

# Kodaikanal Observatory.

BULLETIN No. XCII.

## SUMMARY OF PROMINENCE OBSERVATIONS FOR THE SECOND HALF OF THE YEAR 1930.

In pursuance of the programme of work adopted since 1st January 1923 under the auspices of the International Astronomical Union, all observatories taking spectroheliograms 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 1930, the Mount Wilson Observatory supplied calcium ( $K_{85}$ ) prominence plates for 49 days and  $H\alpha$  disc plates for 23 days, the Meudon Observatory supplied calcium ( $K_3$ ) disc plates for 10 days and  $H\alpha$  disc plates for 33 days and the Pitch Hill Observatory (Mr. Evershed's) at Ewhurst, Surrey, England, supplied one  $H\alpha$  prominence plate and two  $H\alpha$  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.

### *Calcium prominences at the limb.*

The mean daily areas and numbers of prominences photographed during the half-year by means of the K line of calcium are given below. The means are corrected for incomplete or imperfect observations, the total of 181 days for which plates were available being reduced to 156 effective days.

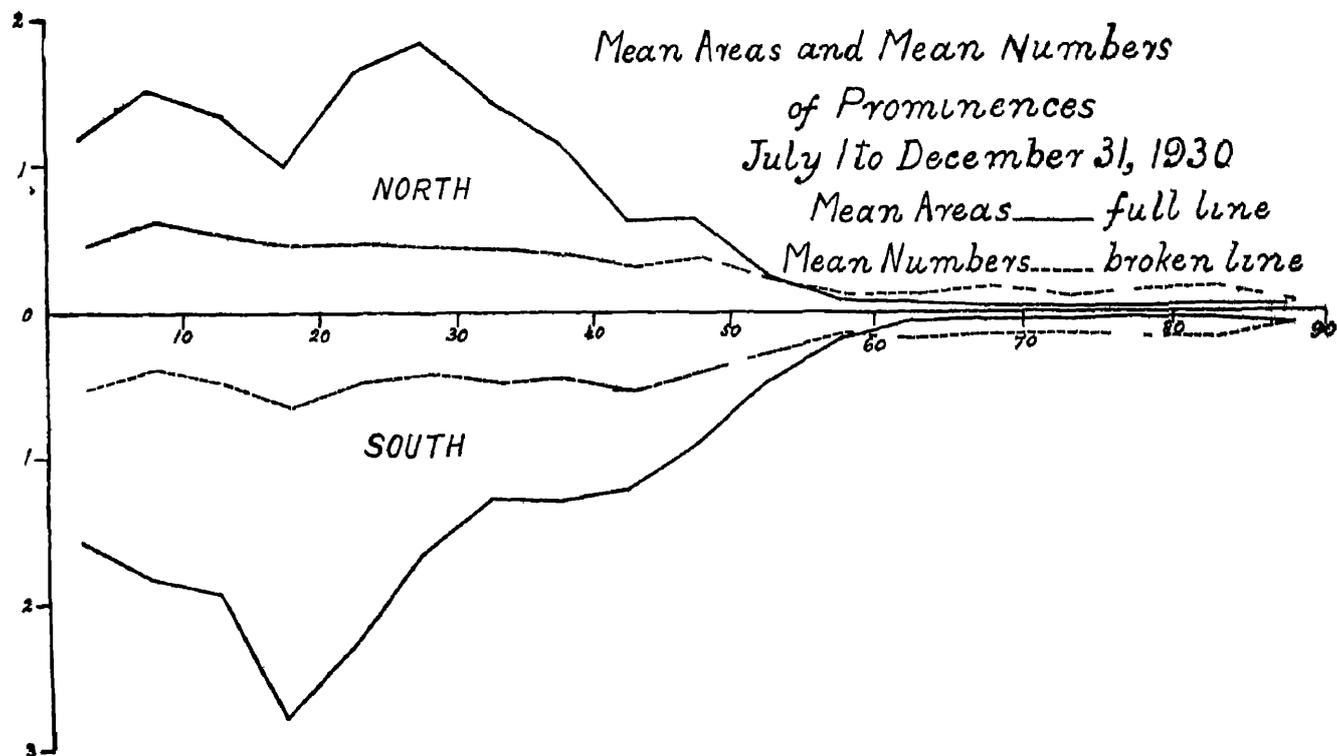
							Mean daily areas (square minutes)	Mean daily numbers.
North	...	...	...	..	...	...	1.31	5.71
South	...	...	...	...	...	...	1.76	6.08
						Total	3.07	11.79

