

# Kodaikanal Observatory.

BULLETIN No. LXXV.

## SUMMARY OF PROMINENCE OBSERVATIONS FOR THE SECOND HALF OF THE YEAR 1923.

In accordance with a resolution of the International Astronomical Union meeting held in Rome in 1922, the Kodaikanal Observatory has undertaken, with effect from 1st January 1923, the work of compilation and discussion of statistics derived from photographs of prominences and H $\alpha$  absorption markings of the Sun. All observatories taking prominence and H $\alpha$  spectroheliograms of the Sun have been asked to co-operate by supplying copies of their photographs on those days when the Kodaikanal record is imperfect or wanting. In this Bulletin 11 K $\alpha$  disc plates and 34 H $\alpha$  disc plates from the Mendon Observatory and 2 prominence plates from the Yerkes Observatory have been used to supplement the records available at Kodaikanal for the second half of the year 1923. The publication of this bulletin has been delayed through waiting for 41 prominence plates and 31 H $\alpha$  plates from the Mount Wilson Observatory, but as it now appears that these have been lost in transit, they could not be included in the discussion. If these photographs turn up eventually, the data for this half-year will be corrected in a later bulletin.

When incomplete or imperfect photographs from more than one observatory are available for the same day, 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 incomplete or imperfect observations, the total of 142 days being reduced to 112 effective days.

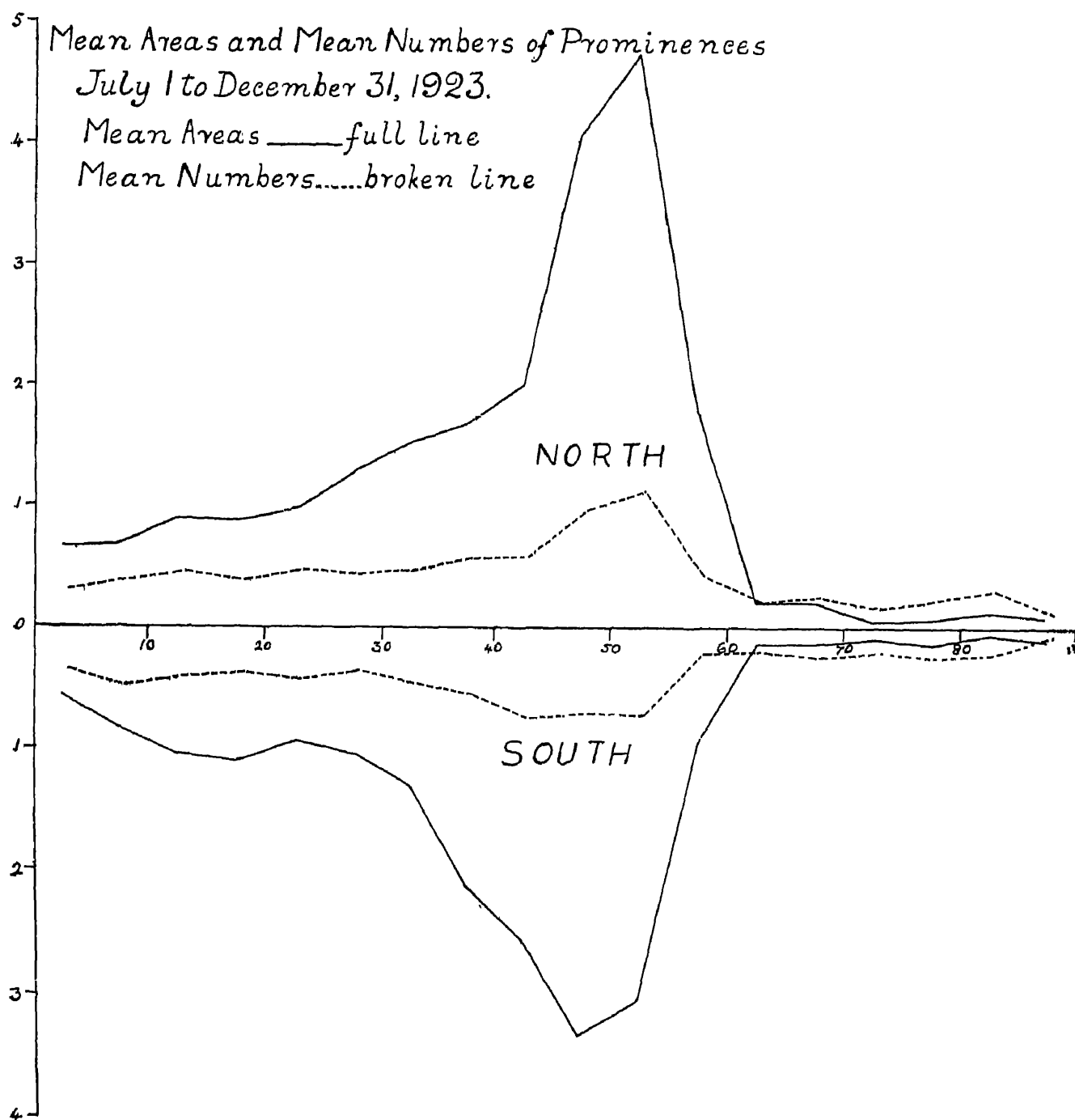
								Mean daily areas (square minutes).	Mean daily numbers.
North	...	...	...	...	...	...	...	2.20	7.89
South	...	...	...	...	...	...	...	1.96	7.11
						Total	...	4.16	15.00

