

Kodaikanal Observatory

Bulletin No. CXXXVIII

PART I

SUMMARY OF PROMINENCE OBSERVATIONS FOR THE FIRST HALF OF 1952

This bulletin summarises the results of prominence observations made at Kodaikanal supplemented by the data derived from photographs supplied by Mount Wilson and Meudon Observatories for the days on which no, or only incomplete, observations were possible at Kodaikanal.

During this period prominence photographs in the K line were taken at Kodaikanal on 142 days and these were supplemented by 30 prominence spectroheliograms from Mount Wilson and 22 from Meudon Observatories. On the whole the data were available for 175 days which were counted as 168 effective days after giving due weightage to photographs.

The mean daily areas of prominences in square minutes of arc and the mean daily numbers derived from the combined data are given below.—

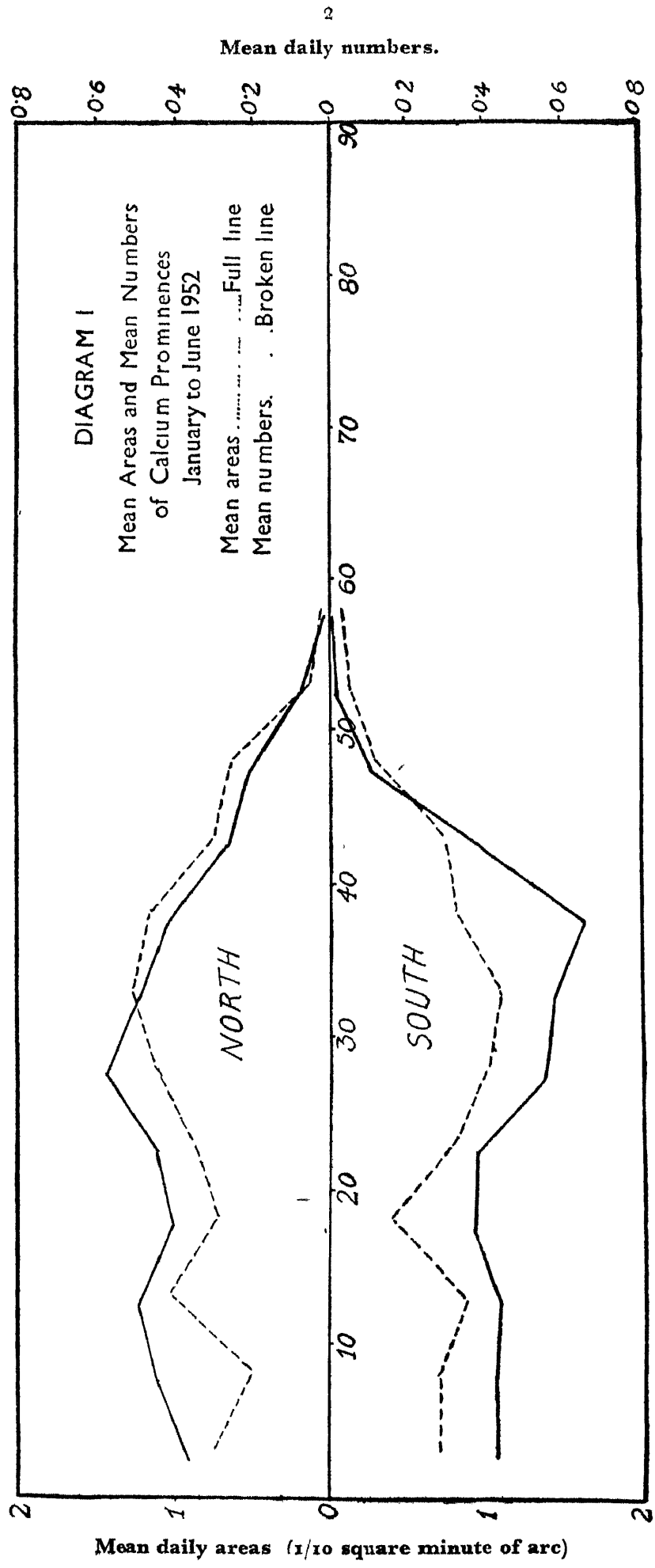
	Combined data	
	Mean daily areas (square minutes)	Mean daily numbers
North	1 06	3 77
South	1 07	2 97
TOTAL	<u>2 13</u>	<u>6 74</u>

These figures show a decrease of 31.7% in area as compared with the activity for the previous half year while the numbers do not show any appreciable change.

For comparison with bulletins prior to 1923 the means based on Kodaikanal data alone are given in the following table, 142 days of observations being counted as 135 effective days.

	Kodaikanal data	
	Mean daily areas (square minutes)	Mean daily numbers
North	1 15	4 15
South	1 20	3 23
TOTAL	<u>2 35</u>	<u>7 38</u>

The distribution in latitude of the prominence areas and numbers in 5° zones is shown in diagram I in which the full line curves represent the areas and the broken line curves the numbers. The curves show peaks of activity of prominence areas in the latitude zones 25°-30° in the north and 35°-40° in the south.



The monthly, quarterly and half-yearly mean areas, numbers, heights and extents of prominences are shown in the following table:—

TABLE I

Months 1952	Number of days (effective)	Areas (square minutes)	Numbers	Daily Means		Mean height "	Mean extent •
				Area (sq min.)	Numbers		
January	26½	50 90	159	1 92	6 00	39 62	2 82
February	26½	68 75	157	2 59	5 93	42 71	4 18
March	29	72 20	195	2 49	6 72	38 90	3 36
April	28½	62 55	224	2 19	7 86	38 29	2 89
May	27¾	52 65	197	1 90	7 10	39 77	3 26
June	29½	50 95	200	1 71	6 72	39 10	2 80
1st quarter	82	191 85	511	2 34	6 23	40 30	3 44
2nd quarter	86	166 15	621	1 93	7 22	39 01	2 98
1st half year	168	358 00	1132	2 13	6 74	39 59	3 19

The east-west distribution of prominence areas and numbers is given below .—

	East	West	Percentage east
Total area	163 05	194 95	45 54
Total number	553	579	48 85

Both the areas and numbers show an eastern defect.

Observations with the Prominence Spectroscope

No Metallic prominences were observed during the half year. Particulars of displacements observed in the chromosphere and prominences in the spectroscop are given in the following table :—

TABLE II

Date	Time I. S. T. (G.M.T.+05 h. 30 m) H. M.	Latitude		Limb	Displacement in A			Remarks
		North	South		Red	Violet	Both ways	
March 6	08 45	..	33½	W	1	0 5	..	To red at top and violet in middle.