Compared with the first half of the year, areas show a decrease of 38 per cent, the decrease in the northern hemisphere alone being as large as 55 per cent, whilst numbers show a slight increase. As opposed to the previous half-year, activity now preponderates in the southern hemisphere.

For comparison with bulletins issued prior to the co-operation of other observatories, the means based on Kodaikanal photographs alone are also given, 146 days of observation being counted as 125½ effective days.

						Mean daily areas (square minutes).	Mean daily numbers.
North (Kodaikanal photographs only)	...	...	...	...	...	1.36	6.26
South ( do. )	...	...	...	...	...	1.96	6.64
					Total	3.32	12.90

The distribution of 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. Apart from the general falling off of activity, the northern hemisphere shows a notable decrease in latitudes 15°—20° and 40°—60°, whilst the southern hemisphere shows a decrease between 20°—30° and an increase of activity in the belt 35°—60°.



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 I. The unit of area is one 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 1930

Months	Number of days (effective)	Areas	Numbers	Daily means		Mean height	Mean extent
				Areas	Numbers		
1930						"	"
July	24½	83.4	302	3.4	11.1	29.9	5.08
August	25½	60.9	263	2.4	10.9	30.6	4.80
September	27½	72.0	284	2.6	10.4	29.6	4.81
October	25½	83.0	264	3.2	10.2	34.8	5.51
November	25½	68.7	243	2.7	9.5	35.3	6.22
December	27½	110.1	484	3.7	17.4	26.8	3.71
Third quarter	77	216.3	849	2.8	11.0	30.0	4.89
Fourth quarter	79	261.8	991	3.3	12.5	31.0	4.80
Second half year	156	478.1	1,840	3.1	11.8	30.6	4.84

*Distribution east and west of the sun's axis.*

Like the previous half-year, there is an excess of areas but a defect of numbers at the east limb, as will be seen from the following table.—

1930 July to December.		East.	West	Percentage East
Total number observed	...	893	943	48.64
Total areas in square minutes	.	251.2	226.9	52.54

*Hydrogen prominences at the limb.*

During the half-year photographs of the prominences in hydrogen light were taken in this observatory on 122 days which were counted as 113 effective days. The mean daily areas, in square minutes of arc, of hydrogen prominences are given below—

		Mean daily areas (square minutes).
North (Kodaikanal photographs only)	... . . . .	0.48
South (do. )	... . . . .	0.66
Total		1.14

Compared with the previous half-year, H $\alpha$  prominence areas show a decrease of about 49 per cent. The percentage of H $\alpha$  areas to calcium areas has also decreased from 42 to 34. The curve of distribution of H $\alpha$  prominences in latitude is similar to that of calcium prominences. As in the case of calcium prominences, the preponderance of activity is now in the southern hemisphere, the ratio of the southern areas to the northern being 1.38 and 1.44 for H $\alpha$  and K prominences, respectively.

*Metallic prominences*

Seven metallic prominences were observed during the half-year. Their details are given below:—

TABLE II.—LIST OF METALLIC PROMINENCES OBSERVED AT KODAIKANAL, JULY TO DECEMBER 1930.

