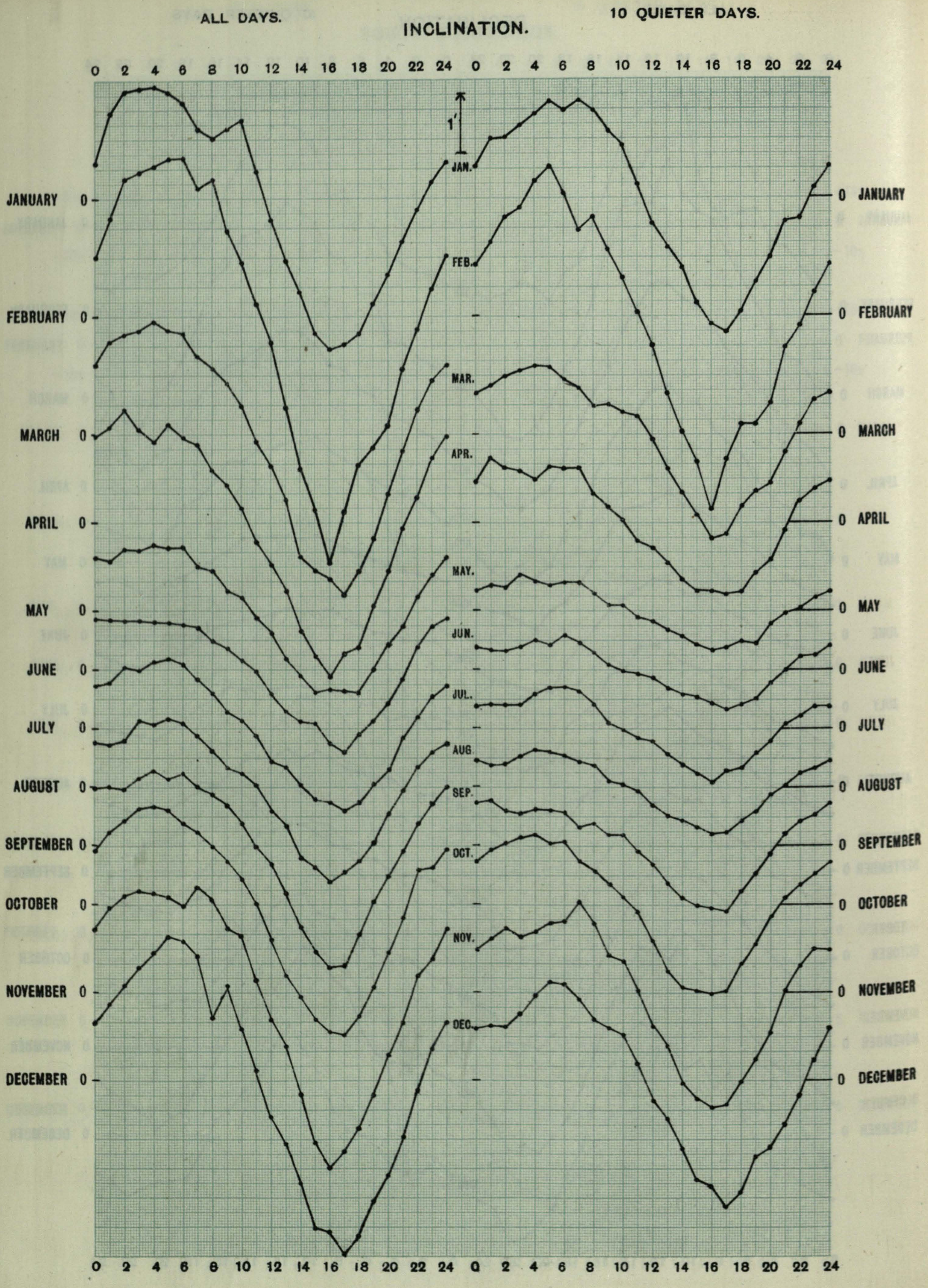

ALL DAYS.
INCLINATION.
10 QUIETER DAYS.
0 2 4 6 8 10 12 14 16 18 20 22 24
1'
JAN.
FEB.
MAR.
APR.
MAY.
JUN.
JUL.
AUG.
SEP.
OCT.
NOV.
DEC.
JANUARY 0
FEBRUARY 0
MARCH 0
APRIL 0
MAY 0
JUNE 0
JULY 0
AUGUST 0
SEPTEMBER 0
OCTOBER 0
NOVEMBER 0
DECEMBER 0

Plate V.

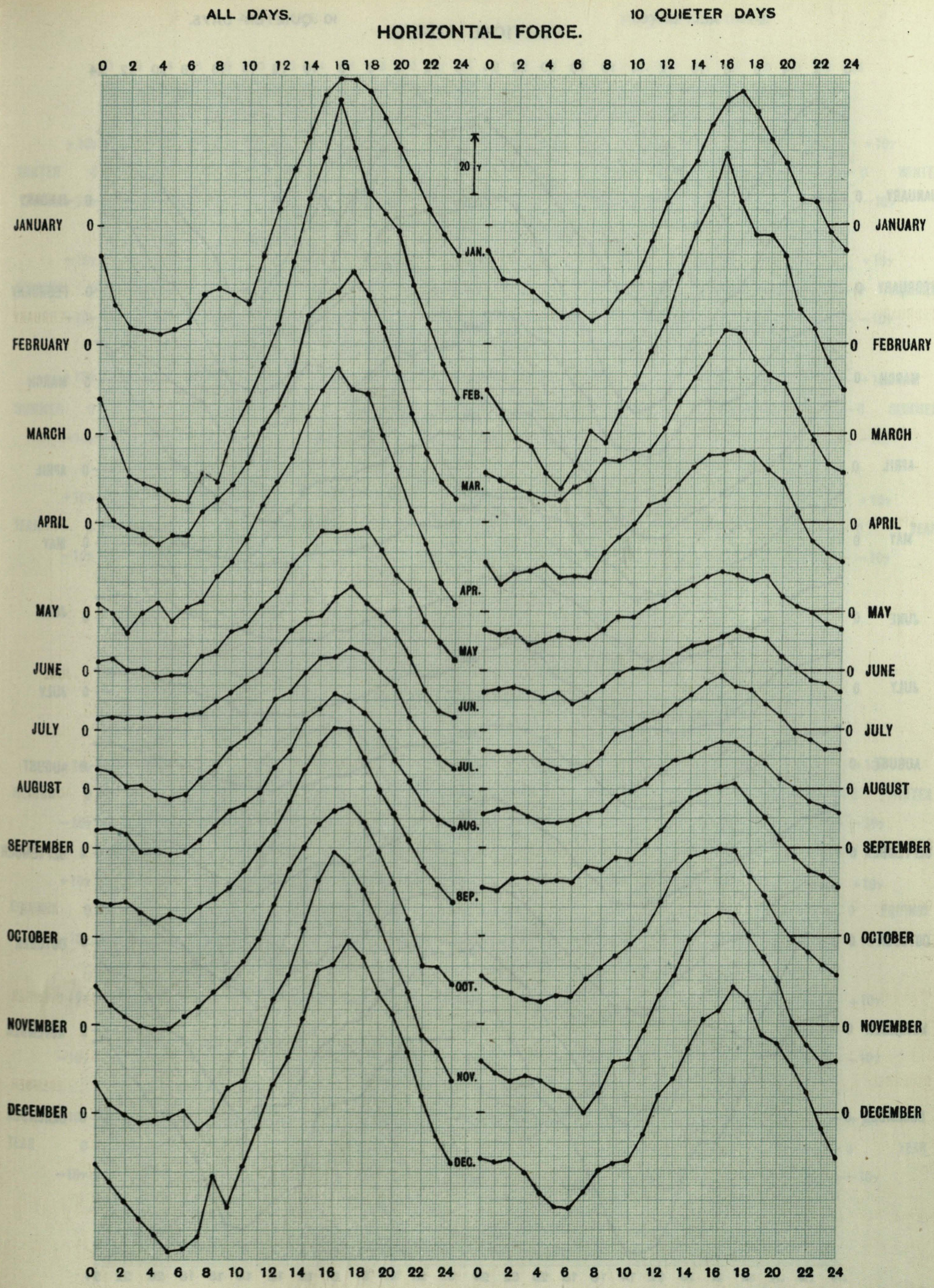

ALL DAYS.
10 QUIETER DAYS
HORIZONTAL FORCE.
20 γ
JANUARY 0
FEBRUARY 0
MARCH 0
APRIL 0
MAY 0
JUNE 0
JULY 0
AUGUST 0
SEPTEMBER 0
OCTOBER 0
NOVEMBER 0
DECEMBER 0
JAN.
FEB.
MAR.
APR.
MAY
JUN.
JUL.
AUG.
SEP.
OCT.
NOV.
DEC.
0 2 4 6 8 10 12 14 16 18 20 22 24

Plate VI.

VERTICAL FORCE.

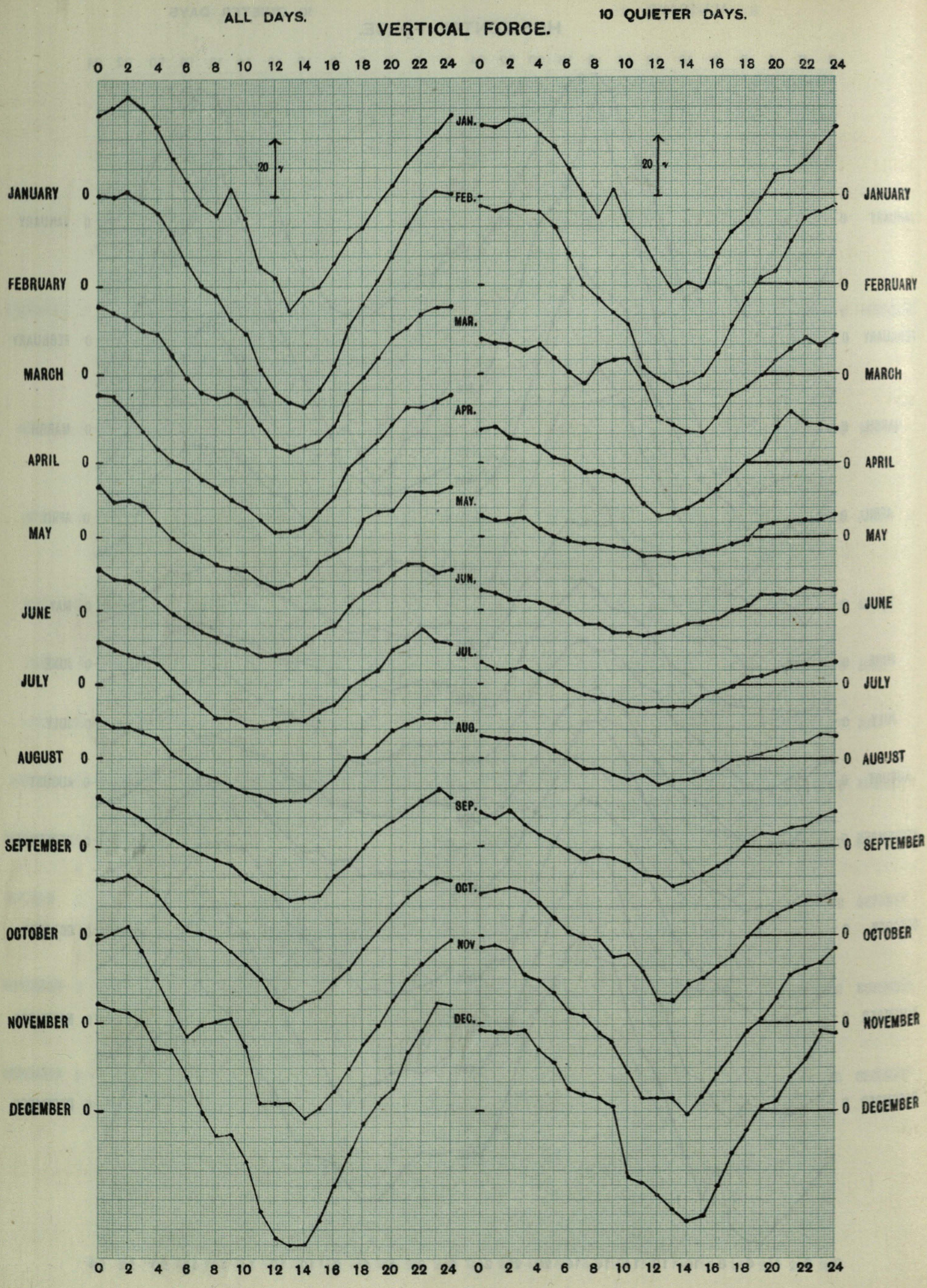
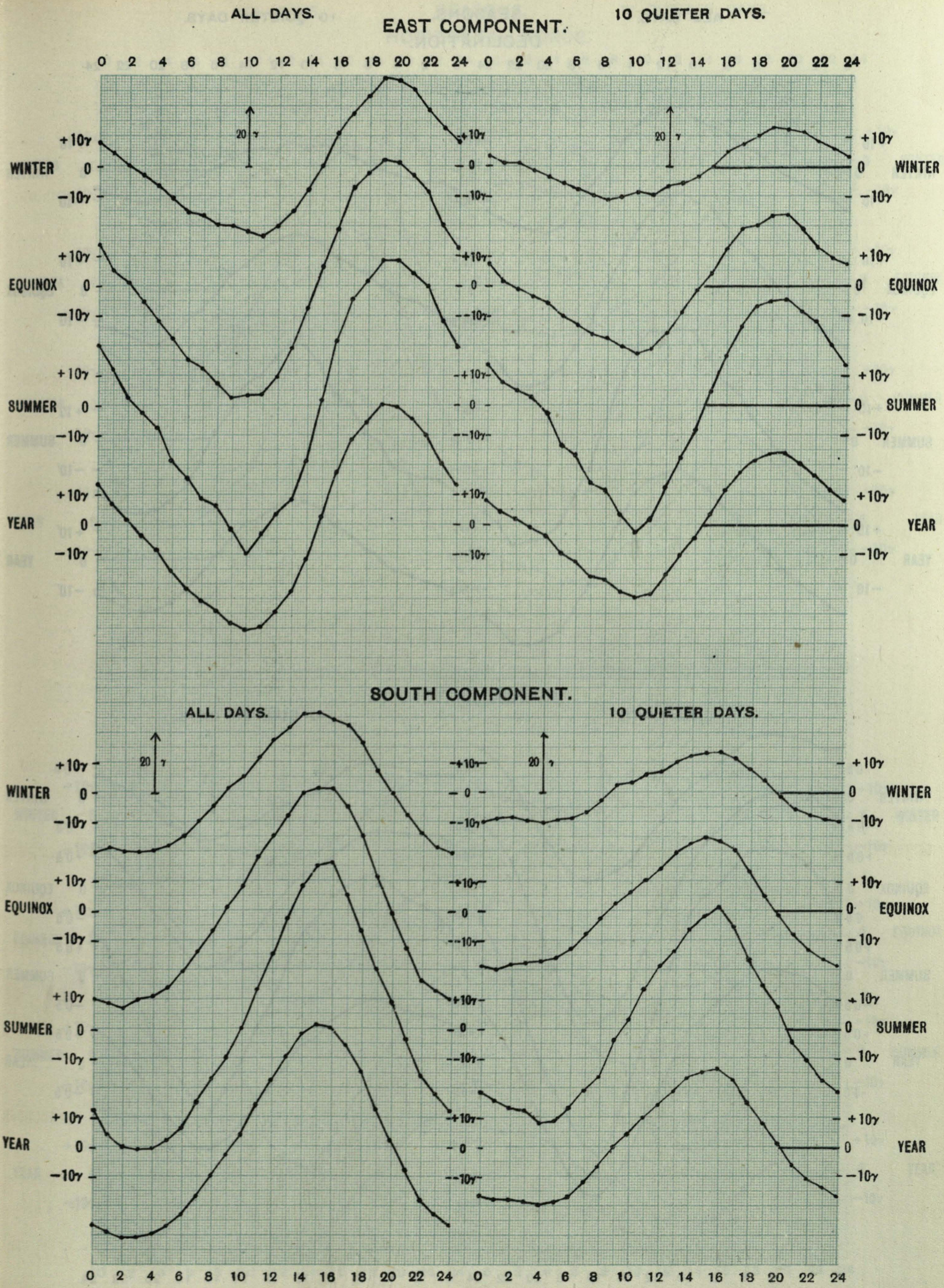


Plate VII.



EAST COMPONENT.
ALL DAYS.
10 QUIETER DAYS.
WINTER
EQUINOX
SUMMER
YEAR
+10γ
0
-10γ
20 γ
0 2 4 6 8 10 12 14 16 18 20 22 24
SOUTH COMPONENT.
ALL DAYS.
10 QUIETER DAYS.

Plate VIII.

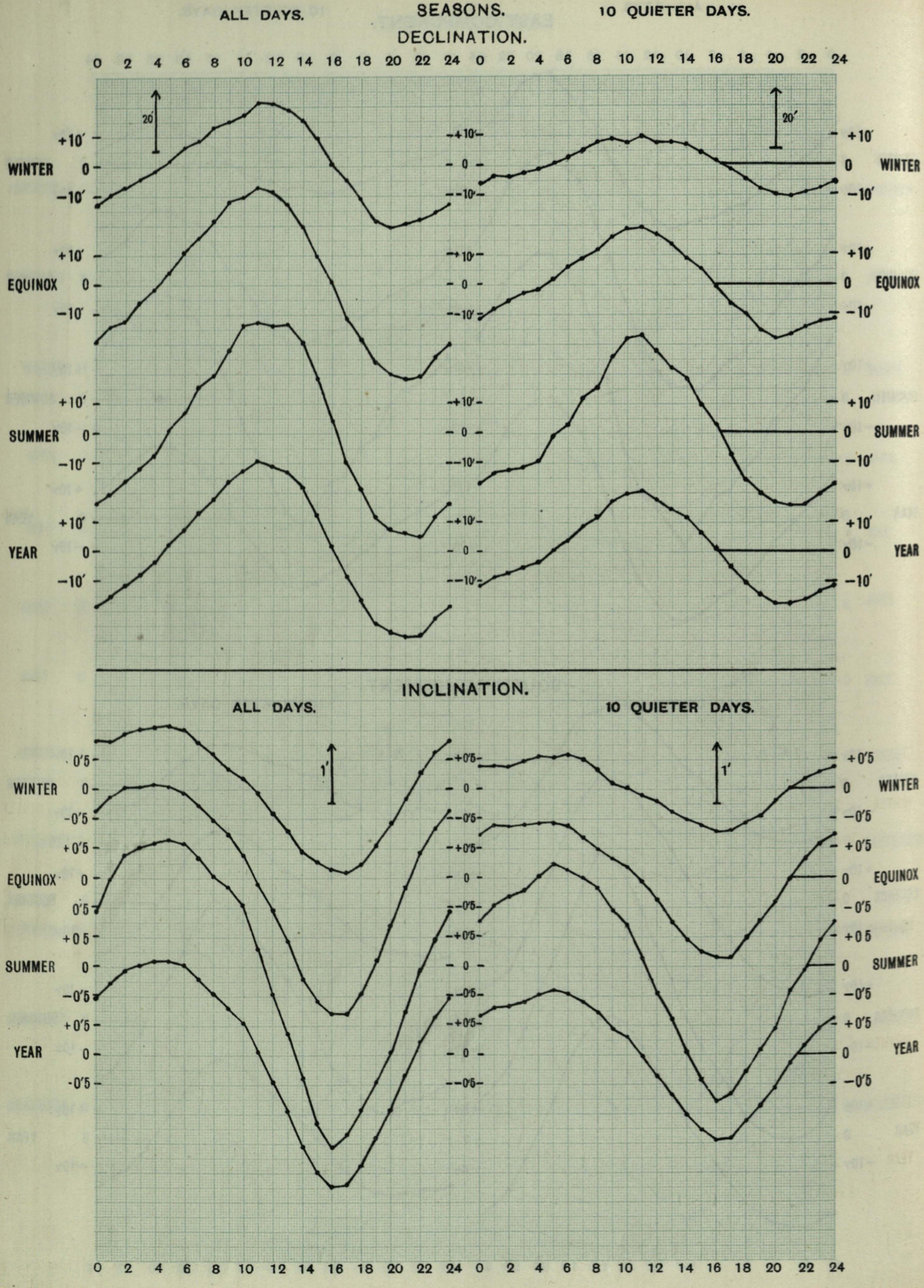
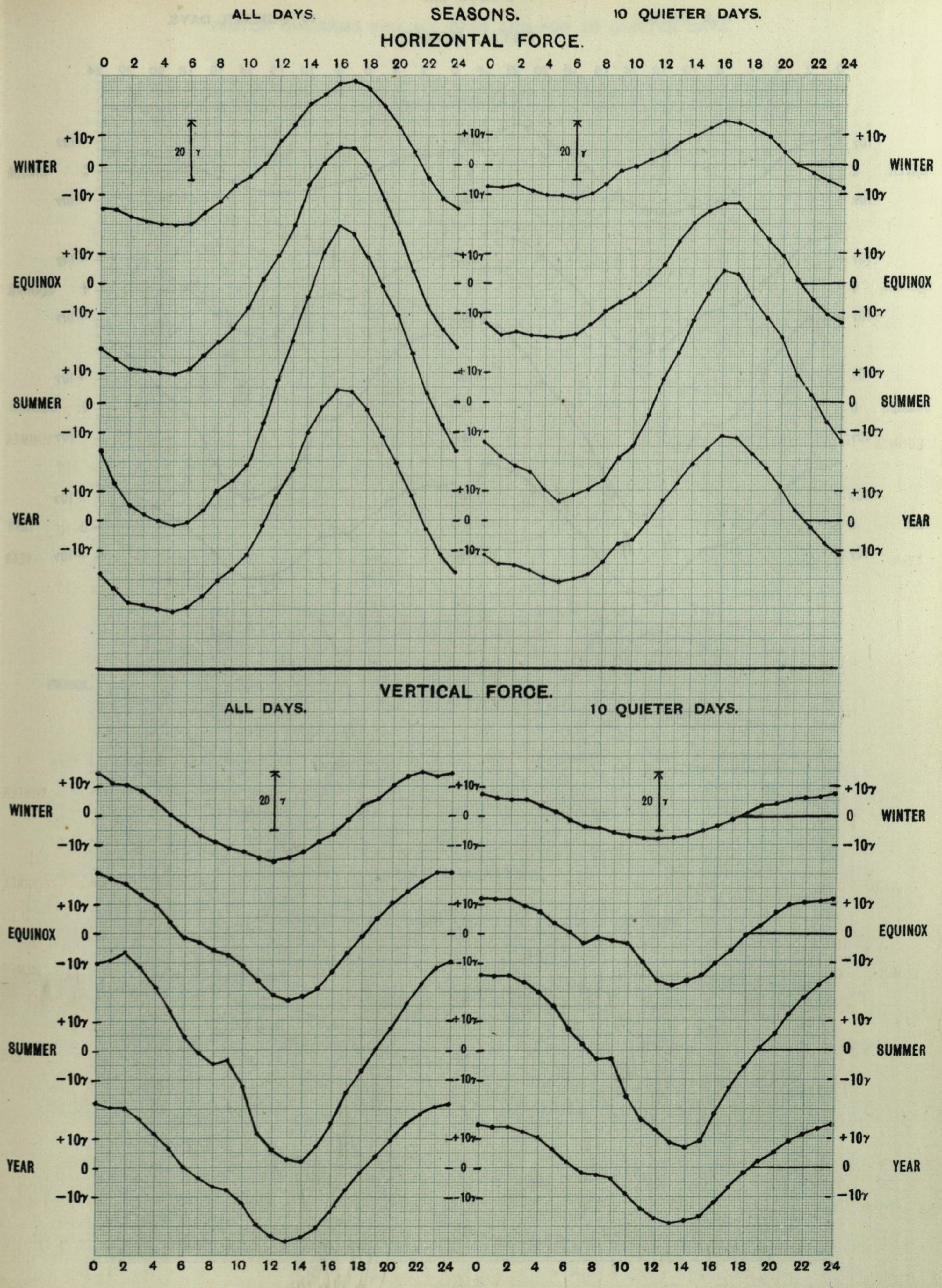

ALL DAYS.
SEASONS.
10 QUIETER DAYS.
DECLINATION.
0 2 4 6 8 10 12 14 16 18 20 22 24 0 2 4 6 8 10 12 14 16 18 20 22 24
20′
20′
WINTER
EQUINOX
SUMMER
YEAR
+10′
0
−10′
INCLINATION.
ALL DAYS.
10 QUIETER DAYS.
1′
1′
WINTER
EQUINOX
SUMMER
YEAR
+0′5
0
−0′5

Plate IX.



ALL DAYS.
SEASONS.
10 QUIETER DAYS.
HORIZONTAL FORCE.
0 2 4 6 8 10 12 14 16 18 20 22 24
0 2 4 6 8 10 12 14 16 18 20 22 24
20 γ
20 γ
+10γ
WINTER 0
−10γ
+10γ
EQUINOX 0
−10γ
+10γ
SUMMER 0
−10γ
+10γ
YEAR 0
−10γ
VERTICAL FORCE.
ALL DAYS.
10 QUIETER DAYS.
20 γ
20 γ
+10γ
WINTER 0
−10γ
+10γ
EQUINOX 0
−10γ
+10γ
SUMMER 0
−10γ
+10γ
YEAR 0
−10γ
0 2 4 6 8 10 12 14 16 18 20 22 24
0 2 4 6 8 10 12 14 16 18 20 22 24

Plate X.

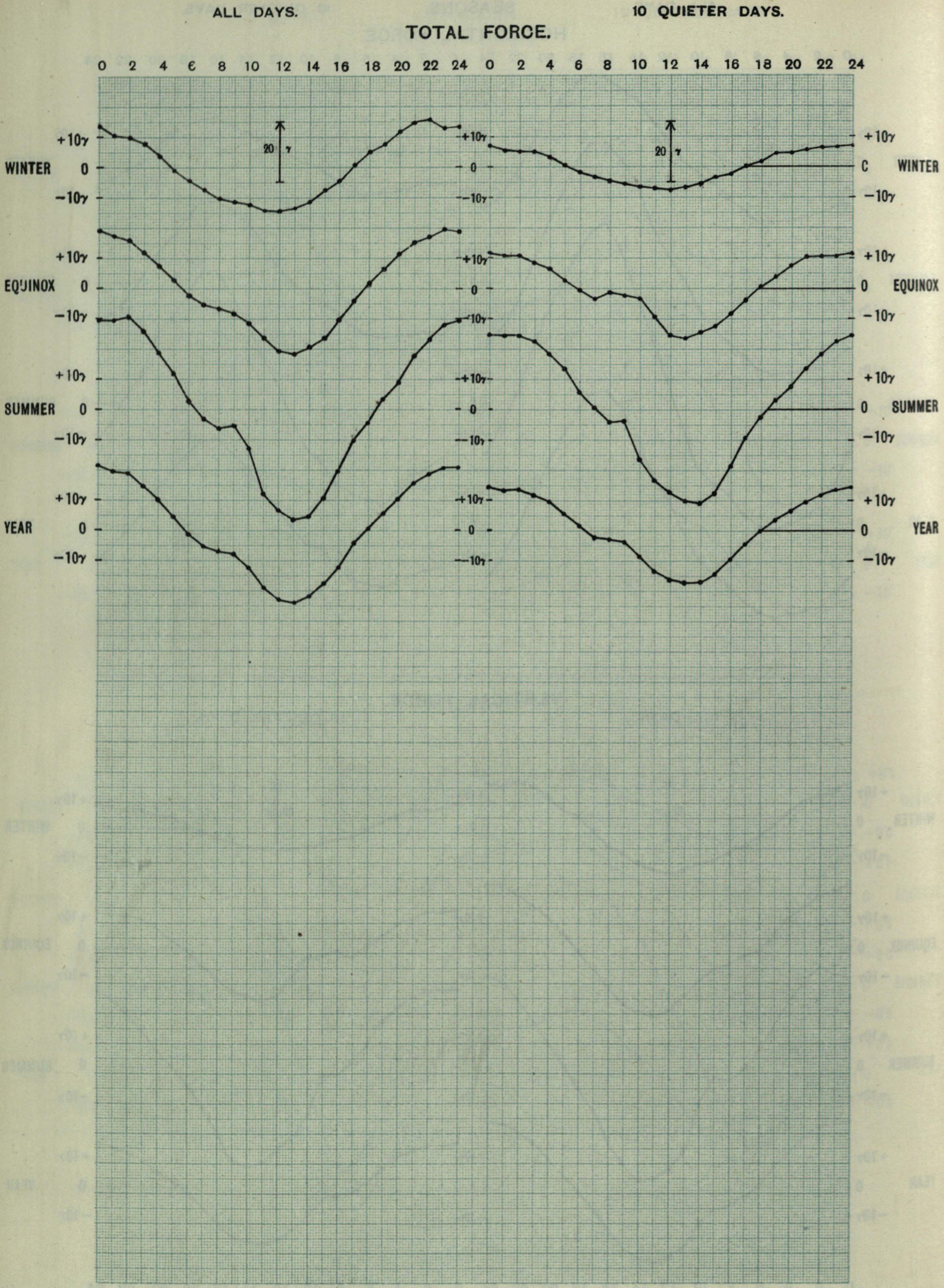

ALL DAYS.
10 QUIETER DAYS.
TOTAL FORCE.
0 2 4 6 8 10 12 14 16 18 20 22 24
WINTER
EQUINOX
SUMMER
YEAR
+10γ
0
−10γ
20 γ

Plate XI.

VECTOR DIAGRAMS FOR ALL DAYS AND FOR 10 QUIETER DAYS.

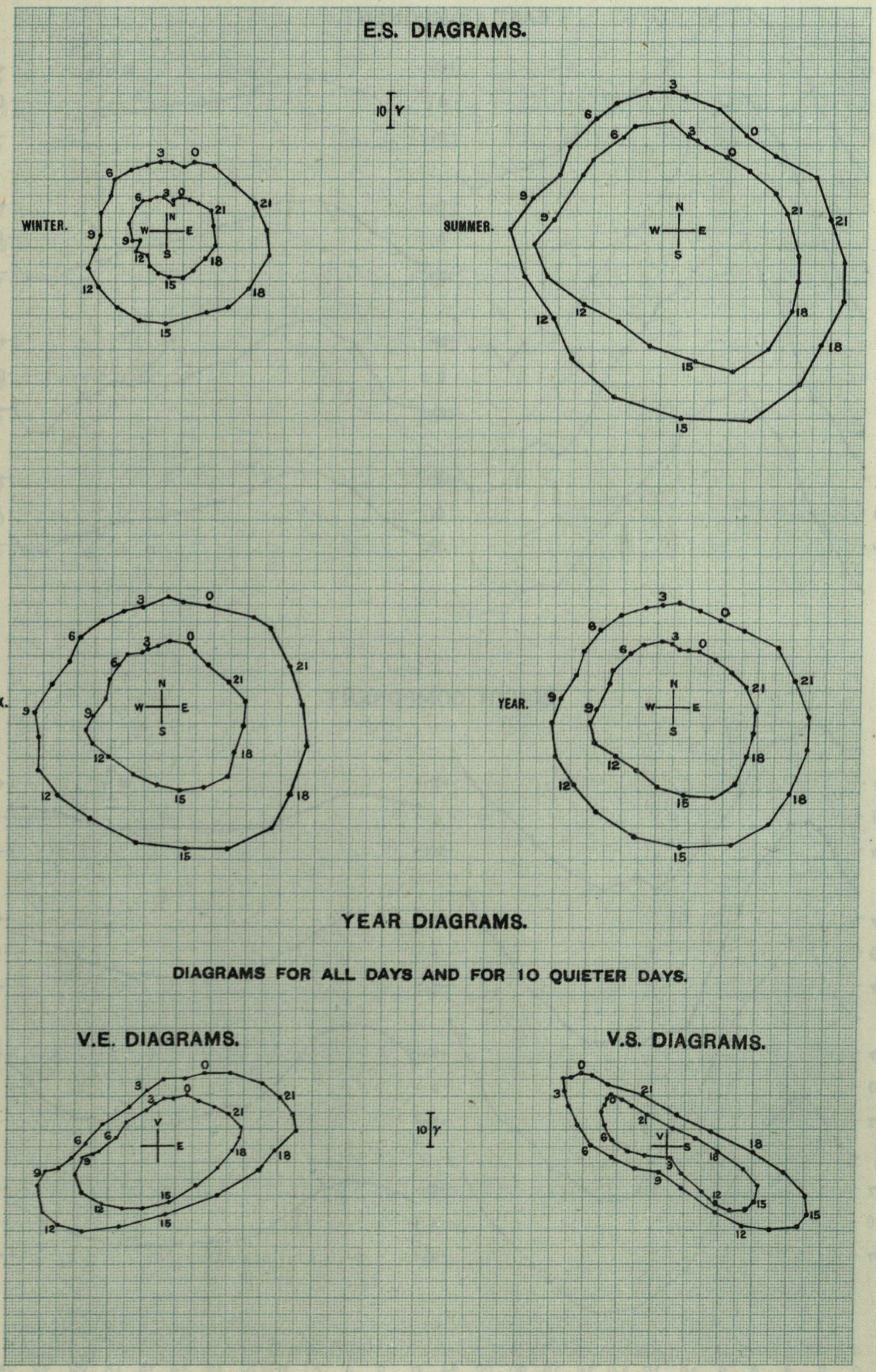
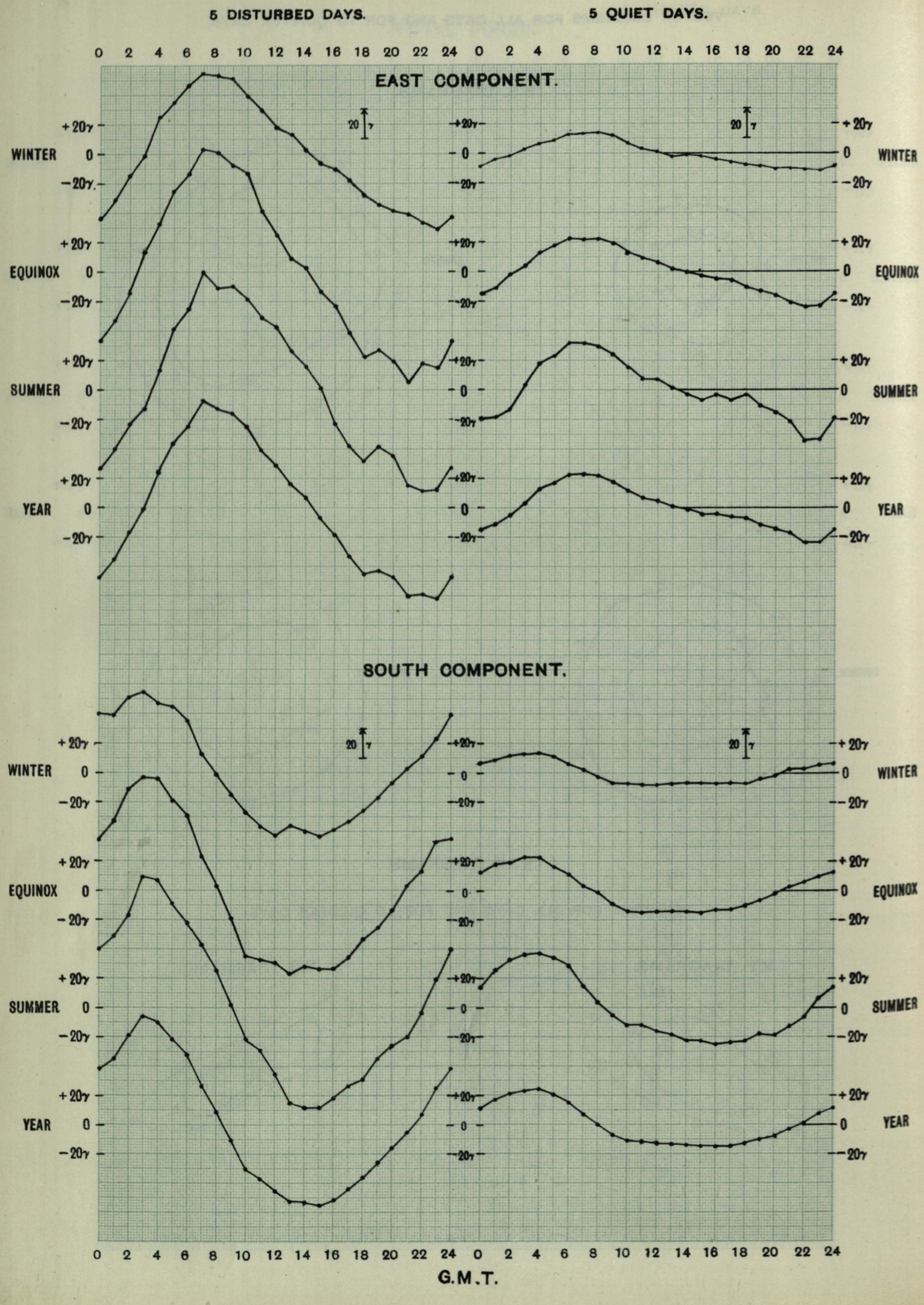


Plate XII.



