Kodaikanal Observatory.

BULLETIN No. LXXXI.

SUMMARY OF PROMINENCE OBSERVATIONS FOR THE SECOND HALF OF THE YEAR 1926.

In pursuance of the programme of work adopted since 1st January 1923 under the auspices of the International Astronomical Union, all observatories taking spectrohelıograms of the Sun have been asked to co-operate with the Kodaikanal Observatory by supplying copies of their photographs on those days when the Kodaikanal records are imperfect or wanting In response to our requirements for the second half of the year 1926, the Mount Wilson Observatory supplied prominence plates for 25 days and Hα disc plates for 19 days, Meudon Observatory supplied K$_3$ disc plates for 3 days and Hα disc plates for 12 days, and the Pitch Hill Observatory (Mr. Evershed's) at Ewhurst, Surrey, England, supplied 9 prominence plates and 13 Hα disc plates.

When only incomplete or imperfect photographs for any day are available from more than one observatory, the best photograph is chosen as representing the solar activity of that day after weighting it according to its quality, and the remaining photographs are ignored.

The mean daily areas and numbers of prominences during the half-year are given below The means are corrected for imperfect or incomplete observations, the total of 182 days for which plates were available being reduced to 166 effective days.

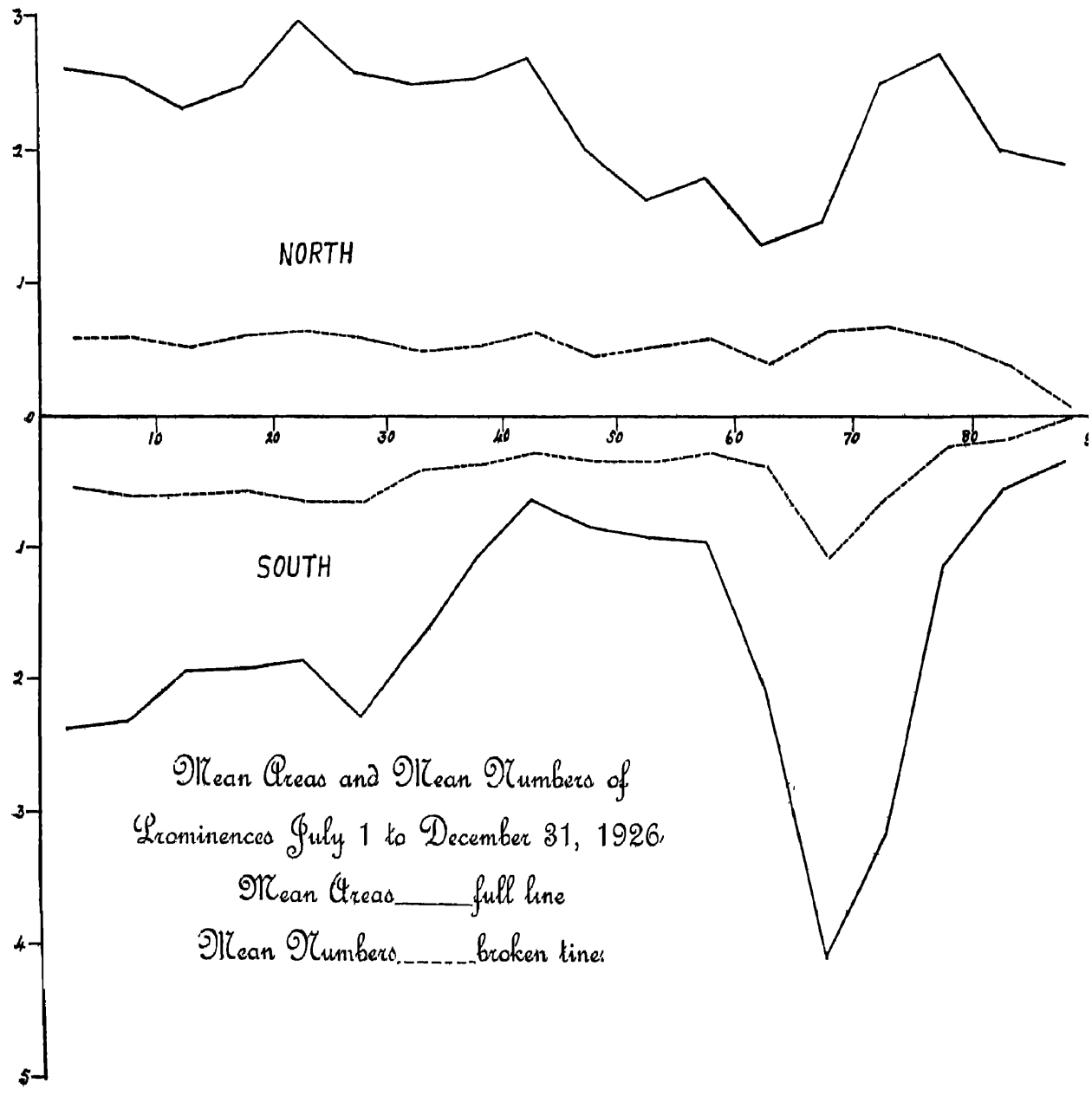
	Mean daily areas (square minutes).	Mean daily numbers
North	4 03	9·53
South	3 02	8·32
Total .	7·05	17 85