Date.	Time I.S.T.	Base.	Latitude		Limb	Height.	Lines.
			North.	South			
1930.	H M.	°	°	°		"	
July 8	8 54	2	10		W	10	5018.6, b <sub>4</sub> , b <sub>3</sub> , b <sub>2</sub> , b <sub>1</sub> , 5276.2, 5316.8, D <sub>2</sub> , D <sub>1</sub>
September 14	9 4	2	14		E	15	4924.1, 5018.6, b <sub>4</sub> , b <sub>3</sub> , b <sub>2</sub> , b <sub>1</sub> , 5276.2, 5316.8, D <sub>2</sub> , D <sub>1</sub>
21	9 27	1	8.5		W	10	4924.1, 5016, 5018.6, b <sub>4</sub> , b <sub>3</sub> , b <sub>2</sub> , b <sub>1</sub> , 5363.0, D <sub>2</sub> , D <sub>1</sub> , 6677, 7065
November 13	9 11	4	5		W	20	b <sub>4</sub> , b <sub>3</sub> , b <sub>2</sub> , b <sub>1</sub> , D <sub>2</sub> , D <sub>1</sub> (faintly metallic)
December 22	8 55		5		W	15	4924.1, 5016, 5018.6, b <sub>4</sub> , b <sub>3</sub> , b <sub>2</sub> , b <sub>1</sub> , 5234.8, 5276.2, 5316.8, 5363.0, D <sub>2</sub> , D <sub>1</sub> , 6677, 7065
	8 55		9		W	15	4924.1, 5016, 5018.6, b <sub>4</sub> , b <sub>3</sub> , b <sub>2</sub> , b <sub>1</sub> , 5234.8, 5276.2, 5316.8, 5363.0, D <sub>2</sub> , D <sub>1</sub> , 6677, 7065
26	9 6	4	45		W	30	b <sub>4</sub> , b <sub>3</sub> , b <sub>2</sub> , b <sub>1</sub> , D <sub>2</sub> , D <sub>1</sub> .

The distribution of metallic prominences was as follows —

	1—10°	11°—20°	21°—30°	31°—40	41—50°	Mean latitude	Extreme latitudes
North	5	1			1	13° 8	5° and 45°
South							

One was on the east limb and six on the west limb

Displacements of the hydrogen lines

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

TABLE III

Date	Hour I.S.T		Latitude		Limb	Displacement			Remarks
			North	South		Red	Violet	Both ways	
1930	H	M		°		A	A	A	
July	7	8 56	26		W	0.5			At top
	8	8 54	10		W	1			Do
	13	8 40	1		W	1	2.5		To red at top, to violet at base
	14	8 48	10		W		0.5		At base
	17	9 50		88	W		Slight		
	21	8 58		16	E		1.5		At top
August	7	10 18		37	E	1.5			At top
	12	8 46	78		E	1			Do
	13	10 37		42.5	W	2			Do
	18	9 11		13	W		0.5		Do
	19	8 38	5		W		0.5		At base
	21	9 25	62.5		W	1.5			At top
	22	9 6	1		W	1			
	24	8 47	19		W		Slight		At base
	26	8 44	72.5		E		Do		Do
		8 46	69		E	0.5			At top
September	4	9 21	22		E	2.5			At base; extends over 2 from 21° to 23°
	11	9 21	20		E		1		At top
		9 0		4.5	W	1.5			Do
	12	8 58		1	W		0.5		Do
		8 49	27		W		1		No prominence
	16	8 48	31.5		W		1		Do
		8 54		28	W	0.5	1		To violet at base, to red at top
	19	8 49	13		W	1.5			At top
		9 8	15		W	0.5			Do
	21	9 30	5		W	1			At base
9 27		8.5		W	2			Do	
25	9 20	1		E		1.5		At top	
	9 1		28	W	1			Do	
27	9 30	45.5		W	Slight			At base	
	9 30	46.5		W		Slight		At top	
October	2	9 50		30	W	1			At base
	3	10 46		13	W		1.5		At top
		9 6	47.5		W		1.0		No prominence
	8	9 2	4		W	1			At top
		9 2	10		W	1			At top, extends over 2° from 9° to 11°
	30	8 59	21		W		0.5		In chromosphere
9 50		61.5		W	2			At top	
9 23		27		E	2.5			No prominence	

TABLE III—cont.

