

# Kodaikanal Observatory.

BULLETIN No. CVI.

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## SUMMARY OF PROMINENCE OBSERVATIONS FOR THE SECOND HALF OF THE YEAR 1934.

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In pursuance of the programme of work adopted since 1st January 1923 under the auspices of the International Astronomical Union, all observatories taking spectrohelograms of the sun have been asked to co-operate with the Kodaikanal Observatory by supplying copies of their photographs for those days when the Kodaikanal records are imperfect or wanting. In response to our requirements for the second half of the year 1934, the Mount Wilson Observatory supplied calcium ( $K_{232}$ ) prominence plates for 36 days and  $H\alpha$  disc plates for 20 days, the Meudon Observatory supplied calcium ( $K_2$ ) disc plates for 9 days and  $H\alpha$  disc plates for 30 days, and the Pitch Hill Observatory, Ewhurst (Mr J Evershed's) supplied hydrogen prominence plate for 1 day and  $H\alpha$  disc plates for 7 days.

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 Lamb.*—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 176 days for which plates were available being reduced to 148 effective days.

	Mean daily areas (Square minutes)	Mean daily numbers
North . . . . .	1 97	6 70
South . . . . .	1 96	6 65
Total	3 93	13 35

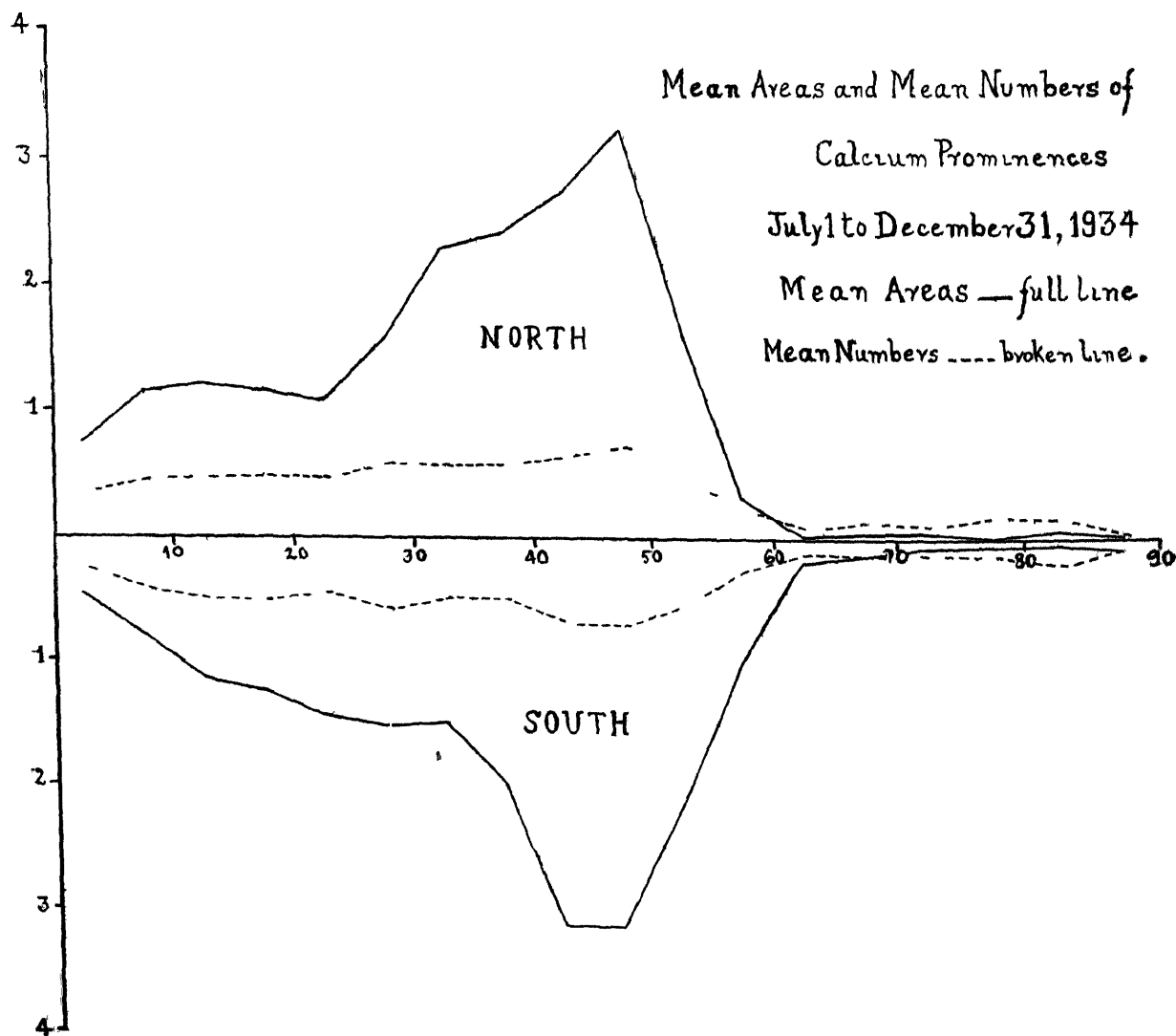
Compared with the previous half-year, areas and numbers show an increase of 16 per cent. and 6 per cent. respectively.