Reversals and displacements on the disc

During the period the H-alpha line was seen in emission and the D₃ line in absorption on 31 occasions. The H-alpha line was also seen displaced over dark markings on 5 occasions (one towards red and four both ways). These distributions were as follows :—

	North	South	East	West	Total
Bright reversal of H-alpha line on the disc	8	23	17	14	31
Dark reversal of D ₃ line on the disc	8	23	17	14	31
Displacement of H-alpha line on the disc	3	2	4	1	5

Heights of prominences in K, H-alpha, D₃ and H_β lines

12 prominences were observed in K, H-alpha, D₃ and H_β lines. The mean heights in the different lines were found to be as follows

Mean height in K-line	90" 8
Mean height in H-alpha line	87" 6
Mean height in D ₃ line	84" 9
Mean height in H _β line	83" 2

Observations with the Hale Spectroheliograph

Details of Doppler displacements in H-alpha line observed in prominences and absorption markings with the spectroheliograph are given below.—

	North	South	East	West	Total	Displacements		
						To red	To violet	Both ways
Displacements in prominences	6	2	5	3	8	1	..	7
Displacements in absorption markings	9	7	11	5	16	2	2	12

Solar Flares

Table III gives a list of solar flares observed at Kodaikanal during the period under review :—

TABLE III

Date 1952	Time in I S T.			Mean latitude	Mean longitude from central meridian	Intensity	Maximum width of H-alpha line observed	Remarks
	Beginning	Maximum	End					
	H M	H M	H M	°	°		A°	
<i>January</i> 12	11 20	11 51	12 15	10 N	50 E	2	1 9	
26	09 45	..	10 00	10 S	32 E	1	1 6	
<i>February</i>				<i>NIL</i>				
<i>March</i> 14	08 55	.	09 00	12 S	30 E	1	1 0	
15	07 30		07 55	11 S	16 E	1	1 7	
<i>April</i> 21	09 45	..	09 58	5 S	67 E	1	..	
<i>May</i>				<i>NIL</i>				
<i>June</i> 23	08 15	08 26	09 45	17 N	45 E	1	1 3	
28	15 04	7 S	8 W	1	..	

The distribution of mean daily areas in 5° ranges of latitude is shown in diagram II. The peaks of activity are centred around latitude 25°-30° in the northern hemisphere and 35°-40° in the southern hemisphere.

Kodaikanal data	
Mean daily numbers of the sun's visible hemisphere)	Mean daily numbers
North	11.20
South	7.75
Total	18.95
North	1227.2
South	861.7
Total	2088.9

The figures based on Kodaikanal data alone are also given below for comparison with similar data:—

Compared with the figures for the previous half-year, the areas and the numbers show a decrease of 36.7% and 28.7% respectively.

Combined Data	
Mean daily areas (millions of the sun's visible hemisphere)	Mean daily numbers
North	11.02
South	7.94
Total	18.96
North	1226.9
South	932.3
Total	2159.2

H-alpha focculus photographs were taken at Kodaikanal on 155 days and 21 photographs were supplied by Mount Wilson and 19 by Meudon Observatories. On the whole the records were available for 177 days which were counted as 166½ effective days. The mean daily areas in millions of the sun's visible hemisphere (without applying foreshortening correction) and the mean daily numbers as derived from all the records are given below. —

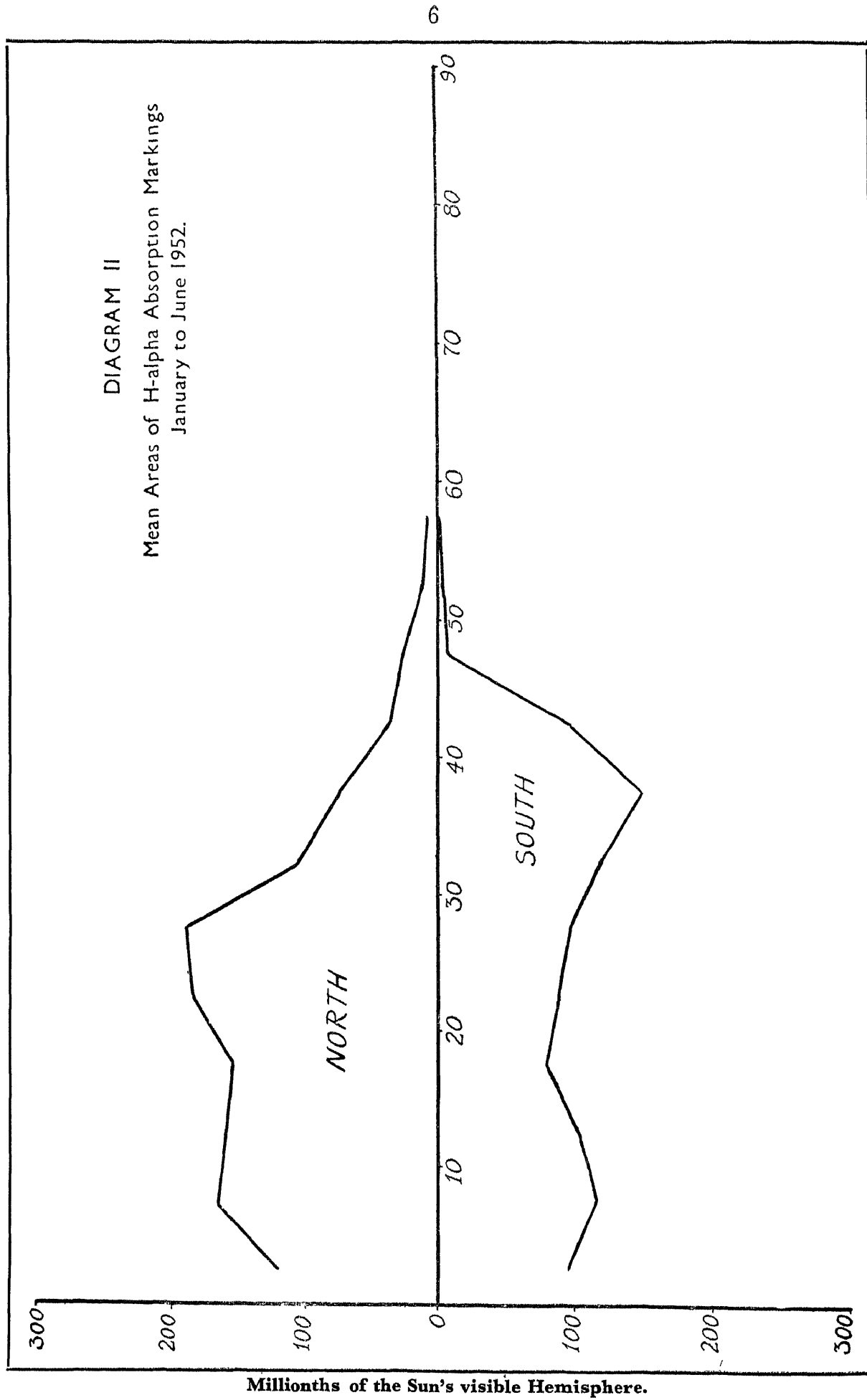
Prominences projected on the disc as H-alpha absorption markings