Compared with the previous half-year, areas show a decrease of 13 per cent both in the northern and southern hemispheres, while numbers show a slight increase in the northern hemisphere and a slight decrease in the southern, both the increase and decrease being less than 2 per cent The excess of activity in the northern hemisphere recorded in the first half of the year has been maintained.

For comparison with bulletins issued prior to the co-operation of other observatories, the means based on Kodaikanal photographs alone are also given, 155 days of observation being counted as 140 effective days.

	Mean daily areas (square minutes).	Mean daily numbers.
North (Kodaikanal photographs only)	4 40	9 72
South do.	3 26	8 56
Total ..	7 66	18·28

The distribution of the prominences in latitude is represented in the following diagram, in which the full line gives the mean daily areas and the broken line the mean daily numbers for each zone of 5° of latitude. The ordinates represent tenths of a square minute of arc for the full line and numbers for the broken line. Compared with the previous half year the distribution exhibits some well-marked differences. The maximum in high latitudes has made a greater stride towards the poles, the advance being 10° in both the hemispheres. Although the southern hemisphere in this region still lags behind the northern by about 10°, it shows a preponderance of activity over the northern. A peak has appeared near 25° in both hemispheres, whilst the peak near 40° has disappeared in the southern hemisphere.



The monthly, quarterly and half-yearly areas and numbers, and the mean height and mean extent of the prominences on photographs from all the co-operating observatories are given in Table 1. The unit of area is 1 square minute of arc. The mean height is derived by adding together the greatest heights reached by

individual prominences and dividing by the total number of prominences observed; the mean extent is derived by adding together the lengths of the base on the chromosphere of individual prominences and dividing by the total number of prominences.

TABLE I.—ABSTRACT FOR THE SECOND HALF OF 1926.

Months.	Number of days (effective)	Areas	Numbers	Daily Means		Mean height.	Mean extent
				Areas	Numbers		
1926						"	°
July	28½	161 6	478	5 7	16 8	35 6	5 39
August	27¼	233·6	519	8·6	19 0	39 0	5 81
September	27½	192·0	476	7 0	17 5	36 9	5·48
October	28½	207 5	529	7 3	18 6	40 6	5 04
November	25	172 0	424	6 9	17 0	40 1	5 71
December	29½	203 9	537	6·9	18 2	41·5	5 72
Third quarter	83	587 2	1473	7 1	17 7	37 2	5 57
Fourth quarter	83	583·4	1490	7 0	18·0	40 8	5·48
Second half-year	166	1170 6	2963	7 1	17 8	39 0	5 52

Distribution east and west of the Sun's axis.

During the half-year areas showed a large western preponderance and numbers a slight eastern preponderance, as will be seen from the following table :—

1926 July to December	East.	West	Percentage East
Total number observed	1511	1452	51 0
Total areas in square minutes	524·4	646 2	44 8

Metallic prominences.

Nineteen metallic prominences were observed during the half-year, as against 133 in the previous half-year. Their details are given below :—

TABLE II.—LIST OF METALLIC PROMINENCES OBSERVED AT KODAIKANAL, JULY TO DECEMBER 1926.