For comparison with bulletins issued prior to the co-operation of other observatories the means based on Kodaikanal photographs alone are also given, 145 days of observation being counted as 127 effective days.

	Mean daily areas (Square minutes).	Mean daily numbers
North (Kodaikanal Photographs only) . . . . .	1 99	6·86
South ( Do ) . . . . .	2 05	6·78
Total . . . . .	4 04	13 64
<b>355</b>		

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  $5^\circ$  of latitude. The ordinates represent tenths of a square minute of arc for the full line and numbers for the broken line.

The general increase in prominence activity observed in the first half year is maintained. Compared with the first half of 1934, there has been increased activity in the belts  $45^\circ$  to  $50^\circ$  in the northern hemisphere and in the belt  $40^\circ$  to  $50^\circ$  in the southern hemisphere. The maximum of prominence activity has again moved about  $5^\circ$  towards the poles in both the hemispheres.



The monthly, quarterly and half yearly areas and numbers and the mean height and the mean extent of the prominences on photographs from all co operating observatories are given in Table I. 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 1934

Months.	Number of days (effective)	Areas.	Numbers	Daily means.		Mean height	Mean extent
				Areas	Numbers		
1934							
July . . . . .	24½	120 3	308	4 9	12 6	38 8	4 89
August . . . . .	24½	99 7	357	4·1	14 6	34·5	4 04
September . . . . .	28½	116·2	424	4 1	15 0	33·0	4 26
October . . . . .	23	82·9	291	3 6	12 7	35 3	3 69
November . . . . .	23½	89 7	275	3 8	11 7	38 0	4 83
December . . . . .	24½	73 1	320	3 0	13 2	32 5	3 50
Third quarter . . . . .	77½	336 2	1089	4 4	14 1	35 1	4 27
Fourth quarter . . . . .	70½	245 7	886	3 5	12 5	35 1	3 97
Second half year . . . . .	148	581 9	1975	3 9	13 3	35 1	4 14

*Distribution East and West of the Sun's Axis*—As in the previous half-year, both areas and numbers show a slight preponderance in the east limb as will be seen from the following table —

1934 July to December	East	West	Percentage East
Total number observed . . . . .	1013	962	51 29
Total areas in square minutes . . . . .	305 3	276 7	52 45

*Metallic Prominences*.—Three metallic prominences were observed during the half-year and their details are given below —

TABLE II.—LIST OF METALLIC PROMINENCES JULY TO DECEMBER 1934

Date	Time I S. T.		Base.	Latitude		Limb	Height	Lines (See note at end of table).
	H.	M.		North	South			
1934			°					
July . . . . .				Nil.				
August 6 . . . . .	9	26	2		35	E	15	4, 10
September . . . . .				Nil				
October . . . . .				Nil				
November 19 . . . . .	10	40	8		22	E	35	4, 10
December 18 . . . . .	10	32	1		21·5	W		4, 10

*Note*.—The key to the wave-lengths of metallic lines is as follows —

No.	$\lambda$	Element.	No	$\lambda$	Element
1	4924·1	Fe+	7	5276 2	Fe+
2	5016·0	He	8	5316·8	Fe+
3	5018·6	Fe	9	5363 0	Fe+
4	$b_4, b_3, b_2, b_1$	Mg	10	$D_2, D_1$	Na
5	5234·8	Fe+	11	6677	He
6	5276·0	Cr	12	7065	He

The distribution of metallic prominences was as follows —

	1°—10°	11°—20°	21°—30°	31°—40°	Mean latitude °	Extreme latitudes °
North						
South			2	1	26° 2	21° 5 & 35°

Two were on the east limb and one 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 HYDROGEN LINE

