Kodaikanal Observatory

BULLETIN No. CXXIV.

SUMMARY ON PROMINENCE OBSERVATIONS FOR THE YEAR 1945.

PART I.

Summary of Prominence Observations for the First Half of the Year 1945.

As in the previous bulletins, the summary given in this bulletin is based on the data computed from Kodaikanal observations supplemented by these derived from the photographs obtained from the co-operating observatories of Mount Wilson and Meudon for the days on which incomplete or no photographs could be obtained at Kodaikanal.

Calcium Prominences on the limb.—K- Prominence photographs were taken at Kodaikanal 163 days and photographs for 19 days were obtained from Mount Wilson making the data available for 176 days which were counted as 137 effective days after giving weightage to photographs according to their quality. The mean daily areas (in square minutes of arc) and the mean daily numbers computed from these photographs are given below. The data from Kodaikanal records only are also given for comparison, with bulletins issued before 1923 *i.e.* before the co-operation of other observatories came into force.

	Combined data		Kodaikanal data only	
	Mean daily areas	Mean daily numbers	Mean daily areas	Mean daily numbers
North	1·35	4·56	1·36	4·68
South	1·35	4·45	1·25	4·39
Total	2·70	9·01	2·61	9·07

Compared with the figures for the last half year, the areas show a decrease of 4 per cent and the numbers an increase of 23 per cent.

The distribution of the areas and numbers in latitude is illustrated in the following diagram where the thick line represents the areas and the broken line the numbers. The ordinate represents tenths of square minutes of arc for the full line and numbers for the broken line. The curve shows well-marked peaks of activity, in the zones 45° to 50 north and 50° to 55° south indicating a shift of the activity towards the poles by 5° as compared with the curves for the previous half year.

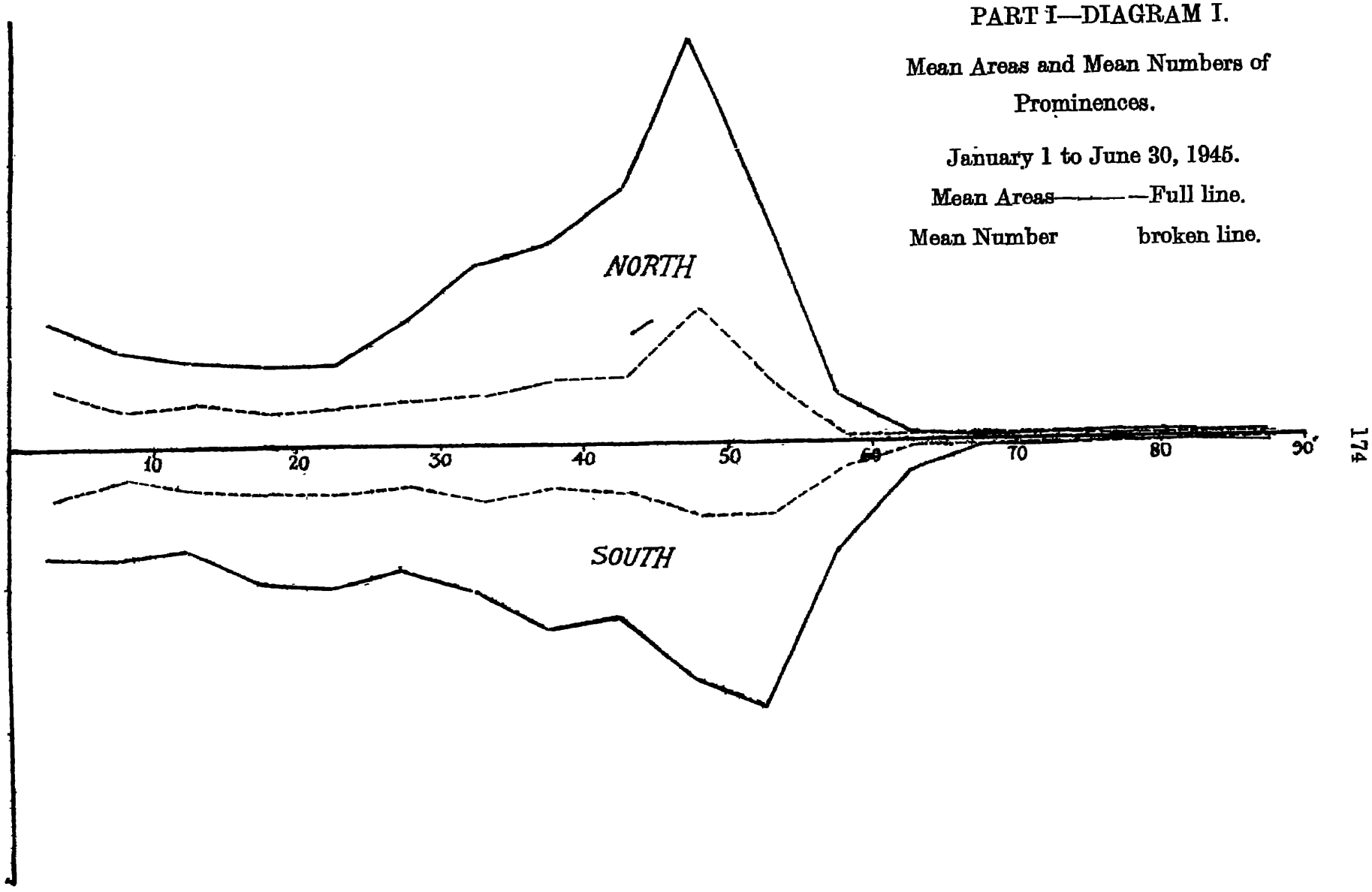
PART I—DIAGRAM I.