Nature of phenomenon	Month	Date	Time (IST)	Mean latitude	Mean longitude	Remarks
K-Prominence	January	22	14 31	35 S	90 E	Disappeared by 24th
	February	1	11 24	28 N	90 E	Disappeared next day
	January	12	11 00	12 N	55 E	Ditto.
	February	16	14 13	28 N	Central meridian	Ditto.
	February	19	07 46	7 S	57 E	Ditto.
	May	1	07 36	7 S	57 E	Ditto.
H-alpha absorption marking	January	22	H. M.	.	.	
	February	1	14 31	35 S	90 E	
	February	1	11 24	28 N	90 E	
	January	12	11 00	12 N	55 E	
	February	16	14 13	28 N	Central meridian	
	February	19	07 46	7 S	57 E	

TABLE IV

Sudden disappearances of prominences and dark markings
 Details of K-prominences and H-alpha absorption markings whose sudden disappearances were observed between two consecutive observations are given below —

DIAGRAM II
Mean Areas of H-alpha Absorption Markings
January to June 1952.



Millionths of the Sun's visible Hemisphere.

The east-west distribution of the areas and numbers of dark markings is given in the following table:—

	East	West	Percentage east
Total area (millionths of the sun's visible hemisphere)	175756	182295	49.08
Number	1559	1594	49.44

Both areas and numbers show a slight eastern defect.

Thanks are due to the co-operating observatories for the photographs supplied by them.

PART II

SUMMARY OF MAGNETIC OBSERVATIONS FOR THE FIRST HALF OF 1952

Introduction

The history of the Kodaikanal Observatory, a brief description of the absolute instruments and the Watson variometers and the system of observations are given in bulletin No. CXXXII of this Observatory. As mentioned in Bulletin No. CXXXVI a set of La Cour magnetographs became available since 1951. Since the La Cour records are more steady and reliable than the Watson records, the practice of using the La Cour records for routine statistics has been adopted since the beginning of 1952. The data for the first half of 1952 derived from the records of the La Cour instruments are given here. Watson magnetograms were however used to derive the data on a few occasions when there was loss of La Cour records.

Determination of absolute values

- (1) Absolute observations of horizontal force are made once every week (on Wednesdays) with Kew Magnetometer No. 3.
- (2) Absolute observations of declination are made once every week (on Thursdays) with the same instrument.
- (3) Observations of inclination are made with the earth inductor on all days excepting Saturdays, Sundays and other holidays.

Variometer records

(a) *Watson instruments*:—The charts of the three Watson variometers are changed every alternate day, the records for two consecutive days being obtained on the same paper in the usual way. The optical arrangements for the magnetographs are such that with the H and V instruments an increase in the ordinate corresponds to an increase in the value of the elements; for the D magnetograph, however, an increase in the ordinate corresponds to a decrease in the westerly declination.

(b) *La Cour instruments*:—The chart for the La Cour instruments is changed daily with all the three elements recorded on the same paper. The optical arrangements for the H, V and D magnetographs are such that with H and V instruments an increase in the ordinates corresponds to an increase in the value of the elements; for the D magnetograph, however, an increase in the ordinate corresponds to a decrease in the westerly declination.

Determination of scale coefficients

(a) *Watson variometers*—The scale coefficients of the H. F. and V. F. magnetographs are obtained fortnightly from deflection observations performed on the instruments with the deflector magnet at distances of 100 cms. and 120 cms. in the case of the H. F. instrument and at distances of 122.6 cms. and 148.6 cms. in the case of the V. F. instrument. The value of the scale coefficient adopted for any month is the average of the mean observed value for that month and those of the preceding and succeeding months.

The scale coefficient of the declination magnetograph has been determined once for all and is 1.03 per mm.

(b) *La Cour variometers*—The scale coefficients of the H. F. and V. F. magnetographs are obtained once every month by placing a Helmholtz coil over the instruments and noting the deflections when known currents are passed through the coil. The coil constant as given by the manufacturers is 7.49 γ /milliamp.

The scale coefficient of the declination magnetograph has been determined once for all and is 0.9/mm. The adopted scale coefficients of the H. F. and V. F. magnetographs for the first half of 1952 are 80.0 γ /cm. and 110.0 γ /cm. respectively.

Temperature coefficients of the magnetographs

(a) *Watson magnetographs*—The adopted value for the H. F. magnetograph is 32 γ /°F. The temperature coefficient of the V. F. magnetograph was found to be negligible.

(b) *La Cour magnetographs*—Temperature compensation has been incorporated in the design of these instruments.

Base line values

(a) Base line values for H. F. magnetograms are derived by converting the mean ordinates corresponding to absolute observation with Kew Magnetometer No. 3 in terms of gammas and subtracting these converted ordinates from the mean observed horizontal force. The values derived from the Watson instruments are further reduced to a uniform temperature of 65°F to make the series comparable from month to month and year to year.

The adopted base line value for any week is the mean of five values (all reduced to 65°F in the case of the Watson instrument) including the week in question as the third among the five. In the case of the Watson instrument the base line values for the individual days of the week were determined after applying necessary temperature correction. The accuracy of the base line value derived from the above procedure is estimated to be $\pm 10\%$.

(b) The base line values for the V. F. magnetograms are derived by expressing the mean ordinates of the V. F. magnetograms at the times of inclination observations in terms of gammas and subtracting these from the values of vertical force obtained by multiplying the values of H. F. at that time by the tangent of the inclination.

(c) The base line values for 'D' were derived by the usual procedure of converting the ordinates corresponding to absolute observations with Kew Magnetometer No. 3 into angles and adding these to the corresponding observed absolute declination values.

Basic hourly values and associated means

Basic results—Tables 1 to 18 contain hourly values of magnetic declination, horizontal intensity and vertical intensity. The hourly values from the magnetograms represent the average values during one hour, centred at the full hours of U. T.

The columns headed 'maximum' and 'minimum' give the momentary extreme values of the element for each day.

Computed means—At the bottom of each table are given the average hourly values obtained (i) for all days, (ii) for five international quiet days, and (iii) for five international disturbed days.