Date 1934	Hour		Latitude		Limb	Displacement			Remarks	
	I	S	North	South		Red	Violet	Both ways		
										H
July	13	10	48	37			Sl		At base	
	14	8	45	73 5	W		Sl		In chromosphere	
	15	9	45	4	E		1		At base	
	17	8	59	31	W	Sl			Do	
	22	10	16	25 5	E	0 5			At top	
August	6	9	8	83 5	E			0 5	At top	
				17 5	E	1			Do extends over 5° from + 15° to + 20°	
		9 26		35	E			1	At top	
	9 26		40	E			1	Do Extends over 2° from — 39° to — 41°		
	9 26		48	E	2			Do Extends over 4° from — 46° to — 50°		
	7	8	46	78 5	W	Sl			In chromosphere	
	23	8	54	35 5	W	1			At base Extends over 2° from + 34 5° to + 36 5°	
	26	8	44	79 5	W	Sl			In chromosphere	
	28	9	40	85	W			Sl		Do
				4	E			Sl		Do
September	3	9	15		14	W	1		At top	
				25	W	0 5			At base	
	4	10	8	82 5	E	Sl			In chromosphere	
	7	9	20		27	W	Sl		Do	
		9	18	1	27	W		Sl	Do	
	13	9	21		38	E	Sl		At base	
	15	9	40		30 5	W	1		At top	
	18	9	38		26	W	1			Do
9 6				76	E			Sl	Do	
October	5	9	50		49 5	E			At base	
				8	8 20	60 5	W			Sl
		8	20					1	Do Extends over 2° from + 59 5° to + 61 5°	
	November	3	10	27		29	E	1		At top
					28	E			Sl	At base
	19	10	40		18 5	E		1	Do	
	22	8	54		42	W	Sl		At top	

TABLE III.—DISPLACEMENTS OF HYDROGEN LINE

Date. 1934	Hour.		Latitude.		Limb	Displacement.			Remarks.
	I	S T.	North.	South		Red.	Violet.	Both ways.	
	H.	M.	°	°		▲	▲	▲	
December	1	11 20		73	E		Sl		At top.
	7	8 57		61	W	0.5			In chromosphere.
	8	10 30	84		W	1			At top
		10 32	86		W		1		Do
	9	9 55	54.5		E	0.5			At base
	18	10 54		25	E		Sl		At top.
		10 18	46		W	0.5			Do.
		10 15	61		W		Sl		At base
	19	10 7	45		E	Sl			At top
		10 15		28.5	E	0.5			Do.
	24	9 45		26.5	E			Sl	
	25	8 55		35	E	Sl			At base. Extends over 2° from — 34° to — 36°.
	27	10 33		49	E		Sl		In chromosphere.
	31	9 37	31.5		W	3			At top. Extends over 3° from + 30° to + 33°.

The total number of displacements was 45 as against 92 in the previous half-year and their distribution was as follows:—

	North.	South.
1 to 30° . . . . .	6	9
31° to 60° . . . . .	8	9
61° to 90° . . . . .	11	2
Total . . . . .	25	20
East Limb . . . . .		25
West Limb . . . . .		20
Total . . . . .		45

Of these displacements, 24 were towards the red, 20 towards the violet and one both ways simultaneously.

*Reversals and Displacements on the Sun's Disc.*—Fifty-five bright reversals of the H $\alpha$  line, 45 dark reversals of the D $\beta$  line and 3 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 $\alpha$ . . . . .	28	27	38	17
Dark reversals of D $\beta$ . . . . .	24	21	32	13
Displacements of H $\alpha$ . . . . .	1	2	3	.

Two displacements were towards the red, none towards the violet and one both ways simultaneously

*Prominences projected on the Disc as Absorption Markings* —Photographs of the sun's disc in H $\alpha$  light were available from Kodaikanal and the co-operating observatories for a total of 177 days which were counted as