Mean Areas and Mean Numbers of Prominences.

January 1 to June 30, 1945.

Mean Areas———Full line.

Mean Number broken line.



The monthly, quarterly and half-yearly means of areas, numbers, hights and bases of prominences are given in table I.

TABLE I.

Months	Number of days (effective).	Areas (sq. mts.)	Numbers.	Daily means.		Mean height.	Mean. extent
				Areas. (sq. mts.)	Numbers.		
						″	°
January	23½	70·15	175	3·02	7·53	61·67	7·86
February	19	47·05	160	2·48	8·42	50·62	5·62
March	24½	64·35	249	2·60	10·06	47·34	6·21
April	22½	59·45	191	2·67	8·58	44·16	7·25
May	23½	55·75	227	2·35	9·56	39·76	5. 39
June	24	73·15	233	3·05	9·71	48·56	7·06
1st Qr.	67	181·55	584	2·71	8·72	53·21	6·60
2nd Qr.	70	188·35	651	2·69	9·30	44·16	6·53
First Half year	137	369·9	1235	2·70	9·01	48·69	6·56

Both areas and numbers shown an eastern defect as is seen from the following table :—

	East.	West.	Percentage East.
Total areas (sq. minutes)	183·5	186.5	49·65
Total numbers	583	652	47·22

Among the prominences photographed, special mention may be made of the following : (*i*) a long filament type prominence of height 4′ and of base only 1° photographed on the east limb of the sun on February 13, 1945, (*ii*) a large prominence of base extending from 2°N to 54°S on the east limb of the sun showing a height of 2½′ and covering an area of 3 sq. minutes photographed on January 6, 1945; and (*iii*) a prominence of large extent with base extending from 42°N to 15°S having an area of 4 sq. minutes photographed on April 19, 1945.

Observations with the Prominence Spectroscope :—Details of metallic prominences observed during this half year are given in table II.

TABLE II.

Date 1945.	Time I.S.T. (G.M.T. +5h. 30m.)	Base.	Latitude.		Limb.	Height.	Lines.
			North.	South.			
	H. M.	°	°	°			
April—							
9	09 30	1		28·5	W	15	D_1, D_2 only.
25	09 40	4		18	E	15	b_1, b_2, b_3, b_4 and D_1, D_2.
May—							
14	09 05	2		27	E	20	D_1, D_2 only.
19	09 35	3		23·5	W	20	D_1, D_2 only.

The distribution of metallic prominences was as follows :—

	1°—10°	11°—20°	21°—30°	31°—40°	Mean latitude.	Extreme latitudes.
North	..	..	..	..	..	..
South	..	1	3	..	24·3	18° and 28·5°

Particulars of displacements observed in the chromosphere and the prominences with the spectroscope are given in the following table:—

TABLE III.