5 DISTURBED DAYS.
5 QUIET DAYS.
EAST COMPONENT.
SOUTH COMPONENT.
WINTER
EQUINOX
SUMMER
YEAR
+20γ
0
−20γ
20 γ
0 2 4 6 8 10 12 14 16 18 20 22 24
G.M.T.

Plate XIII.

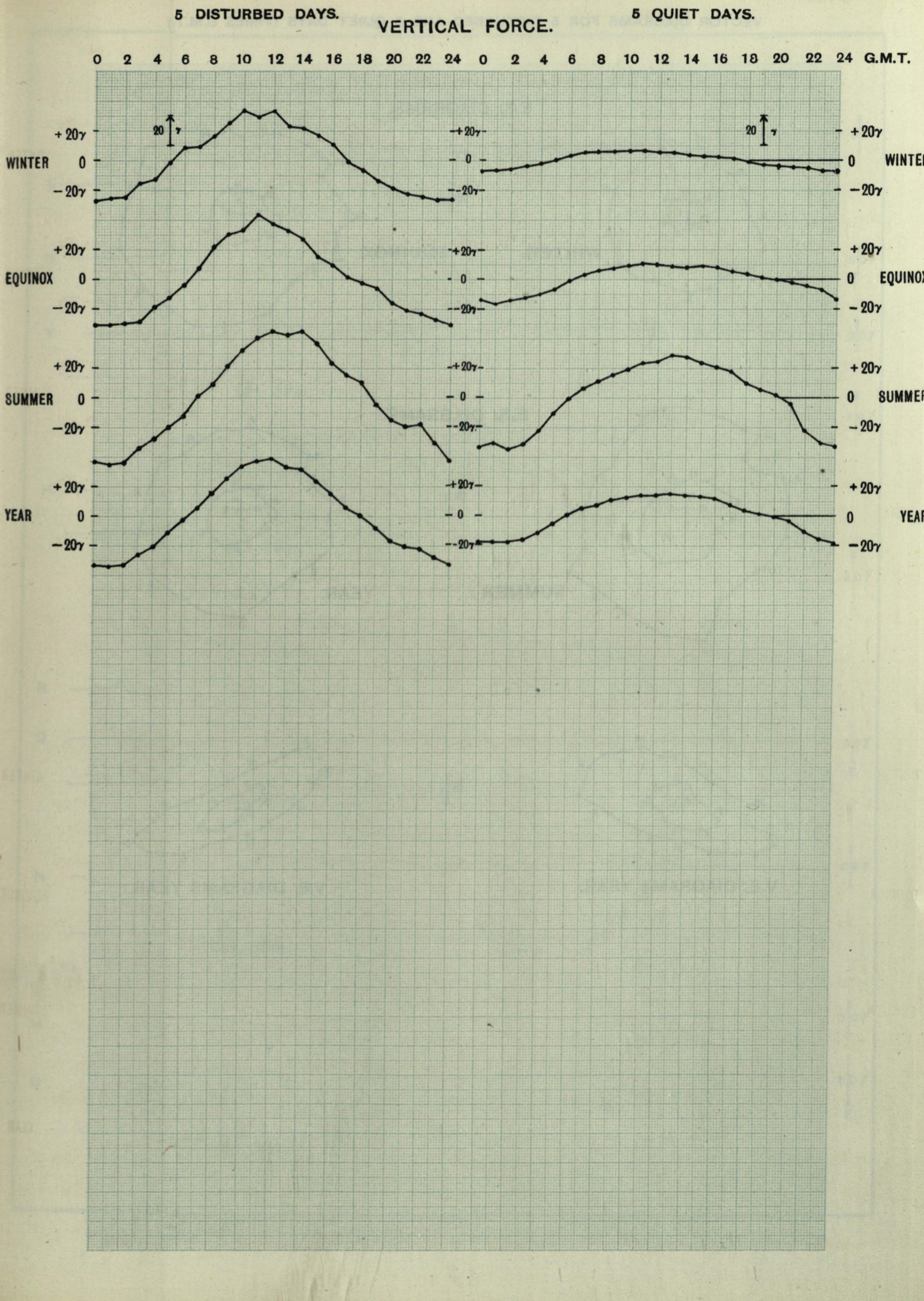
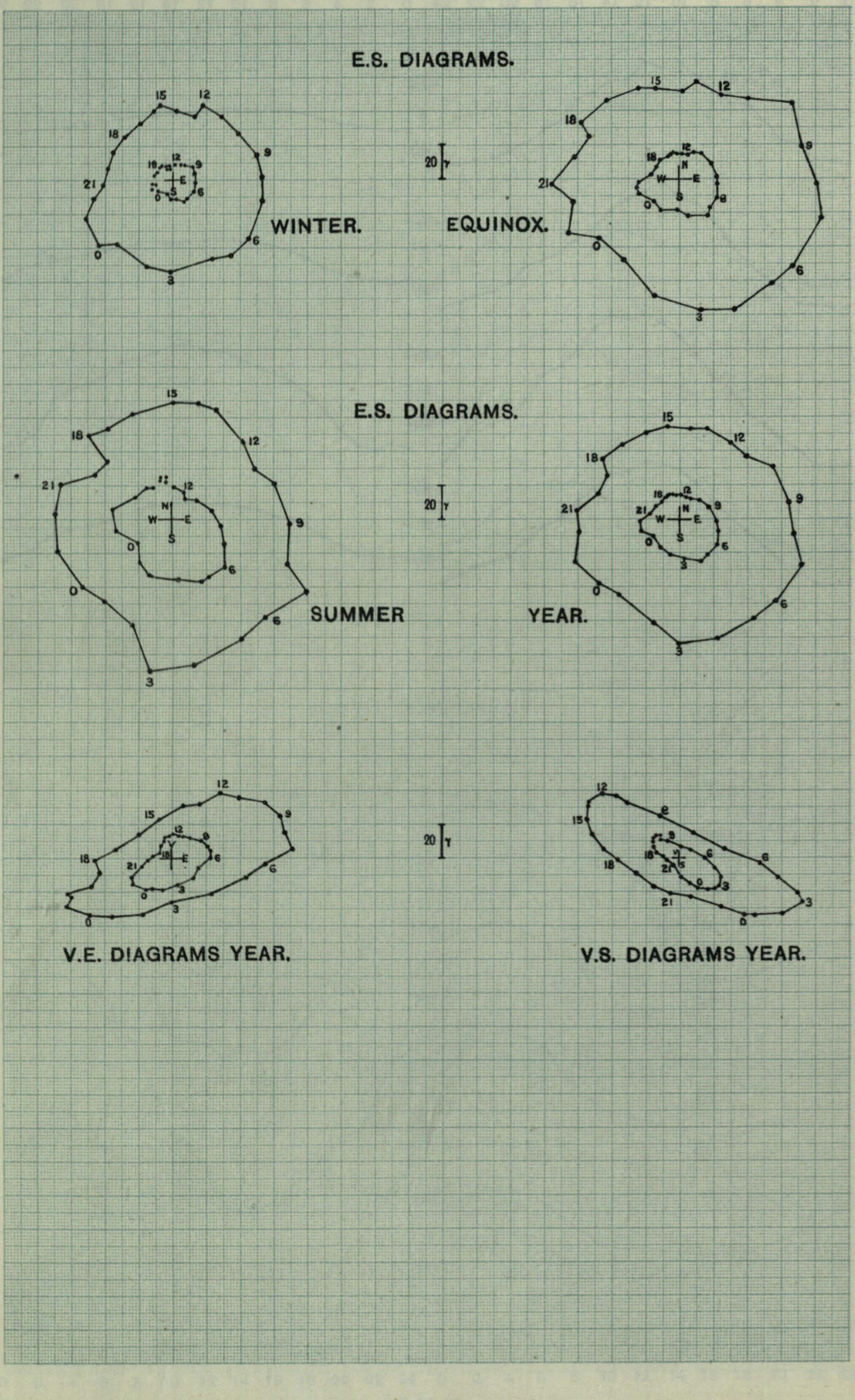
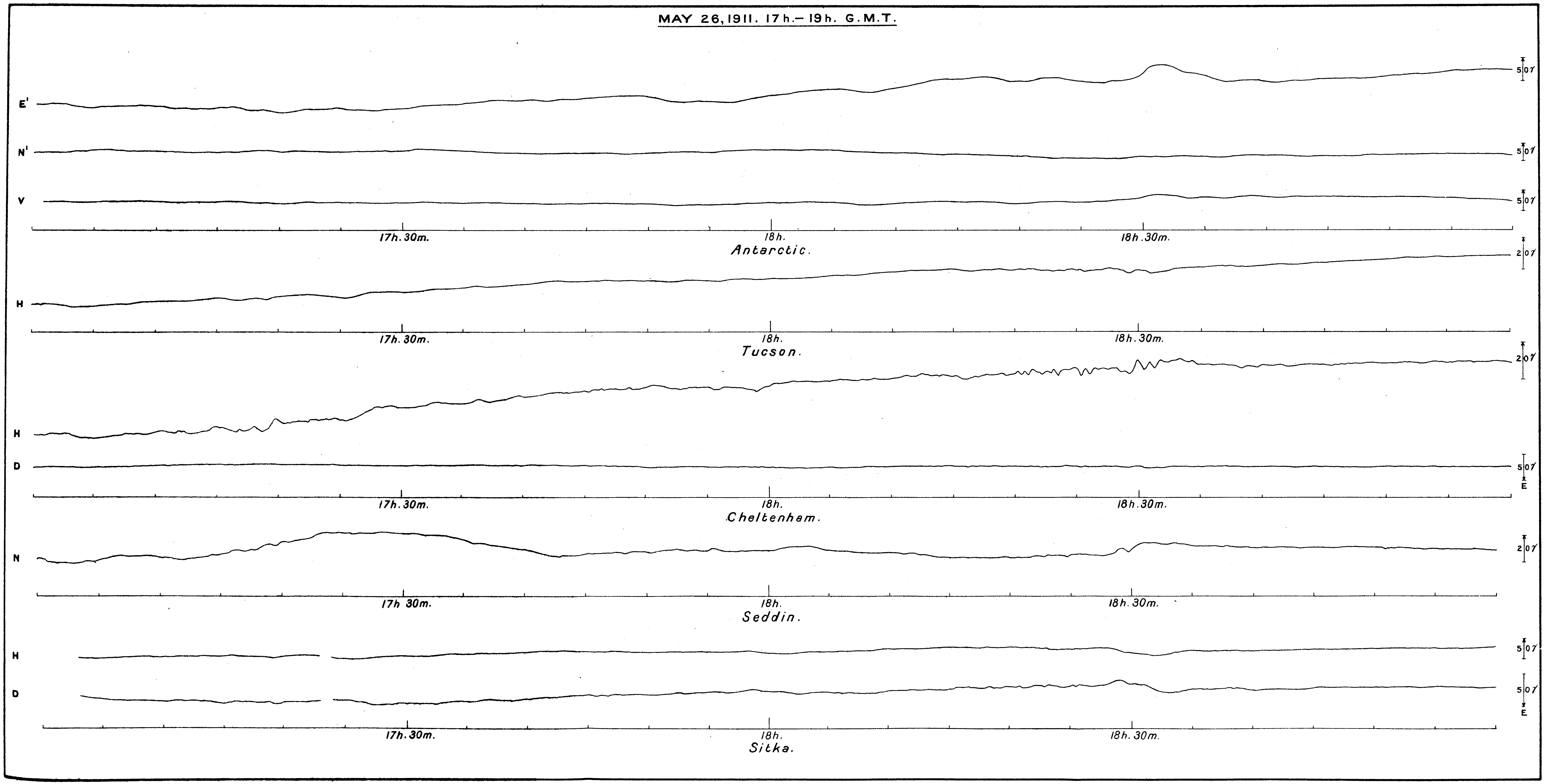

5 DISTURBED DAYS.
VERTICAL FORCE.
5 QUIET DAYS.
0 2 4 6 8 10 12 14 16 18 20 22 24
0 2 4 6 8 10 12 14 16 18 20 22 24 G.M.T.
WINTER
EQUINOX
SUMMER
YEAR
+ 20γ
0
− 20γ
20 γ

Plate XIV.

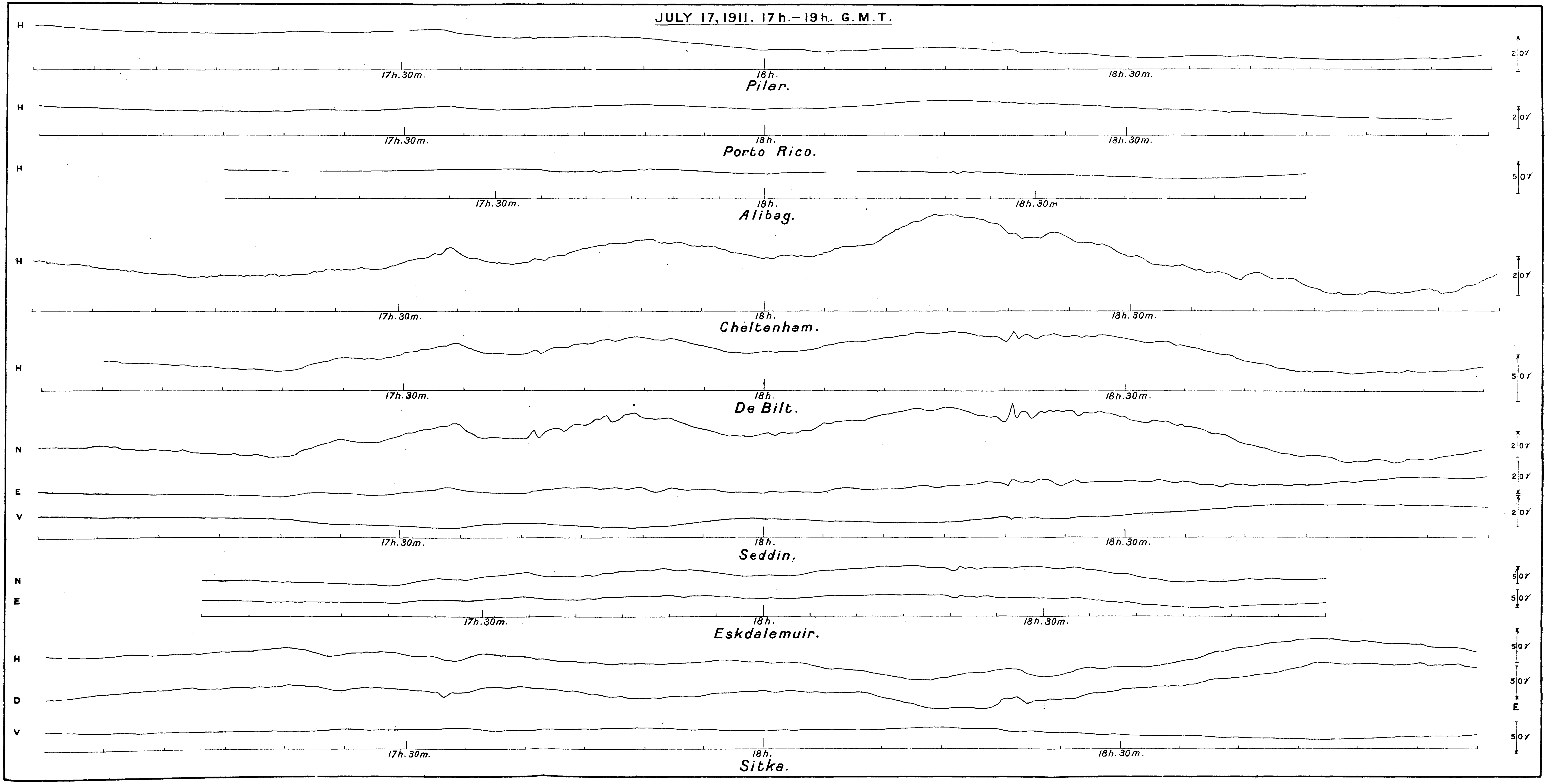
VECTOR DIAGRAMS FOR 5 DISTURBED AND 5 QUIET DAYS (TIMES G.M.T.)



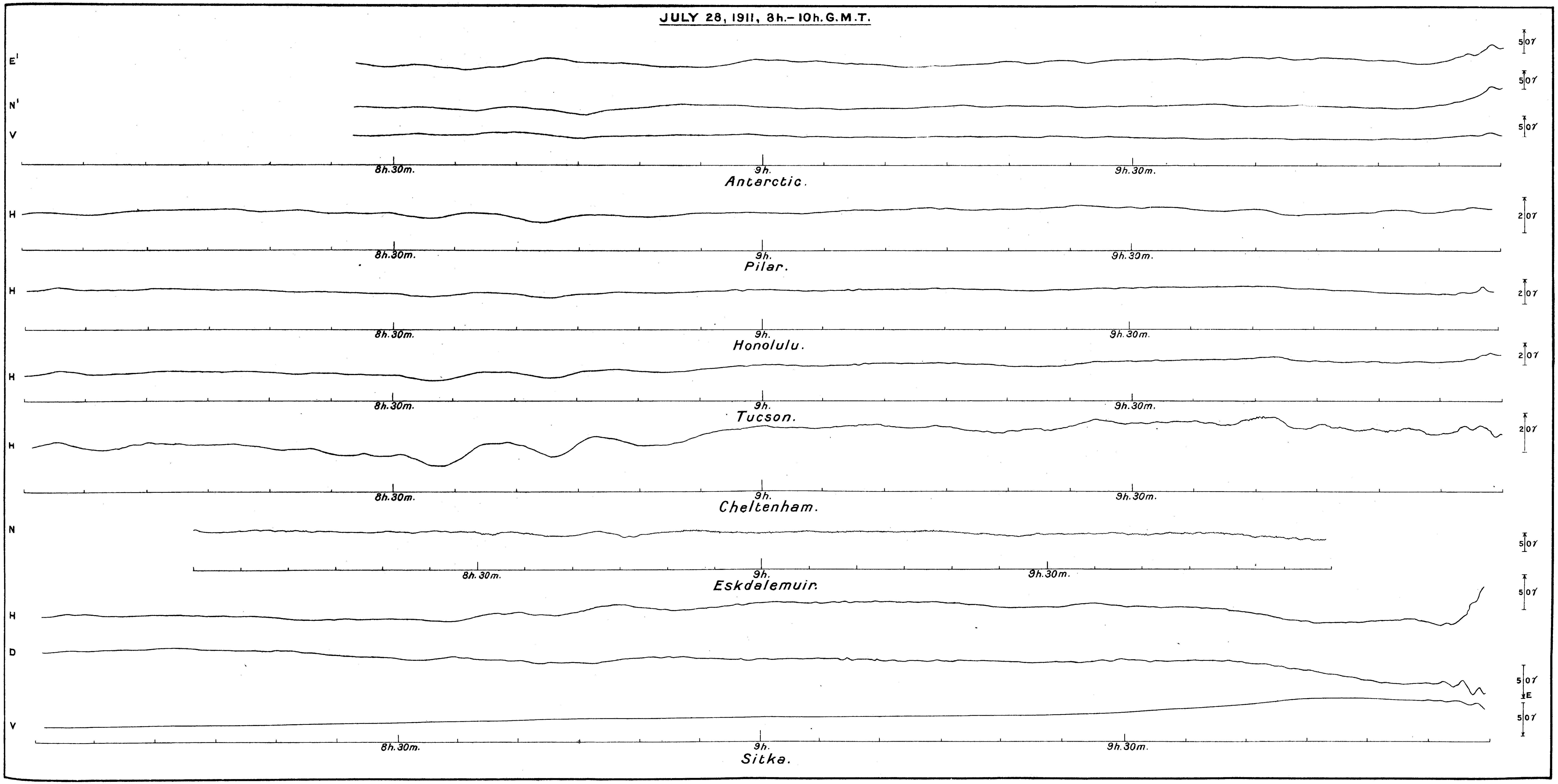
Quick Runs.


MAY 26, 1911. 17h.–19h. G.M.T.
E'
N'
V
50γ
17h. 30m.
18h.
18h. 30m.
Antarctic.
H
20γ
Tucson.
H
D
50γ
E
Cheltenham.
N
Seddin.
H
D
Sitka.

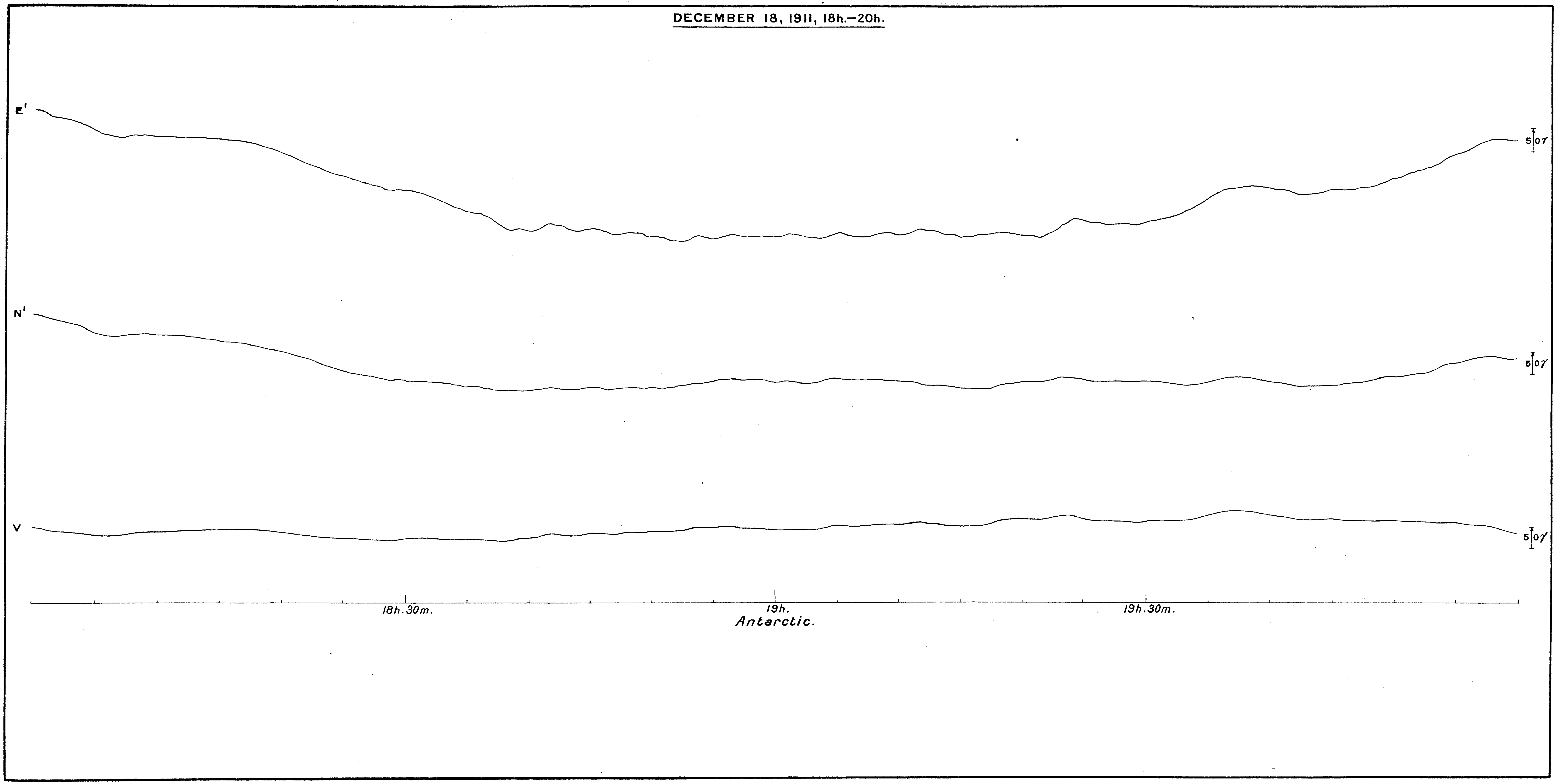
Quick Runs.


JULY 17, 1911. 17h.–19h. G.M.T.
H
17h. 30m.
18h.
18h. 30m.
20γ
Pilar.
Porto Rico.
50γ
Alibag.
Cheltenham.
De Bilt.
N
E
V
Seddin.
Eskdalemuir.
D
E
Sitka.

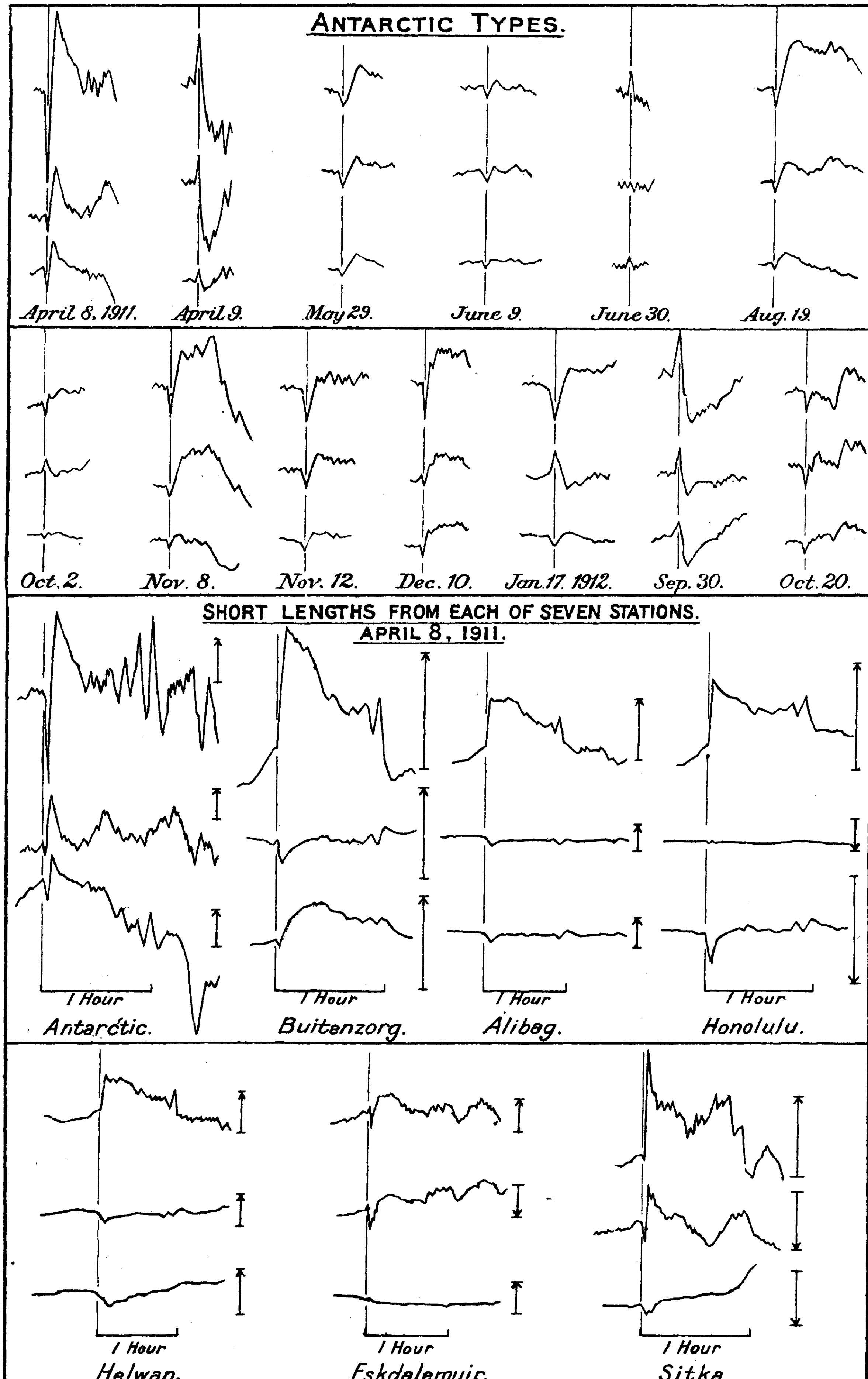
Quick Runs.


JULY 28, 1911, 8h.-10h. G.M.T.
E'
N'
V
5 0γ
5 0γ
5 0γ
8h.30m.
9h.
9h.30m.
Antarctic.
H
2 0γ
8h.30m.
9h.
9h.30m.
Pilar.
H
2 0γ
8h.30m.
9h.
9h.30m.
Honolulu.
H
2 0γ
8h.30m.
9h.
9h.30m.
Tucson.
H
2 0γ
8h.30m.
9h.
9h.30m.
Cheltenham.
N
5 0γ
8h.30m.
9h.
9h.30m.
Eskdalemuir.
H
D
V
5 0γ
5 0γ
E
5 0γ
8h.30m.
9h.
9h.30m.
Sitka.

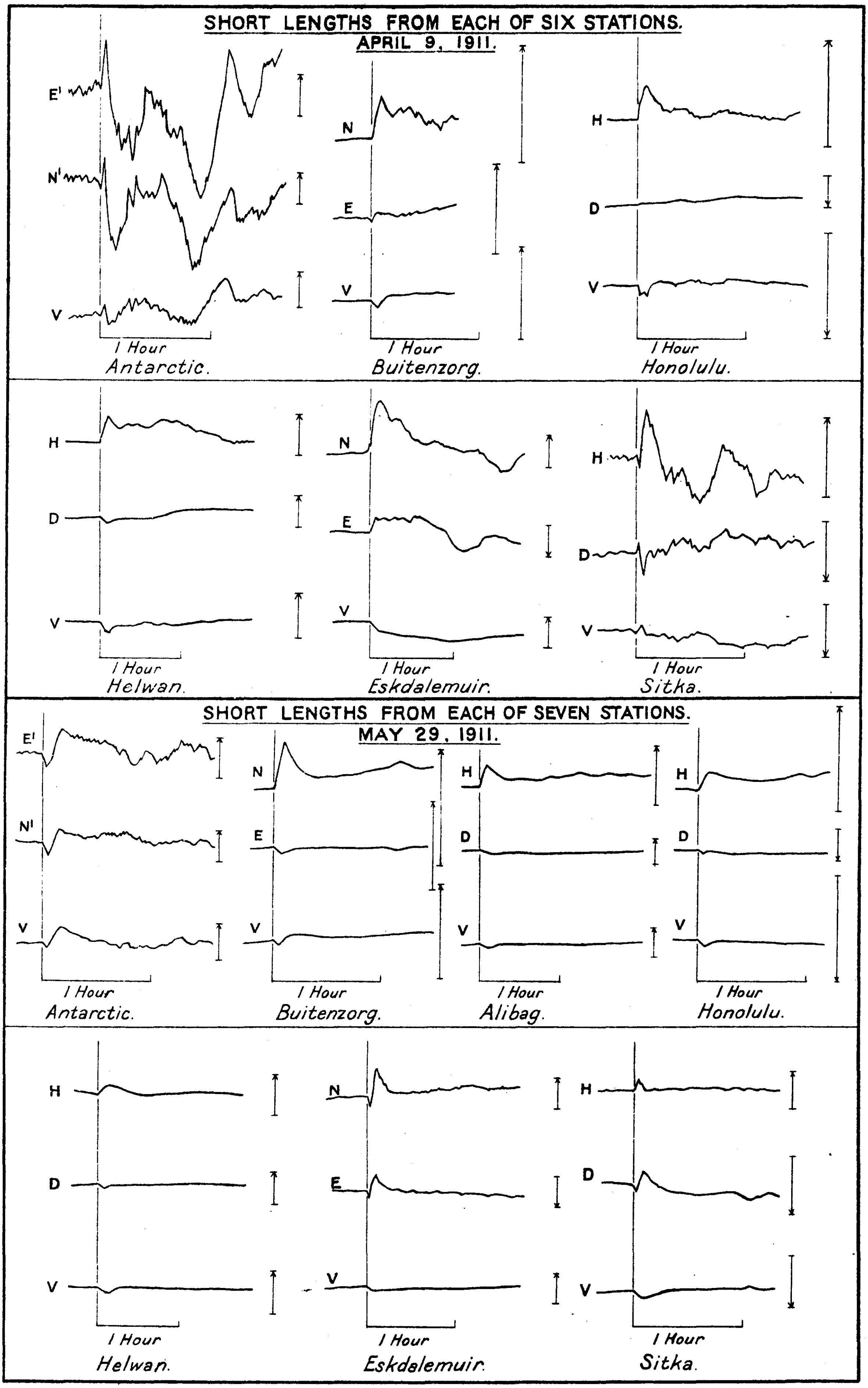
QUICK RUNS.


DECEMBER 18, 1911, 18h.–20h.
E'
N'
V
5 0γ
5 0γ
5 0γ
18h. 30m.
19h.
19h. 30m.
Antarctic.

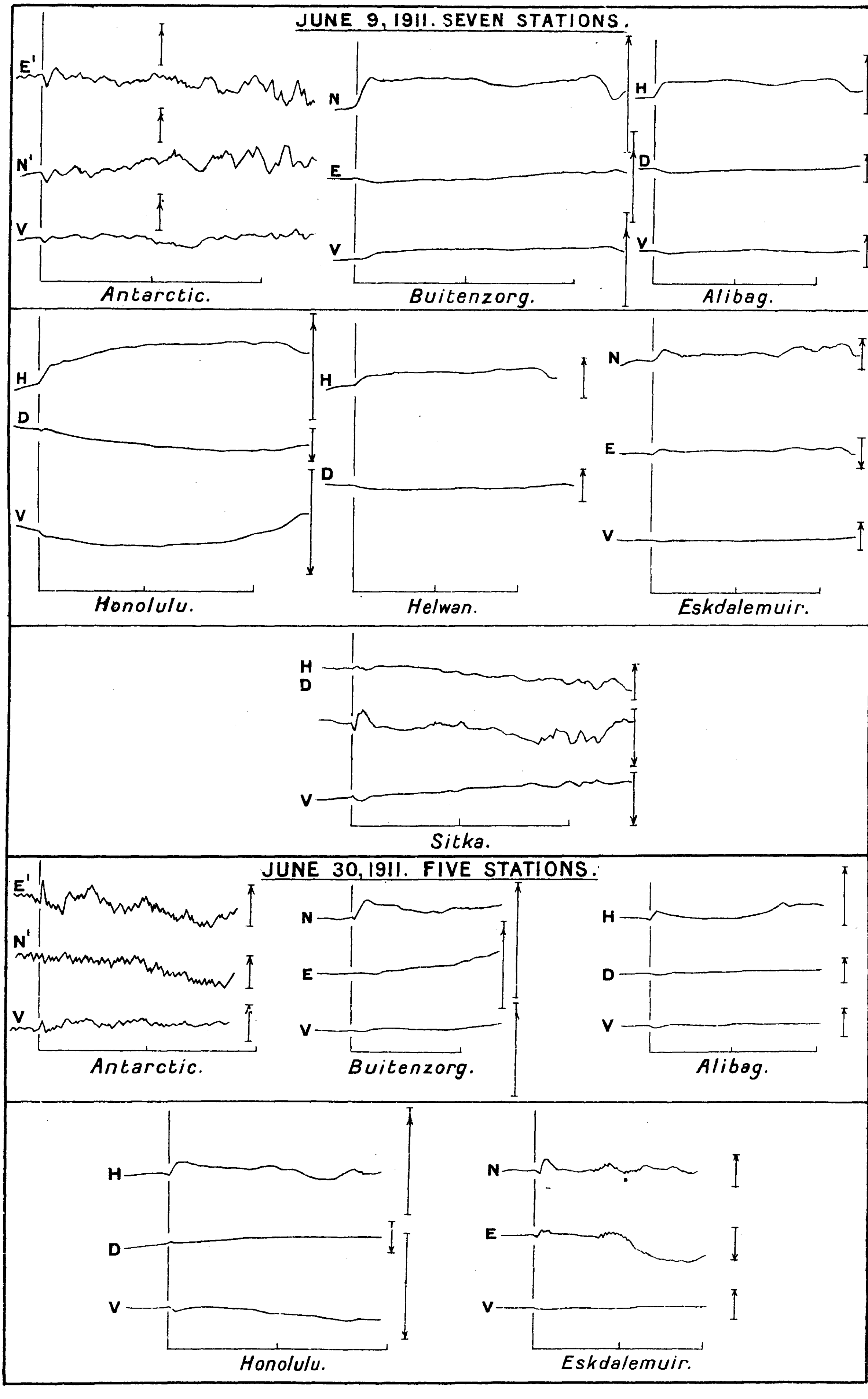
Sudden Commencements.