Principal magnetic storms

Magnetically a day is considered to be (a) a quiet day, (b) a day of slight disturbance, (c) a day of moderate disturbance, (d) a day of moderate storm, and (e) a day of great storm, depending on the ranges and the oscillations in the magnetograms. At Kodaikanal, a day is provisionally being taken as (i) one of great storm if the range in H is above 400 γ , (ii) of moderate storm if the range is between 251 γ and 400 γ , and (iii) of moderate disturbance if the range lies between 150 γ and 250 γ . The range is, however, not the only criterion used in assigning the character of a storm.

Table 19 gives a list of principal magnetic storms recorded during the first half of 1952.

KODAIKANAL }
November 1953. }

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TABLE I

Hourly Values of Declination (Westerly), 1952

(Averages for sixty minutes centred at the full hours of Greenwich Mean Time)

January

2° plus tabular quantities

Date	Hours G. M. T.														
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	35 3	36 1	36.7	36 3	36 2	36 0	35 9	36 1	35 9	35 7	35 3	34 5	34 6	34 9	34 9
2	35 8	35 7	35 8	35 8	35 7	35 6	35 8	36 2	36 2	36 0	35 6	35 3	35 2	35.2	35.2
3	35 7	36 0	36 2	35 7	35 4	35 3	35 7	36 0	35 9	35 9	35 6	35 3	35 8	35 1	35 1
4	35 9	35 8	35 8	35 6	34 8	35 0	35 3	36 0	35 5	35 3	35 6	35 1	35 0	35 1	35 0
5†	36 1	36 2	36 0	35 9	35 0	34 8	34 7	34 9	35 1	34 7	34 8	34 7	34 6	34 8	35 3
6	35 8	35 8	35 8	35.7	35 8	35 3	35 5	35 6	35 5	35 1	34 9	34.7	34 4	34 3	34.1
7	35 7	35 8	35 8	35.6	35.1	35 2	35 3	35 6	36 1	36 3	36 1	35 7	35 5	35 1	34 8
8	35 8	35 9	35 9	35 6	34 5	34 5	34 4	34.3	31 6	34 7	34 7	34 6	34 6	34 7	34 9
9	36 1	36 1	36 2	35 9	35 9	36 2	36 3	36 3	36 1	36 3	36 3	36 4	36.2	35 7	35.6
10	35 7	35 8	36 2	36 2	35 9	35 4	35 0	35 3	35 5	35 9	35 8	35 4	35 1	35 2	35.2
11	35 6	35 4	35 5	35.3	35 4	35 5	36 1	35 4	36 1	36 9	36 7	36 4	35 6	35.5	35.4
12	35 9	36 1	36 3	35 7	35 7	35 5	35 6	35 4	35 8	35 1	35 6	35 5	35 6	35 5	35 4
13‡	35 7	35 6	35 6	35.8	35 7	35 8	35 7	35 8	35 4	35 7	35 4	35 5	35.4	35 5	35 3
14†	35 6	35 7	35 5	35.1	35 1	35 1	35 5	35 3	35 0	34.8	34.6	34.6	35.1	35.1	35 3
15	35 6	35 8	36 0	36.1	36.4	36 1	36 3	36 7	36 9	36 4	36 3	35.7	35 4	35 3	35.4
16	35 6	35 8	35 8	35 5	34 6	35 0	35 6	35 4	34 8	34 6	34 6	34.5	34.1	35 4	35 3
17	35 5	35 7	35 8	35 5	34 7	34 7	35 5	36.1	36.2	35 8	35 5	35 4	35 4	35 4	35 4
18†	35 6	35 7	35 6	35 5	35 5	35 4	35 6	36 1	35 8	35 1	35 5	35.5	35 5	35 4	35 5
19†	35 7	35 8	35 8	35 8	35 6	35 5	35 4	35 5	35 6	36 0	35 8	35 5	35 4	35 4	35 5
20†	35 6	35 9	36 1	35 9	35.6	35 5	35 5	35 5	35 2	35 4	35.5	35 5	35 5	35.5	35 5
21†	35 6	35 7	36 0	35 4	35 1	34 9	35 4	36.0	36 5	36.2	35 7	35 5	35.5	35 5	35 4
22	35 9	36 2	36 4	35 9	35 1	35 1	35 6	36 2	36 5	36.1	35 8	35 5	35 4	35 5	35 5
23	35.4	35 5	35 7	35 9	35.9	35 5	35 9	36 2	35 9	35.5	35 5	35.5	35.4	35 3	35.2
24	36 1	35 9	36 0	35 8	35 6	35 9	36 1	36 4	37 0	37 3	36 9	36 1	35 6	35.5	35.5
25	35 8	35.7	35 4	35 2	35 8	36 1	36 3	36 8	37.2	36.8	36.5	36 1	35 4	35.4	35.4
26†	36 1	36 2	36.3	36 1	35 6	35 4	35 9	36 0	36 0	35 6	35 4	35 1	35 3	35.4	35.4
27†	36 3	36 7	36 9	36 6	36 6	36 2	36 0	35 6	35 5	35 4	35.3	35 5	35 6	35 3	35.4
28	35 1	35 3	35.1	35 3	35 2	35 1	35 3	35 4	35.1	35 2	35 3	35 5	35 4	35 4	35.5
29†	35 5	35 5	35 6	35 8	36 0	35 9	36 0	35 8	35 4	35.3	34 7	34 7	34 6	34 6	34 8
30	35 6	35 8	36 1	36 1	35 8	35 6	35 4	35 4	35 5	35.4	35 4	35 4	35 2	35 3	35.4
31	35 7	35 7	35 8	35 8	35 6	35 6	35 6	35.8	36 1	36 0	35 8	35 5	35 3	35.4	35.4
Mean .	35 9	35 8	35 9	35 8	35 5	35 3	35 6	35 8	35 8	35 7	35 6	35 4	35 3	35 2	35.3
Mean† .	35 7	35 9	36 0	35 7	35 5	35 3	35 6	35.8	35 8	35.7	35.6	35.5	35 4	35.4	35 5
Mean‡	35 8	35 9	35 9	35.8	35 7	35 6	35 6	35 5	35.3	35 2	35 0	35 0	35 1	35.1	35.2

* Loss of record (Day omitted for means)

† Five international quiet days

‡ Five international disturbed days.