Date 1945.	Time. I S. T.	Latitude. North.	Latitude. South.	Limb.	Displacements in A° Red.	Displacements in A° Violet.	Remarks.
	H. M.	°	°				
January —							
3	11 00		10	E		0·5	At top.
4	10 30	20		W		0·5	At base.
17	10 00	40·5		E		0·5	
24	10 00	47		W	0·5		At middle.
31	10 00		59·5	E	Slight		
February—							
9	10 00		25	E	0·25		At top.
	09 50		47	W	0·5		At top.
20	09 58		48	W	0·5		At middle.
March—							
	10 05		19	E	0·5		At base.
	10 00		44	W	0·25		At top.
2	09 45		24	E	0·5		
5	09 40	34		E	0·5		At base.
6	09 30	34		E	0·5		In chromosphere.
14	09 30	48		W	0·5		At top.
16	09 40	12·5		W		0·5	At base.
April—							
9	09 15	37		W	1·25	1·25	At top.
12	09 15		56	W	2·0		At top.
15	10 00	53		E	0·5		At base.
24	09 30	32		E	3·5	3·5	At middle.
	10 04	32		E	2·0	2·0	At middle.
May							
1	10 00	48		W	0·5		
8	10 10		21	W	0·3		
14	09 05		27	E		0·5	At base.
15	09 45		18·5	W		1·0	At base.
20	09 15		19·5	W		2·5	At middle.
June—							
5	09 10		43·5	E	0·5		At top.
17	09 21		27	W	0·5	0·5	At base.
24	09 40		14	W	0·5		At top.
25	10 05		25	E		0·5	At top.
26	10 45		22	W		0·25	At base.

The number of displacements observed was 30 as against 12 in the previous half year. The distribution in latitude of these displacements was as follows :—

Latitude.	North.	South.
0°—30°	2	12
31°—60°	10	6
61°—90°	..	..
East limb.		14
West limb.		16

Of these, 17 were towards red, 9 towards violet and 4 both ways simultaneously.

Bright reversals of the Hα line and dark reversals of D3 were observed on the sun's disc on 3 and 6 occasions respectively. The distribution of these was as follows :—

	North.	South.	East.	West.	Total
Bright reversals of Hα	..	3	2	1	3
Dark reversals of D_3	2	4	5	1	6

Observations with the Spectrohelioscope :—Observation of prominences, dark markings and bright flocculi were continued with the Hale Spectrohelioscope as in previous years. The displacements observed with the instrument in the prominences and in the Hα dark and bright markings are summarised below :—

	North.	South.	East.	West.	Total.
Prominences	34	35	32	37	69
Dark markings	1	20	15	6	21
Bright flocculi	..	4	3	1	4

	Displacement Towards			
	Red.	Violet.	Both ways.	Total.
Prominences	40	29	..	69
Dark makings	11	10	..	21
Bright flocculi	2	2	..	4

The chromospheric eruptions observed during the half year are detailed in table IV :—

TABLE IV.

Date 1945.	Time (I.S.T.) Beginning.	Maximum	End.	Mean latitude.	Mean longitude from C. M.	Intensity	Remarks.
	H. M.	H. M.	H. M.	°	°		
March							
13		09 30	10 20			1	From spectrohelioscope.
18		07 52		+ 25	46 E	1	From spectroheliogram.
28		08 03		— 32	5 E	1	Do. (at points).
28		08 03		— 20	55 E	1	do.
30		07 50		— 32	17 W	1	do.
April							
5		07 55		— 20	48 W	1	do.
25	07 55	08 05	08 40	— 18	85 E	1	From spectrohelioscope and Spectroheliogram.
May							
2		07 57		— 22	40 E	1	From spectroheliogram.
16		09 06		— 20	37 W	1	do.

Prominences projected on the disc as Hα dark markings :—Hα flocculus plates were taken at Kodaikanal on 158 days and photographs were received for 22 days from Mount Wilson and for 2 days from Meudon observatories. On the whole, data were available for 175 days which were reckoned as 144½ effective days. The mean daily areas in millionths of the visible hemisphere (uncorrected for foreshortening) and the mean daily numbers as derived from this data are given below :—

	Combined data.		Kodaikanal data only.*	
	Mean daily areas.	Mean daily numbers.	Mean daly areas.	Mean daily numbers.
North	580	5·86	470	5·29
South	959	10·29	861	9·99
Total	1539	16·15	1331	15·28

Compared with the figures for the previous half year the areas and numbers show an increase of 3 per cent. and 7½ per cent. respectively.

The following diagram illustrates the distribution in latitude of the areas of the markings. In the northern hemisphere the areas show a steep peak of activity at 45° to 50°, while in the southern hemisphere 3 peaks of activity at 20°—25°, 30°—35° and 50°—55° are seen. Compared with the curves for the previous half year, the major peaks at 45°—50°N and 50°—55°S indicate a poleward drift of activity by 5° as in the case of the prominences while the peaks at 20° to 25°S and 30° to 35°S are new ones.