Sudden Commencements.

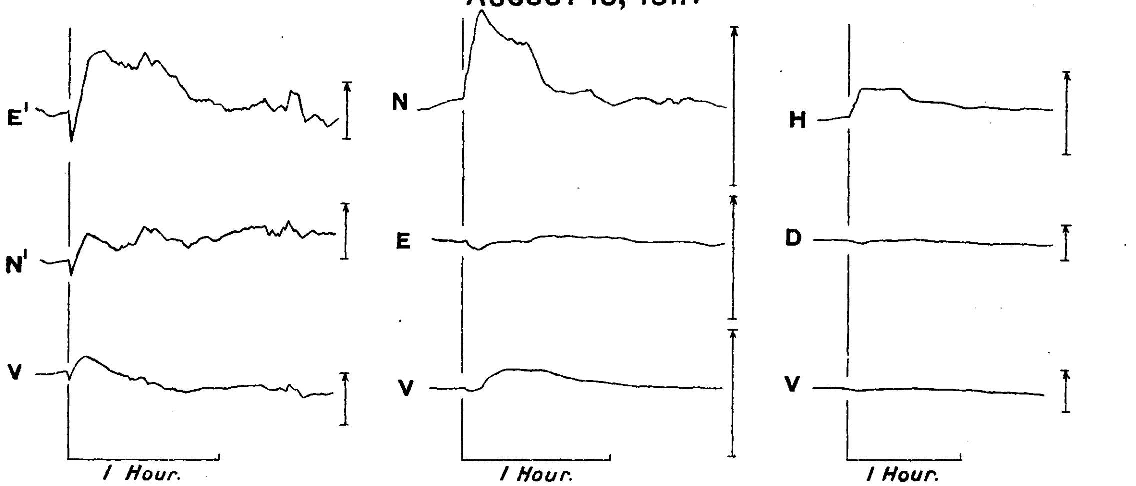


Sudden Commencements.

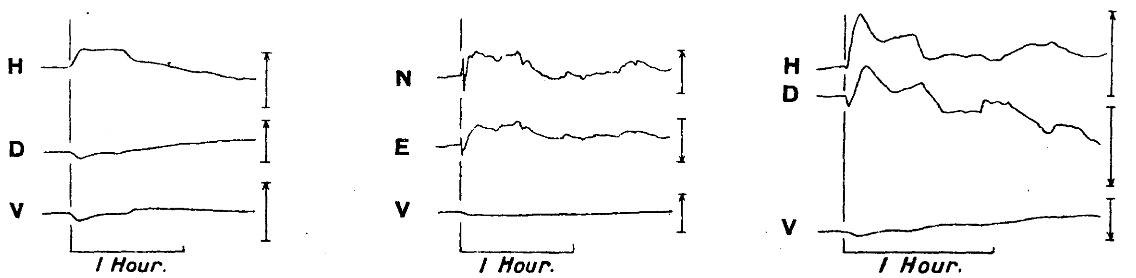


Sudden Commencements.

Short lengths from each of six stations, August 19, 1911.

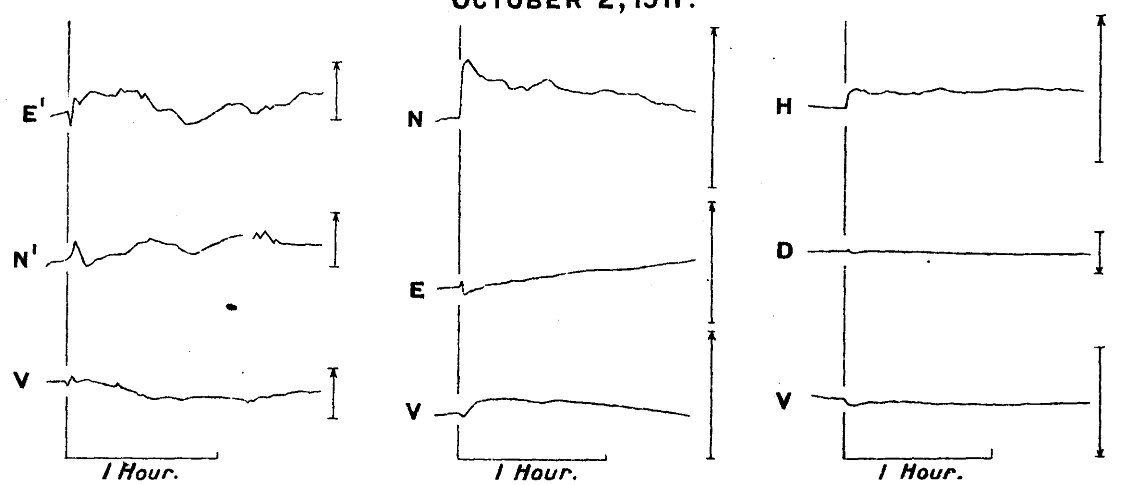


Antarctic. Buitenzorg. Alibag.

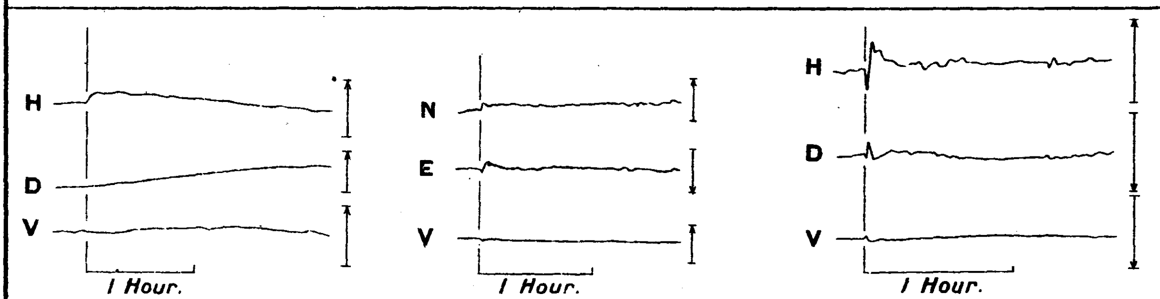


Helwan. Eskdalemuir. Sitka.

Short lengths from each of six stations, October 2, 1911.

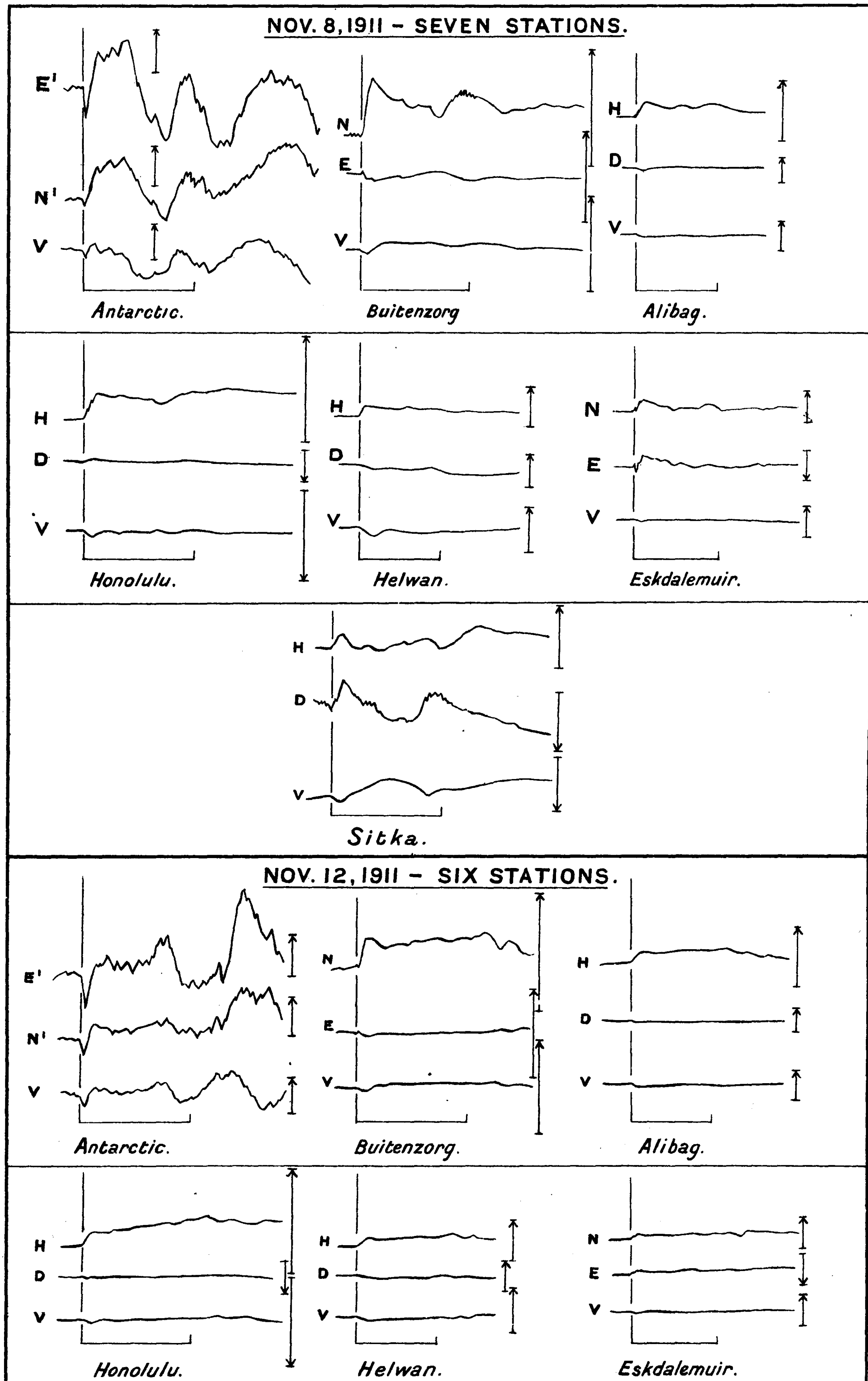


Antarctic. Buitenzorg. Honolulu.

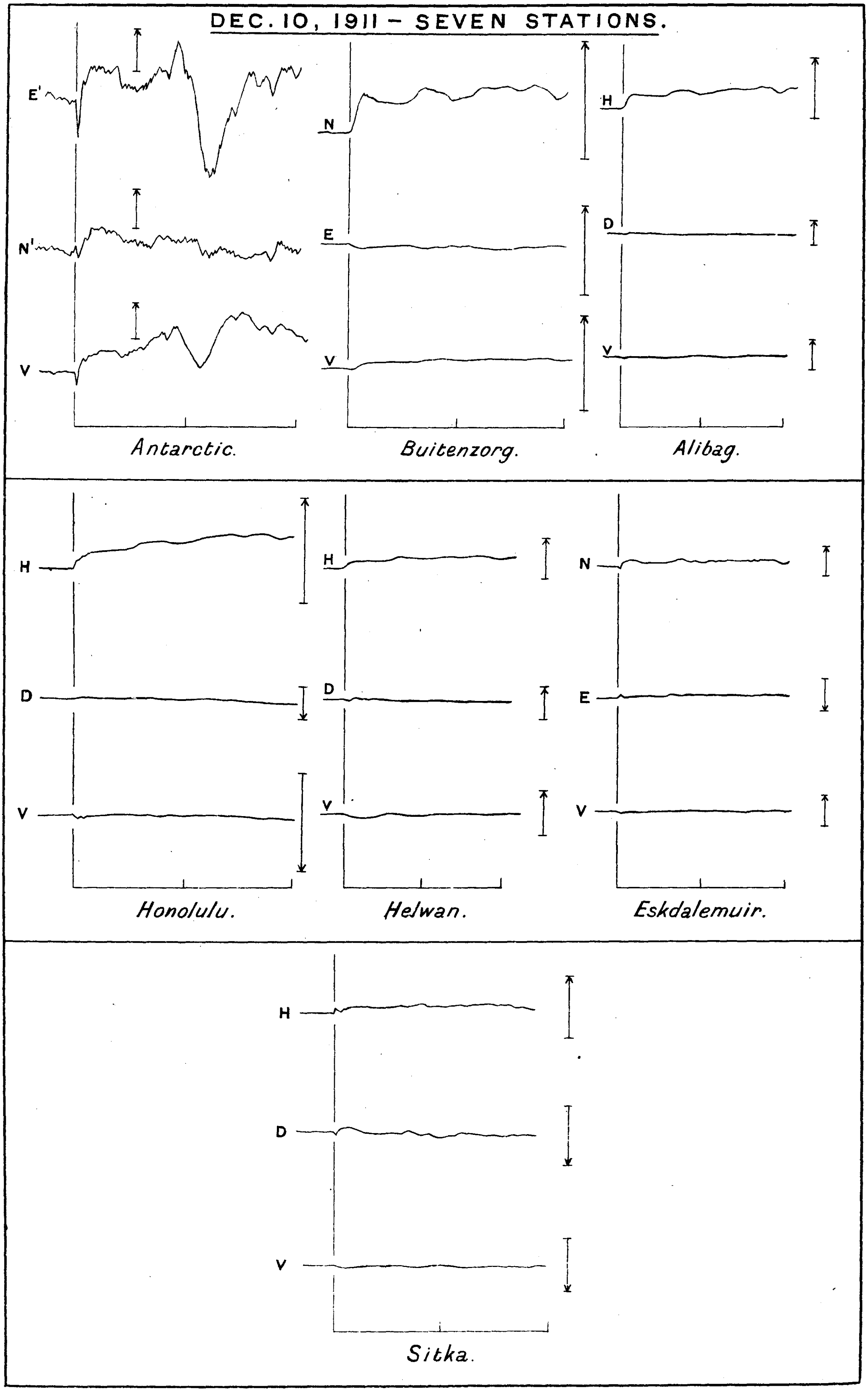


Helwan. Eskdalemuir. Sitka.

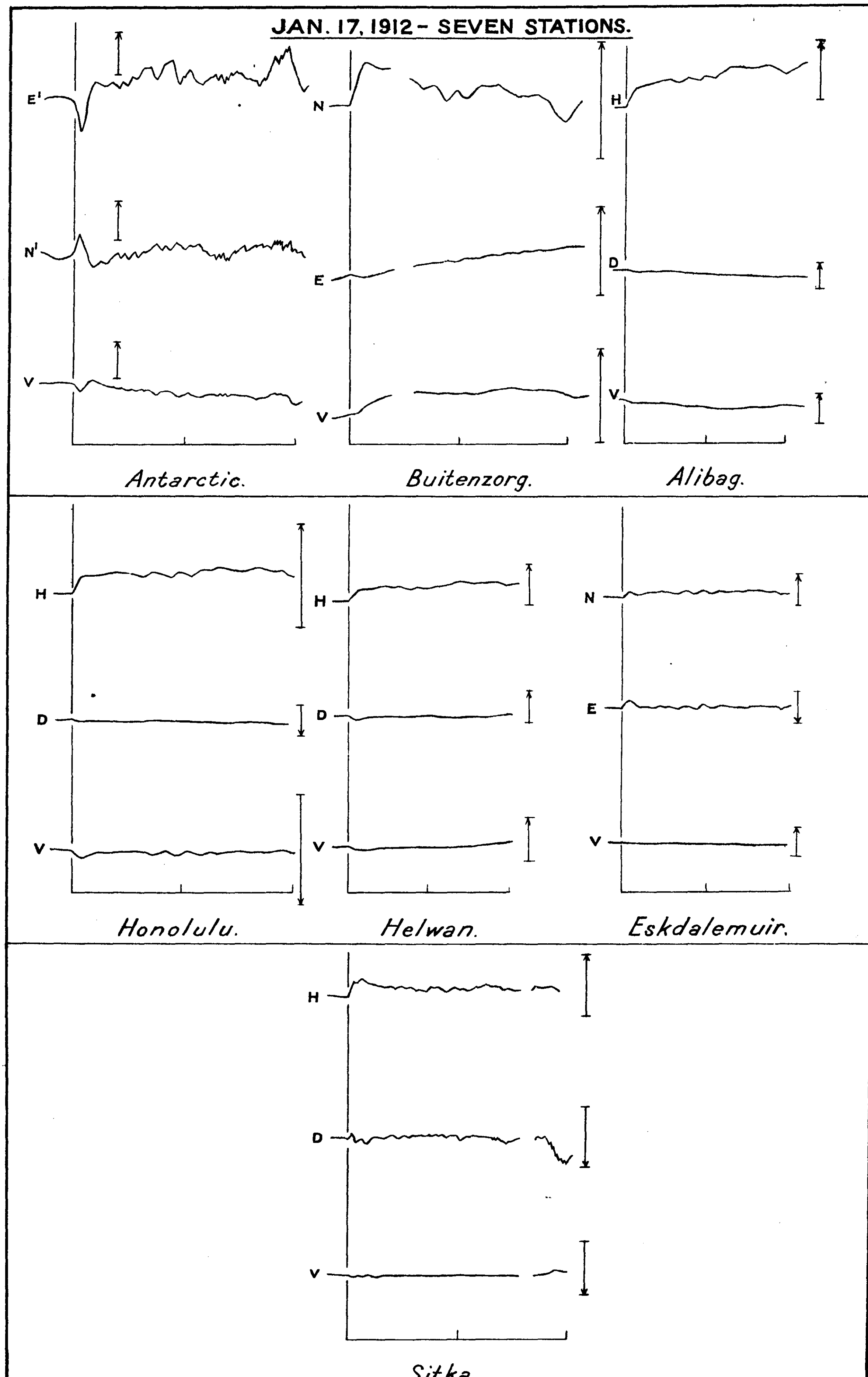
Sudden Commencements.



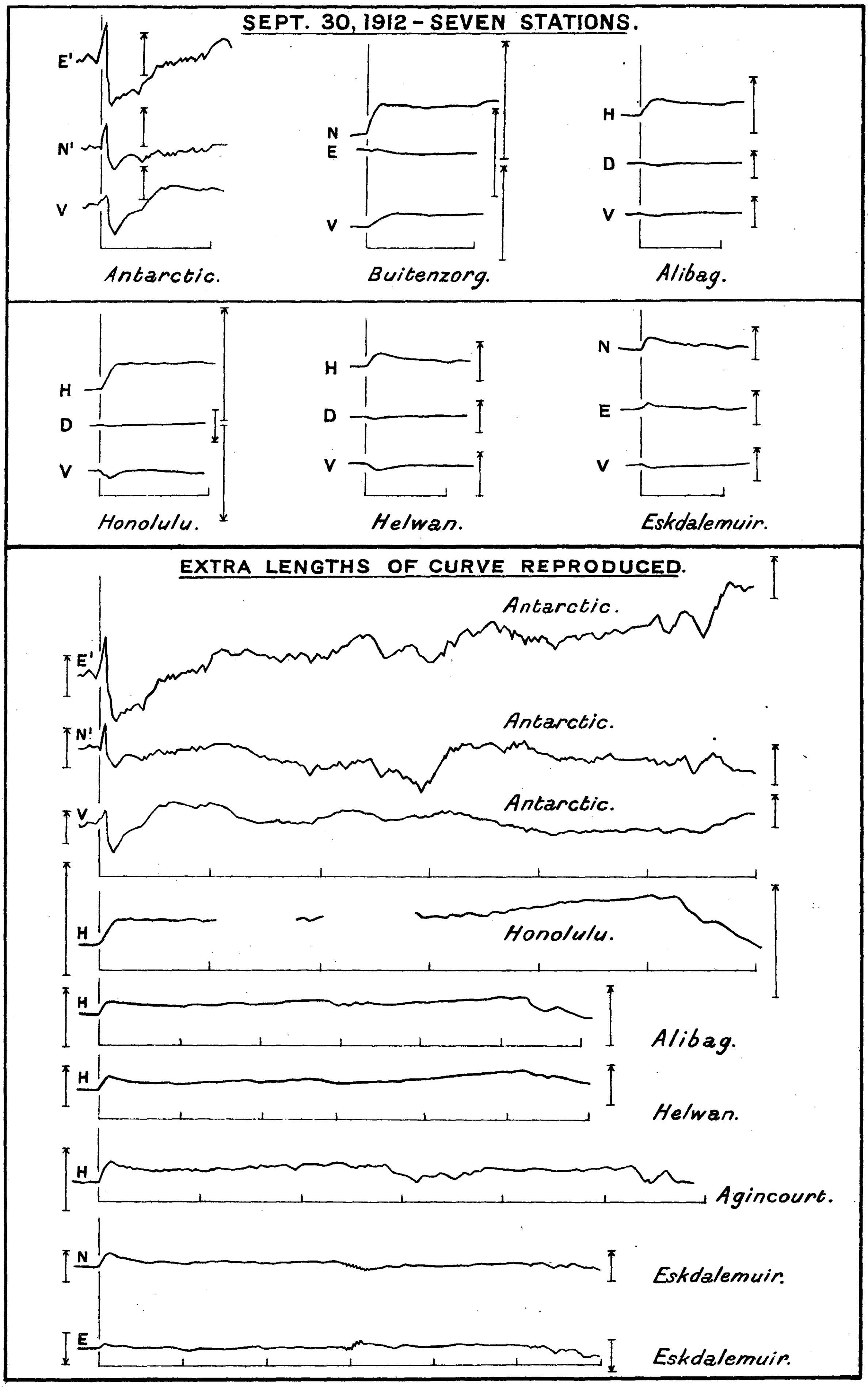
Sudden Commencements.



Sudden Commencements.

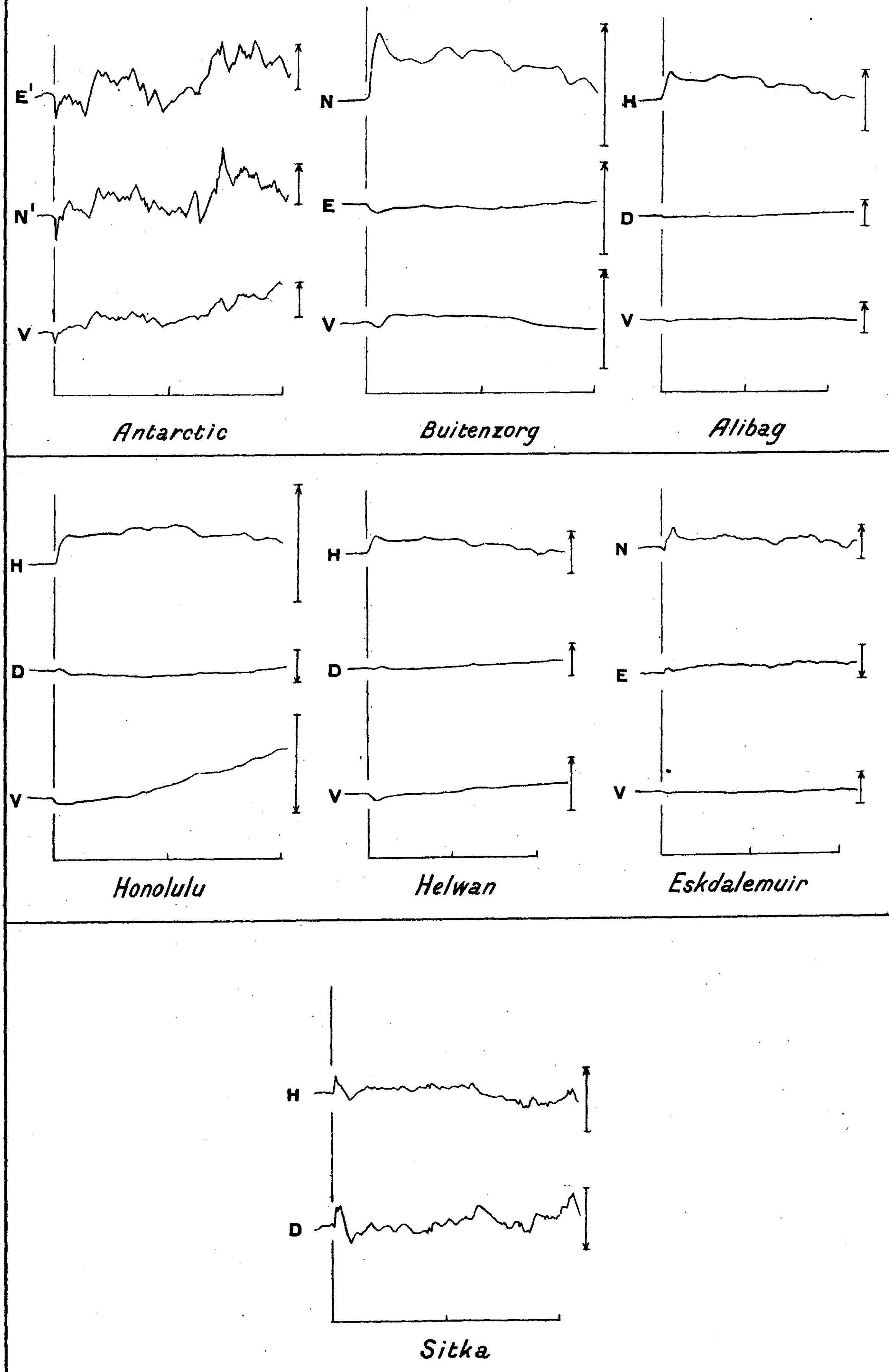


Sudden Commencements.

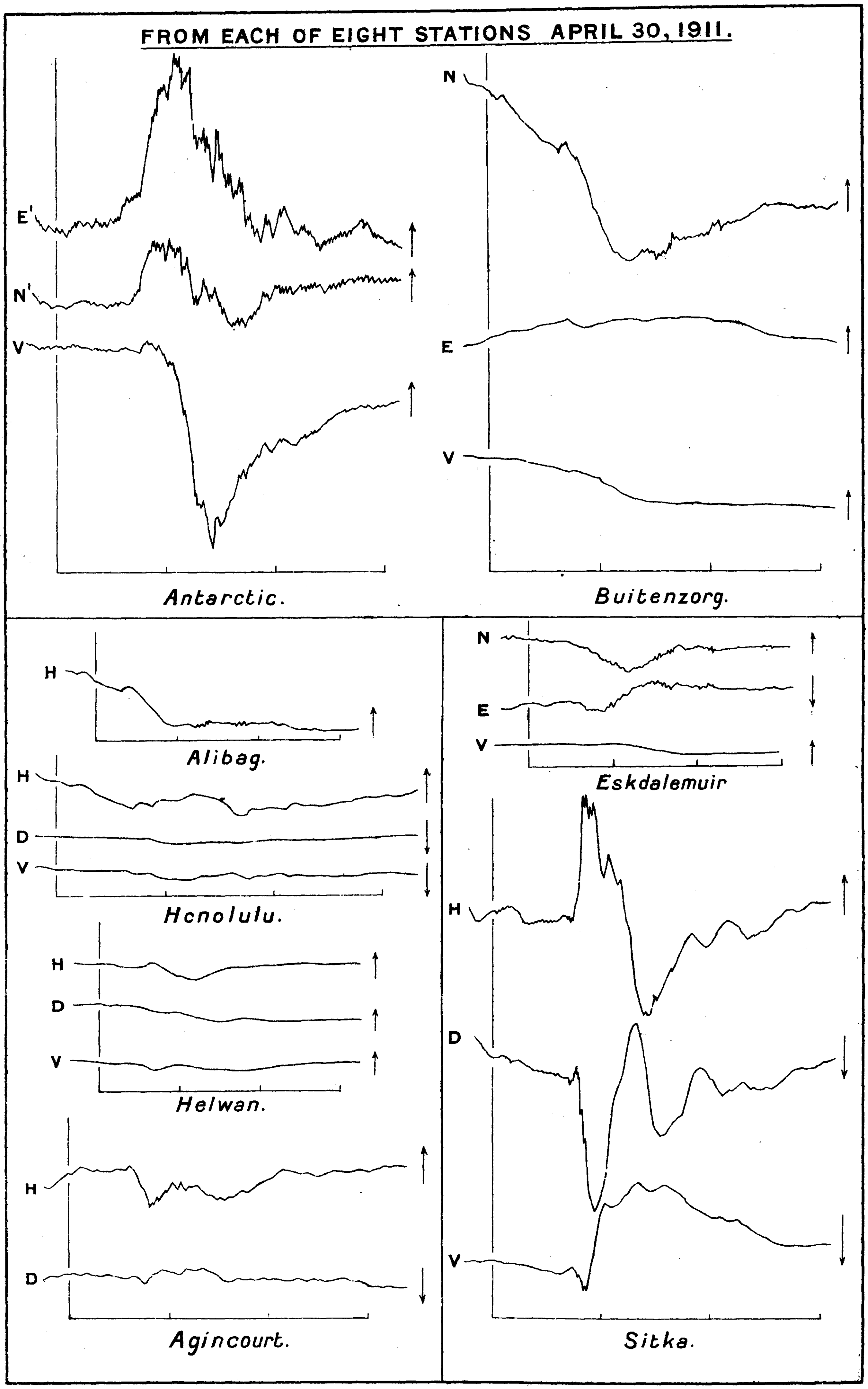


SUDDEN COMMENCEMENTS.

SHORT LENGTHS FROM EACH OF SEVEN STATIONS, OCTOBER 20, 1912.

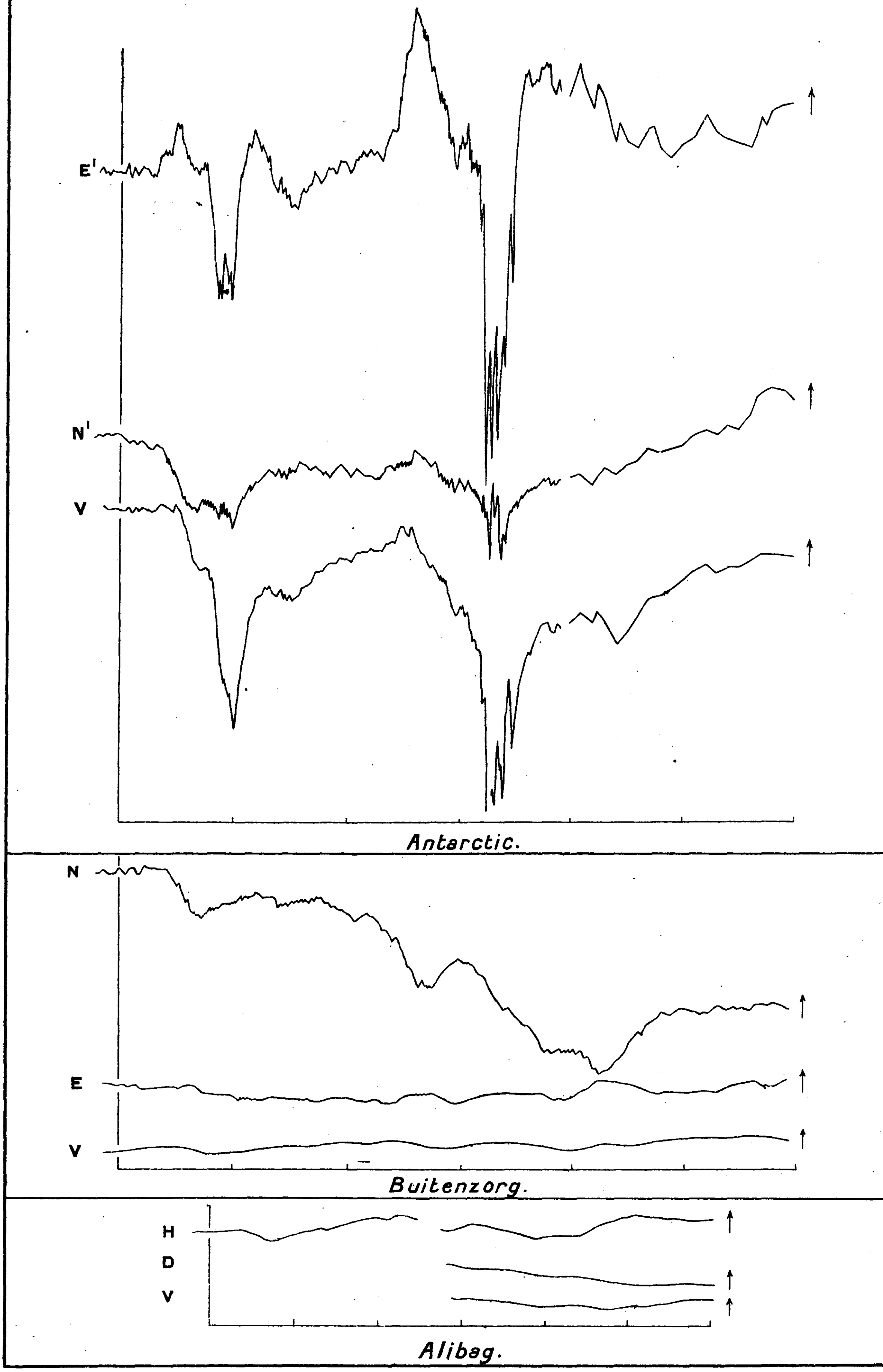


Short Storms.

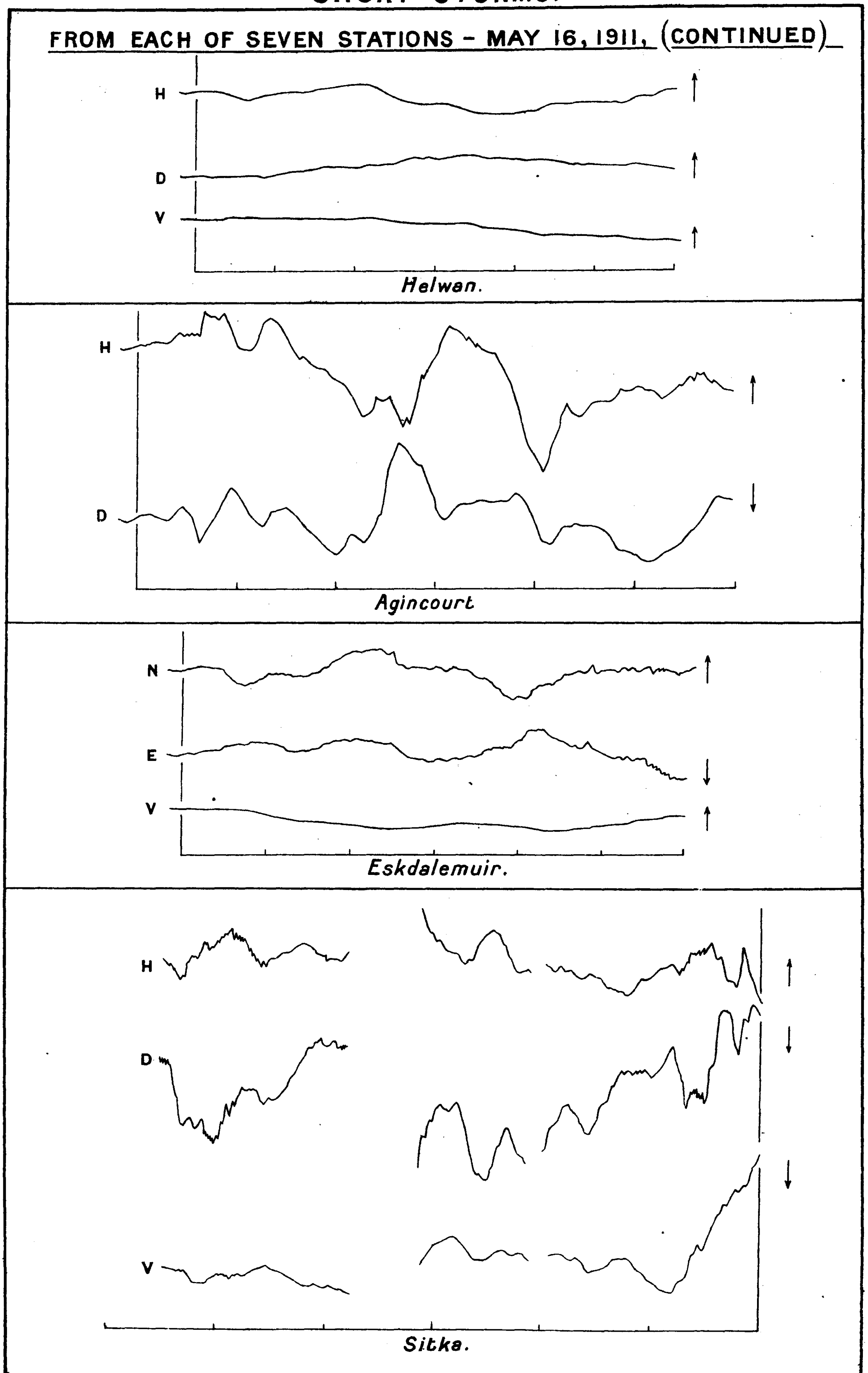


SHORT STORMS.