TABLE I

Hourly Values of Declination (Westerly), 1952

(Averages for sixty minutes centred at the full hours of Greenwich Mean Time)

January

2° plus tabular quantities

Hours G. M. T.									Mean	Maximum		Minimum		Range	Date
15	16	17	18	19	20	21	22	23		Time	Mag	Time	Mag		
									H M		H. M				
'	'	'	'	'	'	'	'	'	'						
35 0	35 1	35 2	35 2	35 3	35 4	35 4	35 5	35 6	35 0	02 00	37.0	11 42	34.2	2.8	1
35 2	35 2	35 2	35 4	35 4	35 4	35 6	35 5	35 6	35 3	07 50	36.7	11 50	34.7	2.0	2
35 0	35 1	36 0	35 3	35 4	35 6	35 7	35.8	35 9	35 6	01 54	36.5	11 10	34.4	2.1	3
35 0	35 0	35 1	35 1	35 3	35 6	35 9	36 1	36 0	35 4	07 10	37.4	14 30	34.4	3.0	4
35 5	35 5	35 7	35 9	36 0	36 1	36 1	36 6	35 7	35.4	22 22	37.1	14 22	33.9	3.2	5†
34 1	34 1	34 2	34 2	34 1	34 1	31 9	35 1	35 3	35 0	06 24	35.9	17 42	34 0	1.9	6
34.5	34 6	31 8	34 9	35 1	35 1	35 3	35 6	35 7	35 4	08 42	37.1	11 22	34 1	3.0	7
35 2	35 5	35 5	35 5	35 6	35 6	35.6	35 7	35.9	35 2	01 50	36.4	06 46	34 2	2.2	8
35 5	35 5	35 5	35 4	35.5	35 5	35 7	35 9	35 6	35 9	08 10	36.9	16 42	35 1	1.8	9
35 3	35 1	35.1	34 8	35 3	35 5	35 4	35 7	35 8	35 5	01 42	36.5	05 12	34 4	2.1	10
35 3	35 4	35.5	35 5	35.6	35.6	35.6	35 9	35 7	35 7	09 02	38.2	14 06	34 9	3.3	11
35 5	35 4	35 4	35 5	35.6	35 5	35.5	35 5	35 9	35 6	02 10	36.5	11 10	34.3	2.2	12
35 5	35 5	35 5	35 4	35 3	35 4	35 5	35.5	35.4	35.5	00 10	36.6	14 10	34 7	1.9	13†
35 1	35 2	35.1	35 3	35 5	35 5	35 5	35 6	35 7	35 2	02 28	36.2	10 52	34 2	2.0	14†
35 0	34.9	34 7	35 0	35 2	34 8	34 9	34 9	35 3	35 6	07 40	37 0	14 48	33 6	3.4	15
35 3	35.4	35 4	35 3	35 3	35.3	35.4	35 3	35 4	35 2	01 42	36.5	09 42	34.3	2.2	16
35.4	35 3	35 4	35 3	35.5	35 5	35 5	35.5	35 5	35 5	07 42	36.8	04 42	34.5	2.3	17
35.5	35 5	35 5	35 5	35.5	35 5	35 6	35 6	35 6	35 6	06 54	36.2	09 20	35 1	1.1	18†
35 4	35 5	35 5	35 5	35 5	35 5	35 5	35.5	35 6	35 6	08 30	36.3	06 10	35 2	1.2	19†
35.5	35 5	35.5	35.5	35 5	35.5	35 5	35 6	35 6	35 6	02 00	36.7	07 54	35 1	1.6	20†
35.5	35.5	35.5	35.5	35.5	35 5	35 5	35 5	35 5	35 7	07 54	37.1	04 54	34.7	2.4	21†
35 5	35 3	35.2	35.1	35 0	34.9	35.1	35 2	35 2	35.5	09 30	37 0	05 30	34 7	2.3	22
35.0	35 2	35 1	35 1	35.0	35 3	35 5	35.7	36 1	35.5	07 00	37.3	17 30	34 3	3.0	23
35 4	35 6	35.2	35 4	35 5	35.5	35.5	35 6	35 9	35 9	07 54	37.7	16 10	34.6	3.1	24
35 4	35 4	35.4	35.4	35.4	35.5	35 5	35 5	36.0	35 7	08 14	37.9	14 22	35 0	2.9	25
35.4	35 4	35 5	35 5	35.5	35.8	36.1	36.2	36.2	35 7	01 44	36.4	12 00	34 6	1.8	26†
35.2	35 5	35 1	35.0	35 0	34.9	34 9	35 1	35 0	35.6	01 40	37 0	14 34	34.4	2.6	27†
35 5	35.5	35 6	35 5	35.4	35 4	35.4	35 4	35 5	35 3	17 00	35.9	08 10	34.8	1.1	28
35.2	34 8	35 1	34 9	35 2	34 8	35 3	35 3	35.4	35 3	06 30	36.2	11 22	34 5	1.7	29†
35 4	35 4	35.4	35 1	35.4	35 4	35.4	35.5	35 6	35 5	02 42	36.7	12 00	34.8	1.9	30
35 4	35 4	35.4	35 4	35 5	35.5	35 5	35.5	35 7	35 6	08 18	36.2	12 30	34.7	1.5	31
35.2	35.3	35 3	35 3	35 4	35.4	35 5	35 6	35 6	35 5					2.2	Mean
35.5	35 5	35.5	35.5	35 5	35.6	35.6	35.7	35.7							Mean†
35 3	35.3	35.3	35 3	35 4	35.3	35.5	35.6	35 4							Mean‡

* Loss of record. (Day omitted for means)

† Five international quiet days

‡ Five international disturbed days.

TABLE 2

Hourly Values of Declination (Westerly), 1952

(Averages for sixty minutes centred at the full hours of Greenwich Mean Time)