Date.		Hour I.S.T.	Base.	Latitude.		Limb.	Height.	Remarks.
				North.	South.			
1926.		H. M.	°	°	°		"	
July	16	8 53	3	19·5		E	20	4924·1, 5018 6, b_1, b_2, b_3, b_4, 5269 8, 5276 2, 5316·8, 5535·1, D_1, D_2, 6677, 7065.
	23	8 52	1		11·5	E	25	b_1, b_2, b_3, b_4, 5316 8, D_1, D_2.
	30	9 18	3	20·5		W	30	b_1, b_2, b_3, b_4, D_1, D_2.
August	27	8 55	2	19		W	10	5018·6, b_1, b_2, b_3, b_4, 5316 8, D_1, D_2, 6677.
September	1	8 53	2	32		W	30	b_1, b_2, b_3, b_4, D_1, D_2,
	4	9 0	1		11 5	W	40	4924 1, 5018·6, b_1, b_2, b_3, b_4, 5234·8, 5276·2, 5316·8, 5363 0, D_1, D_2.
	25	9 6	1	23 5		W	5	4924·1, 5018·6, b_1, b_2, b_3, b_4, 5234·8, 5276·2, 5363 0, D_1, D_2.
	27	11 24	4	26		W	10	b_1, b_2, b_3, b_4, 5316 8, D_1, D_2, 7065.
October	4	8 40	3	18 5		E	20	4924 1, 5018·6, b_1, b_2, b_3, b_4, 5316 8, D_1, D_2, 6677, 7065.
	21	9 0	1	17·5		W	10	4924·1, 5018·6, b_1, b_2, b_3, b_4, 5316·8, 5363·0, D_1, D_2, 6677, 7065.
November	28	9 15	4	29		E	15	4924 1, 5018·6, b_1, b_2, b_3, b_4, 5276·2, 5316·8, 5363·0, D_1, D_2.
	29	9 2	5	29·5		E	25	4924·1, 4957·8, 5016·0, 5018·6, b_1, b_2, b_3, b_4, 5276·2, 5316·8, 5363·0, D_1, D_2.
December	9	14 35			7	E	10	b_1, b_2, b_3, b_4, 6677.
	17	9 22		33		E	10	4924·1, 5018·6, b_1, b_2, b_3, b_4, 5316·8, 5363·0, D_1, D_2, 6677.
	18	10 7	4	26		E	15	4924 1, 5018 6, b_1, b_2, b_3, b_4, 5276·2, 5316·8, 5363·0, D_1, D_2, 6677, 7065.
	20	9 5	8		11	E	20	4924·1, 5018·6, b_1, b_2, b_3, b_4, 5276·2, 5316·8, D_1, D_2, 6677.
	22	9 8		8		W	10	4924 1, 5016 0, 5018 6, b_1, b_2, b_3, b_4, 5276·2, 5316·8, D_1, D_2, 6677, 7065.
	29	8 52	2	23		W	15	4924·1, 5016, 5018·6, b_1, b_2, b_3, b_4, 5276·2, 5316·8, 5363·0, D_1, D_2, 7065.
	31	12 0	4		27·5	W	20	4924·1, 5016, 5018·6, b_1, b_2, b_3, b_4, 5276·2, 5316·8, D_1, D_2.

The distribution in latitude of the metallic prominences was as follows :—

	1°—10°	11°—20°	21°—30°	31°—40°	Mean latitude.	Extreme latitudes.
North ..	1	4	7	2	23° 2	8° and 33°
South ...	1	3	1	...	13°·7	7° and 27°·5

Nine were on the east limb and 10 on the west limb.

Displacements of the hydrogen line

Particulars of the displacements observed in the chromosphere and prominences are given in the following table .—

TABLE III —DISPLACEMENTS OF THE HYDROGEN LINE.