Date	Hour L.S.T.	Latitude		Limb	Displacement			Remarks
		North	South		Red	Violet	Both ways	
1930	H. M.	°	°		A.	A	A	
November 1	11 0	84		W		1		At top
9	9 35	54		W	15			Do
12	8 45		59	E		1		A floating filament the whole displaced
	8 36		65	E	05	1		To red at base, to violet at top
	8 34		69	E	1			At top
	9 0		48	W		1		At base
13	9 27	47		E		2		At top.
	9 14		40	W	15			At top, extends over 2° from 39° to 41°
14	9 0	13		W	1			At top.
17	10 12		61	W	15			Do
	10 8	48		W		05		At base
27	9 2	115		W		05		At top, extends over 3° from 10° to 13°
December 5	8 50	2		E	05			At top.
6	9 22		3	E	↓			No prominence.
	9 2	6		W	Slight			At top
13	10 26		9	E		1		Do.
	10 45	84		W	05			Do
14	8 54	8		E		15		Do
	8 48	13		W	05			Do
15	8 54	18		E		Slight		At base
17	8 38	52		W		Do		Do
	8 45		88	W	05			At top
18	9 22		14	E	15			At top, extends over 2° from 13° to 15°
	8 52	77		W		4		At top, extends over 2° from 76° to 78°
19	8 58	865		E		1		At top
	9 12		2	W	1			Do.
21	8 48	54		W		05		At base
22	8 47	70		E		05		Do
	8 55	5		W	15	25		To red at top, to violet at base
	8 55	9		W		05		At base
26	9 6	45		W			25	At top, extends over 4° from 43° to 47°
	9 21		64	W	1			At top
27	9 28		27	E	05			
	9 17		15	W	15			At top
28	9 10	47		E	05			Do
31	9 21		7	W	15			Do.

The total number of displacements was 79 as against 197 in the first half of the year and their distribution was as follows:—

Latitude	North	South.
1°—30°	31	16
31°—60°	10	6
61°—90°	10	6
Total	51	28
East limb		24
West limb		55
Total		79

*Reversals and displacements on the sun's disc*

One hundred and thirty four bright reversals of the  $H\alpha$  line, 129 dark reversals of the  $D_2$  line and 25 displacements of the  $H\alpha$  line were observed during the half-year Their distribution is given below.—

	North	South	East	West.
Bright reversals of $H\alpha$	80	54	78	56
Dark reversals of $D_2$	78	51	75	54
Displacements of $H\alpha$	14	11	15	10

Eighteen displacements were towards the red, 3 towards the violet and 4 both ways simultaneously

*Prominences projected on the disc as absorption markings*

Photographs of the sun's disc in  $H\alpha$  light were available from Kodakanal and the co-operating observatories for a total of 176 days, which were counted as 167 effective days The mean daily areas of  $H\alpha$  absorption markings (corrected for foreshortening) in millionths of the sun's visible hemisphere and their mean daily numbers are given below —