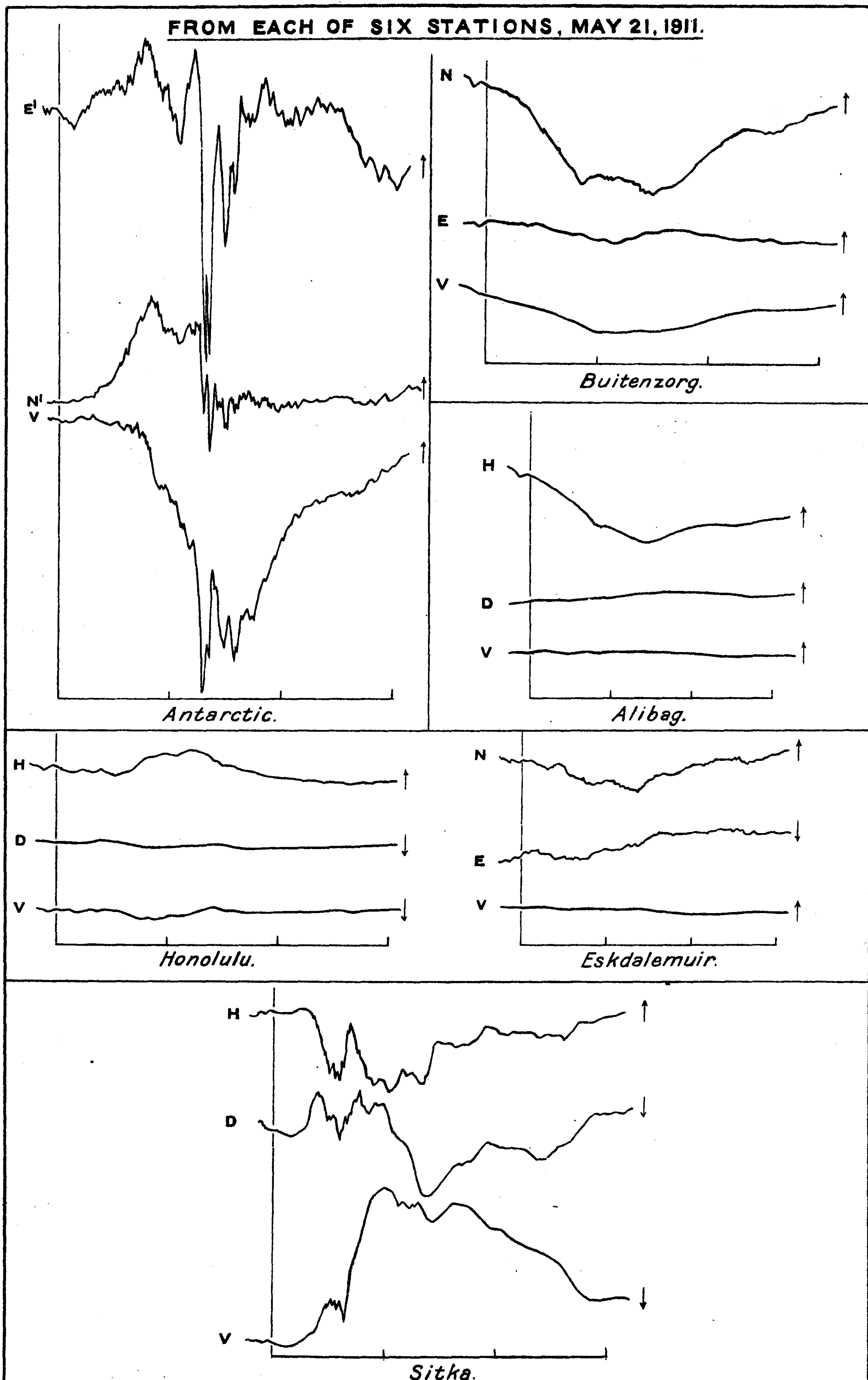
FROM EACH OF SEVEN STATIONS – MAY 16, 1911.



SHORT STORMS.

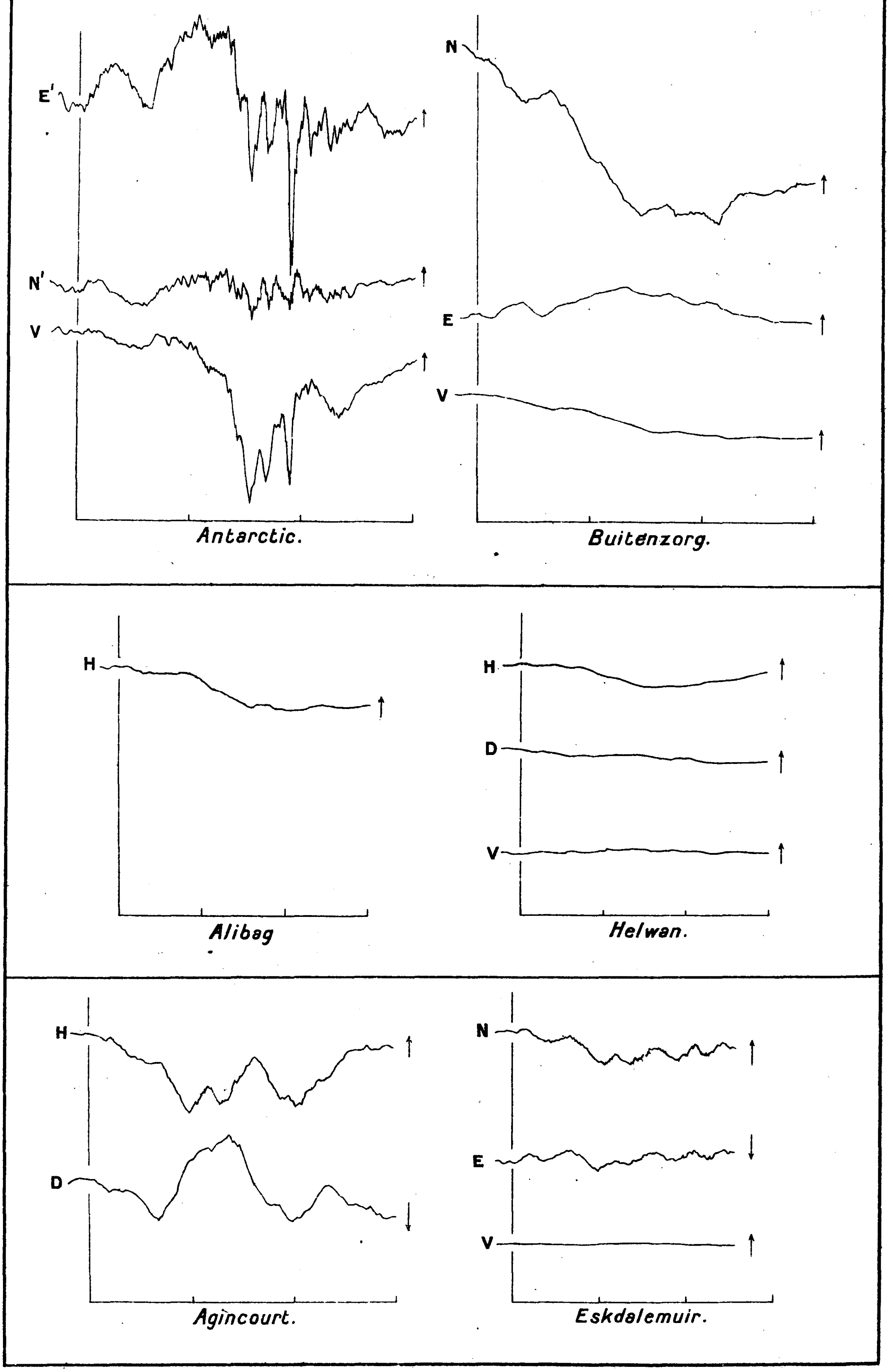


Short Storms.

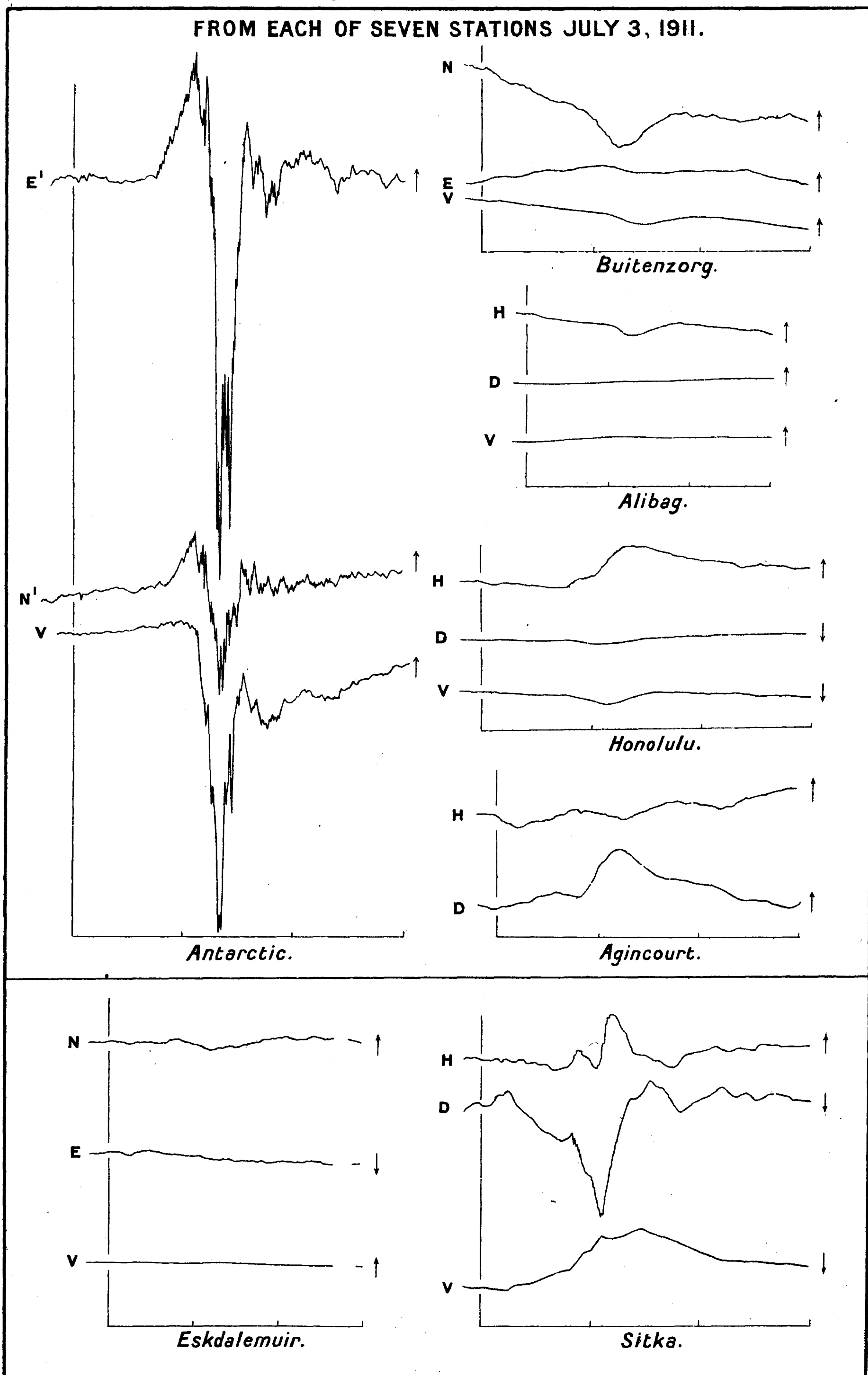


SHORT STORMS.

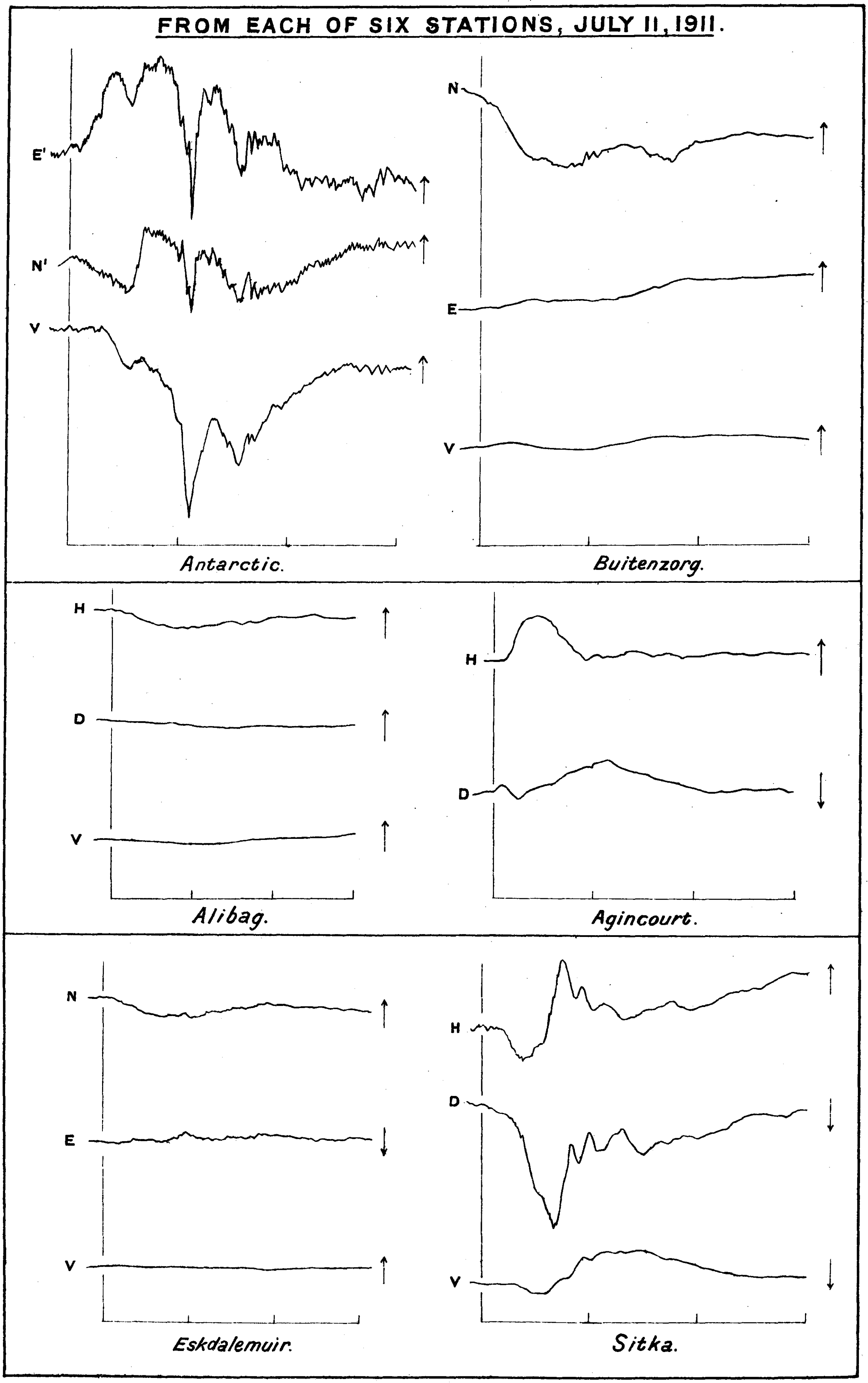
FROM EACH OF SIX STATIONS JUNE 5, 1911.



Short Storms.

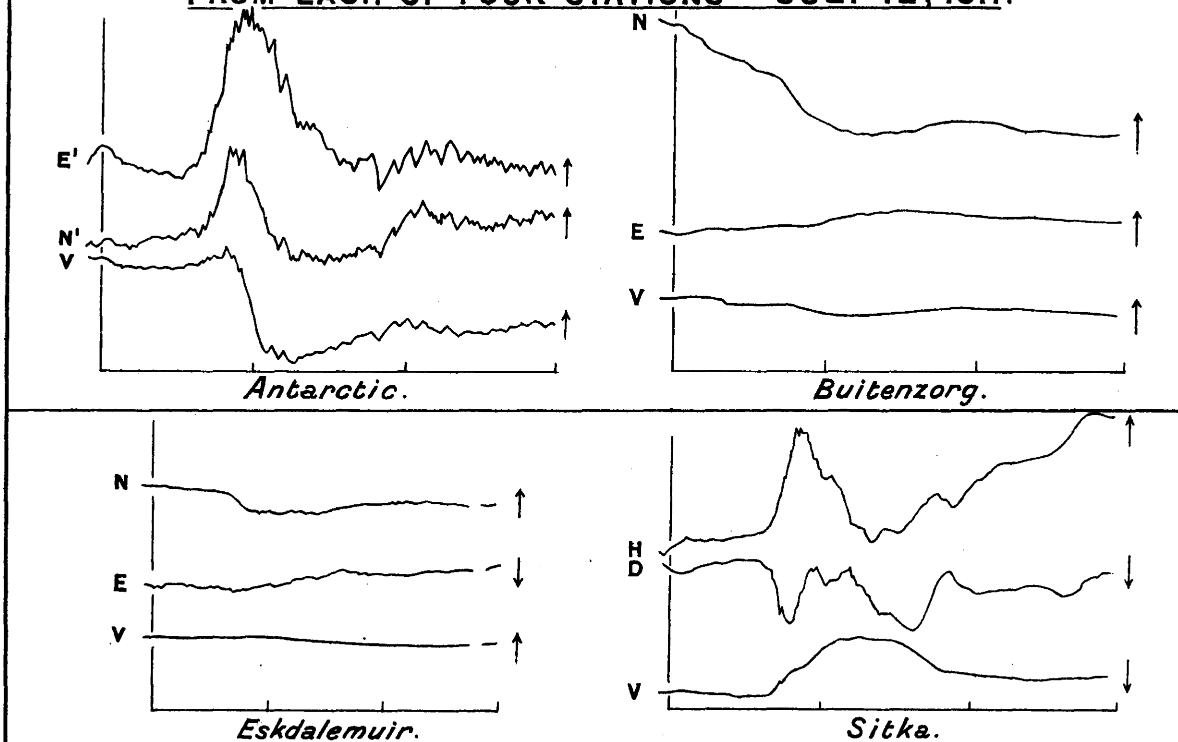


Short Storms.

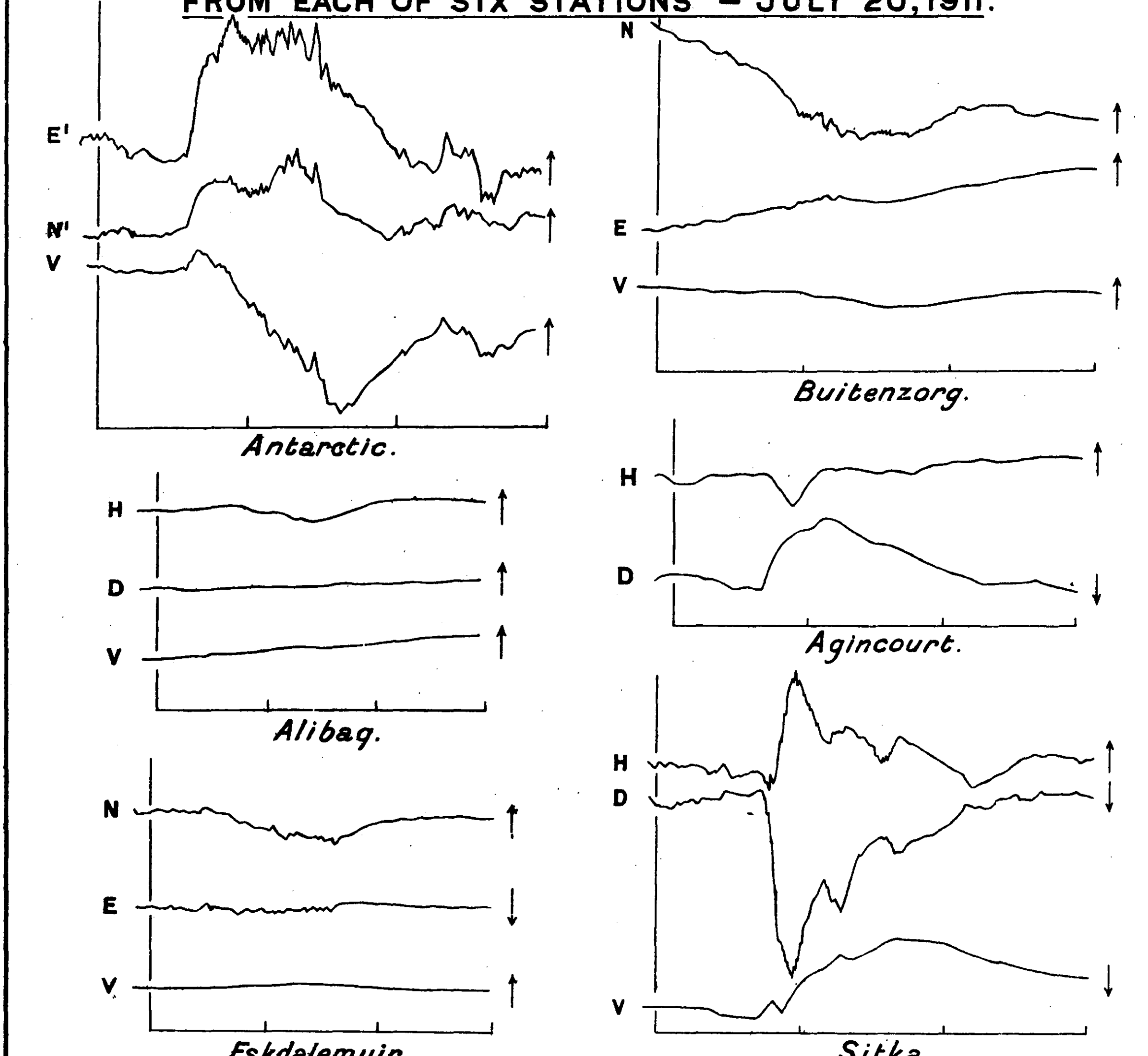


Short Storms.

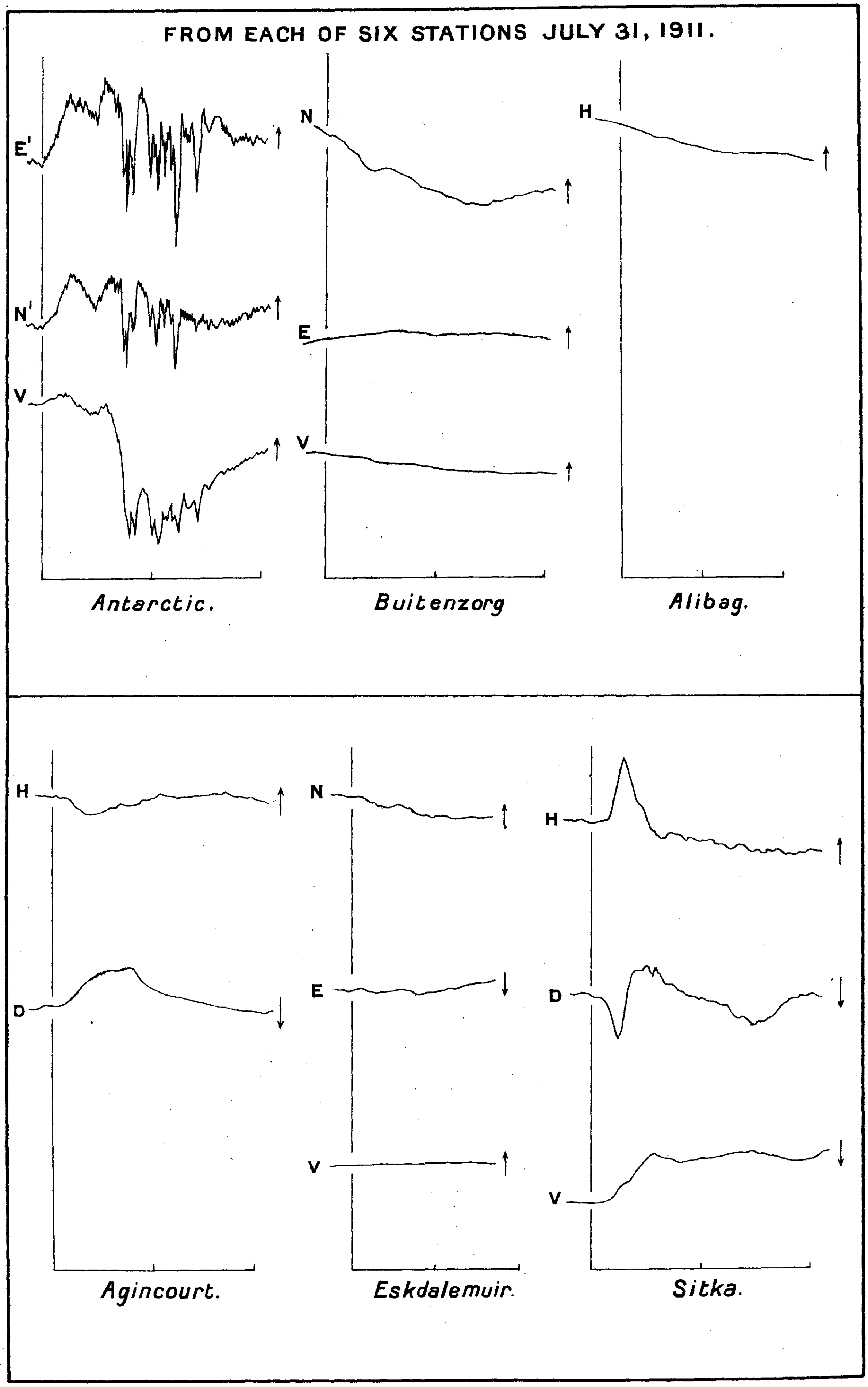
From each of four stations — July 12, 1911.



From each of six stations — July 20, 1911.

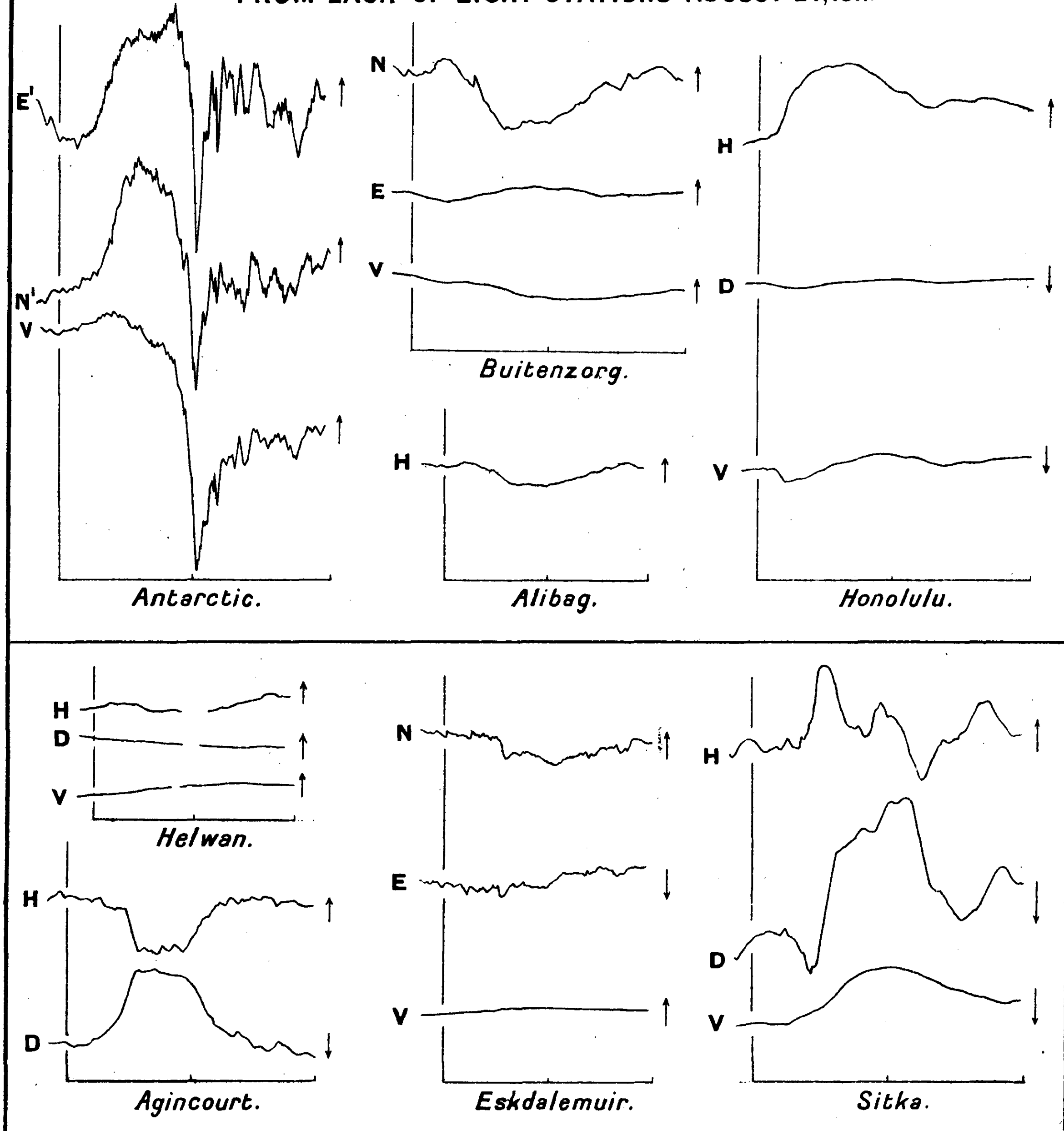


Short Storms.

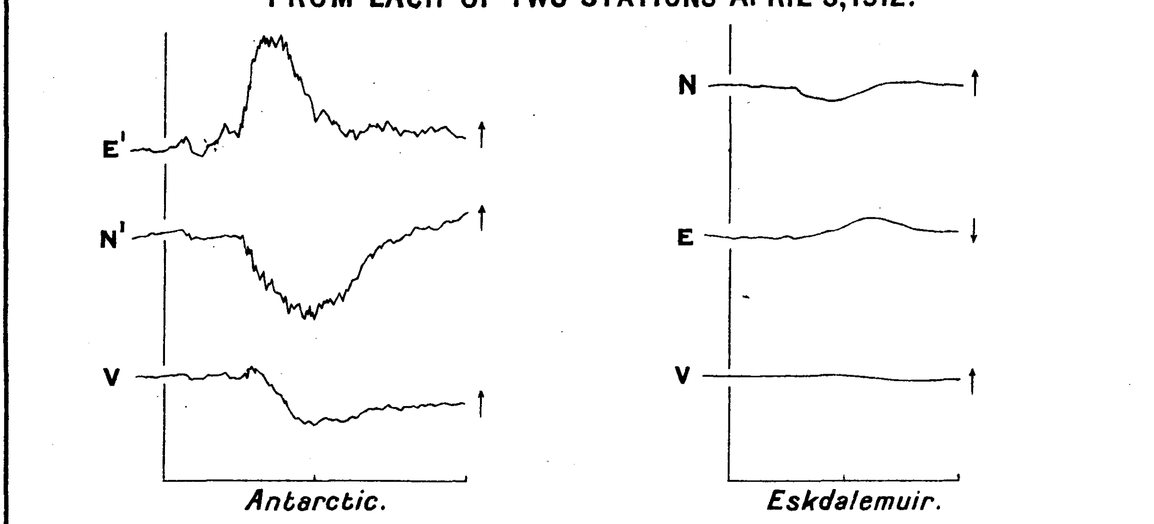


Short Storms.

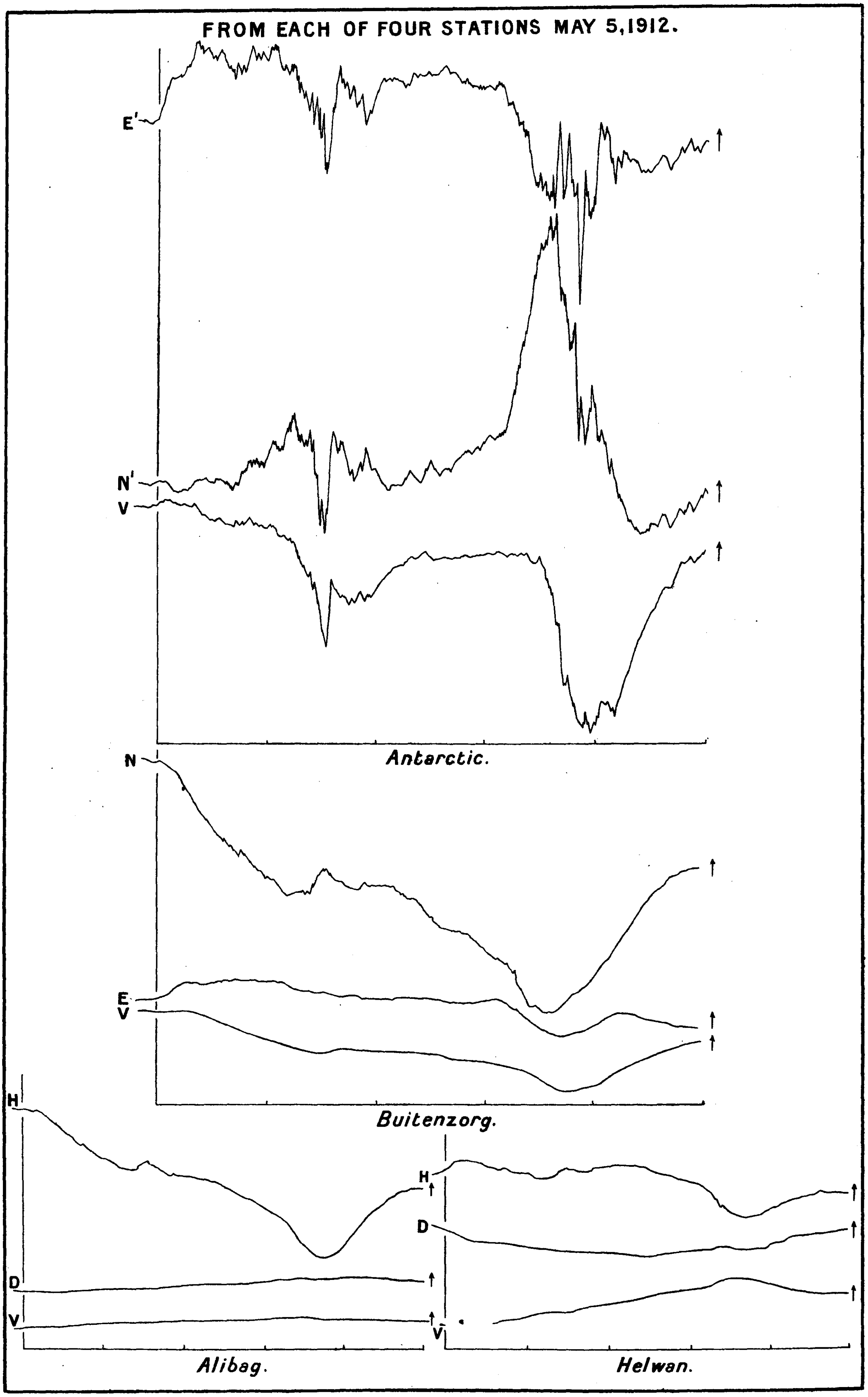
FROM EACH OF EIGHT STATIONS AUGUST 24, 1911.