Date.		Hour I S T		Latitude.		Limb	Displacement.			Remarks
				North	South.		Red	Violet	Both ways	
1926.		H.	M.	°	°		A.	A	A.	
July	6	8	47	77 5		E	Slight			
	11	8	39	.39		W	0 5			At top
	13	11	45		21	W		Slight		
	14	9	50		55	W	1			At top.
	16	8	44		73 5	W	0 5			
	16	8	35	47		W		Slight		
	17	8	52		84	E		1		At top.
	20	8	40		6	W		Slight		
	23	8	52		12	E	Slight			
	27	8	59		24	W		Slight		
	27	8	55	70		W		Do		
	28	9	58		14	E	2	1		To red at lower arm of bend and to violet at top of bend
	28	9	55		17·5	E		1		At top.
	28	9	20		77	E	1			At base
	29	9	43	20		W	0·5			At top.
	30	9	13	55		W	Slight			
August	6	11	37		19	W			1	
	8	9	0		17	W	1			At top
	15	9	2		24	W	1·5			Do
	15	8	58		20	W		1		Do
	18	11	36	4		E		1		Do
	20	9	29		35·5	E	0·5			At base.
	20	9	12	48 5		W	Slight			At top.
	22	9	1		20	W	1			Do
	22	8	52	76		W	0·5			Do.
	23	8	21		67	W	1 5			Do
	24	9	32	29		E	0·5			Do.
	26	10	26		32 5	W	1			
	28	9	3	59 5		E			Slight	At top
	28	8	59	39 5		E	1 5			In chromosphere
	28	9	29	30·5		W	Slight			At top
	28	9	34	78		W	1			Do
	31	9	11		13	E		1		Do.
September	1	8	41	64		W	1			Do.
	3	9	18		65	E	3			Do.
	3	9	10		24	W		Slight		Do.
	3	9	6		3	W	1			Do
	3	9	2		36 5	W		0·5		Do
	4	8	49		15	W	1			Do.
	4	8	49		13	W		1		At base.
	5	9	24		20	W	1			At top
	6	10	28		57 5	W	Slight			Do
	6	10	15	63		W	Do			Do.
	7	9	4	15		W	1			Do.
	7	9	15	79 5		W	Slight			Do
	13	9	46	25		E		1		Do
	17	9	17		41	E	1			At base
	17	9	10	27		W	Slight			At top
	24	9	24		18	E	0 5			At base
	24	9	6	44·5		W		1		Do
	24	9	5	71·5		W		Slight		
	25	9	27	Equator.		W	0 5			At top
	25	9	6	23 5		W		Slight		At base
	25	8	59	58 5		W			Slight	At top
	27	10	26	23		E	0 5			Do
	27	10	15	15		W	1			Do
	27	9	32	19		W	2			At base.

Date.		Hour I.S.T.		Latitude.		Limb.	Displacement			Remarks.
				North.	South.		Red.	Violet.	Both ways.	
1926.		H	M	°	°		A.	A.	A.	
September	27	9	30	26		W	1			At top.
	29	9	5	9		W	0 5			Do
October	2	9	33		23	W	Slight			Do.
	3	8	54	15·5		E	1			At base.
	3	8	56		8	E	0·5			Do.
	3	8	46		24	W		Slight		
	4	8	40	18 5		E	1	1		To violet at top ; to red at base. D_1, D_2, D_3, also were displaced.
	4	9	2		68	E	1·5			At top.
	4	9	12		73·5	E		0·5		Do
	4	8	27	61		W		0·5		At base.
	5	9	15	73		E	1			At top.
	5	9	27	17		E	2	1		To red at base ; to violet at top. Seen in D_3 also.
	5	9	48		2·5	E		3		At top.
	5	10	7		65	E	1			At top.
	5	8	54		65	E		0·5		Do.
	5	10	6		67	E		1 5		Do
	6	8	47	20		E	0 5			
	6	8	50	16		E		1		At top.
	6	9	4	16		E	1			
	9	9	22	27		E		0 5		
	9	8	55	23		E		1		At top.
	9	9	21	23		E	0·5			At base
	9	8	50		16	W	0·5			At top.
	11	8	18	26		E	0 5			Do.
	13	9	11	25		W		0·5		
	14	8	50	84		E		Slight		
	14	8	52	58 5		W	1			At top
	15	8	10	11		W	1			Do.
	15	8	54	41·5		W	1			Do.
	19	9	4	18		W	0·5			Do.
	19	9	19	32		W		1		At base.
	19	8	51	43		W		3		Do
	21	9	10	39 5		E	1			At top.
	21	9	0	17·5		W	0·5	1 5		To red at top ; to violet at base.
	21	8	57	26		W	0·5			At top.
	21	8	57	30		W		0·5		At base.
	21	8	52	62·5		W		Slight		Do.
	22	9	7		13	E	1			Do.
	22	9	11		34	E	0·5			Do.
	22	8	50	27 5		W	1			At top.
	22	8	44	82·5		W	0·5			Do.
	23	8	45		12	E	1·5			At base.
	23	8	45		14	E		4·5		At top
	23	8	50		14	E	1			At base
	23	8	24	21		W		0 5		Do.
	23	8	17	50·5		W		0·5		Do.
	23	8	15	69 5		W	Slight			
	24	9	0	19		E		0·5		At top.
	24	9	0	18		E	1			At base.
	24	8	54	33		W	0 5			At top.
	27	9	20		16	E		0·5		Do.
	30	8	58	24		E	1			At base,
November	3	9	12	49		E	Slight			Do.
	4	10	8	32		E	1			Do.
	8	15	20		18	E	1			At top.
	9	9	24		25	E	0·5			Do.
	9	8	51	13		W		0·5		At base.
	10	9	27	27		E	1			Do.
	10	9	22		29	E		1·5		At top.
	10	9	22		31	E	1			At base.
	10	9	16	21		W		1		Do.
	12	8	55		5	W	Slight			