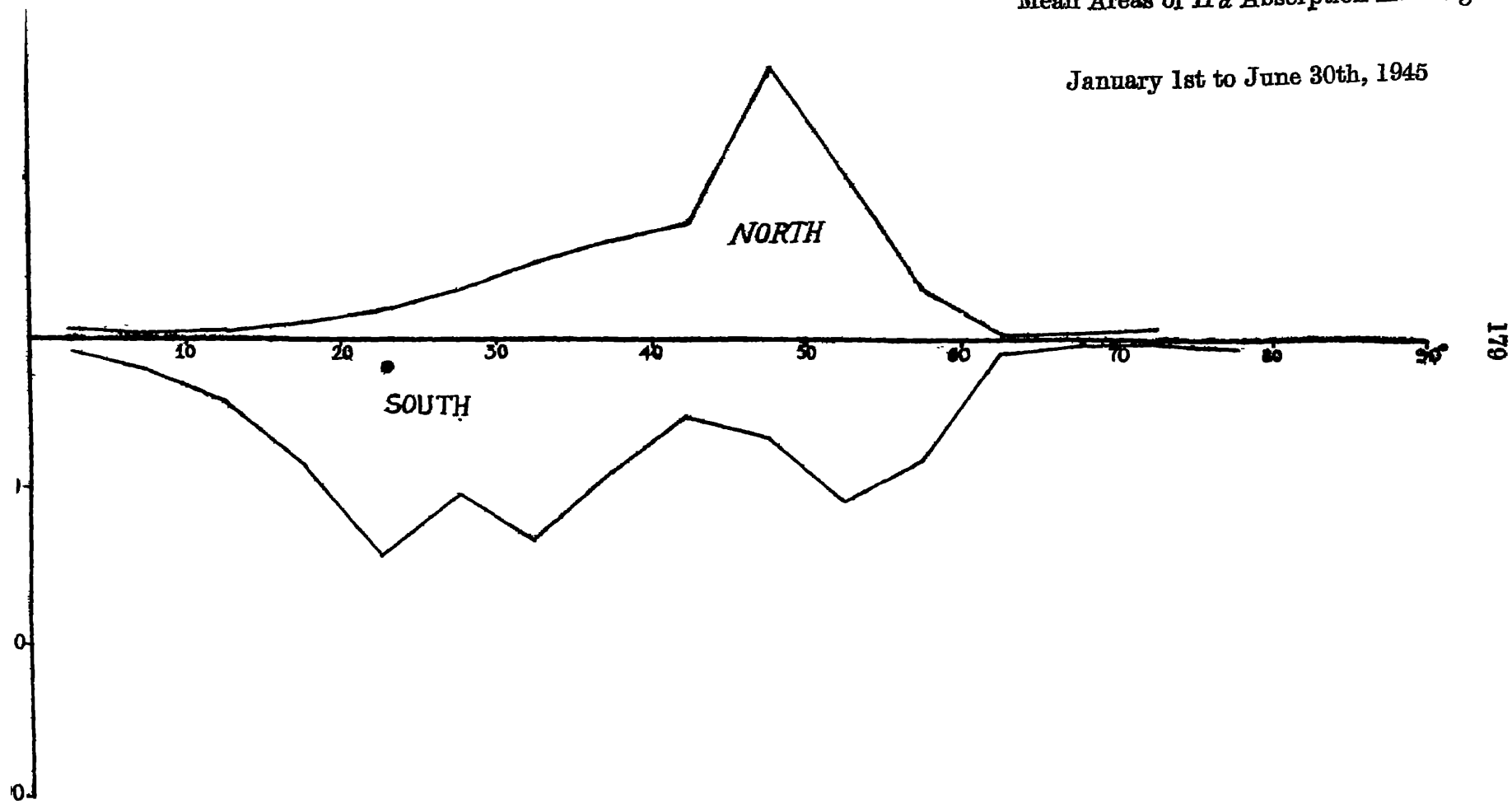
As in the case of the prominences, the Hα markings also show an eastern defect, the percentage east being 47·32 and 47·24 for areas and numbers respectively.

*"The mean values based on "Kodaikanal data only" are found to be appreciably lower compared with the figures under "Combined data". This is perhaps due to the comparatively poor quality oof the spectroheliograms at Kodaikanal during this period".

PART I—DIAGRAM I 1.