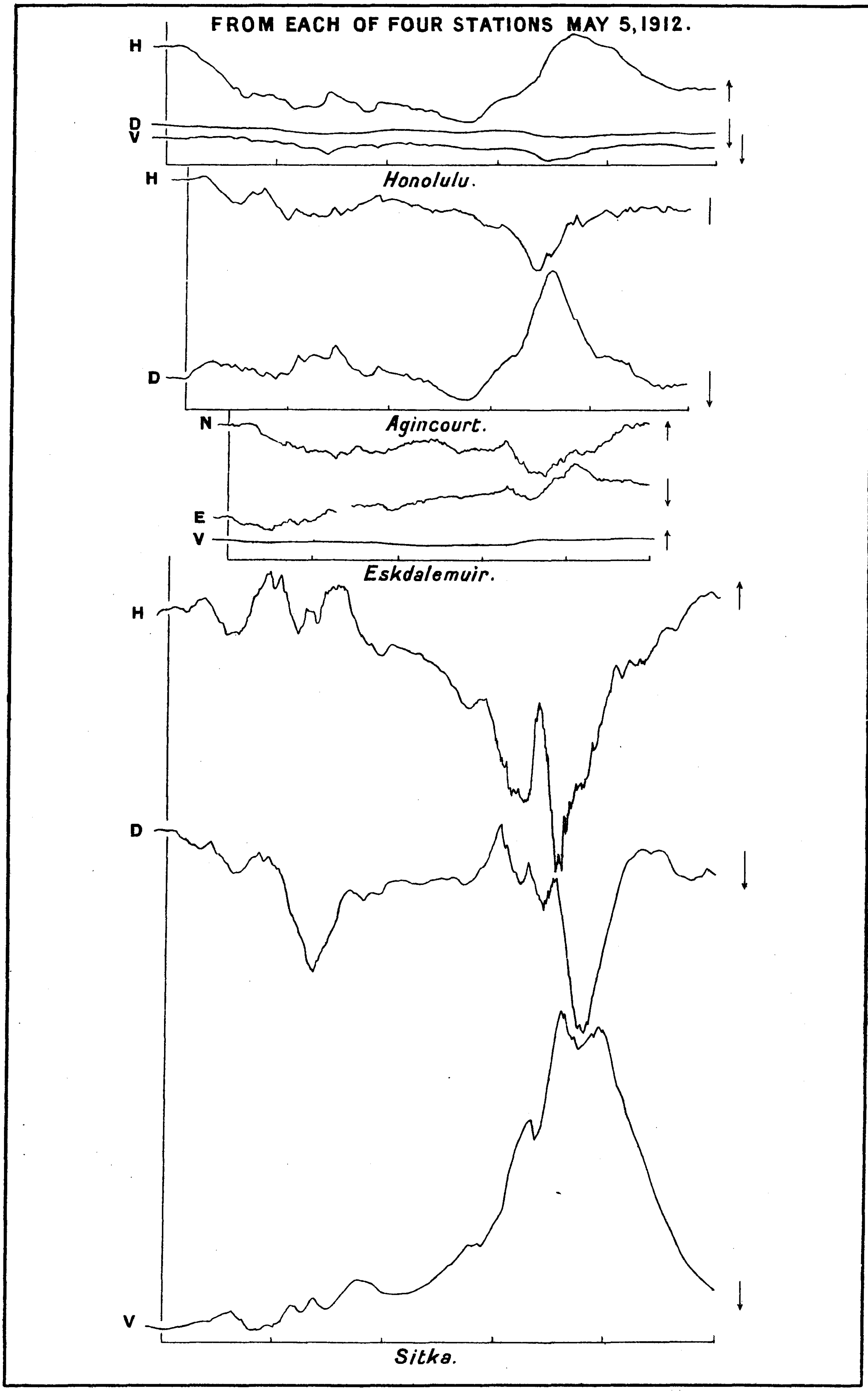
FROM EACH OF TWO STATIONS APRIL 5, 1912.



Short Storms.

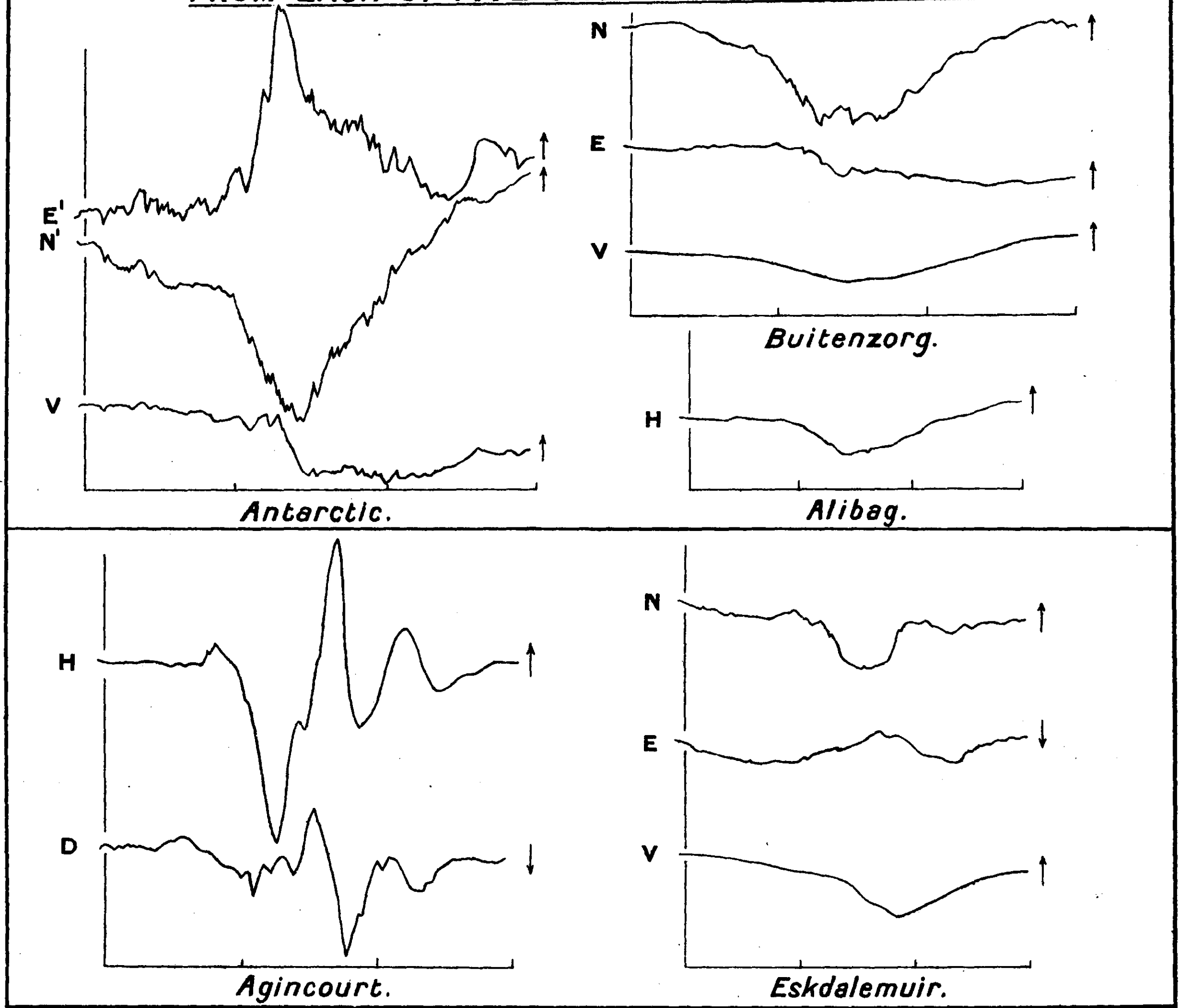


Short Storms.

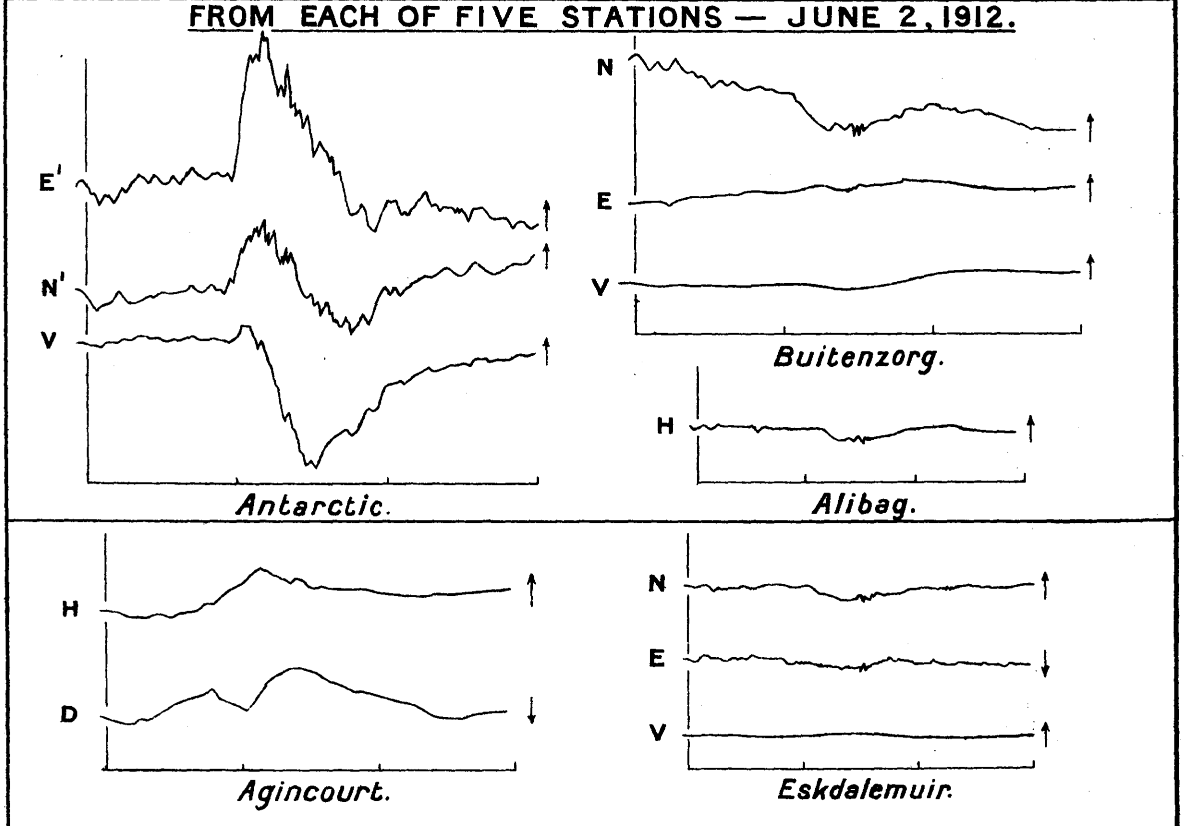


SHORT STORMS.

FROM EACH OF FIVE STATIONS — MAY 13, 1912.

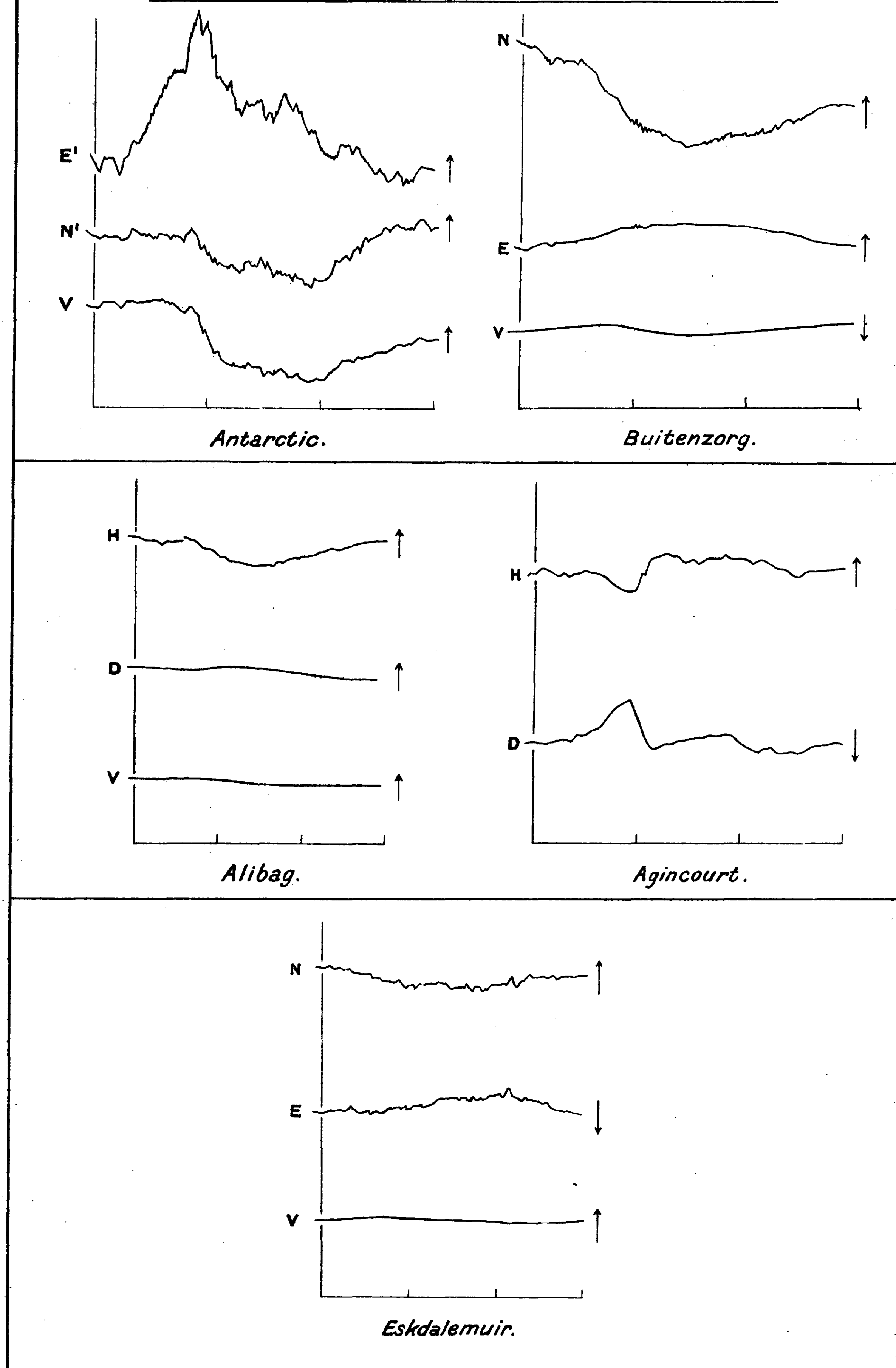


FROM EACH OF FIVE STATIONS — JUNE 2, 1912.



Short Storms.

FROM EACH OF FIVE STATIONS – JUNE 3, 1912.



Short Storms.

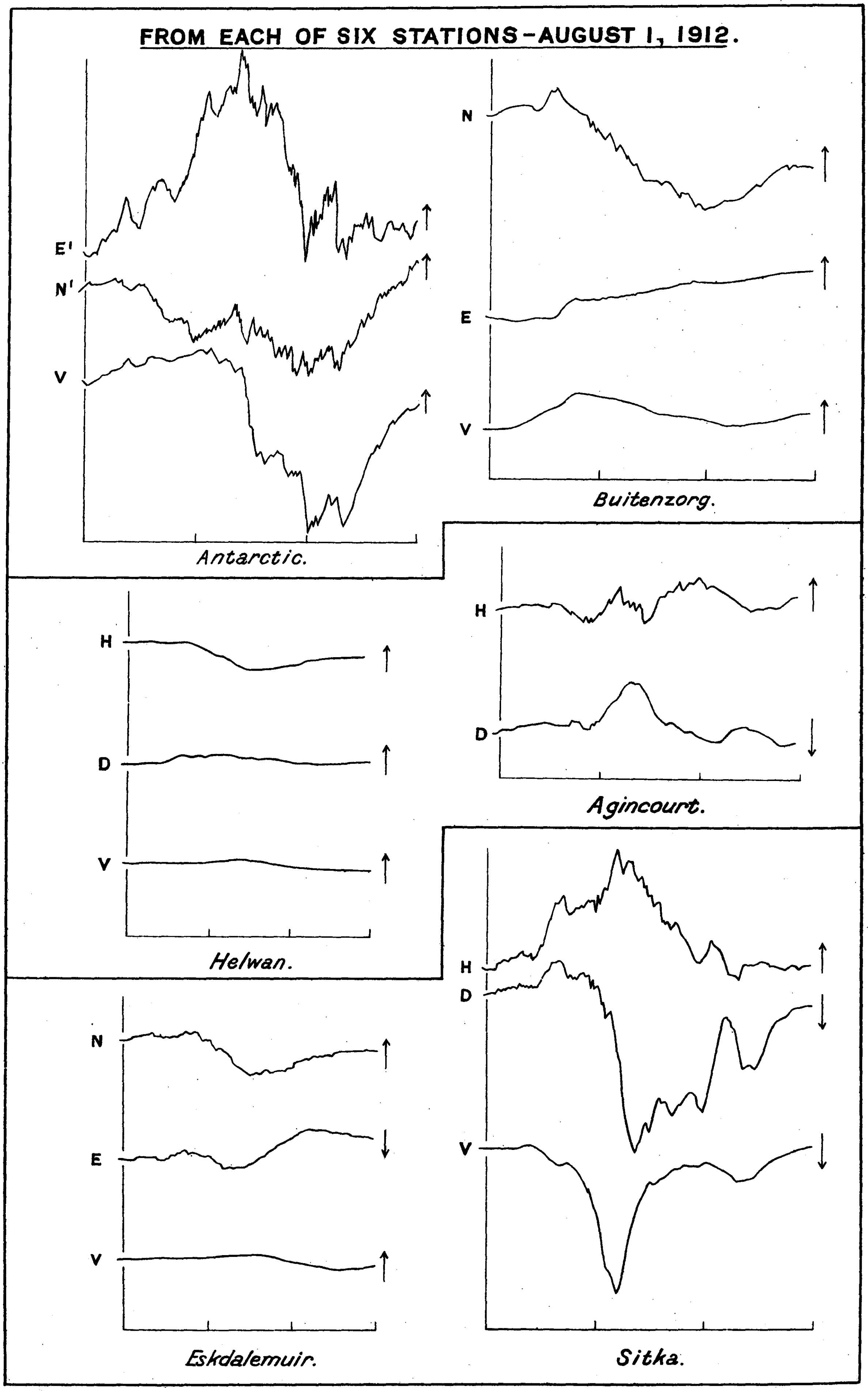


Fig A.

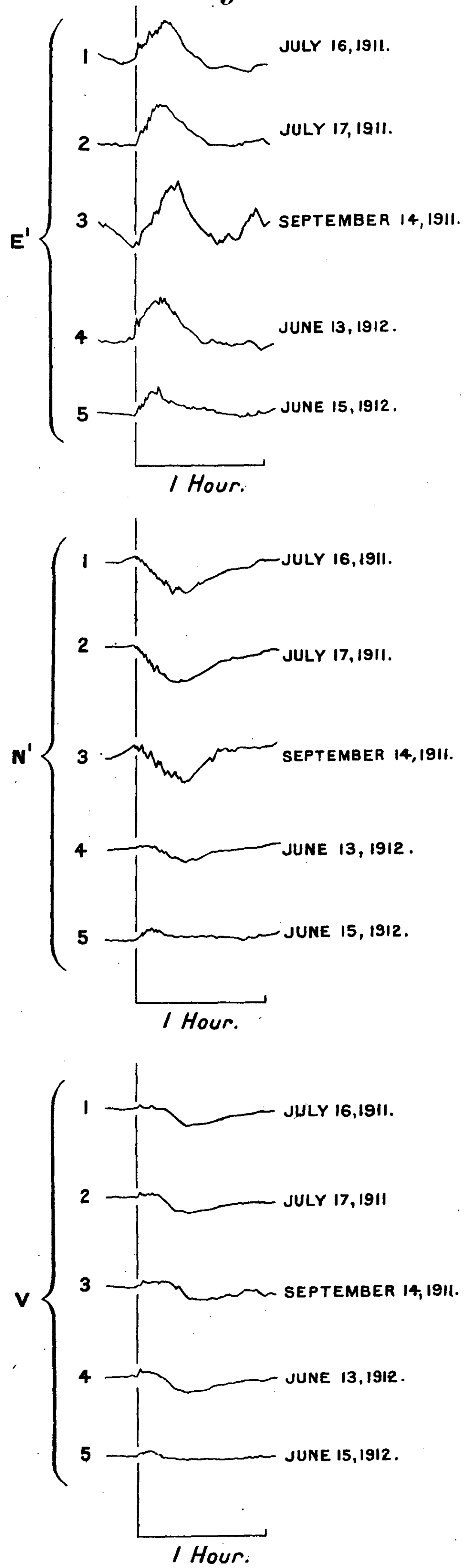
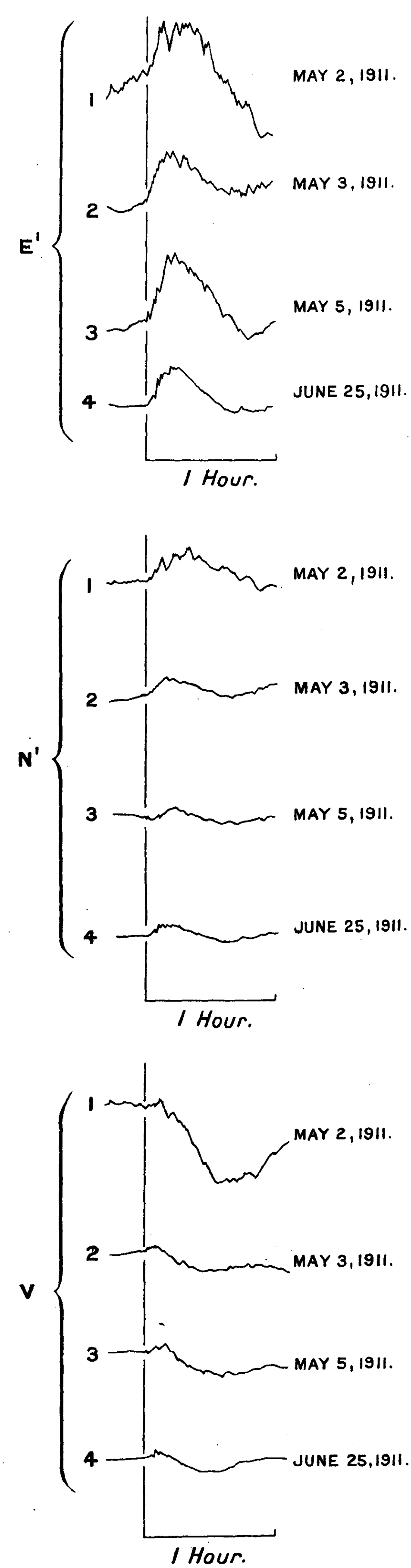
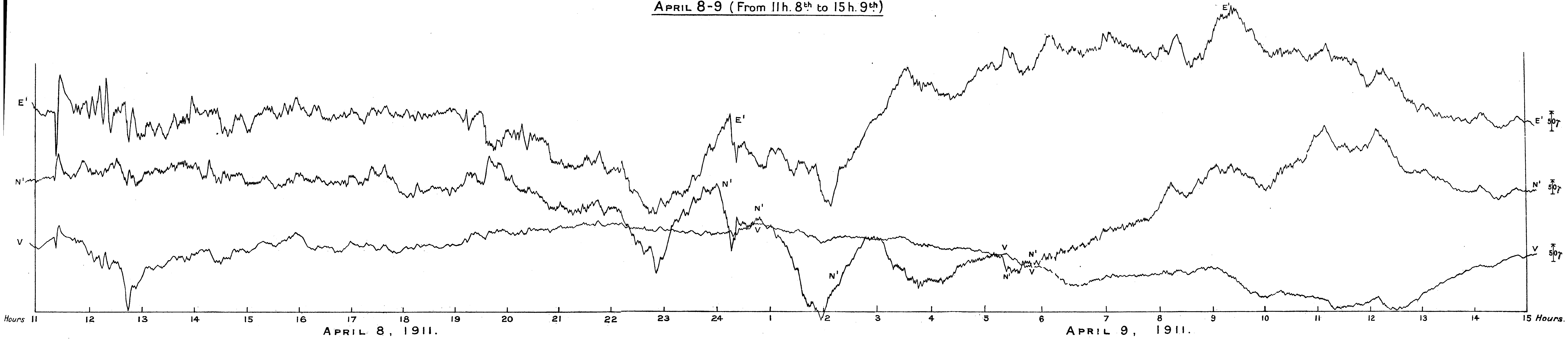

E'
1
JULY 16, 1911.
2
JULY 17, 1911.
3
SEPTEMBER 14, 1911.
4
JUNE 13, 1912.
5
JUNE 15, 1912.
1 Hour.
N'
1
JULY 16, 1911.
2
JULY 17, 1911.
3
SEPTEMBER 14, 1911.
4
JUNE 13, 1912.
5
JUNE 15, 1912.
1 Hour.
V
1
JULY 16, 1911.
2
JULY 17, 1911
3
SEPTEMBER 14, 1911.
4
JUNE 13, 1912.
5
JUNE 15, 1912.
1 Hour.

Fig B.

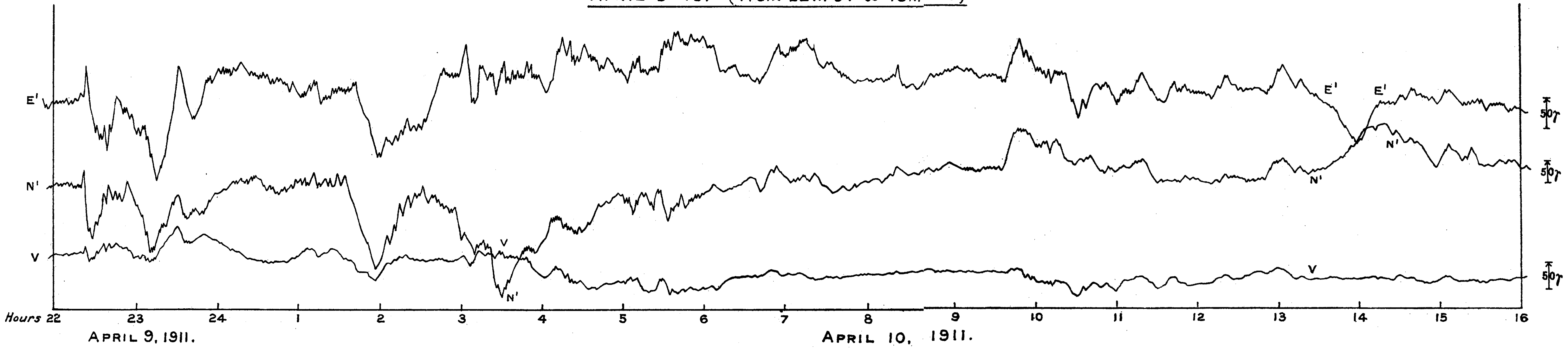

E'
1
MAY 2, 1911.
2
MAY 3, 1911.
3
MAY 5, 1911.
4
JUNE 25, 1911.
1 Hour.
N'
1
MAY 2, 1911.
2
MAY 3, 1911.
3
MAY 5, 1911.
4
JUNE 25, 1911.
1 Hour.
V
1
MAY 2, 1911.
2
MAY 3, 1911.
3
MAY 5, 1911.
4
JUNE 25, 1911.
1 Hour.

Longer Storms, 1911.

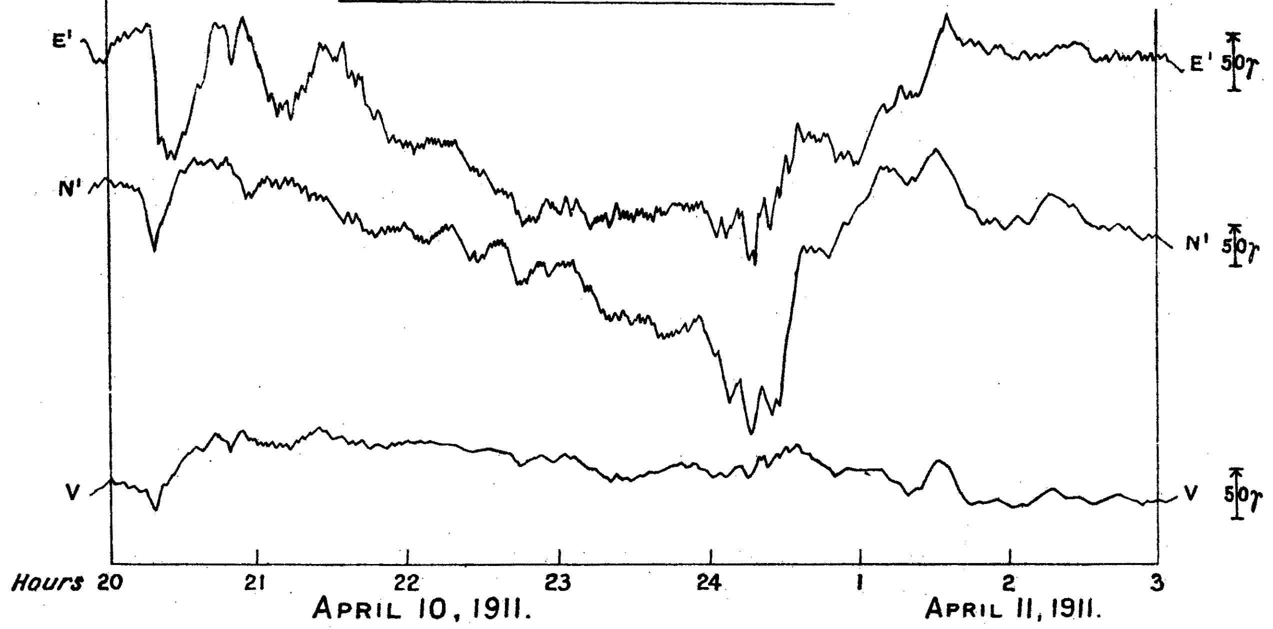
April 8-9 (From 11h. 8th to 15h. 9th)



April 9-10. (From 22h. 9th to 16h. 10th)

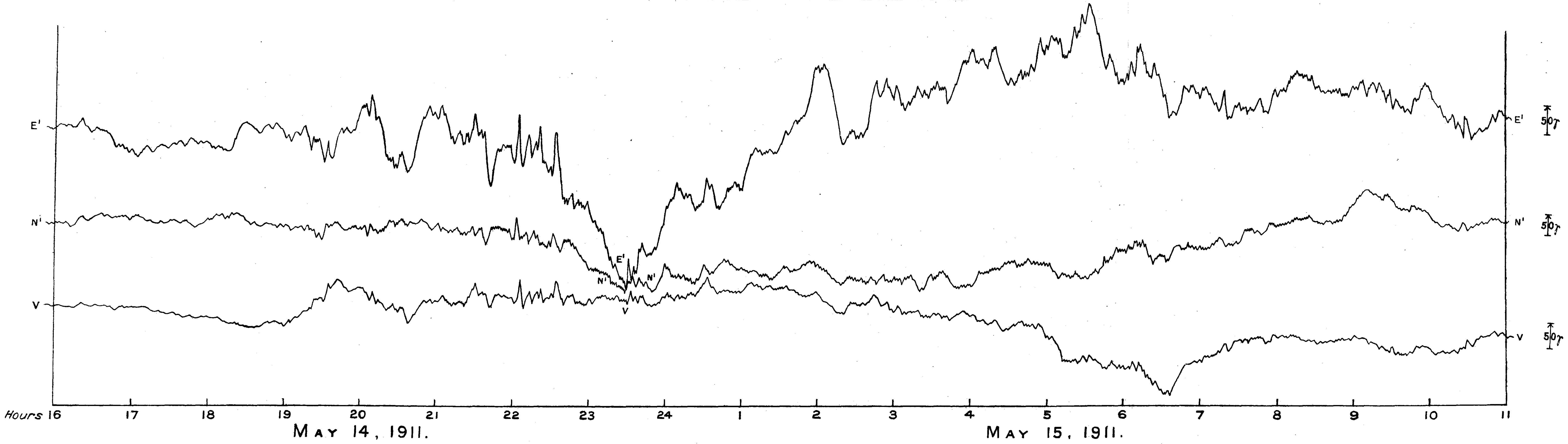


April 10-11 (From 20h. 10th to 3h. 11th)

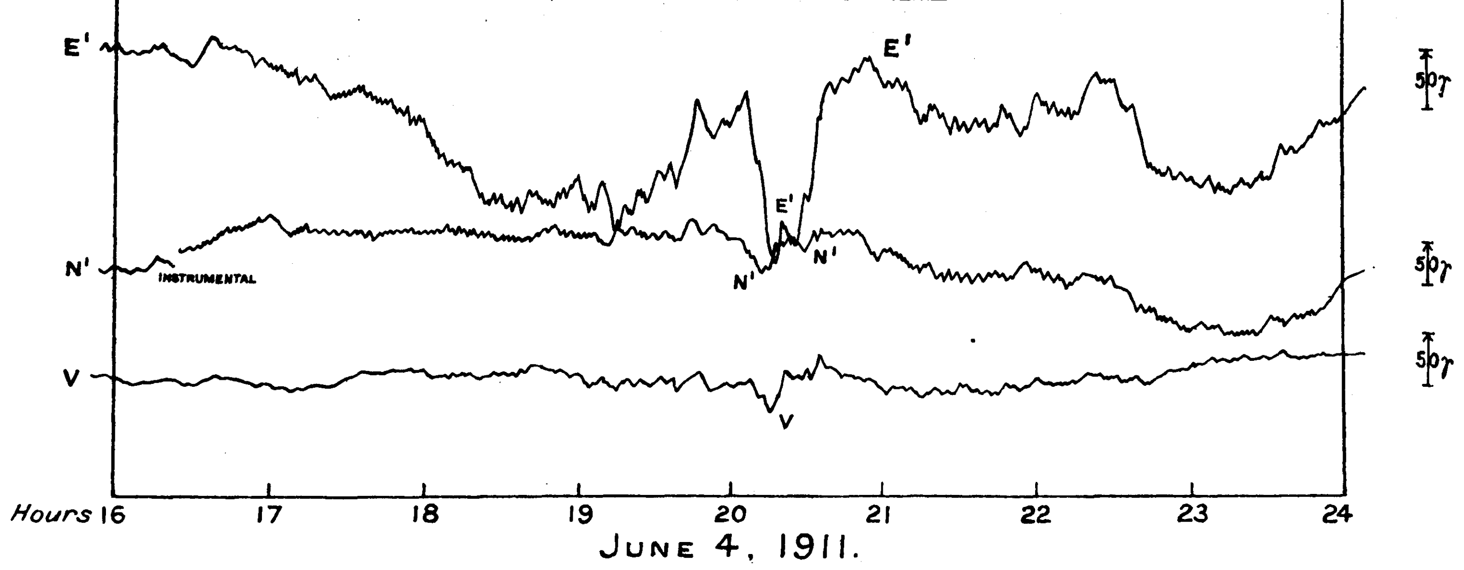


Longer Storms, 1911.

May 14-15. (From 16h. 14th to 11h. 15th)

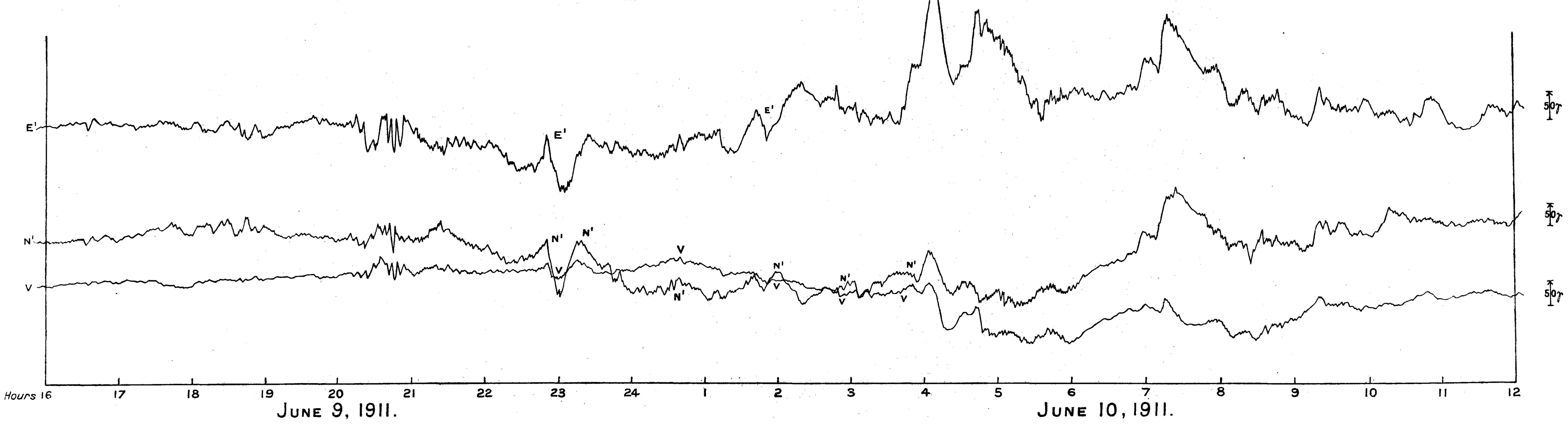


June 4, 1911. (From 16h. to 24h.)