Date.		Hour I S.T		Latitude		Limb	Displacement			Remarks.
				North	South		Red.	Violet	Both ways	
1926		H.	M	°	°		A	A.	A.	
November	13	9	27	13		W	1			At top
	14	8	36	24		W	Slight			Do.
	15	9	48	23		E		1		Do
	15	9	15		16	E	1			At base.
	15	8	40	10		W	2 5			At top.
	15	8	40	15		W		1		At base
	15	8	40	19		W	5	2		To red at top , to violet at base.
	15	9	40	19		W	6			At top.
	15	8	40	23		W	3			Do
	15	11	20	25		W	3	2		To red at top , to violet at base.
	16	8	55	19		W	1			At top
	16	8	48	28		W	0 5	1		To red at top , to violet at base
	17	9	15		60 5	E	0 5			
	17	9	2	15		W	1			At top.
	17	8	48	30		W	1			Do.
	17	8	47	37		W		Slight		At base.
	19	8	20	30		W		0 5		Do
	25	10	22		47	E		3		Over whole prominence.
	26	10	8	6		W	2			At top.
	28	9	15	14		E	1			Do.
	28	9	15	1		E		2		Do.
	28	8	58	65		W	Slight			Do
	29	9	2	30		E	1			At base.
	29	10	1	12		E	1 5			Do.
	29	9	25		12	W	1			At top.
	30	9	9	43		E	1			Do.
	30	9	12	32		E			1·5	
	30	9	14	12		E		1		
	30	9	3		19	W	0 5			At base.
	30	8	58	16		W	0 5			At top
December	1	9	21	42		E	Slight			At base.
	1	9	15	7 5		W		0 5		Do.
	1	9	3	53		W	Slight			At top.
	2	11	3	89 0		E		Slight		
	2	11	34		25	E	1	2		To red at base , to violet at top
	3	10	45		32	E		0 5		At top
	3	10	45		35	E	1			Do.
	3	9	30	5		W	0 5			
	3	10	52	24		W	0 5			At top
	4	9	3	14·5		E	1 5			At base.
	4	9	35	79		W	0·5			Do.
	5	9	10		11	W	4	1		At top
	6	8	35	62		E	Slight			
	6	8	36	8		E	0 5			
	6	8	25		22	W		1		At base.
	6	8	25		16	W	2			At top
	6	8	21	31		W	0 5			Do.
	7	8	47	14		E	0 5			
	7	8	49		18	E		1		
	7	8	49		20	E	1 5			At base.
	7	8	50		25	E	Slight			Do
	7	8	34		39	W		Slight		
	7	8	30		33	W	0 5			
	7	8	20	60		W	0 5			
	9	14	35		7	E		1		
	10	9	30		22	W	0 5			At base.
	11	10	25	36		W		Slight		Do.
	12	9	16		25	E	1			Do
	12	9	16		30	E		2		At top.
	12	9	0		43	W		Slight		
	12	8	55		20	W		1		At top.
	12	8	47	9		W	1			Do
	13	8	35	71		E		0·5		At base.
	13	8	44		28	E			1	
	13	8	42	40		W		1		At top.
	13	8	38	57		W	Slight			Do