Mean Areas of H α Absorption markings

January 1st to June 30th, 1945



PART II

Summary of Prominence Observations for the Second Half of 1945

Calcium Prominences at the limb.—During the second half of this year, K-Prominence plates were taken at Kodaikanal on 119 days and Mount Wilson Observatory supplied plates for 65 days. On the whole, the photographs were available for 179 days which were counted as 155¾ effective days. The mean daily areas and number derived as usual from the above photographs are given below :—

	Combined data		Kodaikanal data only	
	Mean daily areas.	Mean daily numbers.	Mean daily areas.	Mean daily nnmbers
North	1·75	4·98	2·00	5·40
South	2·08	5·23	2·21	5·37
Total .	3·83	10·21	4·21	10·77

Compared with the previous half year, the areas show a steep rise of 42 per cent and the numbers 13 per cent indicating the occurrence of a large r umber of big prominences during this half year.

The distribution in latitude of the areas and numbers is shown in the following diagram. In the northern hemisphere, the peak of activity has shifted 5° more towards the pole when compared with the curve for the first half of the year while in the southern hemisphere the activity is distributed over a large zone from 30° to 60° with maximum at 40° to 50°. The numbers show nearly uniform activity over the range 0°—55° in both the hemispheres, except for one pronounced peak at 50° to 55° North.

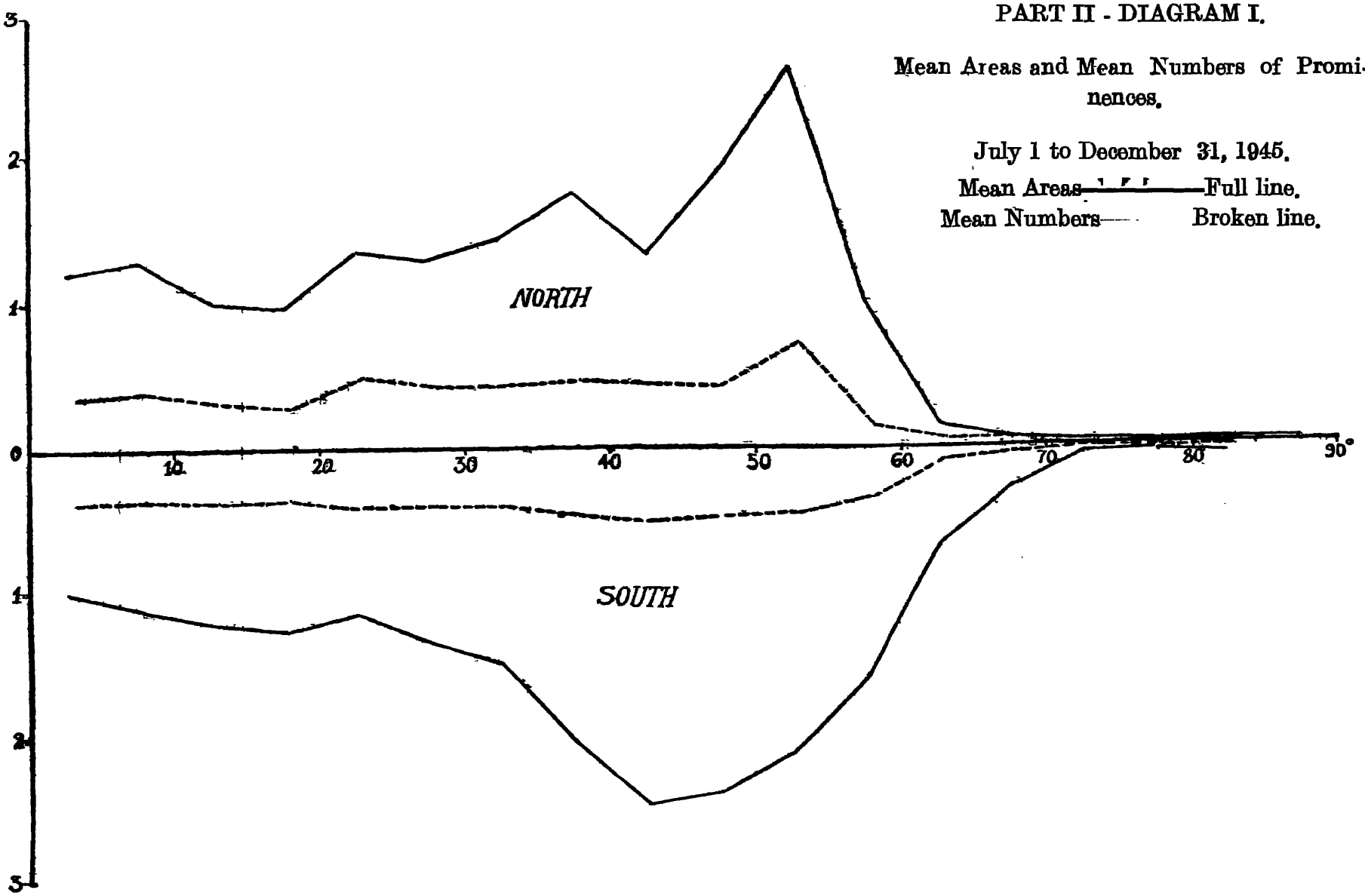
PART II - DIAGRAM I.