161 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

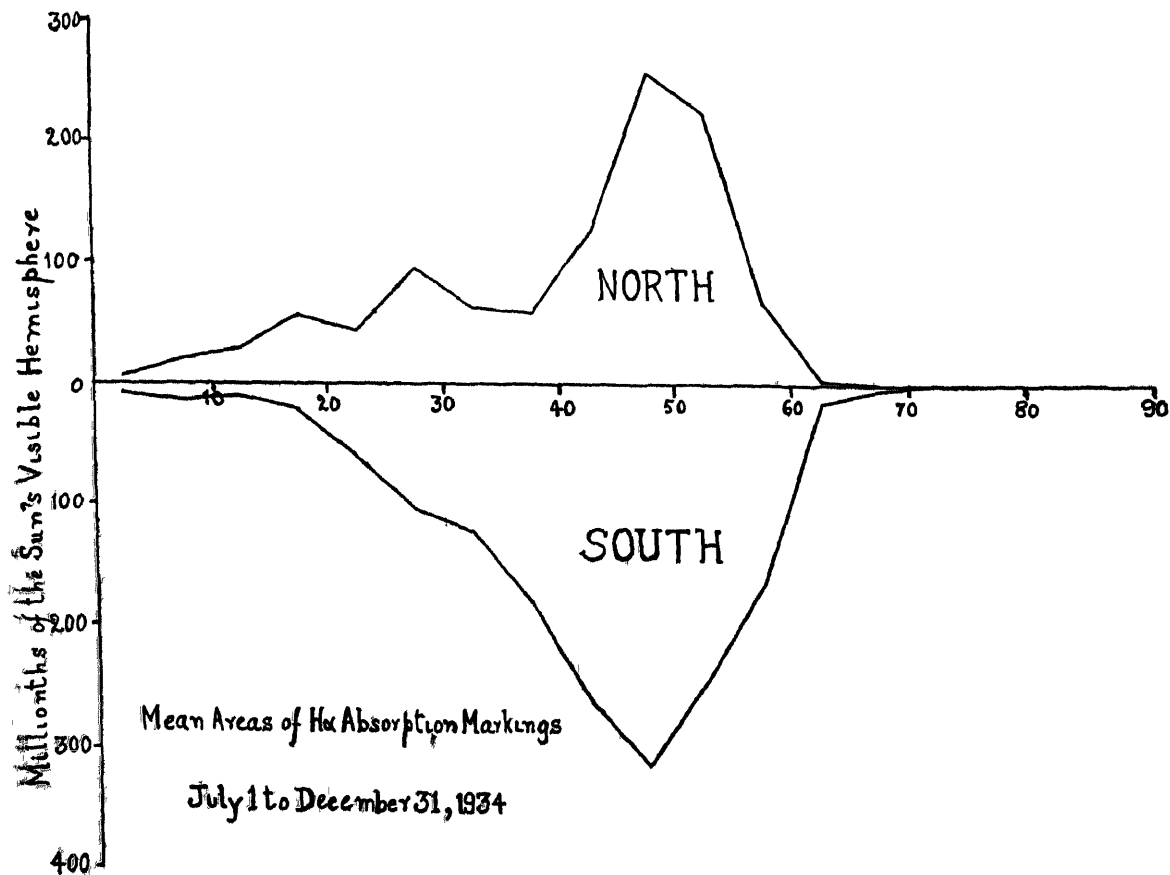
	Mean daily areas	Mean daily numbers
North	1050	5 15
South	1511	6 76
<b>Total</b>	<b>2561</b>	<b>11 91</b>

The above figures show an increase of 64 per cent in areas and 34 per cent in numbers, compared with the first half of the year, the activity in the southern hemisphere being more than doubled

For comparison with bulletins issued prior to the co operation of other observatories the means based on Kodaikanal photographs alone are also given, 135 days of observation being reduced to 122 effective days

	Mean daily areas	Mean daily numbers
North (Kodaikanal photographs only)	1102	5 04
South ( Do )	1439	6 61
<b>Total</b>	<b>2541</b>	<b>11 65</b>

The distribution of mean daily areas in latitude is shown in the following diagram Compared with the previous half year there has been general increase in activity in both the hemispheres, the increase in the southern hemisphere being very marked The maximum of activity is maintained in the zone 45° to 50° in both hemispheres as in the previous half-year and no march of the maximum towards the poles is observed, although the activity between 50° and 60° is greatly increased



Compared with the previous half-year, areas show a slight eastern preponderance and numbers a slight defect, the percentage in areas being 52 and in numbers 49.5.

The mean daily areas of H $\alpha$  absorption markings uncorrected for foreshortening are given below.

	Mean daily areas
North . . . . .	550
South . . . . .	714
Total . . . . .	<hr/> 1264 <hr/>

The uncorrected areas amount to 49 per cent. of the corrected ones, the percentage being slightly less than the previous half-year.

The curve of distribution in latitude is similar to that for the corrected areas as usual.

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

KODAIKANAL,

..9th August 1935

T ROYDS,

Director, Kodaikanal Observatory.