Compared with the previous half-year, areas show a decrease of 9 per cent and numbers a decrease of 6 per cent in the northern hemisphere. In the southern hemisphere areas have decreased by 5 per cent and numbers remain practically unchanged.

For comparison with previous bulletins issued prior to the co-operation of other observatories, the means based on Kodaikanal photographs alone are also given, 135 days being counted as 108 effective days.

					Mean daily areas (square minutes).	Mean daily numbers.
North (Kodaikanal photographs only)	...	...	...	...	2.22	7.98
South		do.	...	...	1.96	7.15
				Total	4.18	15.13

The distribution of the prominences in latitude is represented in the accompanying 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 distribution is similar to that during the first half of 1923, but there is a reduction in activity from the equator to latitude  $30^\circ$  in both hemispheres.



The monthly, quarterly and half-yearly areas and numbers and the mean height and mean extent of the prominences on photographs from the 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 1923.

Months.	Number of days (effective).	Areas.	Numbers.	Daily Means.		Mean height.	Mean extent.
				Areas.	Numbers.		
July	14½	60·3	178	4·5	13·0	35·5	3·61
August	18½	63·6	285	3·4	15·4	29·8	3·26
September	20¾	84·8	334	4·1	16·1	31·7	3·42
October	16¾	67·6	251	4·0	15·0	37·0	2·80
November	25	123·9	390	5·0	15·6	35·6	4·08
December	16½	64·5	244	3·9	14·8	34·0	3·51
Third quarter	53¾	208·7	797	3·9	14·9	31·9	3·40
Fourth quarter	58½	256·0	885	4·4	15·2	35·6	3·56
Second half-year	112	464·7	1682	4·2	15·0	33·8	3·49

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

There is again a western preponderance of both areas and numbers as will be seen from the following table :—

1923 July to December.	East.	West.	Percentage East.
Total number observed ... ..	787	896	46·48
Total areas in square minutes ... ..	225·1	239·6	48·44

*Metallic prominences.*

Only two metallic prominences were observed. Both of them were recorded in the month of November and their details are given below :—

TABLE II.—LIST OF METALLIC PROMINENCES OBSERVED AT KODAIKANAL, JULY TO DECEMBER 1923.

Date.	Time I.S.T.	Base.	Latitude.		Limb.	Height.	Lines
			North.	South.			
1923	H. M.	°	°	°		"	
November 4	9 11	11	30·5		East	70	D <sub>1</sub> , D <sub>2</sub> , 6677.
„ 10	9 58	3	32·5	...	West	40	b <sub>1</sub> , b <sub>2</sub> , b <sub>3</sub> , b <sub>4</sub> , 5316·8, D <sub>1</sub> , D <sub>2</sub> .