Mean Areas and Mean Numbers of Prominences.

July 1 to December 31, 1945.

Mean Areas——— Full line.

Mean Numbers- - - - Broken line.



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

TABLE I.

Months	Number of days (effective)	Areas (sq. mts.)	Numbers	Daily means		Mean height.	Mean extent.
				Areas (sq. mts.)	Numbers	"	°
July	27	84.25	294	3.12	10.88	40.32	4.78
August	26½	113.2	277	4.27	10.46	44.22	6.16
September	26	106.0	297	4.08	11.42	42.36	5.40
October	26½	107.15	230	4.08	8.76	52.99	8.10
November	25½	84.1	255	3.27	9.90	46.52	6.13
December	24½	101.45	235	4.18	9.69	40.68	5.56
3rd Qr.	79½	303.45	868	3.82	10.91	42.27	4.46
4th Qr.	76½	293.7	722	3.85	9.47	46.75	6.59
Second half year	155½	596.15	1590	3.83	10.21	44.34	5.95

The distribution of Prominences East—West of the sun's axis was as follows :—

	East.	West.	Percentage east.
Total areas (sq. minutes)	267.3	328.7	44.80
Total numbers	787	803	49.50

Both areas and numbers show an eastern defect.

Observations with the prominence Spectroscope.—Details of metallic prominences observed during this half year are given in table II.

TABLE II.

Date	Time I.S.T.	Base. °	Latitude. North. °	Latitude. South. °	Limb.	Height. "	Lines.
	H. M.						
October 30	08 45	4	39		W	30	b_1, b_2, b_3, b_4, and D_1, D_2.
November 21	09 00	4	27		E	30	Do.

The distribution of these metallic prominences was as follows :—

	1°—10°	11°—20°	21°—30°	31°—40°	Mean latitude.	Extreme latitudes.
North	..	..	1	1	33°	27° and 39°
South	..	..	..	—	—	—

Particulars of the Doppler displacements observed with the spectroscope in the chromosphere and prominences are given in the following table :—

TABLE III

Date 1945	Time I.S.T	Latitude. North	Latitude. South	Limb	Displacements in A° Red	Displacements in A° Violet	Remarks
	H. M.	°	°				
July 6	09 50	47		E	0·5	0·5	At top.
	10 05		33·5	W	0·5		At top.
17	10 15		33·5	E		0·25	At top.
	10 15		46·5	E	0·5	0·5	At top.
	10 00		42·5	W		0·25	At middle.
18	09 00		35·5	E		0·5	At middle.
	09 06		40·0	E	0·25		At middle.
25	09 18		41·3	E	1·0	1·0	At middle.
	09 20		45·0	E		0·5	At middle
29	11 07	1		W		0·25	At middle.
	11 05		18·5	W	0·5		
	11 15		31·5	E	Slight		
August 12	09 40		29·0	E		Slight	
15	10 03		38·5	W	0·2		At middle.
28	08 40		47·5	W		0·3	At middle.
	08 42		56·5	W	0·3		
September 6	09 50		31·0	E	3·5	1·0	At top.
23	09 30	51		E		0·3	At top.
25	09 45	36		E	Slight		
26	09 46	48		E	Slight		At top.
27	10 00		23·5	E		0·5	At top.
	10 05		34·5	E	0·4		At base.