Date.	Hour I.S.T.	Latitude		Limb.	Displacement.			Remarks.
		North.	South.		Red.	Violet.	Both ways.	
1926.	H. M	°	°		A.	A	A	
December 14	9 2	16		W	1			At top.
17	9 8	50		E	1			
17	9 22	33		E	1			At top.
17	9 22	30		E	1			At base
18	10 7	26		E	1	1·5		To red at base ; to violet at top.
19	9 21	17		E	0·5			At base.
19	9 24		14	W	1			At top
20	9 5		8	E	1·5			Do.
20	9 5		14	E	1			Do
20	8 40	67		W	Slight			Do.
21	8 58	74		E	0 5			Do
21	9 4	80		W		0 5		At base.
22	9 10		19	E	2			At top.
22	9 24		16	W	1			Do.
22	9 8	8		W	1·5	1		To red at top , to violet at base.
23	10 9	68		E		Slight		
23	10 15		20	W			1	
24	9 14		2·5	W	0·5			
24	9 10	63		W	1			At top
25	9 30	16		E		0 5		At base.
25	9 23	12·5		W		5		Do.
26	9 20	25		E	1			Do.
26	8 57		7	E	0·5			Do.
26	9 8		48	W		1		
26	9 4		11	W	0·5			At top.
26	9 0	18		W	1			Do.
27	10 40	11		E	0 5			At base.
28	9 4	10		E	1			Do.
28	9 25	10		E		1		At top.
29	9 10		23	E		Slight		
29	8 54	17		W		1		At top.
29	8 52	23		W	2	3		To red at base ; to violet at top
29	8 44	78·5		E	Slight			At top.
31	12 0		24	W	1			Do.

The total number of displacements was 230 as against 420 in the previous half-year, and they were distributed as follows :—

Latitude	North.	South.
1°—30°	87	62
31°—60°	30	15
61°—90°	25	11
Total ...	142	88

East limb	103
West limb	127
Total ...	230

One hundred and forty-three displacements were towards the red, 81 towards the violet and 6 both ways simultaneously.

Reversals and displacements on the Sun's disc.

Three hundred and seven bright reversals of Hα line, 192 dark reversals of D_3 line and 102 displacements of Hα line were observed during the half-year Their distribution is given below :—

	North	South	East	West.
Bright reversals of Hα	159	148	153	154
Dark reversals of D_3 .. .	97	95	102	90
Displacements of Hα . .	63	39	49	53

Seventy-six displacements were towards the red, 23 towards the violet and 3 both ways simultaneously.

The Eruptive Prominence of 10th December 1926.

A noteworthy eruptive prominence was photographed on 10th December 1926 and appeared in the first photograph taken at $8^h\ 0^m$ I S T. as a tall thin column, $5\frac{1}{2}'$ high, standing on a cone-shaped base extending from − 67° W to − 77° W Its height increased and at $9^h\ 13^m$ the upper portion became detached and continued to ascend. This " flying column " had a length of $5\frac{1}{2}'$ and although the top extended beyond the limits of the photograph in later cases, the bottom ultimately reached a height of 14′ above the chromosphere. The velocity of ascent did not exceed 54 kilometers per second. The propelling force appeared to have its origin at the more northerly end of the base of the prominence.

Prominences projected on the disc as absorption markings

Photographs of the Sun's disc in Hα light were available from Kodaikanal and the co-operating observatories for a total of 180 days, which were counted as 173 effective days. The mean daily areas of Hα absorption markings (corrected for foreshortening) in millionths of the Sun's visible hemisphere and the mean daily numbers are given below .—