*Displacements of the hydrogen lines.*

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

TABLE III.—DISPLACEMENTS OF HYDROGEN LINES.

Date.	Time L.S.T.	Latitude.		Limb.	Displacement.			Remarks.
		North.	South.		Red.	Violet.	Both ways.	
1923	H. M.	°	°		A.	A.	A.	
July	6	8 54	13	E		Slight		At base.
	6	8 57	53	E		Do.		At top.
	6	8 42	24	W	1	0.5		To red at top; to violet at base.
	6	8 36	75.5	W		Slight		
	14	10 23	19	W		Do.		
	16	9 15	23	W		Do.		
	17	8 35	42	E			Slight	
	18	9 12	5.5	E	0.5			At top.
	18	8 48	22.5	W	1			Do.
	27	9 42	63.5	E		0.5		At base.
	27	9 40	69.5	E		Slight		Do.
August	2	9 35	7.5	W	Slight			
	16	8 51	79.5	E	Do.			At base.
	17	8 40	37	W	Do.			
	17	8 42	71	W		Slight		At base.
	19	8 46	26	W		Do.		
	19	8 44	7	W		Do.		
	19	8 41	38	W	0.5			
	20	8 27	63	W		Slight		
	20	8 20	61.5	W		Do.		
	21	8 44	2	W	Slight			
	21	8 40	53.5	W	Do.			
	23	9 5	40.5	W	Do.			
	24	9 15	55.5	E		0.5		
	24	9 1	31.5	W	Slight			At top.
	25	8 50	32	E	Do.			At base.
	28	8 16	23	W		Slight		At top.
	30	8 42	5	E	0.5			Do.
	31	8 44	21.5	E	0.5			Do.
	31	8 48	13	W	Slight			At base.
September	4	9 21	1	W		Slight		
	6	8 52	30.5	W		Do.		
	9	9 55	53.5	E		0.5		At base.
	10	9 15	66	W		0.5		
	10	9 16	24	W		Slight		
	11	9 11	46	E		1.5		At top.
	11	8 57	33.5	W		1		At base.
	12	9 18	33	W		1		At top.
	13	8 40	17	E	Slight			
	13	8 37	6	E	0.5			
	13	8 32	30.5	E	Slight			
	17	8 44	79.5	W	0.5			
	19	9 54	24	W	1			
	21	8 34	15	W		0.5		At base.
	23	8 41	7	W	Slight			At top.
	23	8 40	13	W		0.5		
	24	8 25	19	E			1	
	24	8 35	64	W		0.5		
	25	8 50	38.5	E		Slight		
	25	8 51	35.5	E	1.5			At base
	25	8 41	25	W		0.5		Do.
	25	8 32	53	W		Slight		
	27	9 7	77	W		0.5		In chromosphere.
	28	8 45	15	E		Slight		At base.
	30	9 4	53	E	1			