Date 1945	Time I.S.T.	Latitude		Limb	Displacements in A°		Remarks
		North	South		Red	Violet	
	H. M.	°	°				
October 6	09 20		21·5	W	1·0	0·5	At top.
7	09 20		37·5	E		0·5	At base.
	09 30		53·5	E	0·5	0·25	At middle.
11	09 30		29·5	W	Slight		
13	09 45	29·5		E	0·5	0·5	To red at top & to violet at bottom.
21	08 30		30·0	W	0·5		
23	09 30	23·0		E	Slight		
24	08 45		49·0	E		0·5	At middle.
29	08 15		17·0	W	1·5	2·5	At middle.
30	08 45	30·0		W		1·0	At middle.
November 6	10 15	44		W	Slight		
	10 18	24		W	Slight		
17	09 01		29	E		1·0	At middle.
	08 49		51	W	0·3		At top.
22	11 30	25		E	0·5		At top.
	11 10		12	W	1·0	1·0	
	11 12		19·5	W		Slight	
23	08 15		21	W	2·0	0·3	At base. 2·3
24	08 15		24·5	W	0·5		At top.
27	08 40	54		W	0·5		At base.
30	08 30	23		W	0·5		At top.
December 8	09 30		24·5	E	Slight	0·5	To R at top and to V at bottom.
13	08 25	38		E		0·5	At top.
	08 37	30		E	0·5	0·5	At base.
	08 20	20·5		W	0·5		
14	09 05		20·5	E		0·5	At top
	08 55		40 ·0	W	1·5	1·0	At middle.
	08 30	42·5		W	Slight.		
15	08 45	32		E		Slight	At top.
	08 50	28		W		Slight	
17	09 07	14		E	Slight	Slight	At top.
	09 03		41	W	Slight		
18	09 40	30		E	0·5		
22	08 49		26·5	E		0·5	At top.
27	08 10		22·5	W	0·3		
29	08 00		50·5	W	1·0		

The distribution in latitude of these displacements was as follows:—

Latitude.	North	South
0°—30°	13	18
31°—60°	8	21
61°—90°	1	..
East limb		32
West limb		29

Of these, 28 were towards red, 22 towards violet and 11 both ways simultaneously.

Bright reversals of the Hα line and dark reversals of D_3 line were observed in the neighbourhood of active spot groups on 7 occasions. Displacement of the C line on the disc was observed on one occasion. The distribution of these is given below :—

	North	South	East	West	Total
Bright reversals of Hα	1	6	3	4	7
Dark reversals of D3	1	6	3	4	7
Displacement of Hα	1	1	..	1	1

The displacement observed was towards both ways simultaneously.

Observations with Spectrohelioscope.—Doppler displacements observed with the spectrohelioscope during the second half of 1945 are summarised below :—

	North	South	East	West
Displacements in prominences	18	58	48	28
Displacements in dark markings	0	6	4	2
Displacements in bright flocculi	2	4	6	0

	Displacements Towards			
	Red	Violet	Both ways	Total
Displacements in prominences	37	38	1	76
Displacements in dark markings	3	3	..	6
Displacements in bright flocculi	3	3	..	6

The chromospheric eruptions observed during this half year are detailed below :—

TABLE IV

Date	Time (I.S.T.) Beginning	Maximum	End	Mean latitude.	Mean longitude from C.M.	Intensity	Remarks
	H. M.	H. M.	H. M.	°	°		
July 13		07 53		—17	50 W	1	From spectroheliogram.
13		07 53		+22	32 E	1	Do.
16		08 03		—29	18 E	1	Do.
September 30		08 03		+24	50 E	1	Do.
October 1		07 57		—32	54 E	1	Do.
3		08 00		—34	25 E	1	Do.
5		08 15		—30	12 W	2	Do.
11		07 58		—43	24 W	2	Do.
December 2		08 25		—15·5	13 E	1	Do.
22		09 25	09 45	+30	19 W	1	From spectroheliogram and spectrohelioscope.
27		08 26		—14	46 E	1	Do.

Prominences projected on the disc as Hα dark markings.—During the half year, Hα flocculus photographs were taken at Kodaikanal on 111 days and photographs for 127 days were received from Mount Wilson, making the data available for 182 days which were counted as 161½ effective days. The mean daily areas of Hα markings in millionths of the sun's visible hemisphere and the mean daily numbers computed from the photographs are given below :—

	Combined data		Kodaikanal data only	
	Mean daily areas	Mean daily numbers	Mean daily areas	Mean daily numbers
North	1266	9·99	1266	9·41
South	1562	12·93	1647	12·68
Total	2828	22·92	2913	22·09