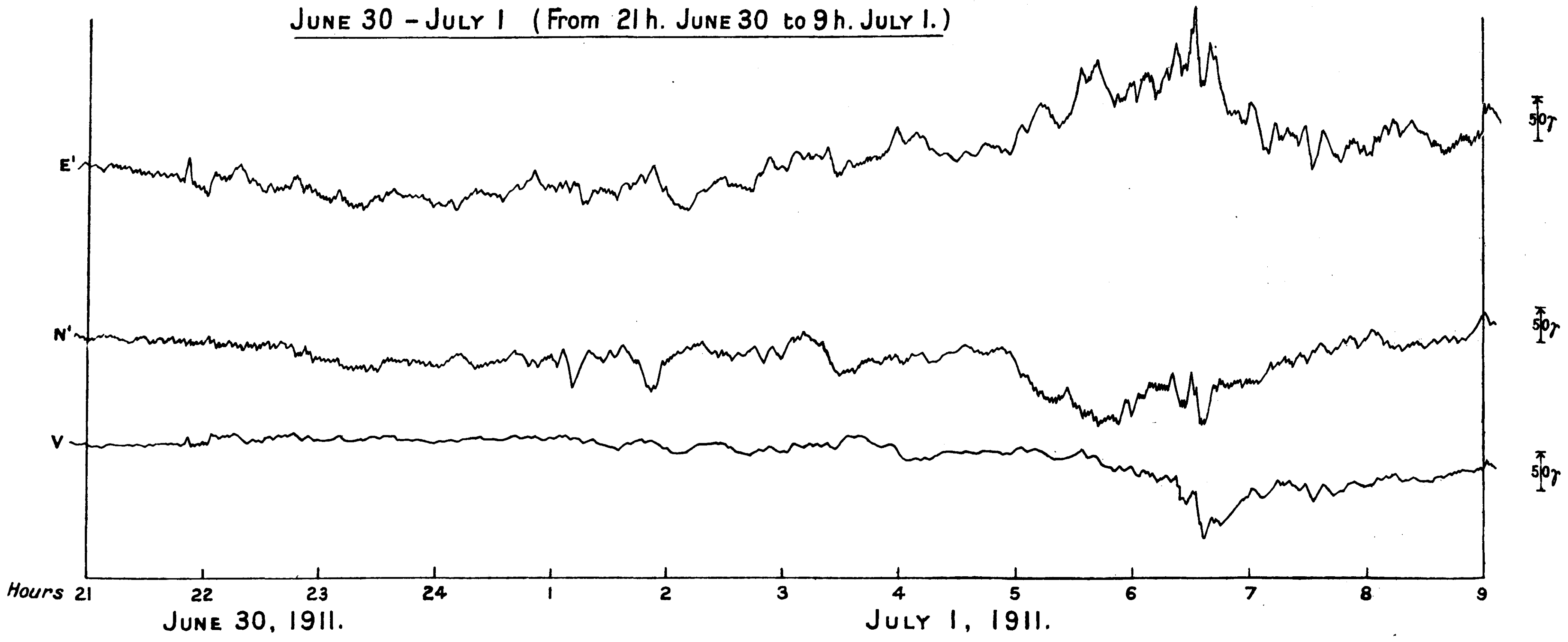


Longer Storms, 1911.

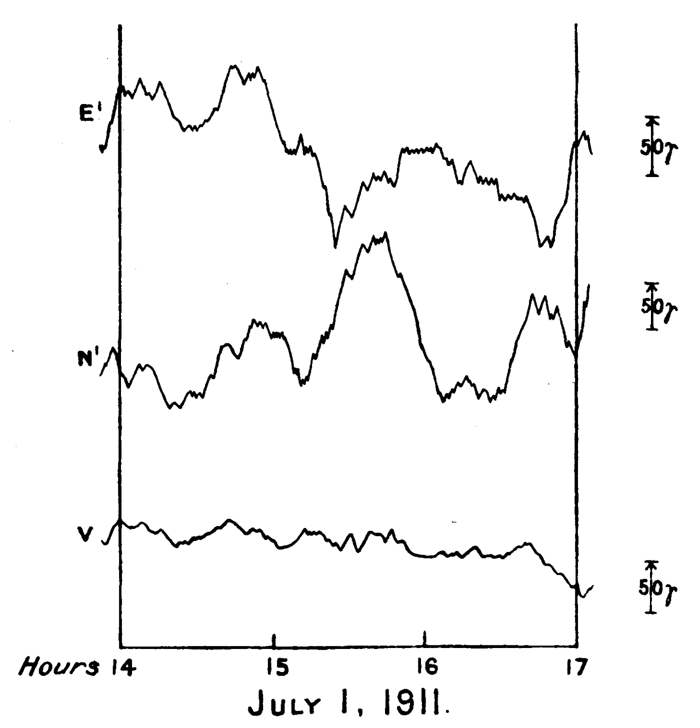
June 9-10. (From 16h. 9th to 12h. 10th.)



June 30 - July 1 (From 21h. June 30 to 9h. July 1.)

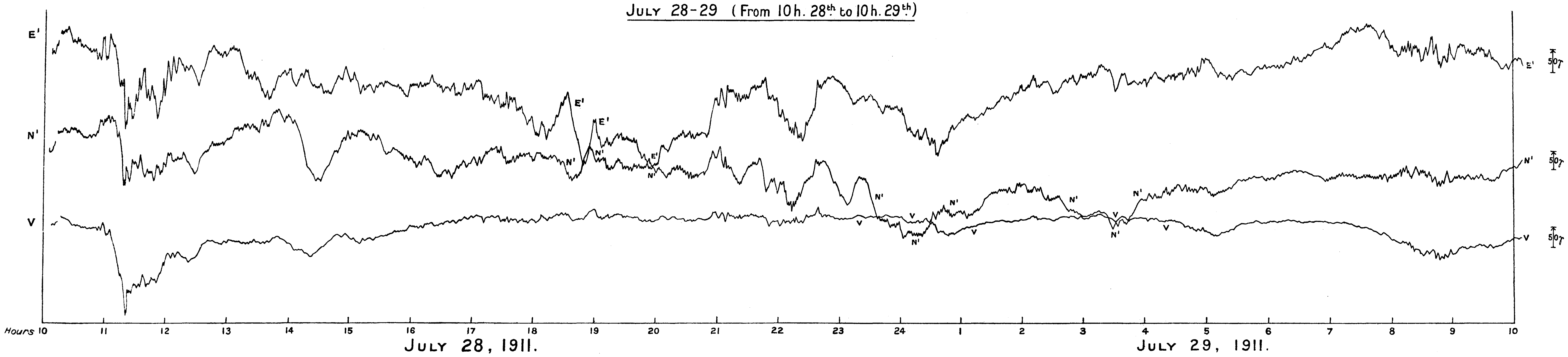


July 1, 1911 (From 14h. to 17h.)

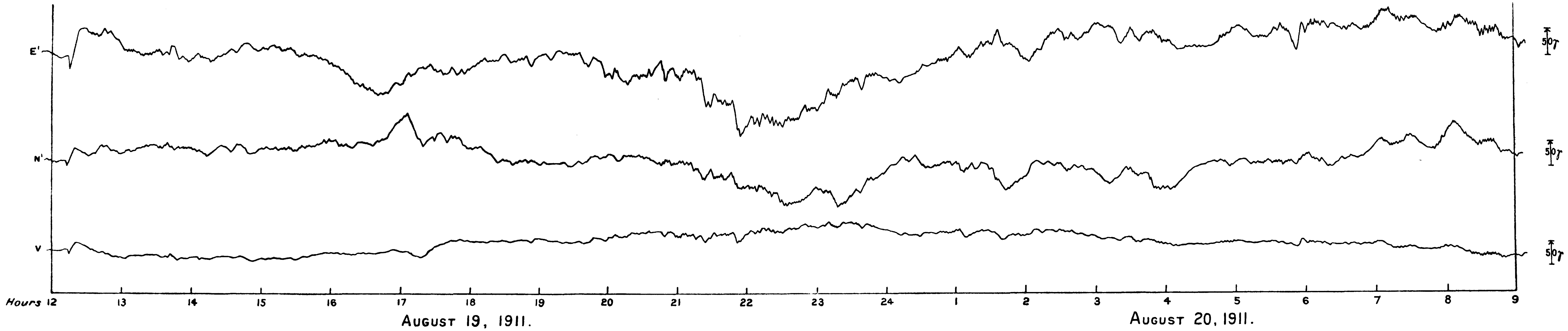


Longer Storms, 1911.

July 28-29 (From 10h. 28th to 10h. 29th)

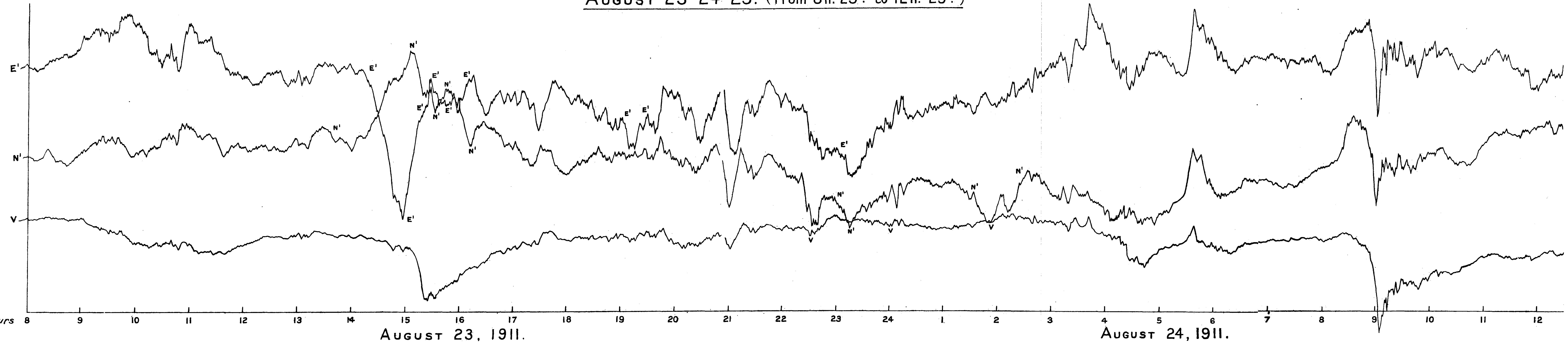


August 19-20 (From 12h. 19th to 9h. 20th)

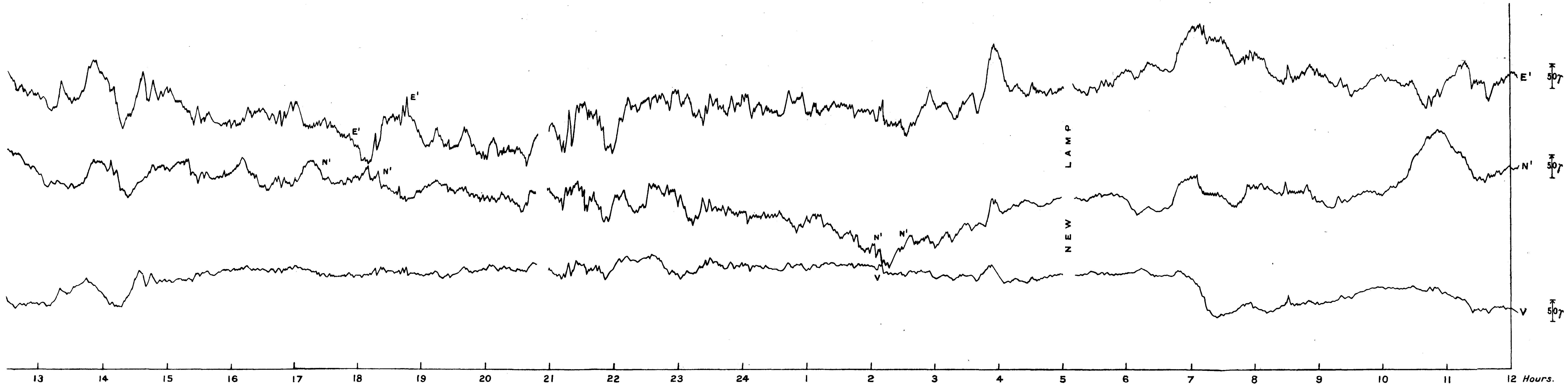


LONGER STORMS, 1911.

AUGUST 23-24-25. (From 8h. 23rd to 12h. 25th)

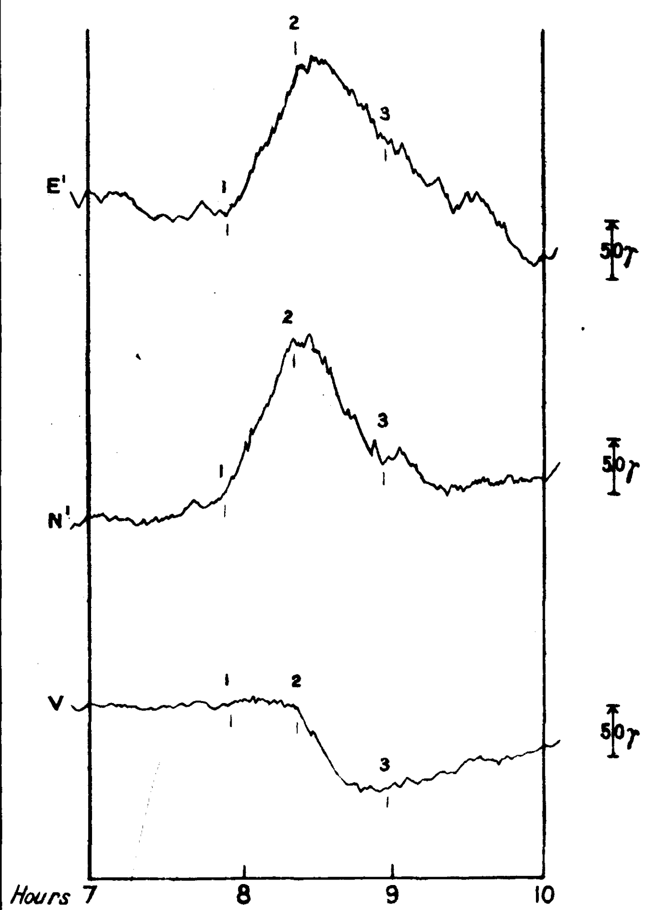


AUGUST 23, 1911. AUGUST 24, 1911.



AUGUST 24, 1911 (CONTD) AUGUST 25, 1911.

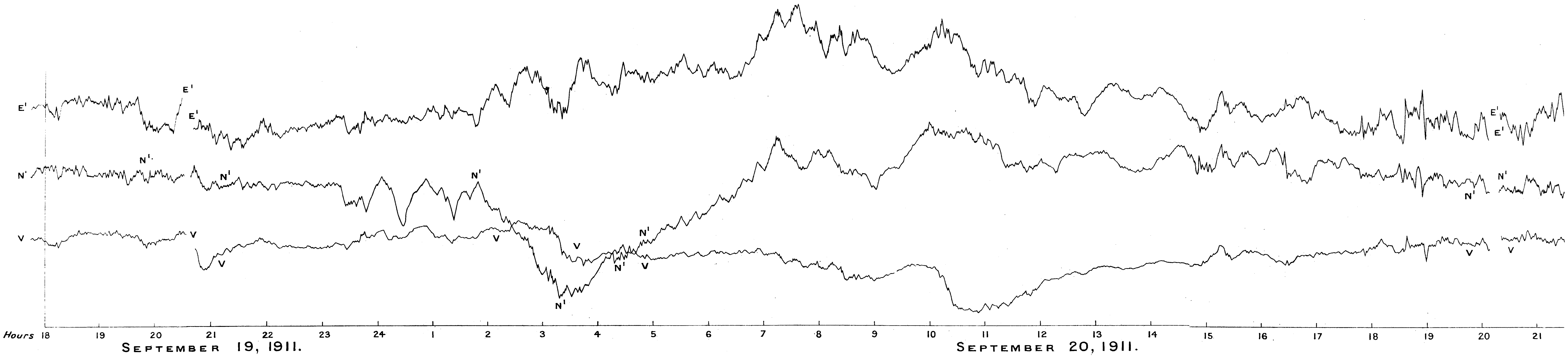
AUGUST 31. (From 7h. to 10h.)

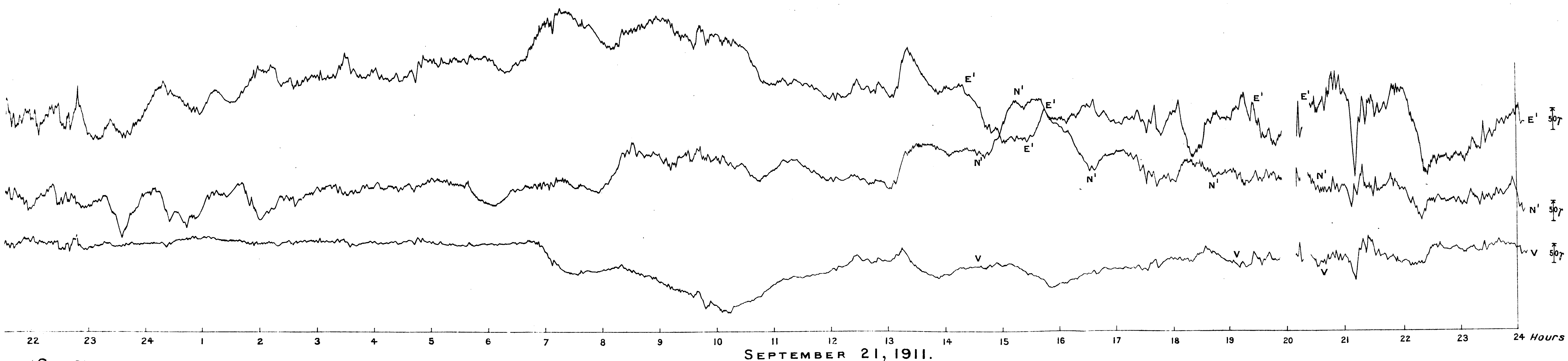


AUGUST 31. 1911.

Longer Storms, 1911.

September 19–21 (From 18h. 19th to 24h. 21st)

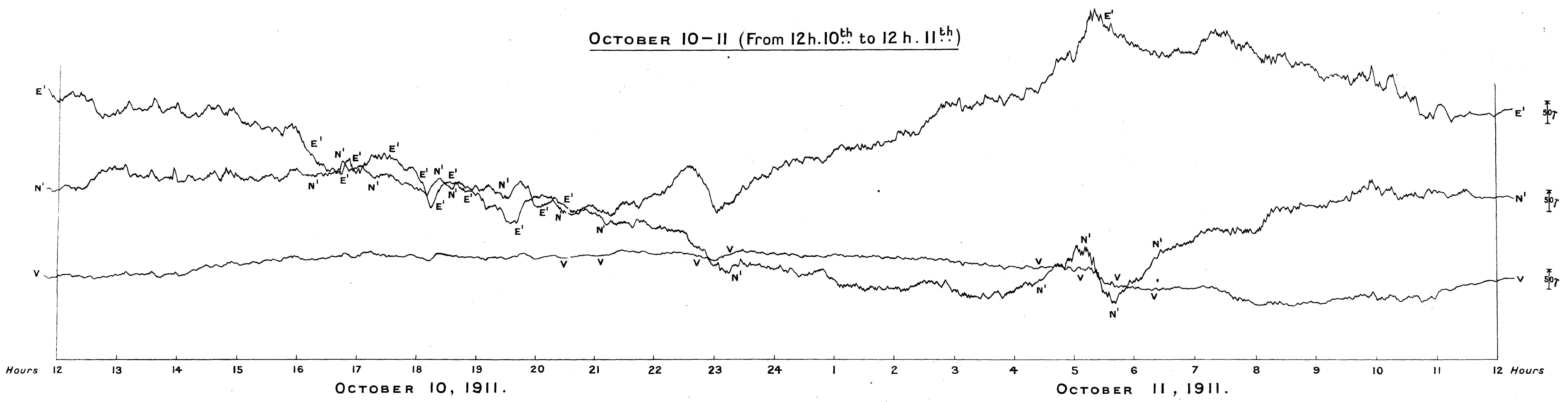




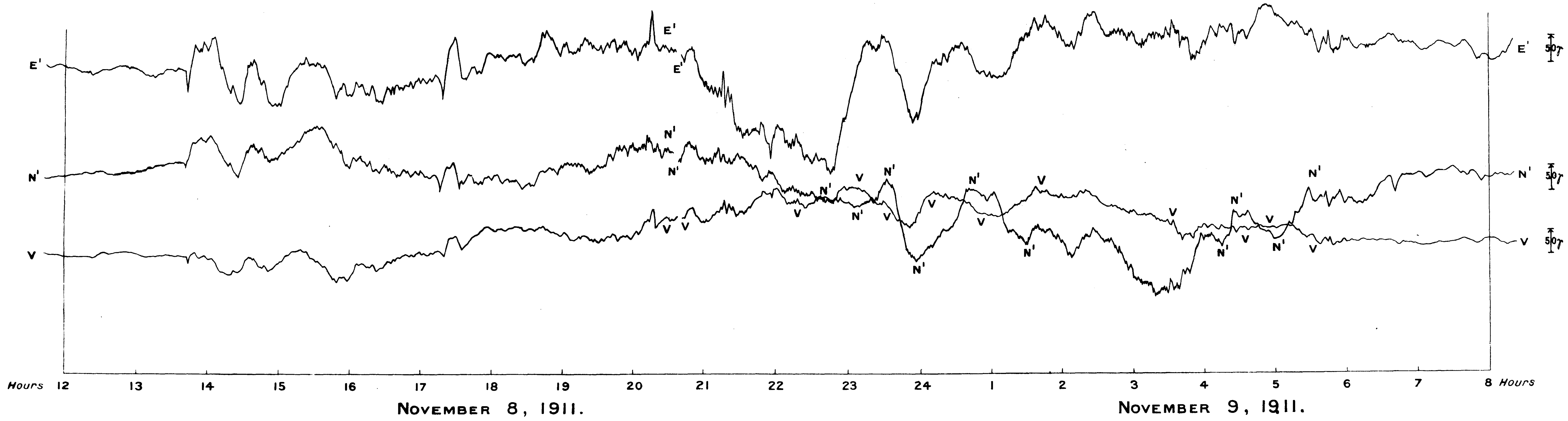
(Contd)

LONGER STORMS, 1911.

OCTOBER 10–11 (From 12h. 10th to 12 h. 11th)

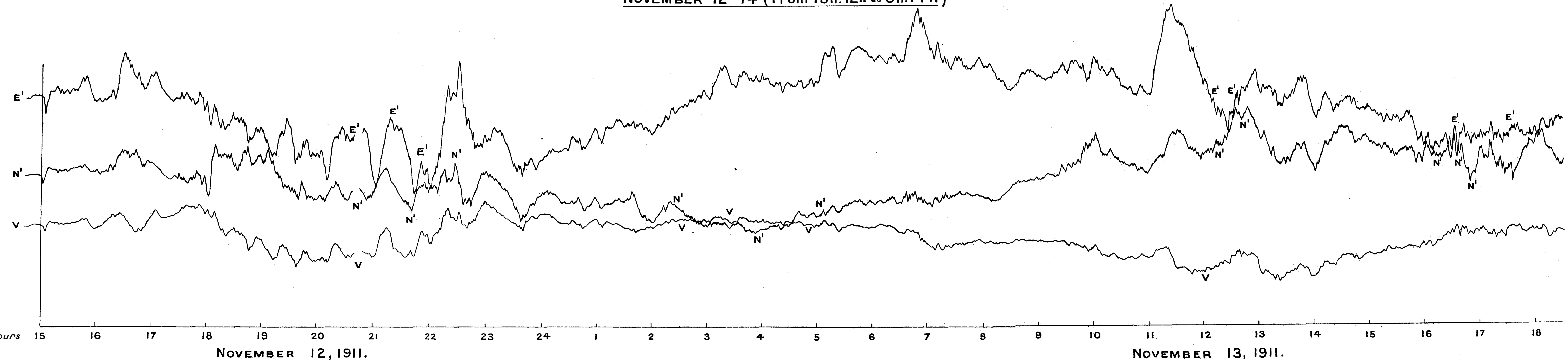


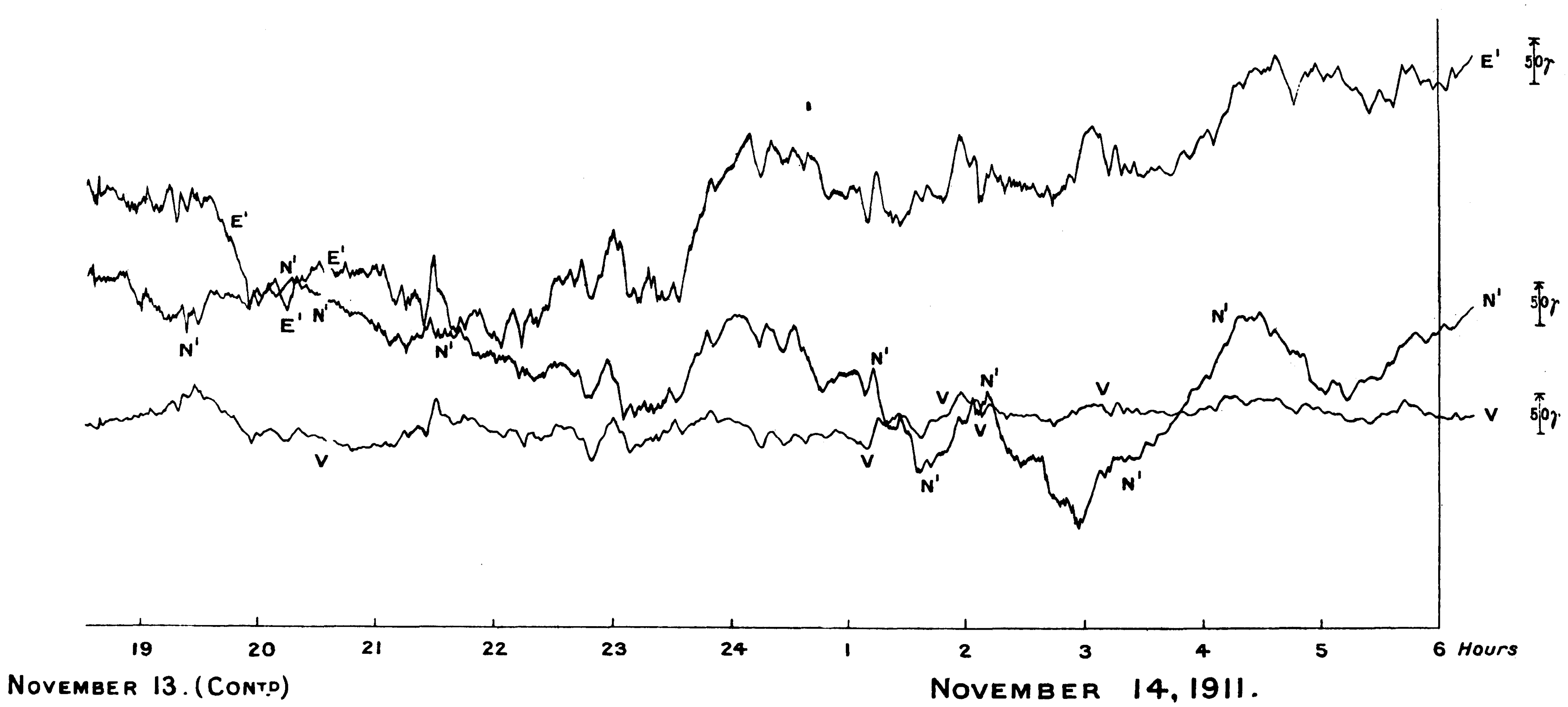
NOVEMBER 8–9 (From 12h. 8th to 8h. 9th)



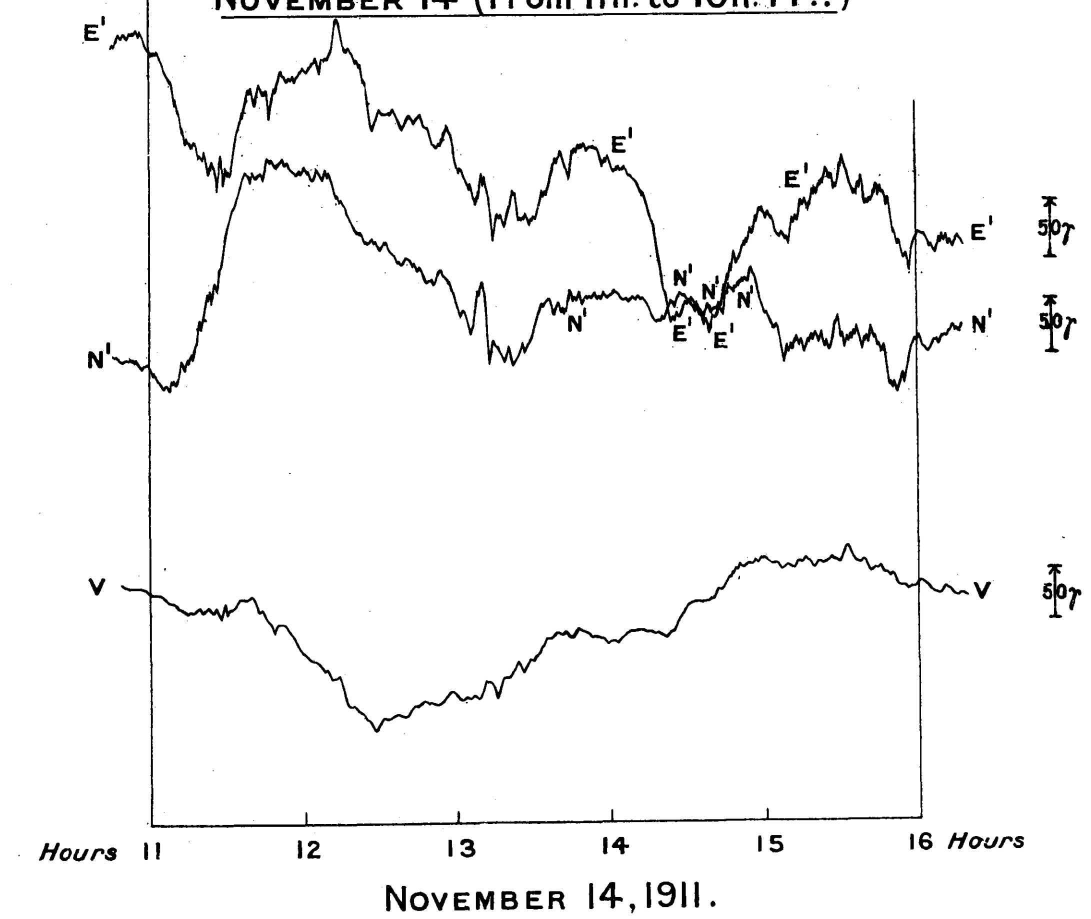
LONGER STORMS, 1911.

NOVEMBER 12-14 (From 15h. 12th to 6h. 14th)



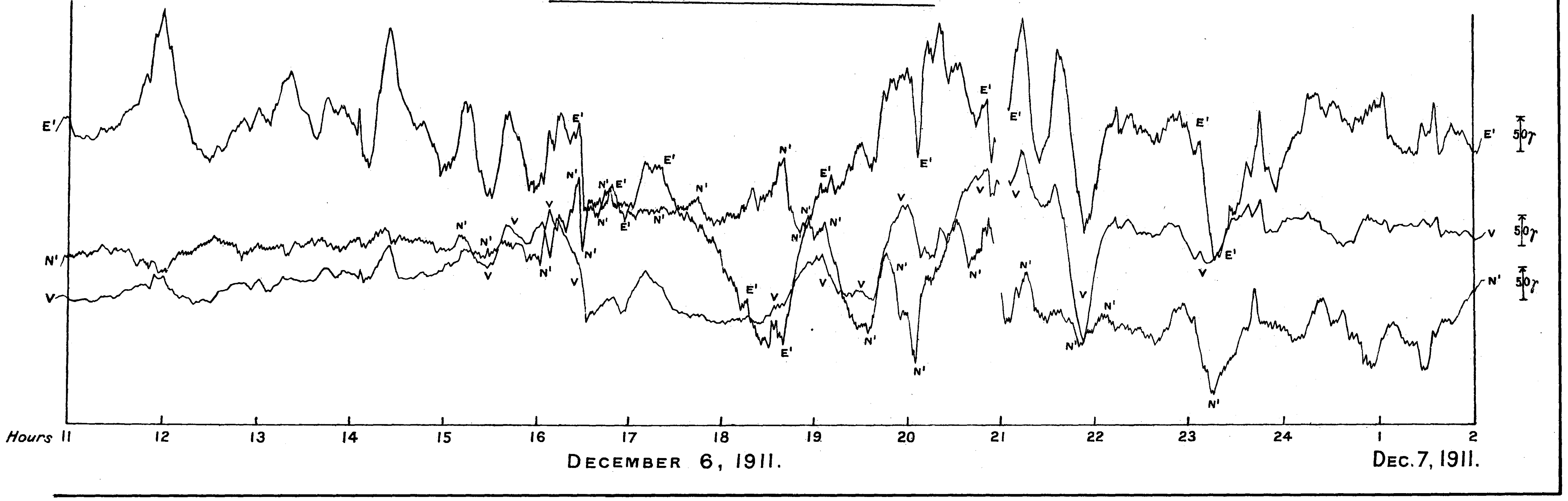


NOVEMBER 14 (From 11h. to 16h. 14th)

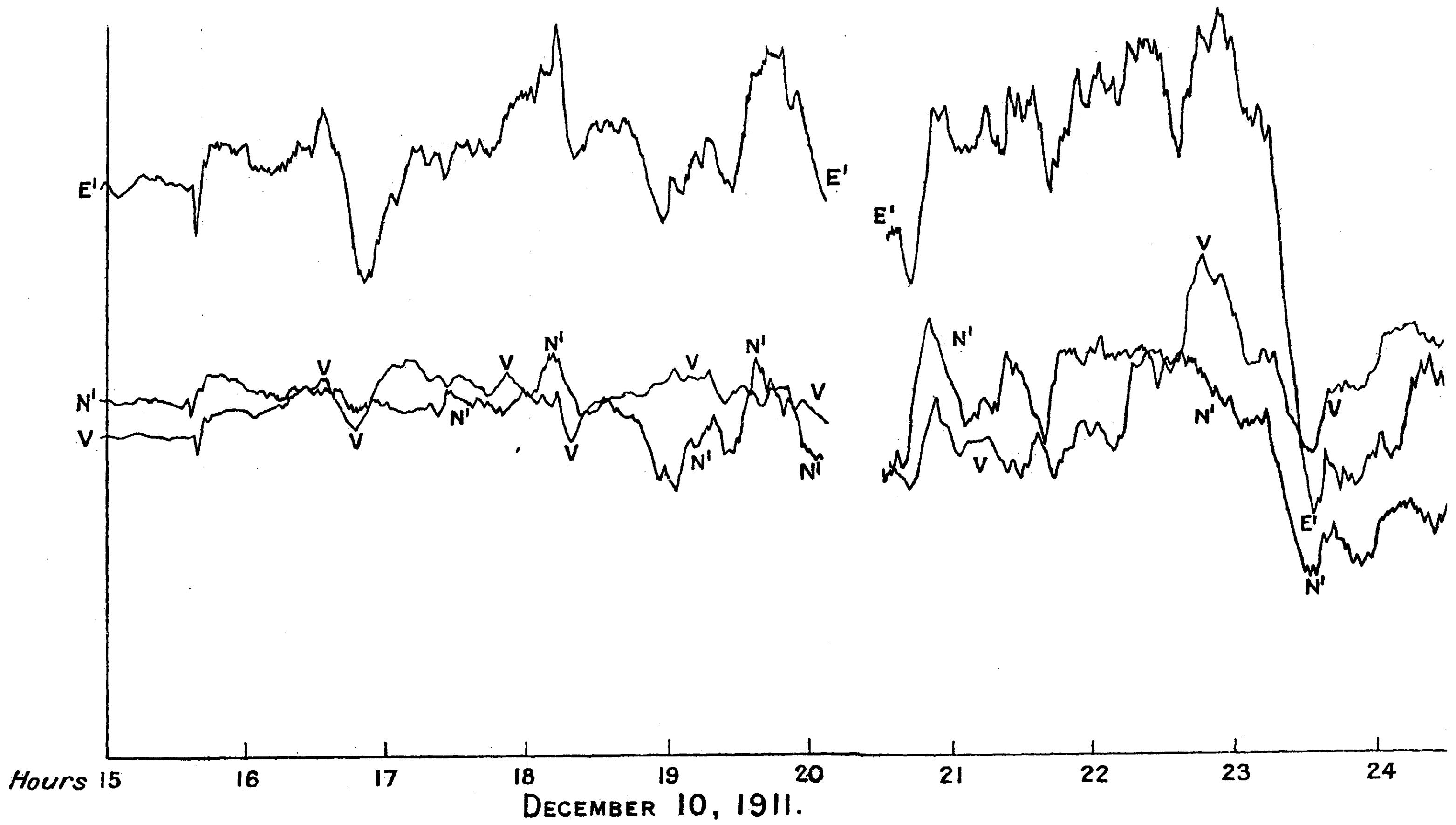


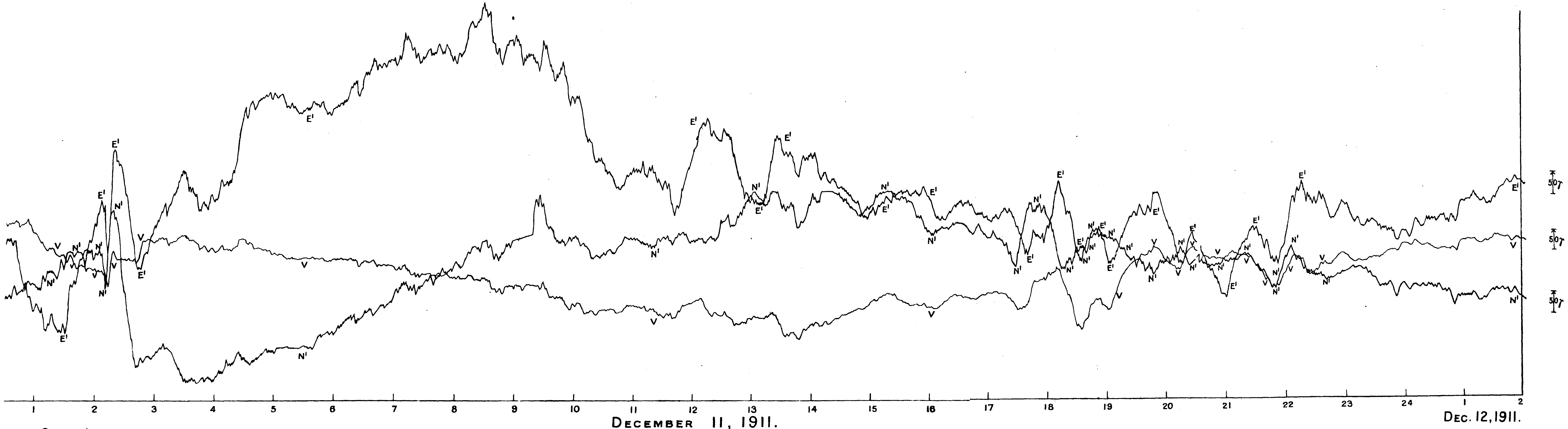
Longer Storms, 1911.