Date.	Time I.S.T.	Latitude.		Limb.	Displacement.			Remarks.
		North.	South.		Red.	Violet.	Both ways.	
1923	H. M.	°	°		A.	A.	A.	
October	4	8 59	80.5	W	2			
	5	9 20	25	E	0.5			At top.
	5	9 12	34	W	1			At top; 2.5 A at 9 h. 15 m
	5	9 22	34	W		0.5		At base.
	5	9 4	27.5	W	1			At top.
	5	8 58	52	W		0.5		At base.
	6	8 30	73	E	Slight			
	6	8 48	22.5	W		Slight		
	7	8 29	66	W		Do.		
	7	8 27	82.5	W	1			At top.
	8	11 37	52	E	0.5			
	9	9 43	9	E		1		At top.
	9	9 30	4	E	1			At top.
	9	9 33	56	W	0.5			
	12	10 34	6	E		1		At top.
	14	10 47	56	E		1		
	15	9 24	65.5	W		0.5		
	22	9 26	53	E	Slight			
	30	8 18		W		Slight		
	31	9 25	8	W	1			At top.
	31	9 20	5	W	Slight			
	31	9 20	51	W	Slight			
November	4	9 11	31	E	1	0.5		To red at top; to violet at base.
	5	8 52	51	E	0.5			At top.
	6	8 43	59.5	E	Slight			
	8	8 40	39.5	W		1.5		
	9	9 20	62	E		Slight		
	10	9 58	32.5	E	0.5			
	11	9 8	38	E	Slight			
	11	9 5		W	Do.			
	11	8 57	60	W		0.5		
	12	8 54	37	W		Slight		
	12	8 38	68	W	0.5			
	16	9 4	47	E		Do.		At base.
	16	8 52	31.5	W	1			At top.
	16	8 38	78.5	W		Do.		
	18	8 40	28	W		Do.		
	18	8 34	69	W	Slight			
	19	8 43	40	W		Do.		At base.
	19	8 35	60	W		Do.		Do.
	20	8 35	64.5	W		Do.		
	22	10 3	26	W	0.5			At top.
	26	8 46	87.5	E		0.5		
December	5	8 35	29	W	0.5	Slight		To red at base; to violet at top.
	11	8 25	56	E	Slight			
	11	8 22	40	E			Slight	Symmetrically widened.
	11	8 32	44	W	0.5			
	12	9 00	77	E		Slight		
	12	9 27	82	W		1		At base
	12	9 28	87	W	1			At top
	18	10 17	70	W	Slight			
	23	9 20	86.5	E	0.5			
	23	9 27	24	W		Slight		
	24	9 6	85.5	W	1			At top.
	25	8 44	53	E	2			At top; not seen at 9 h. 5 m.
	25	9 00	72	W	2			At top.
	25	8 48	82.5	W	1.5			
	25	8 38	86.5	W		Slight		At base.

The total number of displacements was 115, and they were distributed as follows :—

Latitude.		North.	South.				
1°—30°	...	25	14				
31°—60°	...	30	13				
61°—90°	...	19	14				
	Total ...	74	41				
East limb	... ..	...	...	...	...	...	43
West limb	... ..	...	...	...	...	...	72
				Total ...			115

Fifty-five displacements were towards the red, 57 towards the violet and 3 both ways simultaneously.

*Reversals and displacements on the disc.*

Thirty-three bright reversals of the H $\alpha$  line, 10 dark reversals of the D $_3$  line and 10 displacements of the H $\alpha$  line on the disc were observed during the half-year. Their distribution is shown below :—

			North.	South.	East.	West.
Bright reversals of H $\alpha$	... ..	...	17	16	19	14
Dark reversals of D $_3$	... ..	...	5	5	7	3
Displacements of H $\alpha$	... ..	...	6	4	6	4

Nine displacements were towards the red and one towards the violet.

*Prominences projected on the disc as absorption markings.*

Photographs of the Sun's disc in H $\alpha$  light were available from the co-operating observatories for a total of 141 days counted as 124½ effective days. The mean daily areas of H $\alpha$  absorption markings (corrected for foreshortening) in millionths of the Sun's visible hemisphere, and the mean daily numbers are given below :—