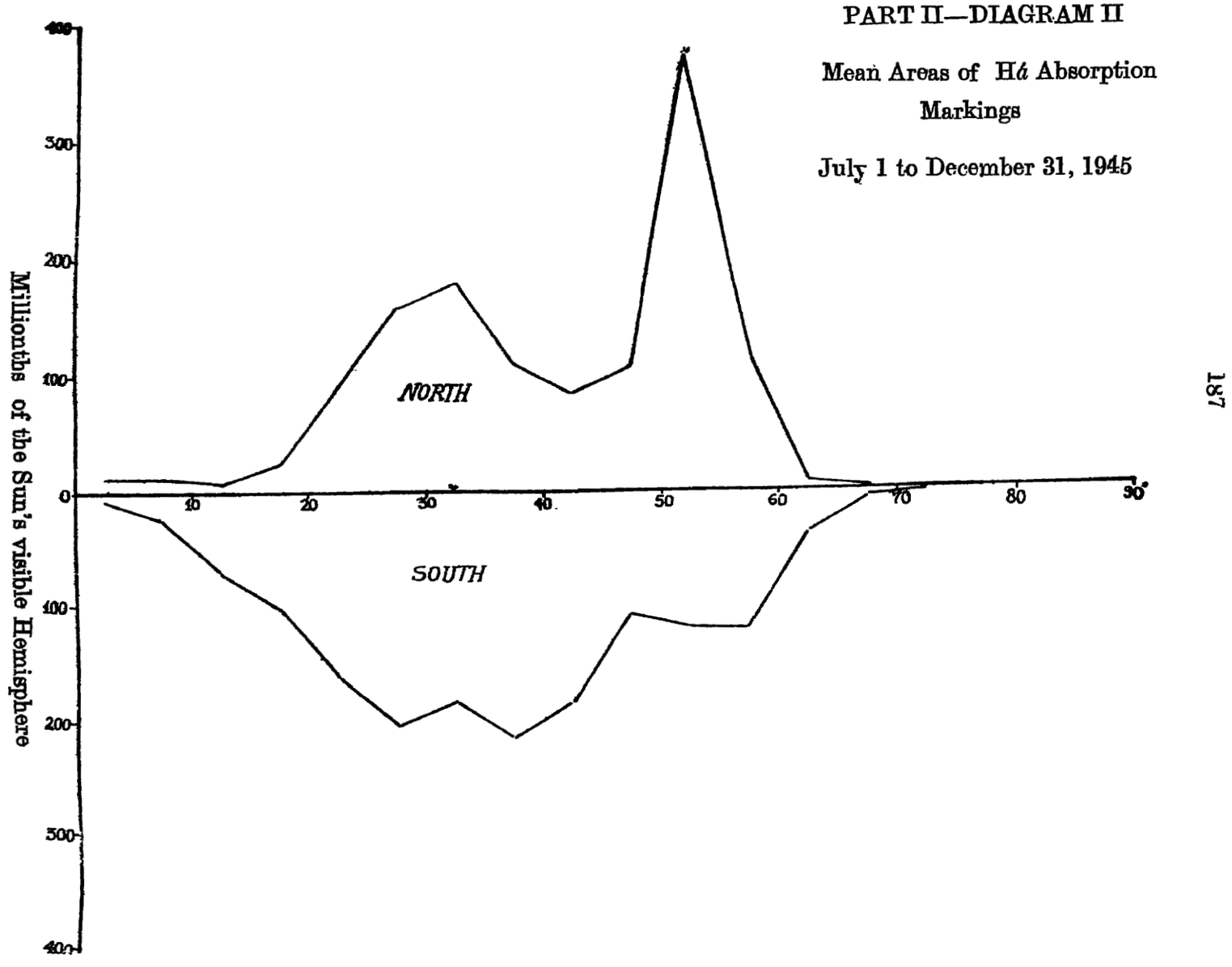
Compared with the figures for the previous half year, both areas and numbers show a very large increase of 84 per cent and 42 per cent respectively.

The distribution in latitude of the Hα areas is illustrated in the following diagram. The curves show marked peaks of activity of 30° to 35° and 50° to 55° in the northern hemisphere while in the southern hemisphere the activity is distributed over a wide range from 20° to 45° with a minor peak at 55° to 60°,

PART II—DIAGRAM II

Mean Areas of Hά Absorption Markings

July 1 to December 31, 1945



Unlike in the case of prominences both areas and numbers of Hα markings show an eastern preponderance the percentage east being 53 for both areas and numbers.

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

A. K. DAS

Kodaikanal Observatory,
August, 1949.

Director, Kodaikanal Observatory.

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