February

2° plus tabular quantities

Date	Hours G. M. T.														
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
1	35 7	35.7	35 7	35 8	34 9	35 4	34.9	36 0	35 8	35 4	35 1	34 6	34 7	35.1	35 2
2	35 7	35 7	35 8	35 5	35 4	35 4	35 4	35 4	35 3	35 4	34 9	35 6	34 8	35.1	35 1
3†	35 4	35 4	35 5	35 4	35 3	35 3	35 5	36.0	36 3	36 3	36 0	35 4	35 3	35 4	35 4
4†	35 6	35 5	35 6	35 6	35 5	35.3	35 5	35 9	35 8	35 5	35 3	35 4	35 4	35 4	35 4
5†	35 9	36 0	36 1	36 0	35.9	36.1	36 3	36 2	36 0	35 8	35 6	35 5	35.4	35 4	35 4
6‡	36 2	36 2	36 2	35 9	35.7	35 5	35 5	35 8	35 3	35 5	35 7	36 0	35 8	35 5	35 5
7	35 3	35 1	35 4	35 3	35 2	35 4	35 6	35 6	35 8	36 0	35 8	35 4	35 4	35 4	35.3
8‡	35 1	35.0	35 2	35 0	34 6	34 4	34.5	34 9	35 0	34 7	34 1	34 1	34 2	34 3	31 4
9	35 4	35 6	35 9	35 6	35 5	35 4	36 0	36 0	35.8	35.3	35.4	35 5	35 4	35 4	35 4
10	35 4	35 5	35 9	35 8	35 6	35 7	35 9	36 0	35 1	35.3	34.9	34 8	35 2	34 9	35 0
11	35 4	34 8	36 0	35 6	35 4	35 1	35 0	35 0	35 0	35 0	34 7	34 6	34 6	35.0	35 3
12	35 3	35 4	36 0	35 8	35 3	35 1	35 3	35.0	35 0	34.8	34 8	34 9	34 6	35 1	35 2
13	35 2	35 5	35 8	36 0	35.7	35 5	35 4	35.4	35 5	35.4	35 4	35 3	35 4	35 4	35 4
14	35 1	35.6	35 9	35 6	35 2	35 1	35 3	35.4	35.0	34 5	34.4	34.9	35.3	35 4	35 4
15	35 3	35 4	35 6	35 6	35 5	35.5	35 4	35 3	34 7	34.5	34 5	35 1	35 4	35 3	35.3
16‡	35 4	35 5	35 6	35 5	35 4	35 3	35 0	34 9	34 0	33 5	33 4	33 7	34 5	34 4	33.7
17	35 4	35 3	35 5	35.7	35 6	35 5	35.4	35 4	35 4	35 3	35 2	35.1	35 3	35 6	34 7
18	35 4	35.3	35.4	35 5	35 8	35 8	35 9	35 6	35.3	35 1	34.7	34 4	34.5	34.7	34 5
19	35 0	35 1	35 5	35 1	35 4	35 5	35 5	35 4	35.2	35 0	34.6	34 4	34 4	34 3	34 5
20	34 7	34 7	34 6	34 5	34.5	34 5	34 3	34.2	34 1	33 9	34.1	34.1	34.5	34 5	34.3
21†	35 2	35 2	35 1	34 7	34 8	34 9	35 1	35.1	35.2	35 0	35 0	35 4	35 5	35 5	35.5
22†	35 4	35.2	35 0	35 1	35 2	35 3	35 4	35 5	35.1	34 6	34 1	34 1	34 6	34 6	34 6
23	35 4	35 5	35 5	35 6	35 8	35 9	36.1	35 6	35.1	34 6	34 5	34.6	35.1	35 4	35.4
24†	35.3	35 0	34 5	34 7	35.1	35 0	35.1	31 9	34 6	34.4	33.7	33 7	33 7	33 6	33 8
25	34.5	34.6	35 2	35 7	35 9	36 1	36 0	35 8	35.4	35 0	34.7	34 9	35.4	35 0	35.2
26	35 4	35 3	35 6	36 1	36 4	36 4	36.1	35.5	35.3	34.8	34 6	34 7	35 4	35 4	35 5
27†	35 1	35 4	35 8	36 0	35 8	35 5	35 2	34 5	34.1	33 8	33.8	33 7	34 8	35.1	34 8
28	36 4	36 4	36 8	36 8	35 9	35 7	35 3	35 0	34 8	34.3	34 6	34 5	34.6	34 6	34 3
29	35 5	35 6	35 6	35.3	35 5	35 7	35 5	35 0	34.5	33 9	33.9	33 8	33 7	33 8	34.3
Mean	35 4	35 4	35 6	35 5	35 4	35 4	35 4	35.4	35.2	34 9	34 7	34 8	34 9	35 0	35 0
Mean†	35 5	35 5	35 5	35 4	35 3	35 4	35 6	35.7	35 7	35.4	35.2	35.2	35.2	35.3	35.3
Mean‡	35 4	35.4	35.7	35 4	35.2	35.1	35 1	35 0	34 6	34.4	34.1	34.2	34 6	34 6	34.5

* Loss of record. (Day omitted for means)

† Five international quiet days.

‡ Five international disturbed days.

TABLE 2

Hourly Values of Declination (Westerly), 1952

(Averages for sixty minutes centred at the full hours of Greenwich Mean Time)

February

2° plus tabular quantities

Hours G M T									Mean	Maximum		Minimum		Range	Date
15	16	17	18	19	20	21	22	23		Time	Mag	Time	Mag		
										H. M	'	H M	'		
35 3	35 4	35 4	35 5	35 1	35 4	35 5	35 5	35 6	35 4	06 00	36 3	12 00	34 4	1 9	1
35 0	35 0	35 0	35 3	35 4	35 4	35 4	35 4	35 1	35 3	01 00	36 2	10 42	34 4	1 8	2
35 4	35 4	35 4	35 4	35 4	35 4	35 6	35 6	35 8	35 6	09 12	36 1	12 28	34 8	1 6	3†
35 4	35 5	35 5	35 5	35 5	35 6	35 6	35 7	35 8	35 5	06 45	36 2	12 22	35 0	1 2	4†
35 4	35 4	35 4	35 1	35 5	35 5	35 8	35 8	36 1	35 7	06 10	36 4	12 11	35 2	1 2	5†
35 5	35 5	35 0	35 2	35 0	35 3	35 1	35 0	35 0	35 5	01 46	36 4	17 20	31 6	1 8	6‡
35 4	35 4	35 3	35 3	35 1	35 1	35 1	35 4	35 1	35 4	09 14	36 1	19 06	31 5	1 9	7
34 1	34 4	34 1	34 4	34 3	34 6	34 3	34 5	31 4	31 5	08 40	36 1	10 46	33 9	2 2	8‡
34 9	34 9	35 1	35 3	35 3	35 2	35 2	35 3	35 1	35 4	06 50	36 4	09 18	34 6	1 8	9
35 2	35 1	35 2	35 0	35 0	34 9	34 9	35 2	35 4	35 3	06 51	36 4	20 42	34 1	2 3	10
35 4	35 3	35 3	35 3	35 0	35 0	35 0	35 1	31 7	35 1	02 00	36 2	11 21	31 4	1 8	11
35 3	35 4	35 4	35 3	35 3	35 1	35 3	35 4	35 5	35 2	00 10	36 2	12 10	34 5	1 7	12
35 4	35 3	35 4	35 2	35 3	35 1	35 1	35 1	35 1	35 1	03 00	36 2	20 22	34 6	1 6	13
35 4	35 1	35 4	35 3	35 1	35 3	35 3	35 4	35 3	35 3	02 30	36 1	09 42	31 2	1 9	14
35 4	35 3	35 2	35 1	35 0	35 0	35 2	35 3	35 2	35 2	02 30	36 0	09 40	34 4	1 6	15
31 2	34 4	34 1	34 1	31 5	31 5	34 7	34 7	35 0	31 6	01 34	36 0	10 10	33 0	3 0	16‡
34 6	34 6	34 6	31 7	34 8	34 8	31 9	35 0	35 3	35 2	02 10	35 9	14 48	34 4	1 5	17
34 6	34 6	34 6	34 7	31 6	31 8	34 9	35 0	35 0	35 0	05 40	36 1	10 54	34 2	1 9	18
34 7	34 8	34 7	34 9	34 8	35 0	35 1	34 9	34 8	31 9	07 11	35 9	12 46	33 8	2 1	19
34 6	34 6	31 6	34 6	34 6	34 7	31 8	35 0	35 1	34 5	23 50	35 2	09 12	33 6	1 6	20
35 5	35 5	35 4	35 4	35 5	35 7	35 5	35 1	35 1	35 3	16 30	35 6	09 48	31 5	.9	21†
34 7	34 8	34 9	34 9	35 0	35 2	35 3	35 4	35 4	35 0	07 22	35 7	10 52	33 8	1 9	22†
35 4	35 4	35 5	35 5	35 5	35 5	35 5	35 6	35 7	35 4	06 06	36 3	10 06	34 3	2 0	23
34 3	34 6	34 6	34 3	34 5	34 5	34 4	34 3	34 3	34 5	00 02	35 5	12 56	33 0	2 5	24‡
35 5	35 5	35 5	35 5	34 4	34 3	35 3	35 4	35 5	35 3	04 42	36 3	19 22	34 1	2 1	25
35 5	35 1	35 0	31 9	34 6	34 6	34 6	34 7	34 9	35 3	05 31	36 8	09 40	34 5	2 3	26
35 4	35 2	35 1	35 3	35 2	35 3	35 5	35 6	35 9	35 1	02 26	37 0	09 36	33 5	3 5	27‡
34 5	34 6	34 6	34 8	34 8	34 9	35 0	35 2	35 4	35 2	01 58	37 0	09 26	33 8	3 2	28
34 4	34 6	34 6	34 6	31 6	34 6	34 8	34 9	35 1	34 7	05 06	35 9	11 58	33 5	2 4	29
35 0	35 1	35 1	35 1	35 0	35 1	35 1	35 2	35 3	35 2					2 0	Mean
35 3	35 3	35 3	35 3	35 4	35 4	35 6	35 7	35 7							Mean†
34 7	34 8	34 7	34 7	34 7	34 8	34 8	34 8	34 9							Mean‡