December 6-7 (From 11h. 6th to 2h. 7th)



December 10-11-12 (From 15h. on 10th to 2h. on 12th.)

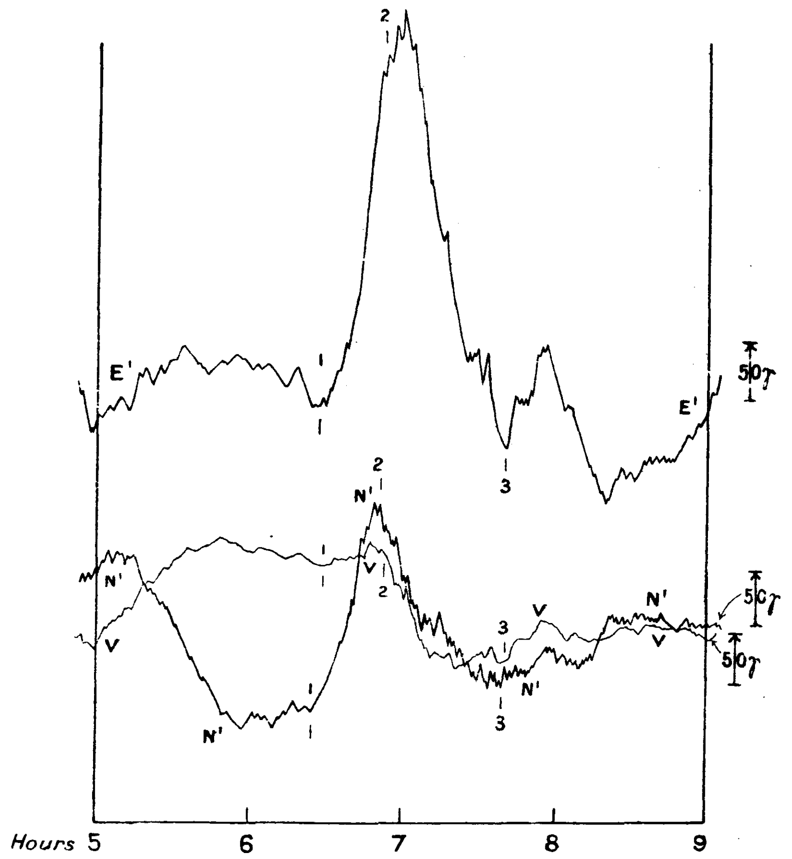




(Contd.)

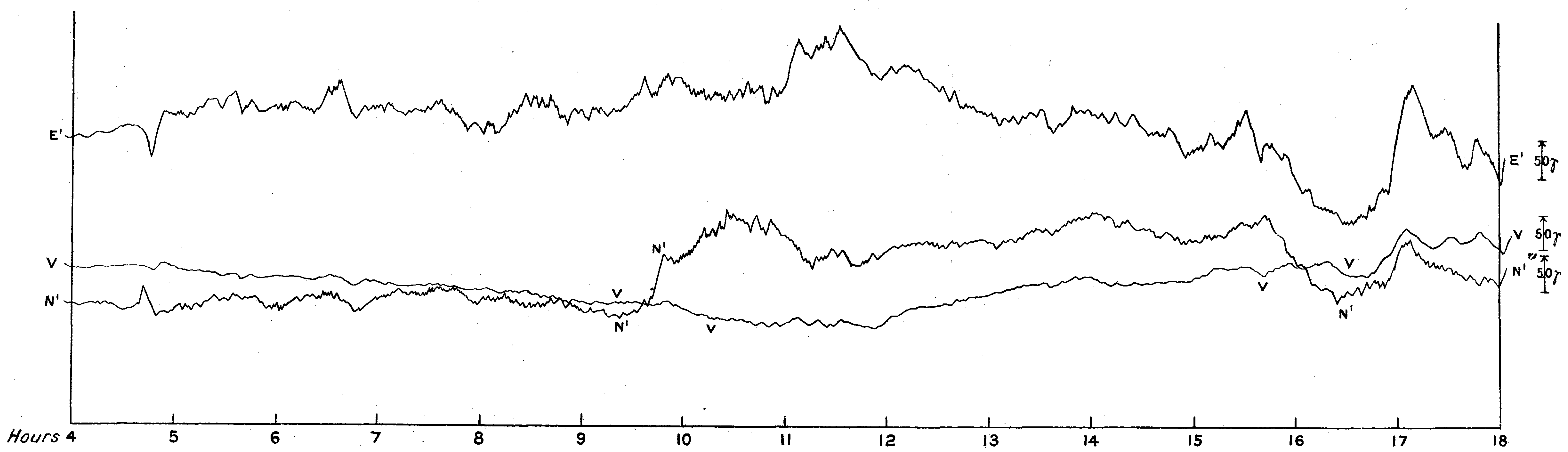
Longer Storms, 1912.

January 13 (From 5 h. to 9 h.)



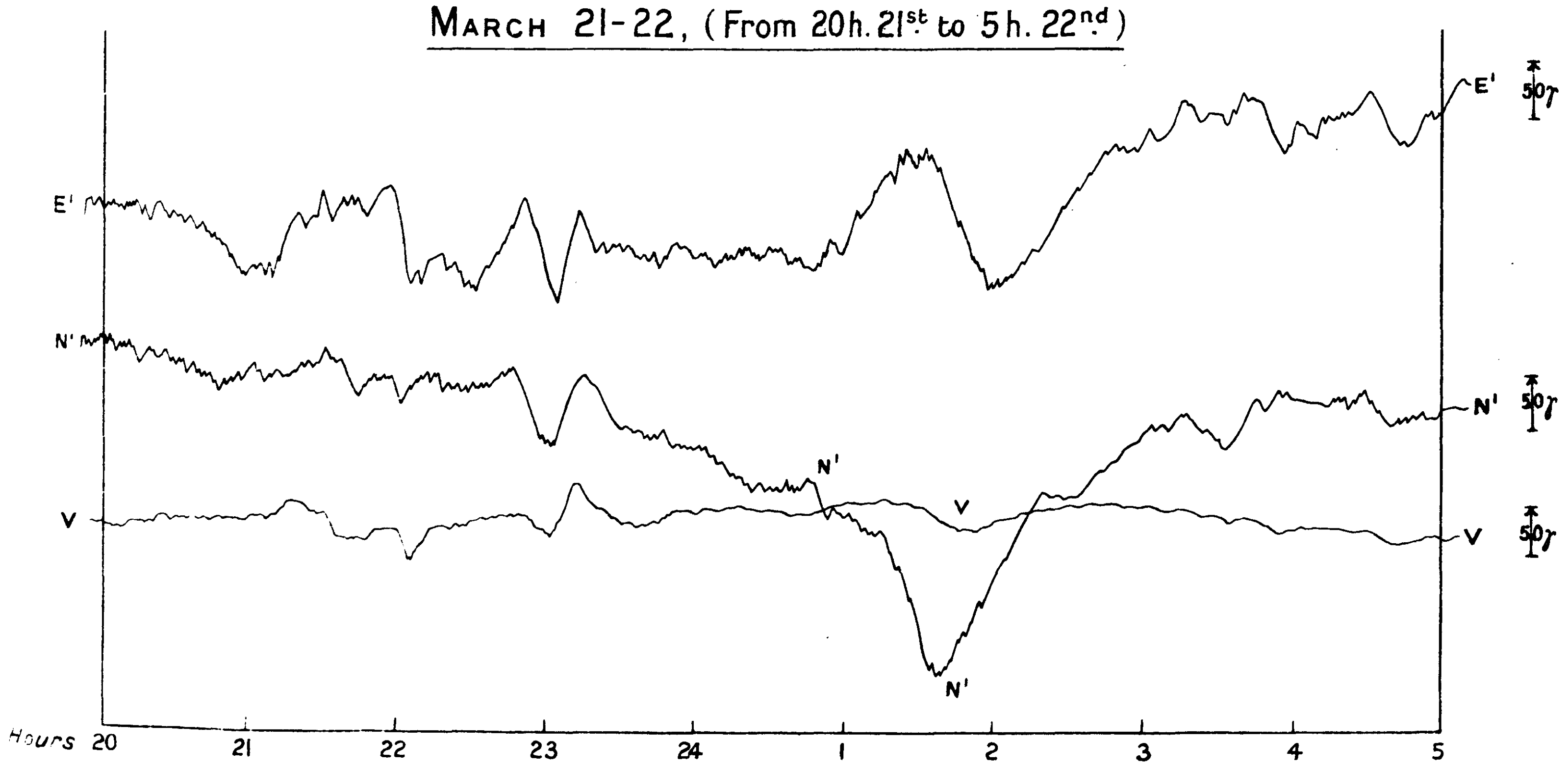
January 13, 1912.

January 17. (From 4 h. to 18 h.)



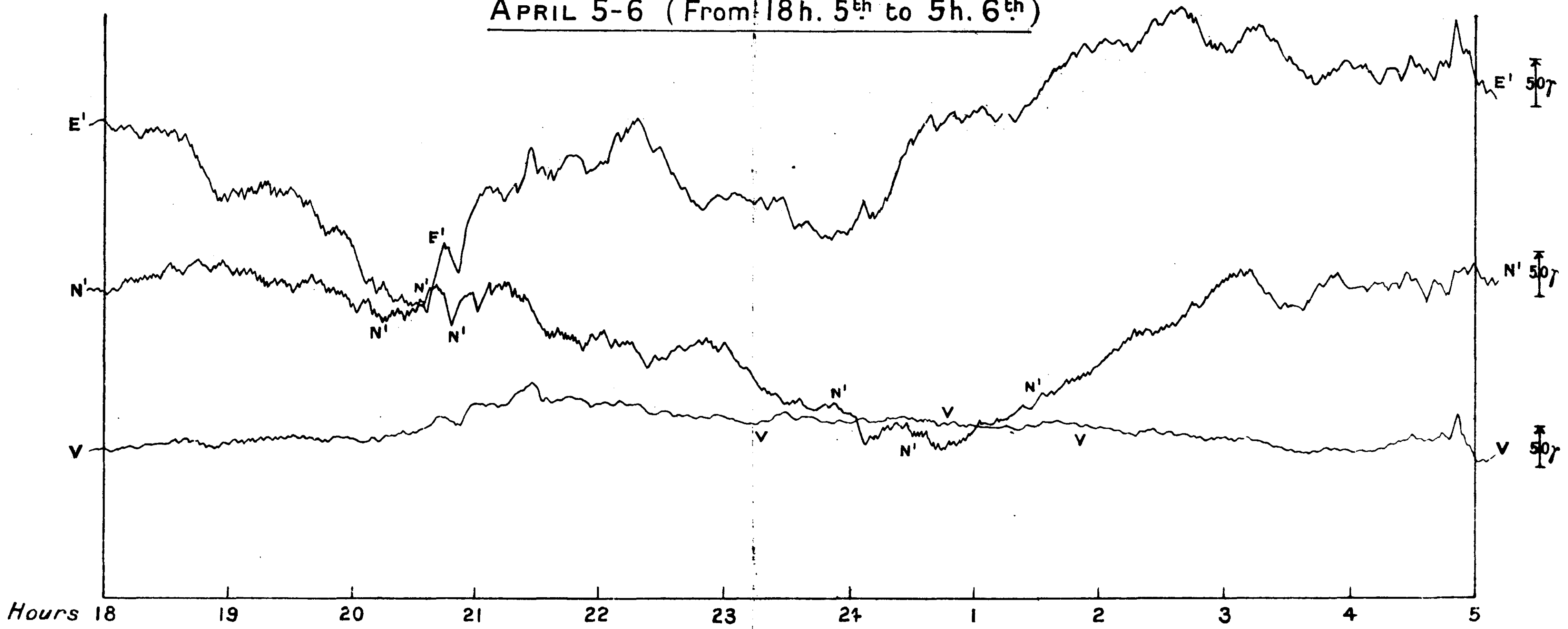
January 17, 1912.

March 21-22, (From 20h. 21st to 5h. 22nd)



March 21. 1912. March 22, 1912.

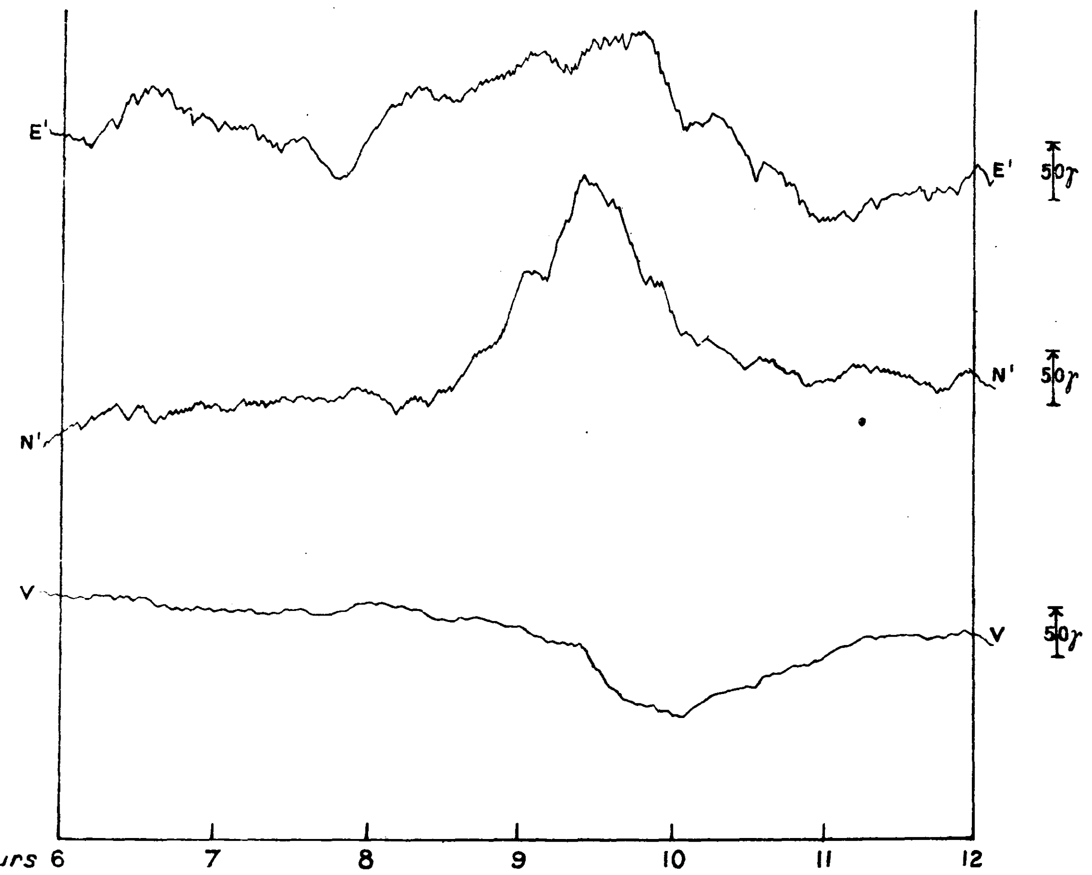
April 5-6 (From 18h. 5th to 5h. 6th)



April 5, 1912. April 6, 1912.

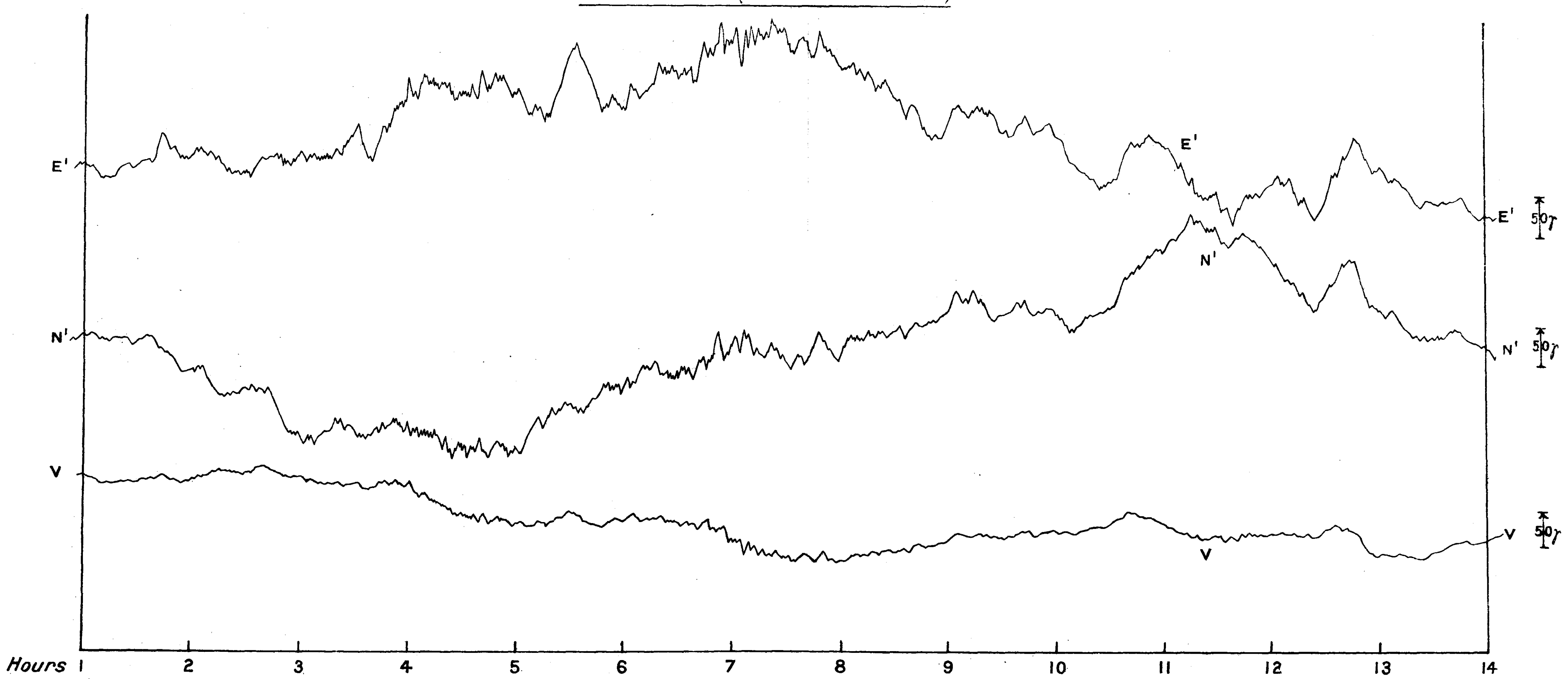
Longer Storms, 1912.

April 10 (From 6h. to 12h.)



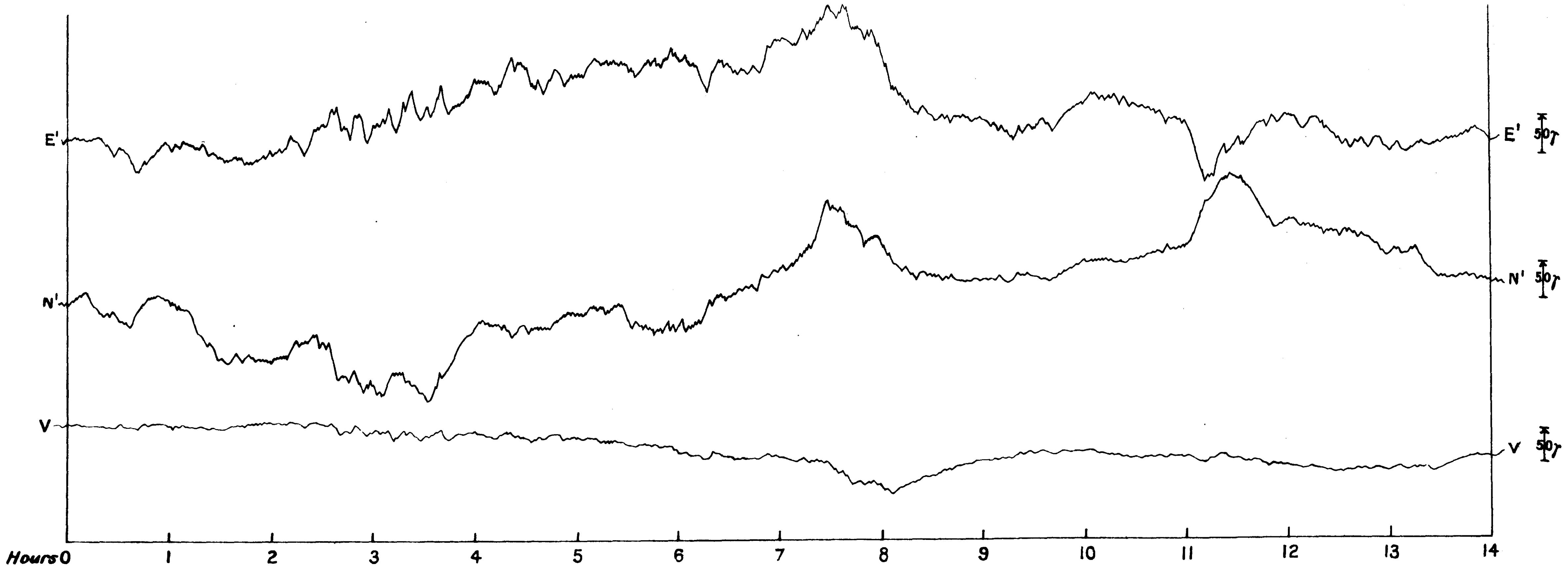
April 10, 1912.

April 15 (From 1h. to 14h.)



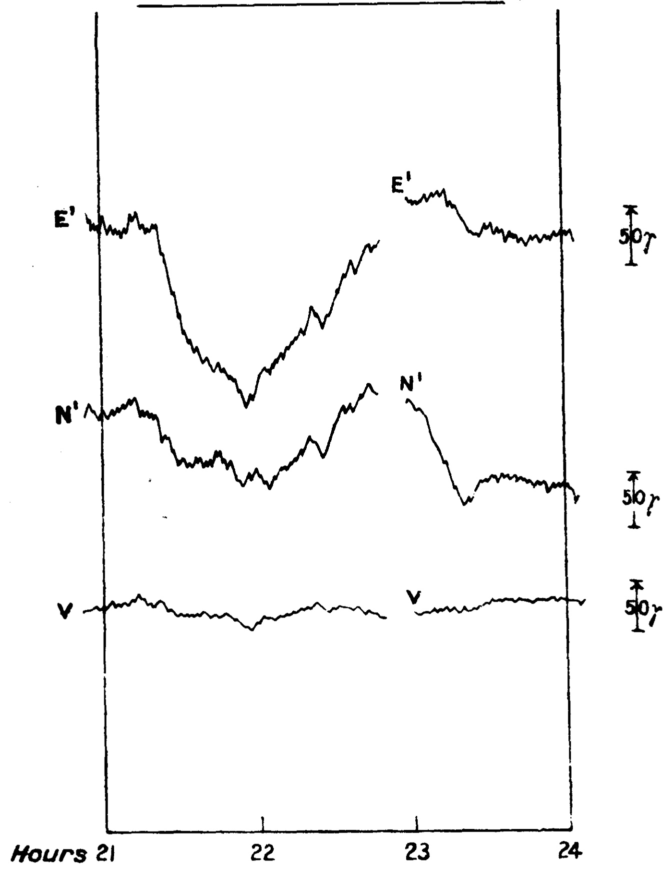
April 15, 1912.

May 12, (From 0h. to 14h.)



May 12, 1912.

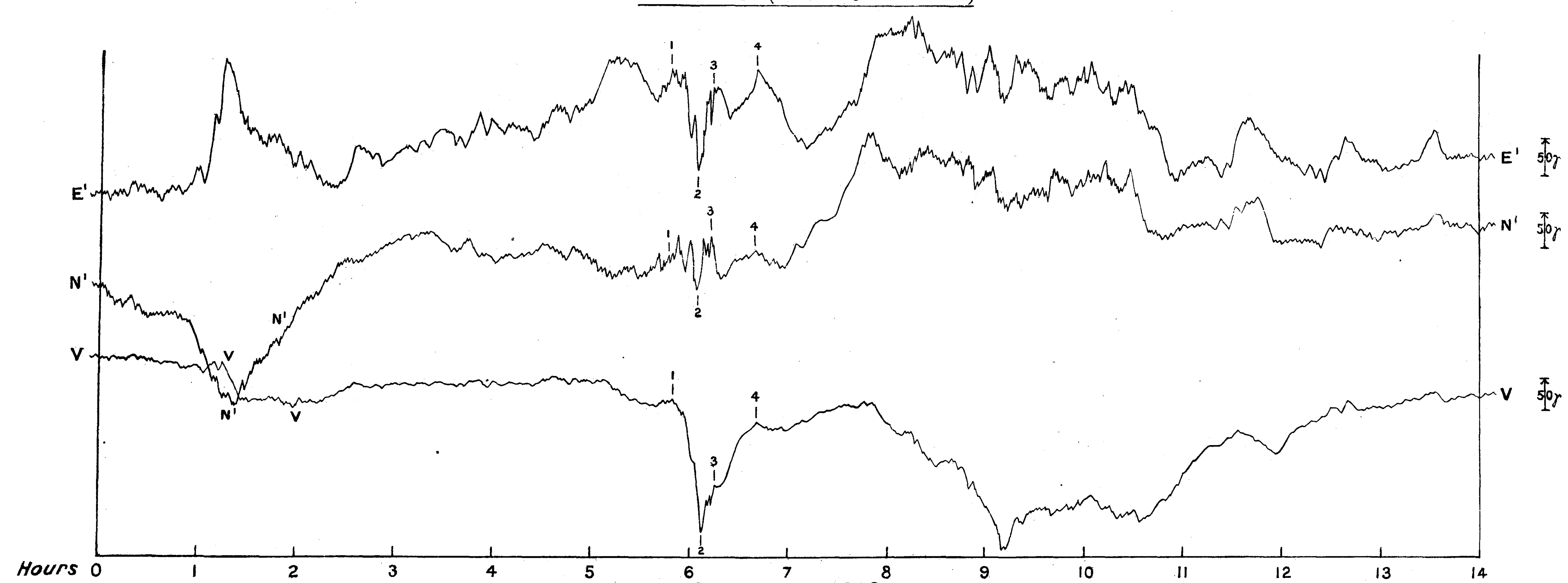
May 12 (From 21h. to 24h.)



May 12, 1912.

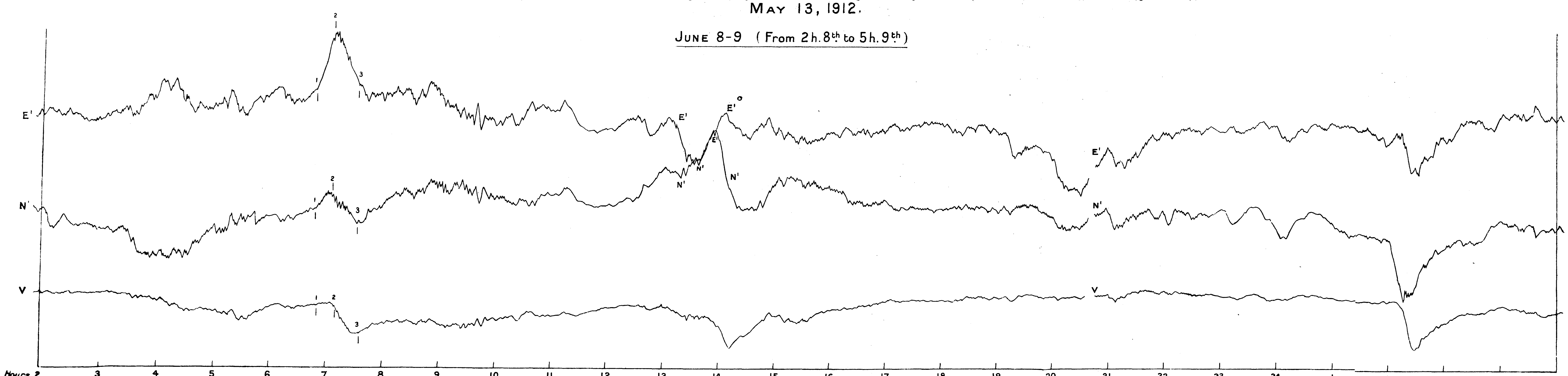
Longer Storms, 1912.

May 13 (From 0h. to 14h.)



May 13, 1912.

June 8-9 (From 2h. 8th. to 5h. 9th.)

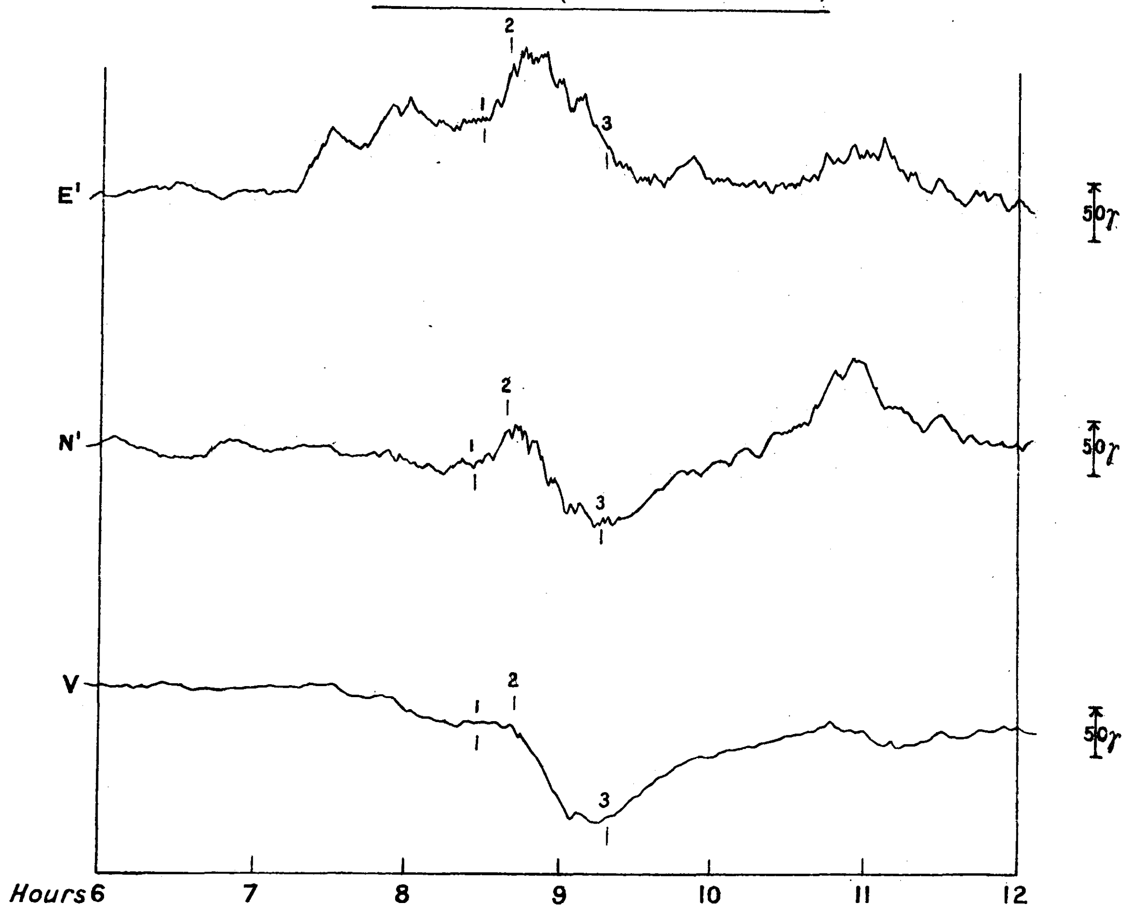


June 8, 1912.

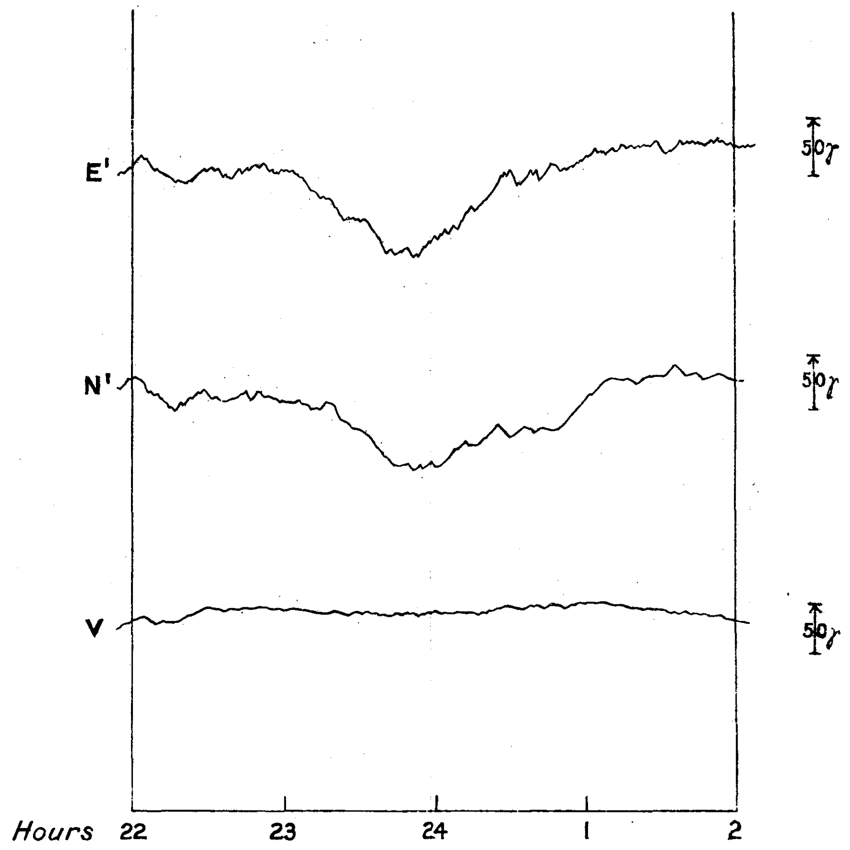
June 9, 1912.

Longer Storms, 1912.