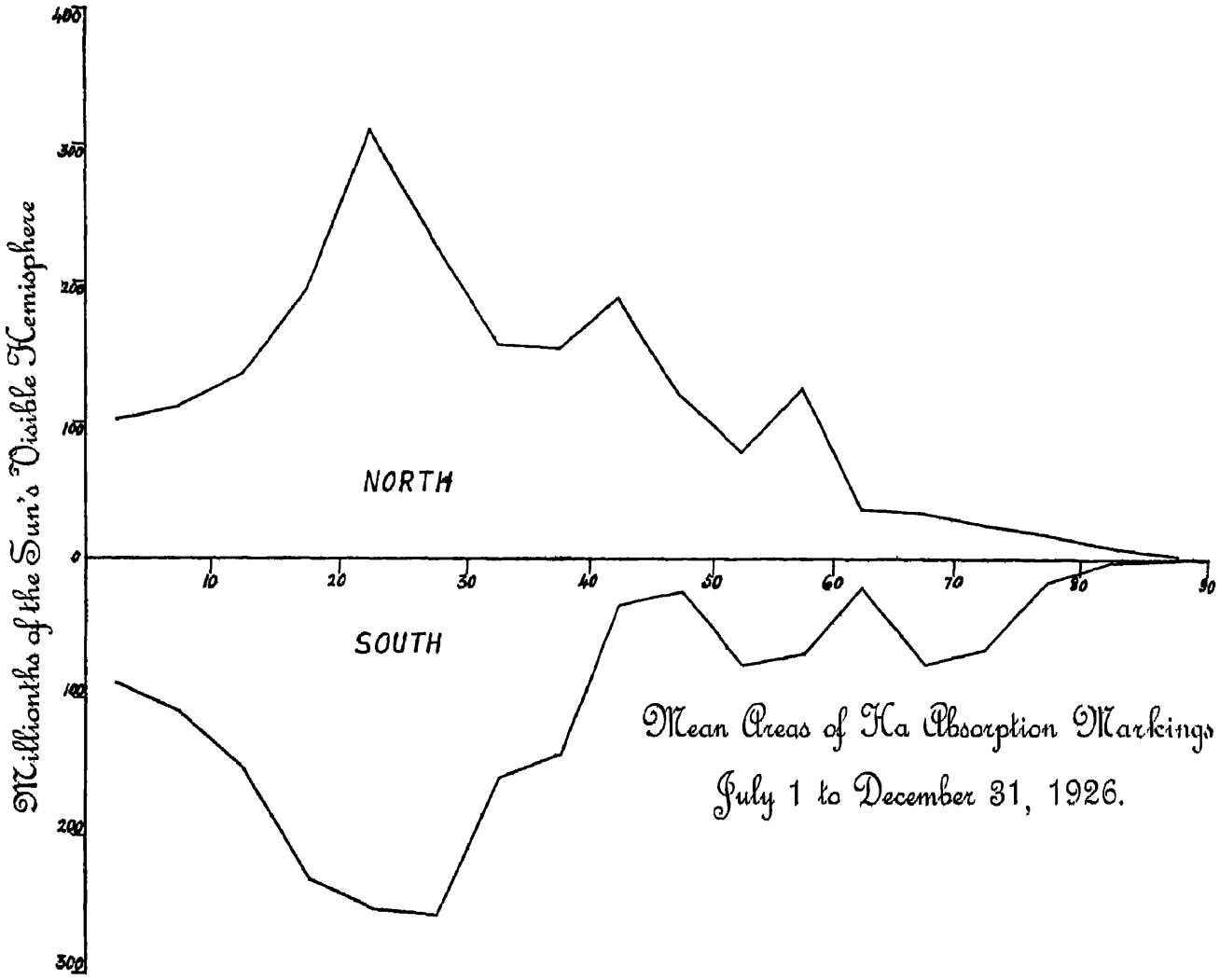
	Mean daily areas	Mean daily numbers.
North	2,094	17·3
South	1,724	15·5
Total ...	3,748	32·8

There is a decrease of 33 per cent in areas and of 6 per cent in numbers, compared with the previous half-year

For comparison with bulletins issued prior to the co-operation of other observatories, the means based on Kodaikanal photographs alone are also given, 153 days of observation being counted as 149 effective days.

	Mean daily areas.	Mean daily numbers.
North (Kodaikanal photographs only)	2,051	17 4
South do.	1,707	15 3
Total .	3,758	32·7

The distribution of the mean daily areas in latitude is shown in the following diagram. The main feature of the latitude distribution of Hα dark markings is a maximum near 25°, the activity in both polar and equatorial regions being relatively small compared with prominence activity



Mean Areas of Hα Absorption Markings
July 1 to December 31, 1926.

The activity was in excess in the western hemisphere, the percentage east being 48·93 for numbers and 46·60 for areas.

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

THE OBSERVATORY, KODAIKANAL,
23rd August 1927.

T. ROYDS,
Director, Kodaikanal and Madras Observatories.

PRICE, 8 *annas*. MADRAS : PRINTED BY THE SUPERINTENDENT, GOVERNMENT PRESS—1927