* Loss of record. (Day omitted for means.)

† Five international quiet days.

‡ Five international disturbed days.

TABLE 3

Hourly Values of Declination (Westerly), 1952

(Averages for sixty minutes centred at the full hours of Greenwich Mean Time)

March

2° plus tabular quantities

Date	Hours G. M. T.														
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
1	35 3	35 5	35 5	35 5	35 5	35 5	35.5	35 4	35.1	34 1	34 1	34 4	34 6	34 6	34 6
2†	35 5	35 5	35 5	35 4	35 4	35 4	35 3	35 3	35 2	35 1	34 6	34 5	35 1	35 3	35 3
3	35 5	35 4	35 4	35 5	35 1	35 2	35 1	35 1	35 4	35 6	35 5	35 1	35 7	35 7	34 7
4‡	34.1	34 1	33 9	34 1	34 6	34 8	34 7	35 1	31 7	34 5	34 1	33 8	33 7	34 1	34.6
5‡	34 6	34 5	35.0	35 3	35 1	35 4	35 7	35 7	35 5	35 7	34 4	33 7	34 5	34 1	34 3
6‡	34 8	34 5	34 5	34 7	35 3	35 3	35 3	35 5	35 7	35 5	35 4	35 0	35 2	35.4	35.5
7‡	34 5	34 4	34 5	34 7	35 0	35 7	35 7	35 4	35 2	35 1	34 7	34 2	34 7	34 9	35.0
8	35 6	35 5	35 6	35 8	35 4	35 2	35 1	35 1	35 1	31 7	34 4	33 8	34 5	34 3	34 5
9	34 8	35 2	34 9	34 8	35 1	35 9	37 2	36 9	36 0	35 5	35 0	34 5	34 5	34 6	34 6
10	35 1	34 9	34 8	34 8	34 7	35 2	35 5	35 4	35 9	35 6	35 4	35 4	35 2	35 3	35 2
11	34.9	34.7	34 6	34.8	35 4	35 9	36 4	35 5	35 9	35 2	34.8	34 6	35 1	34.8	34 7
12	35 1	35 0	34 8	34 9	35 3	35 9	36 3	36 2	35 9	35 5	35 4	35 5	35 5	35.5	35 2
13	35 1	34 9	34 7	34 6	34 6	35 0	35 4	35 4	35 5	35 6	35 4	35 4	35 2	35.0	31 8
14†	34 7	34 6	34 6	34 6	34 7	35 0	35 4	35 7	35 5	35 3	34 6	31 5	34 6	31 7	35.1
15	35 0	34 8	34 6	34 4	34 5	34 8	35 4	34 7	35 5	35 4	35 2	34 8	34 8	35.2	35 1
16	34 8	34.9	34 7	34 8	35 4	35.7	35 9	35 7	35 2	35 0	34 6	34 5	34.6	34 8	35.1
17	35 5	35 4	35 1	34 7	34 6	34 5	34 4	35 0	35 1	35 0	34 6	34 2	34 6	34.3	34.6
18	34 9	34 8	34 6	34 8	35 1	35 5	35 9	36 1	35 9	35 7	35 2	34 8	35 1	35.0	35 2
19†	35 3	35 2	35 1	34 8	34 4	34 6	34 9	34.8	36 1	35 9	35 5	35.4	35 4	35 4	35 3
20†	35 4	35 3	35 0	34 8	34 9	35 4	35 9	36 1	36 1	35 8	35 6	35 3	35 5	35 4	35.3
21	35 4	35 3	35 0	34 7	34 8	35 4	35 9	36 0	35 8	35 1	34 6	34 5	34.7	34 8	35.1
22	35 2	35 3	34 6	34 7	34 6	34 8	35 5	35 7	35 5	34 9	34 9	34 8	35.1	35 1	35 1
23	34 7	34 6	34 5	34 4	34 5	35.1	35 5	36 0	35 7	35 5	35 4	35 2	35 2	35 1	35.4
24	35 1	35.2	35.1	34 7	34 5	34 5	34 6	34 8	35 2	34 8	34 7	34.3	34 5	34 6	34 3
25	34 7	34 6	34 5	34 2	34 4	34 7	35 0	35 3	35 7	35 2	34 6	34 5	34.3	34 5	34.6
26	34 8	34 7	34 5	34 5	35.0	35 3	35 8	36 1	36 0	35 6	35 4	35 3	35 3	35 1	35.3
27	35 2	35.1	34 7	34 5	34 5	31 5	34 9	35 4	35 3	35 0	34 9	34 5	31 4	34 4	34 5
28†	35 3	35 4	35 4	35 4	35 3	35 5	35 8	36 1	36 0	35 8	35 2	34 7	34 6	34 6	34 8
29	35 0	35 2	35 0	34 9	35 2	35 0	35 0	35 5	35 5	35 4	35.1	35 0	35 3	35 5	35.5
30	35 3	35 2	34.8	34 7	34 5	34 7	35 4	36 1	36 2	35 8	35 4	35 4	35.5	35 4	35 1
31‡	34.0	33 7	34.2	34 3	34 6	34 7	35 1	35 4	35 0	34 4	34 0	34 2	34.5	34.5	35 0
Mean	35 0	34.9	34 8	34 8	34 9	35 2	35 5	35 6	35 6	35 3	34 9	34 7	34 9	34.9	34.9
Mean†	35 2	35 2	35 0	35 0	34 9	35 2	35 5	35 6	35.8	35.6	35.1	34 9	35.0	35.1	35 2
Mean‡	34 4	34 2	34 4	34 6	34 9	35 2	35.3	35 4	35 2	35 0	34 5	34 2	34.5	34 6	34 9