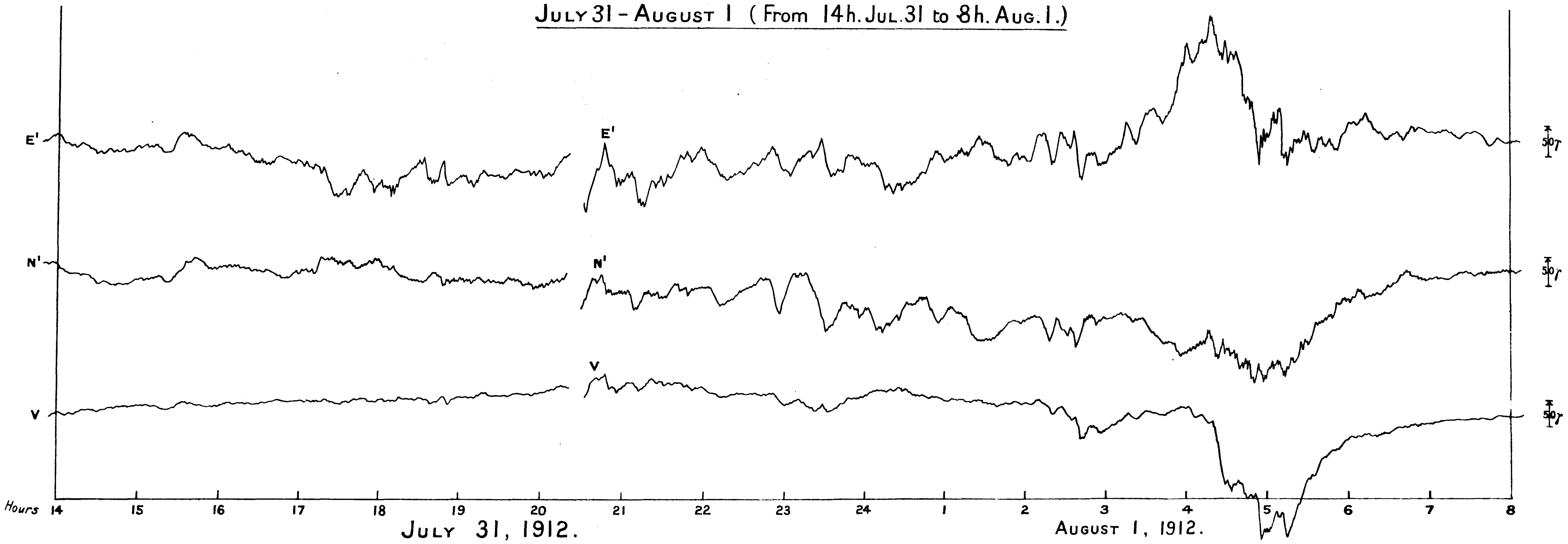
June 27 (From 6h. to 12h.)



June 27–28 (From 22h. 27th. to 2h. 28th.)

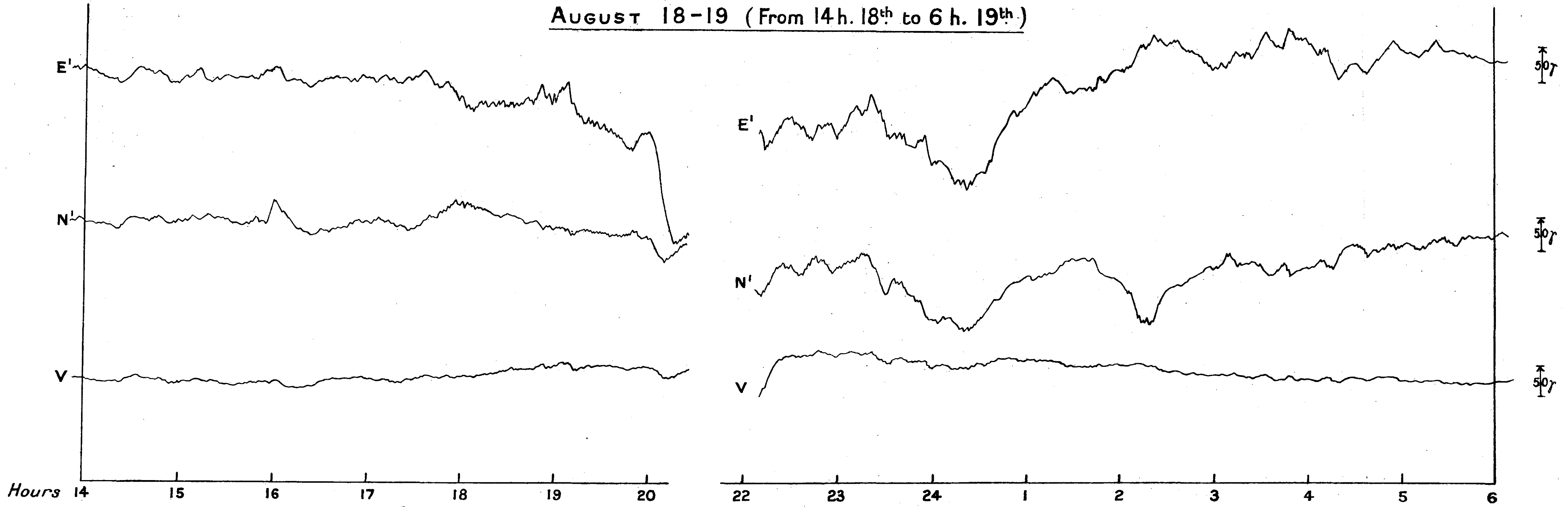


July 31 – August 1 (From 14h. Jul. 31 to 8h. Aug. 1.)



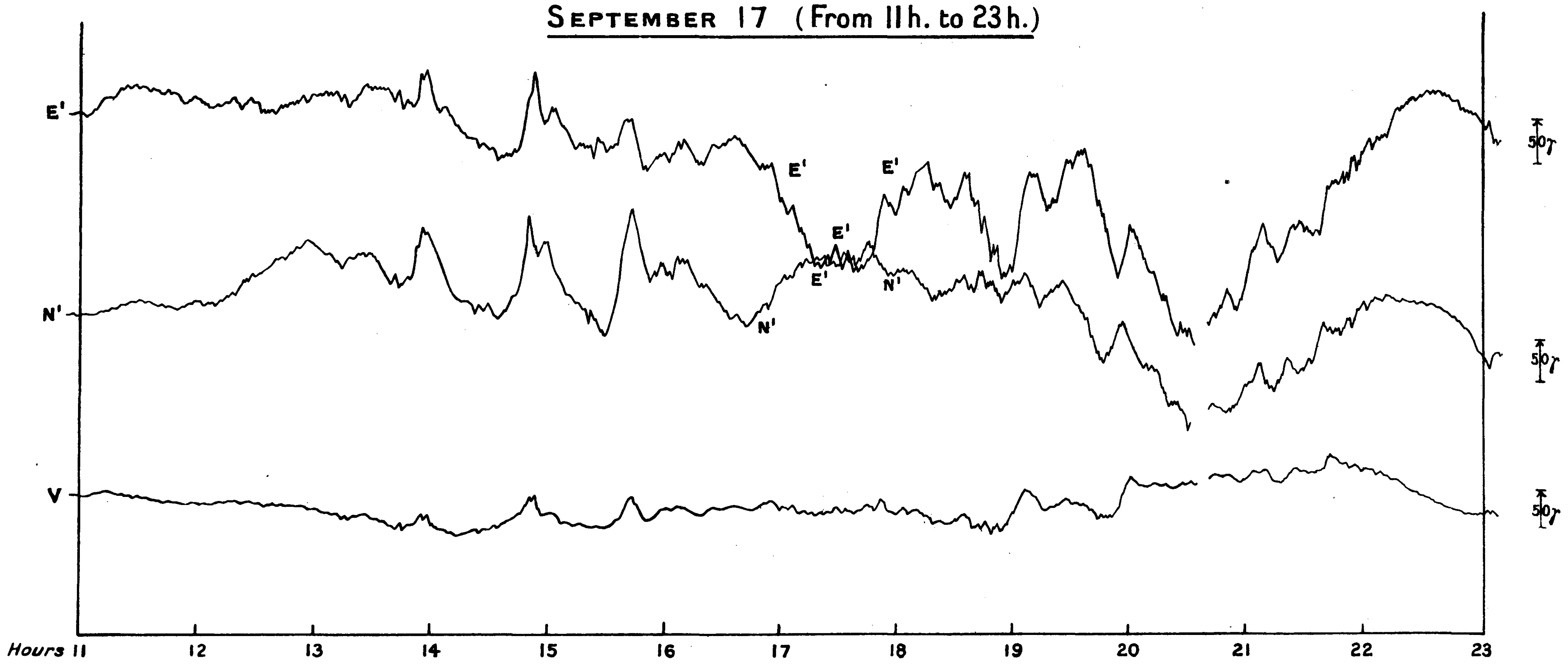
Longer Storms, 1912.

August 18–19 (From 14h. 18th to 6h. 19th)



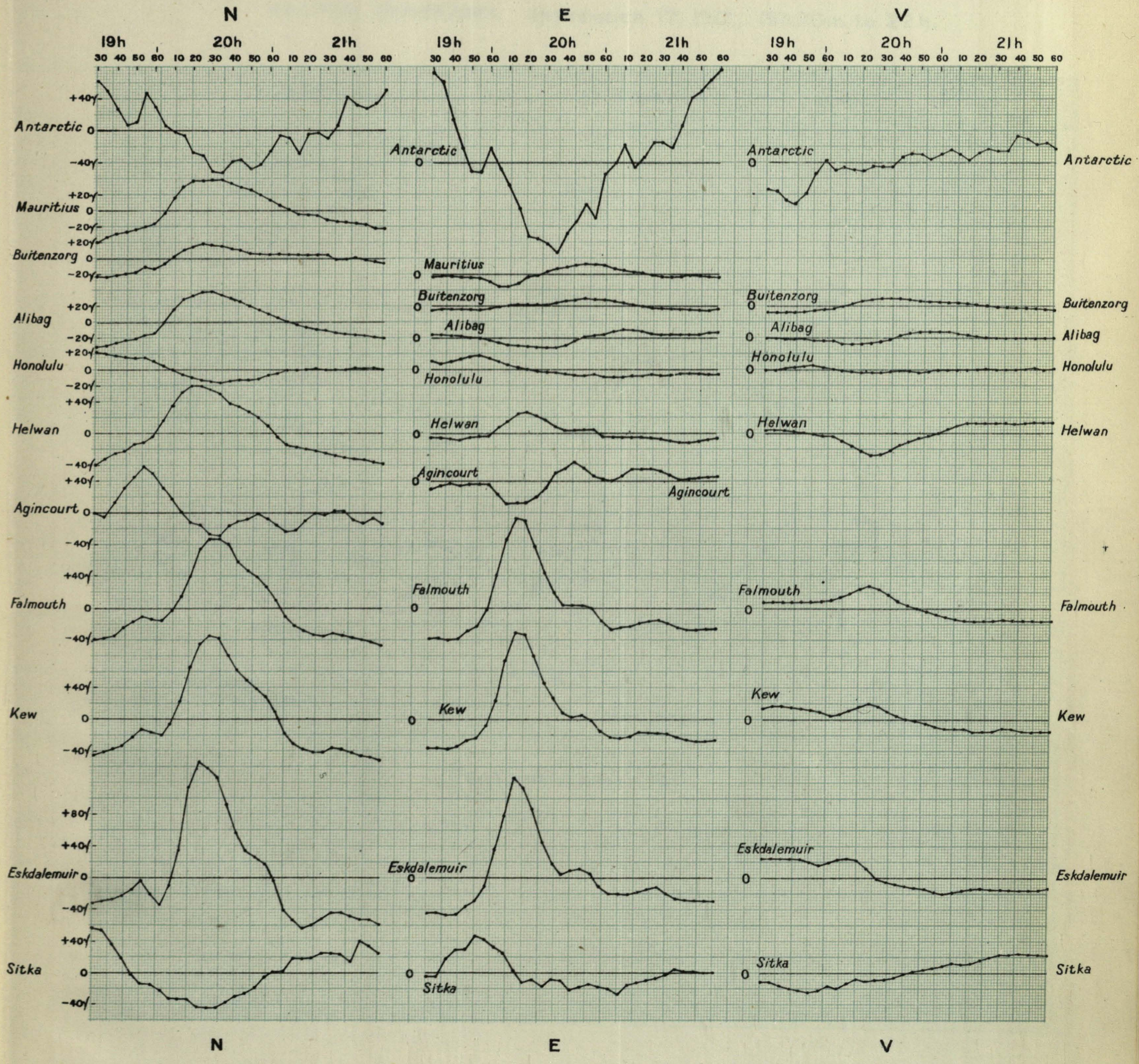
August 18, 1912. August 19. 1912.

September 17 (From 11h. to 23h.)

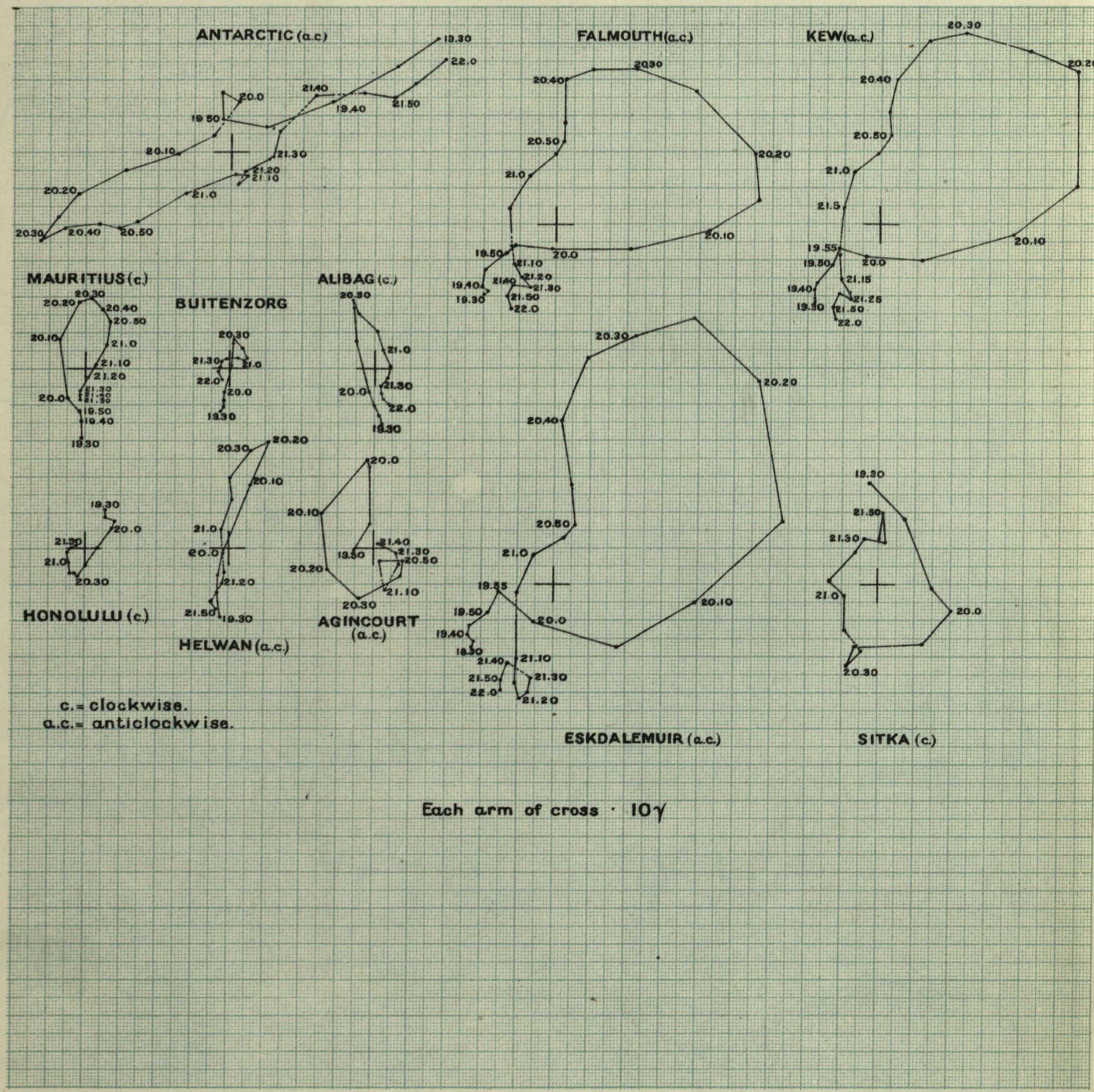


September 17, 1912.

SEPTEMBER 17, 1912. CHANGES BETWEEN 19h.30m. AND 22h. SHOWN AS DEPARTURES FROM MEAN.

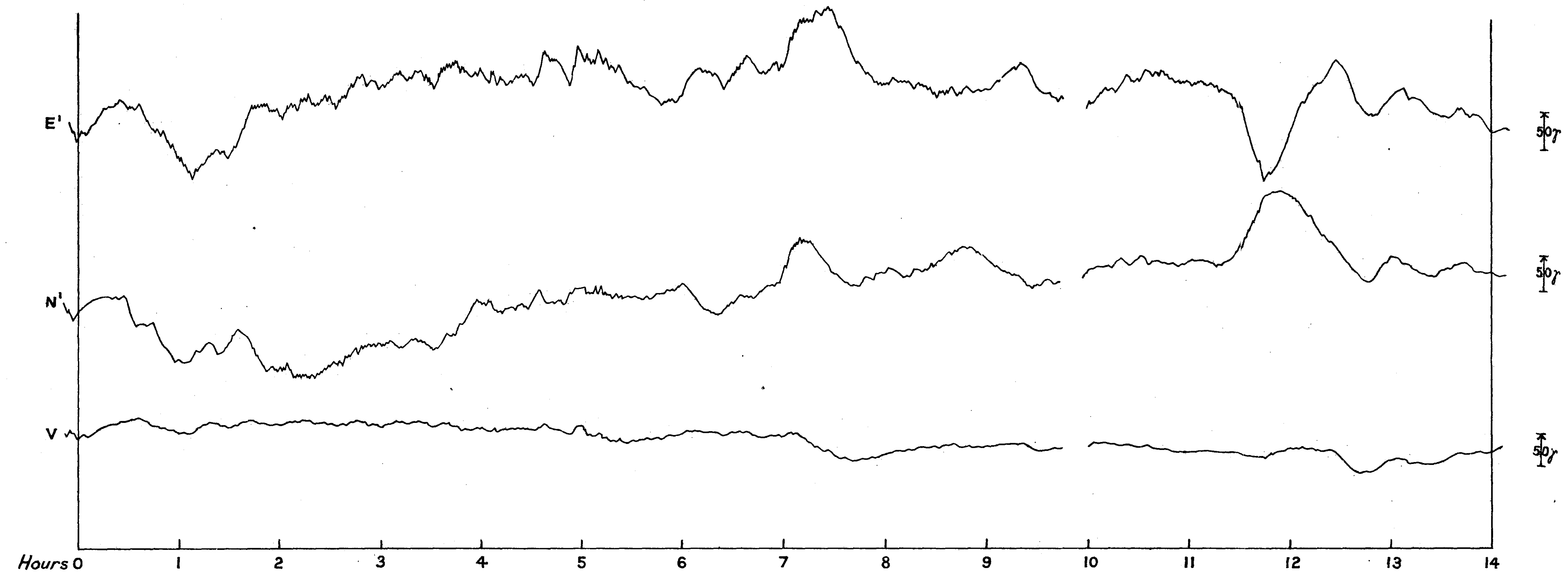


VECTOR DIAGRAMS. SEPTEMBER 17, 1912, 19h.30m. to 22h.



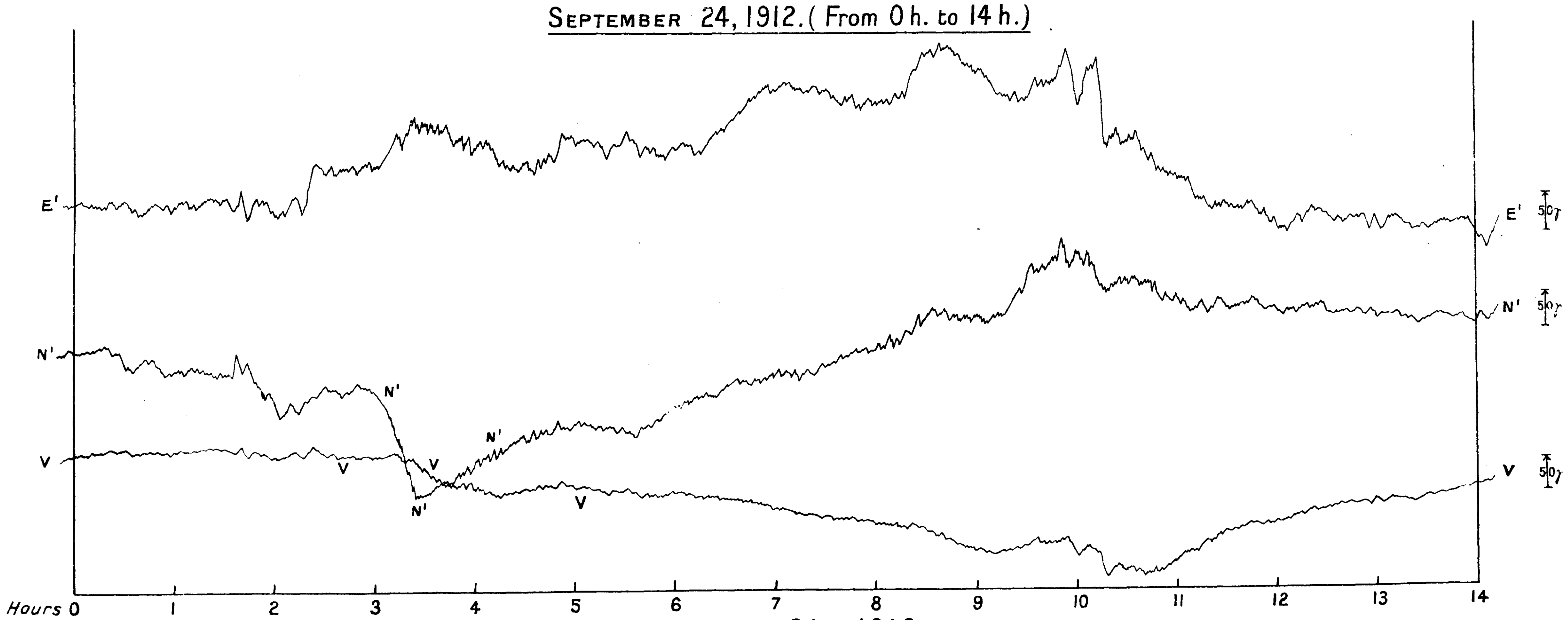
Longer Storms, 1912.

September 18 (From 0h. to 14h.)



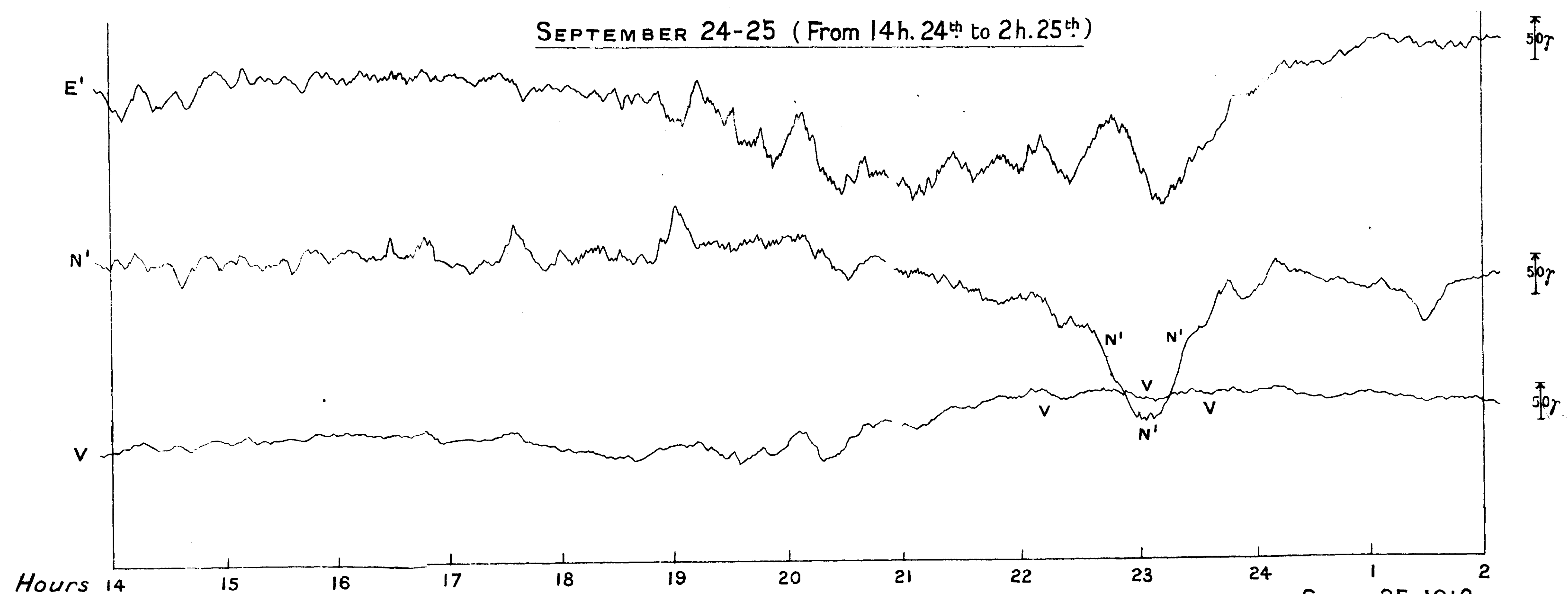
September 18, 1912.

September 24, 1912. (From 0 h. to 14 h.)



September 24, 1912.

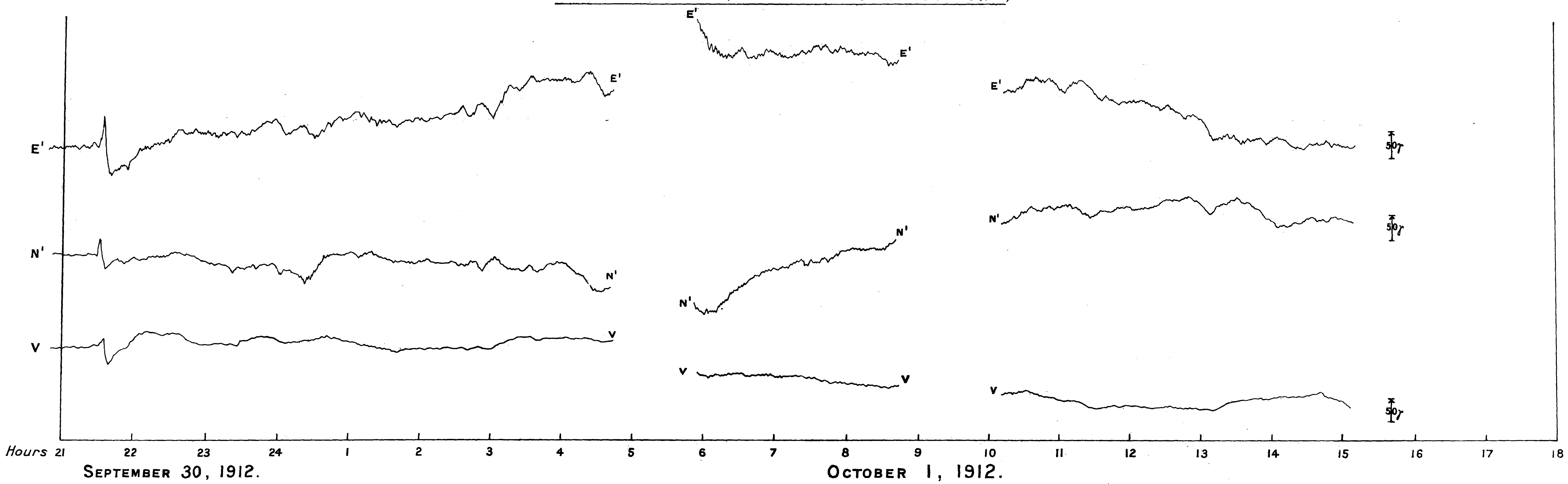
September 24-25 (From 14h. 24th to 2h. 25th)



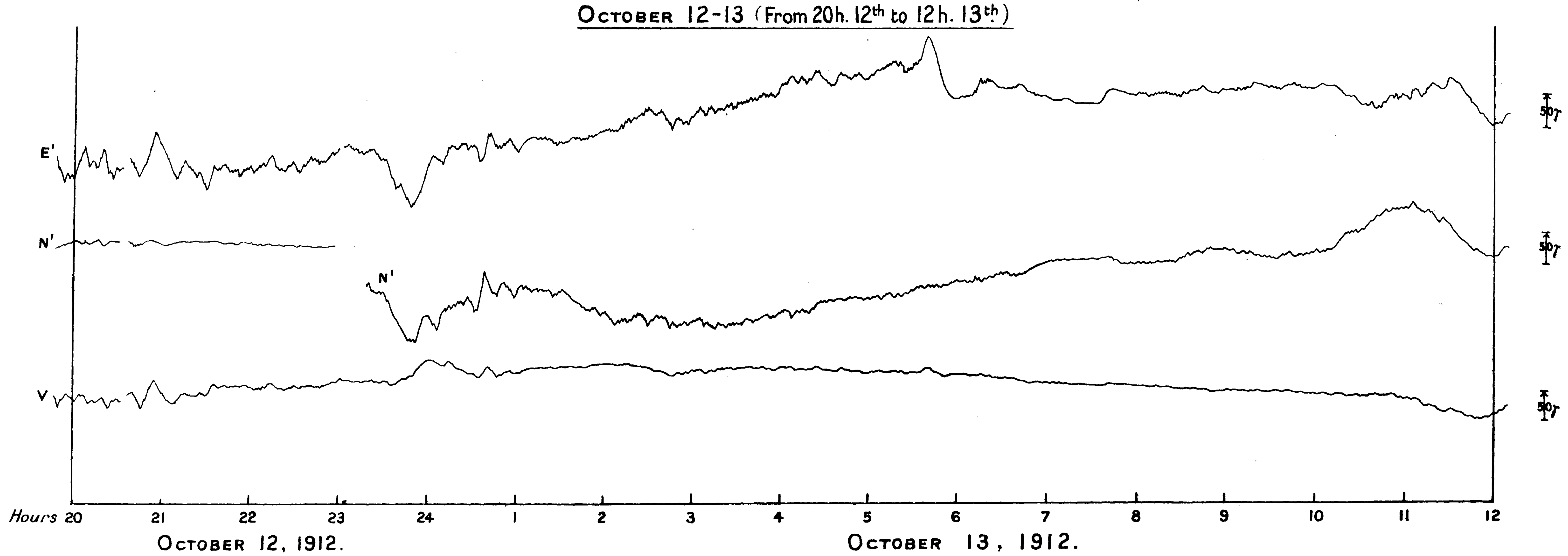
September 24, 1912. Sept. 25, 1912.

Longer Storms, 1912.

Sept. 30 – Oct. 1. (From 21h. Sept. 30 to 18h. Oct. 1.)

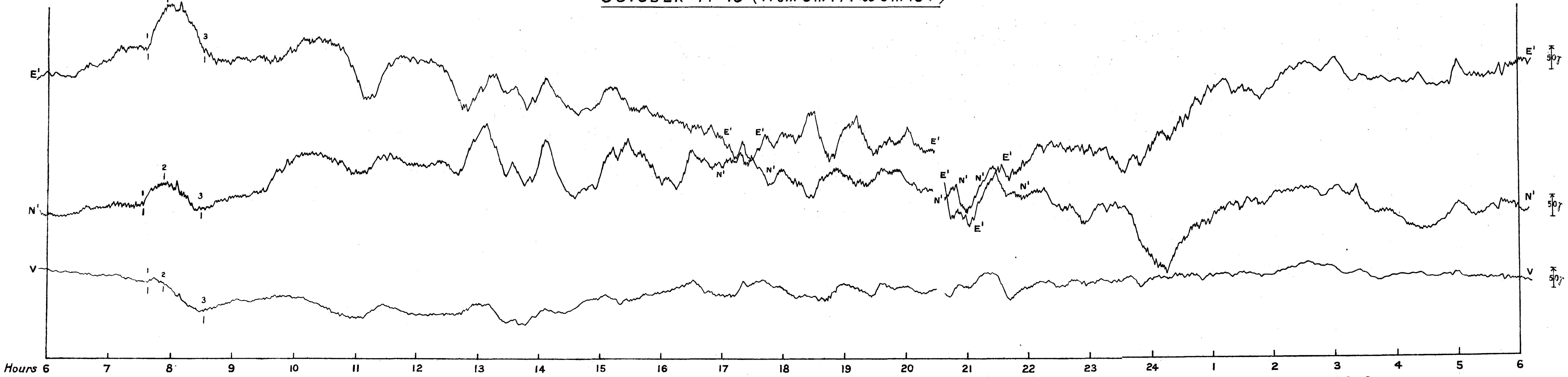


October 12-13 (From 20h. 12th to 12h. 13th.)



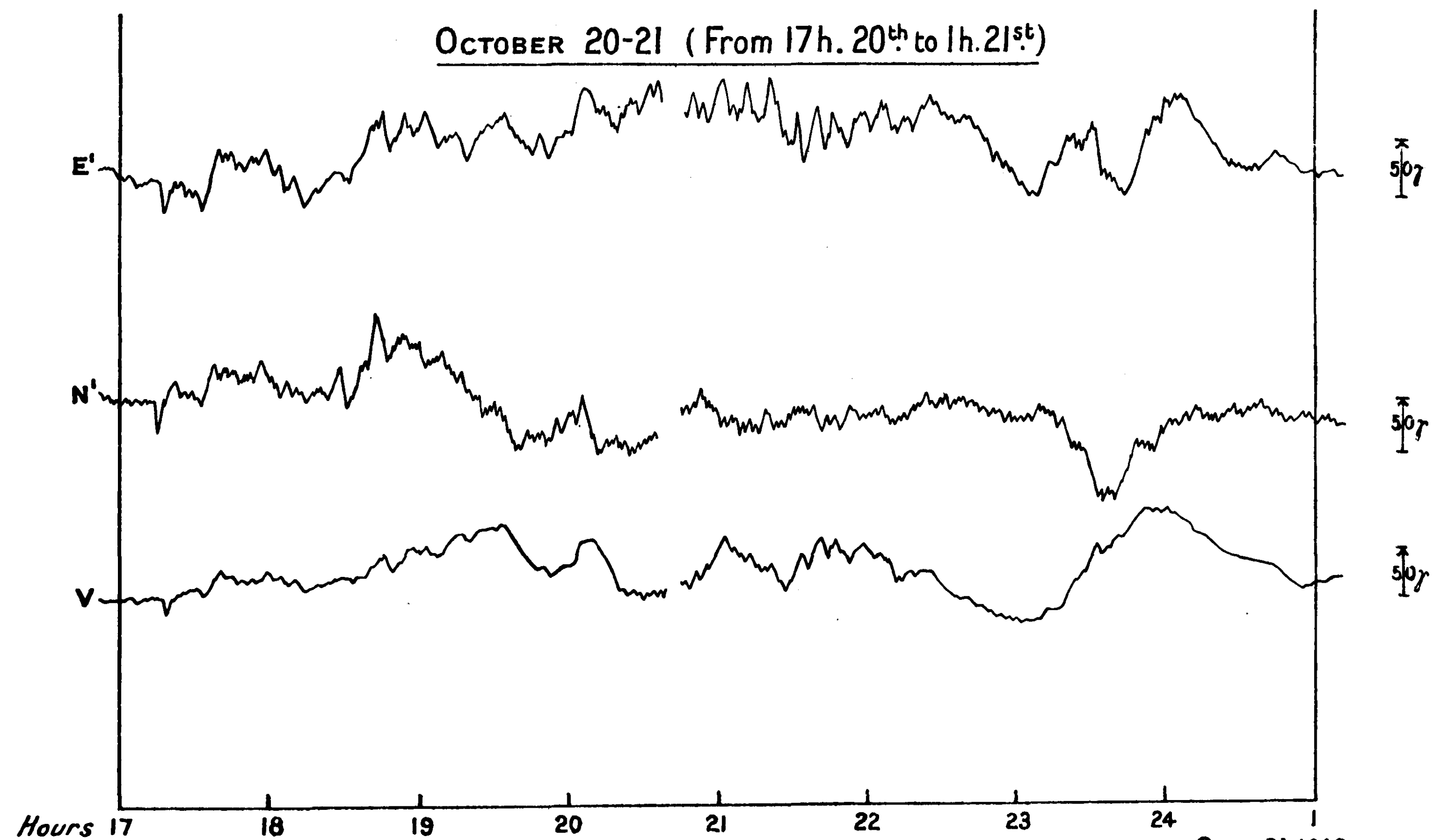
Longer Storms, 1912.

October 14-15 (From 6h. 14th to 6h. 15th)



October 14, 1912. October 15, 1912.

October 20-21 (From 17h. 20th to 1h. 21st)



October 20, 1912. Oct. 21, 1912.