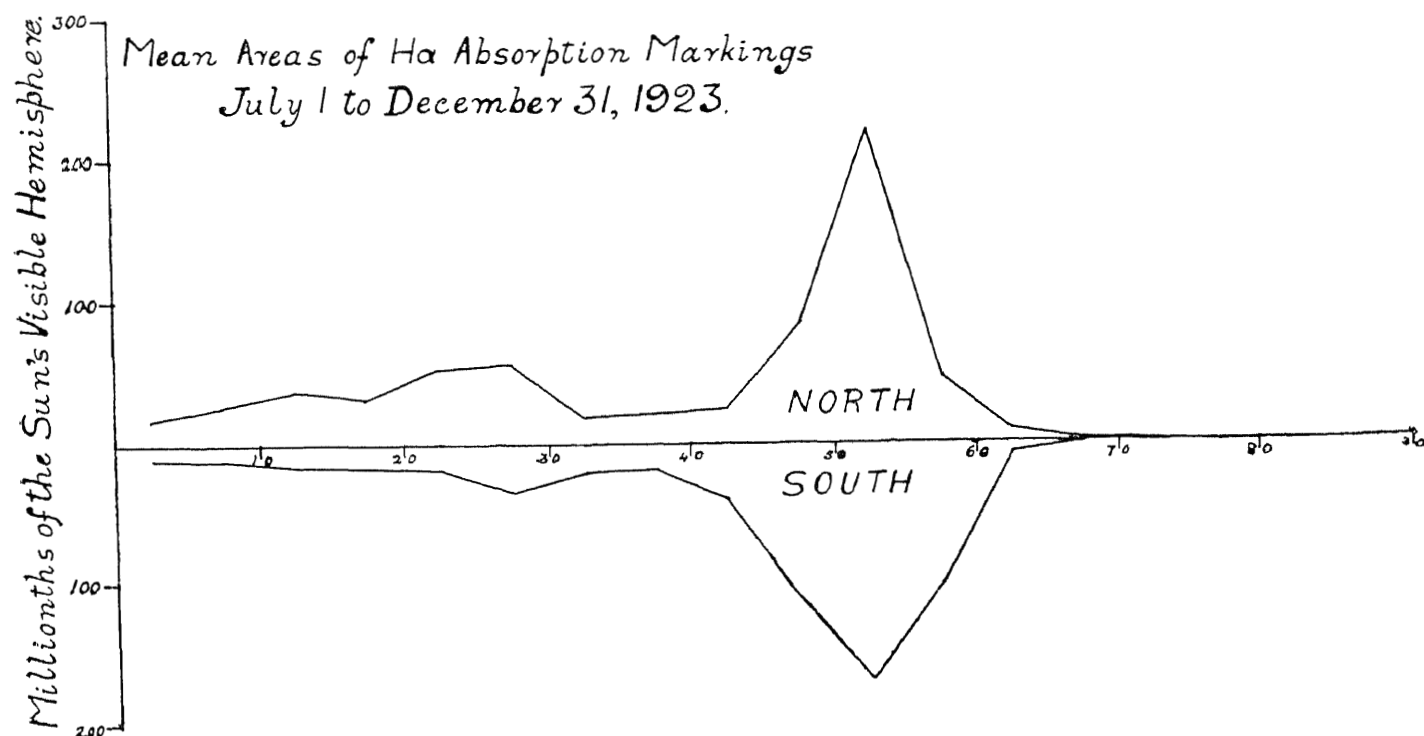
				Mean daily areas.	Mean daily numbers.
North	... ..	...	...	644	5'4
South	... ..	...	...	594	4'7
			Total ...	1238	10'1

These figures indicate an increase of 17 per cent in total areas and 19 per cent in numbers compared with the previous half-year.

For comparison with previous bulletins issued prior to the co-operation of other observatories, the means based on Kodaikanal photographs alone are also given, 114 days of observation being reduced to 92 effective days.

				Mean daily areas.	Mean daily numbers.
North (Kodaikanal photographs only)	... ..	...	...	479	5'1
South do.	... ..	...	...	621	4'9
			Total ...	1100	10'0

The distribution of mean daily areas in latitude is shown in the following diagram and is similar to that for the first half of the year except that the maximum occurs at  $50^{\circ}$ — $55^{\circ}$  in both hemispheres and the minimum at  $30^{\circ}$ — $40^{\circ}$  is less marked :—



Unlike prominences at the limb, the areas of absorption markings show an eastern preponderance, the percentage east being 53'03. In the case of numbers, however, the eastern percentage is only 48'58.

The Director wishes to thank the co-operating observatories for the photographs they have supplied.

THE OBSERVATORY, KODAIKANAL,  
11th November 1924.

T. ROYDS,  
Director, Kodaikanal and Madras Observatories.