* Loss of record. (Day omitted for means)

† Five international quiet days

‡ Five international disturbed days.

TABLE 3

Hourly Values of Declination (Westerly), 1952

(Averages for sixty minutes centred at the full hours of Greenwich Mean Time)

March

2° plus tabular quantities.

Hours G. M. T.									Mean	Maximum		Minimum		Range	Date
15	16	17	18	19	20	21	22	23		Time	Mag.	Time	Mag.		
									H. M.		H. M.				
34.8	34.7	34.9	35.0	34.9	35.0	35.1	35.1	35.4	35.0	02 05	35.7	09 40	33.7	2.0	1
35.3	35.3	35.3	35.3	35.3	35.3	35.3	35.4	35.4	35.3	06 00	35.9	10 26	34.4	1.5	2†
34.1	34.5	34.5	34.6	34.3	34.1	34.3	34.1	34.1	34.9	08 44	35.8	13 22	33.7	2.1	3
34.7	34.7	34.8	34.6	34.5	34.6	34.6	34.4	34.4	34.4	05 07	35.5	12 02	33.4	2.1	4‡
34.1	33.9	33.9	33.9	34.4	31.4	34.3	34.5	35.0	34.7	07 30	36.3	17 00	33.0	3.3	5‡
35.4	35.4	35.1	35.0	35.0	34.7	34.4	34.7	34.6	35.1	08 14	36.2	20 54	34.1	2.1	6‡
35.0	35.1	35.1	35.2	35.0	35.1	35.2	35.2	35.3	35.0	05 50	36.0	11 10	34.1	1.9	7‡
34.6	34.8	34.7	34.9	31.9	31.9	34.8	35.1	35.1	34.9	05 52	35.9	10 54	33.4	2.5	8
34.7	34.6	34.7	34.7	35.0	35.2	35.2	35.1	34.8	35.1	06 35	37.3	11 30	34.0	3.3	9
35.2	34.9	35.4	35.2	34.9	34.9	35.0	34.8	35.0	35.1	08 30	36.2	14 54	34.6	1.6	10
34.7	34.8	34.7	34.8	34.7	34.7	34.6	34.7	35.1	35.0	06 40	36.6	10 54	34.3	2.3	11
35.1	34.9	34.8	34.8	31.8	34.8	34.8	31.8	35.1	35.2	06 52	36.5	19 22	34.6	1.9	12
34.8	34.7	34.7	34.7	34.6	34.6	34.6	34.6	34.6	34.9	08 40	36.0	13 50	34.4	1.6	13
35.1	34.9	35.0	34.8	34.7	34.7	34.8	34.8	35.1	34.9	07 00	36.1	10 42	34.3	1.8	14†
35.2	35.2	34.7	34.6	34.6	34.6	34.8	35.1	35.0	31.9	06 42	36.2	03 22	34.0	2.2	15
35.1	34.6	34.8	35.1	35.1	35.1	35.1	35.2	35.5	35.1	05 54	36.5	10 42	34.3	2.2	16
34.6	34.6	35.1	34.9	34.8	34.8	35.0	35.0	35.1	34.8	08 36	35.6	11 10	33.9	1.7	17
35.1	34.8	35.1	35.2	35.2	35.2	35.3	35.3	35.4	35.2	08 34	36.2	10 46	34.5	1.7	18
34.8	34.7	34.8	34.8	34.9	34.9	34.8	35.0	35.4	35.1	08 30	36.3	09 06	34.1	2.2	19†
35.3	35.3	35.3	35.3	35.3	35.2	35.2	35.2	35.4	35.4	08 18	36.5	10 50	34.7	1.8	20‡
34.6	34.8	34.8	34.8	34.8	34.9	35.0	34.7	34.8	35.0	06 34	36.5	09 50	34.1	2.4	21
35.1	35.1	35.1	35.1	35.1	35.1	34.9	35.2	34.6	35.0	06 58	36.0	11 02	34.5	1.5	22
35.4	35.5	35.4	35.5	35.1	34.8	35.0	35.0	35.3	35.1	07 34	36.4	03 10	34.2	2.2	23
34.5	34.5	34.6	34.6	31.6	34.6	34.8	35.0	35.7	34.7	07 54	35.9	11 24	33.8	2.1	24
31.6	34.5	34.5	34.5	34.6	34.6	34.7	35.0	34.7	34.7	07 50	36.0	11 54	34.0	2.0	25
35.4	35.4	35.1	35.0	35.0	35.3	35.1	35.2	35.2	35.2	07 30	36.2	11 30	34.5	1.7	26
34.6	35.0	34.8	34.7	34.9	35.8	35.0	35.0	35.3	34.9	07 40	35.8	10 54	34.2	1.6	27
35.0	35.0	35.0	34.8	34.7	34.7	31.8	34.9	35.0	35.2	07 06	36.5	11 10	34.5	2.0	28†
35.4	35.4	35.4	35.4	35.4	35.4	35.4	35.4	35.4	35.3	08 34	35.9	10 50	34.6	1.3	29
34.8	34.6	34.9	35.0	34.6	34.5	34.5	33.9	34.4	35.0	08 26	36.3	21 50	33.6	2.7	30
34.8	34.8	34.4	34.4	31.5	34.5	34.5	34.4	34.1	34.5	07 30	35.9	01 10	33.6	2.3	31‡
34.9	34.9	34.9	34.9	34.9	34.9	34.9	34.9	35.0	35.0					2.1	Mean
35.2	35.0	35.1	35.0	35.0	35.0	35.0	35.1	35.3							Mean†
34.9	34.8	34.7	34.6	34.7	34.7	34.6	34.6	34.7							Mean‡

* Loss of record. (Day omitted for means.)

† Five international quiet days.

‡ Five international disturbed days.