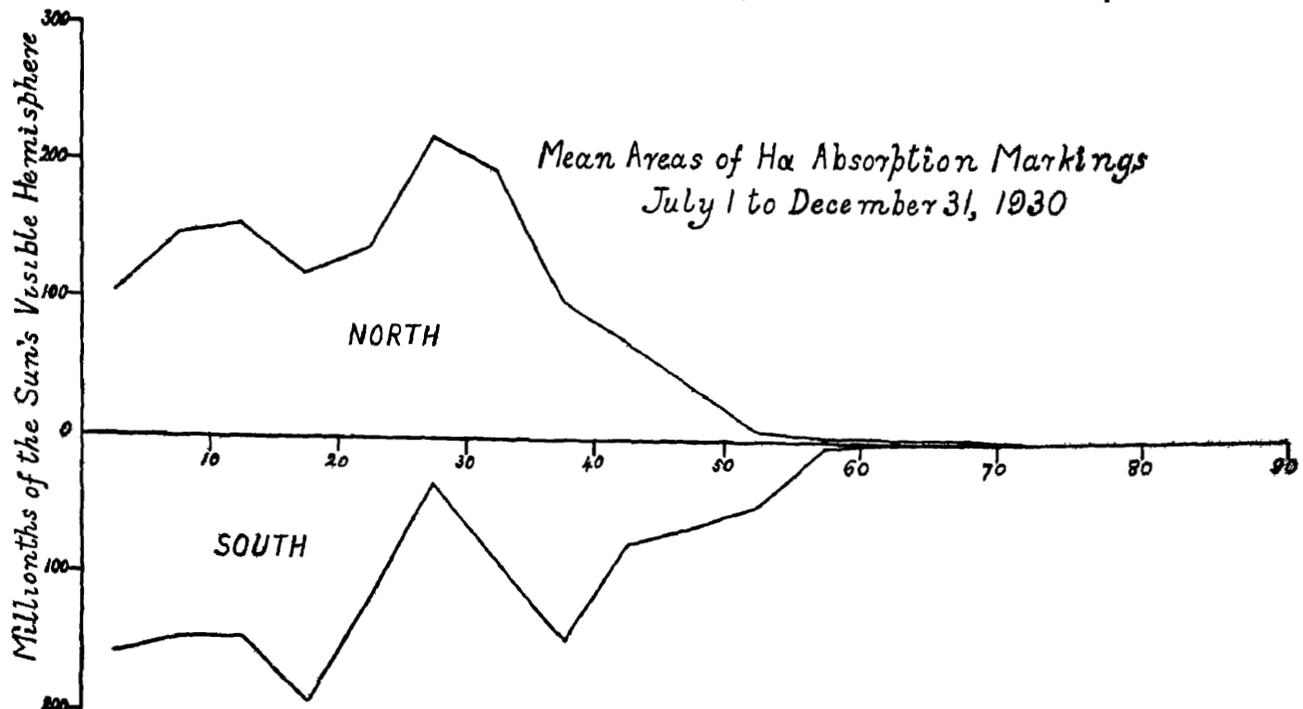
	Mean daily areas	Mean daily numbers
North	1,289	9 49
South	1,205	8 41
Total	<u>2,494</u>	<u>17 90</u>

The above show a decrease of 42 per cent in areas and 26 per cent in numbers, compared with the first half of the year The preponderance of activity in the northern hemisphere is maintained

For comparison with bulletins issued prior to the co operation of other observatories, the means based on Kodakanal photographs alone are also given, 133 days of observation being reckoned as 120½ effective days

	Mean daily areas	Mean daily numbers
North (Kodakanal photographs only)	1,302	9 44
South ( do do )	1,256	8 65
Total	<u>2,558</u>	<u>18 09</u>

The distribution of the mean daily areas in latitude is shown in the following diagram Except for a very low trough in the southern hemisphere near  $30^\circ$  the distribution is very similar to that of calcium and hydrogen prominences at the limb The activity near  $50^\circ$  which in the first half of the year was confined to the northern hemisphere has now disappeared there and reappeared in the southern hemisphere



The areas are equally divided between the eastern and western hemispheres, but the numbers show a slight western excess, with an eastern percentage of 49.3.

The areas of H $\alpha$  absorption markings uncorrected for foreshortening are given below:—

								Mean daily areas
North	..	.	.	...	...	...	...	797
South	..	.	.	...	..	...	..	700
						Total	...	<u>1,497</u>

The uncorrected areas amount to 60 per cent of the corrected ones, a slight increase over the previous three half-years. The curve of distribution in latitude is similar to that for the uncorrected areas

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

KODAIKANAL,  
8th October 1931.

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