

Kodaikanal Observatory.

BULLETIN No. LXXVII.

SUMMARY OF PROMINENCE OBSERVATIONS FOR THE SECOND HALF OF THE YEAR 1924.

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 1924, the Mount Wilson Observatory sent prominence plates for 56 days and *H α* disc plates for 42 days; Meudon Observatory sent *K α* disc plates for 35 days and *H α* disc plates for 23 days and the Heliophysical Institute at Utrecht sent *H α* disc plate for one day. No plates were asked for from the Yerkes Observatory during the half-year.

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 weighing 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 180 days being reduced to 159 effective days.

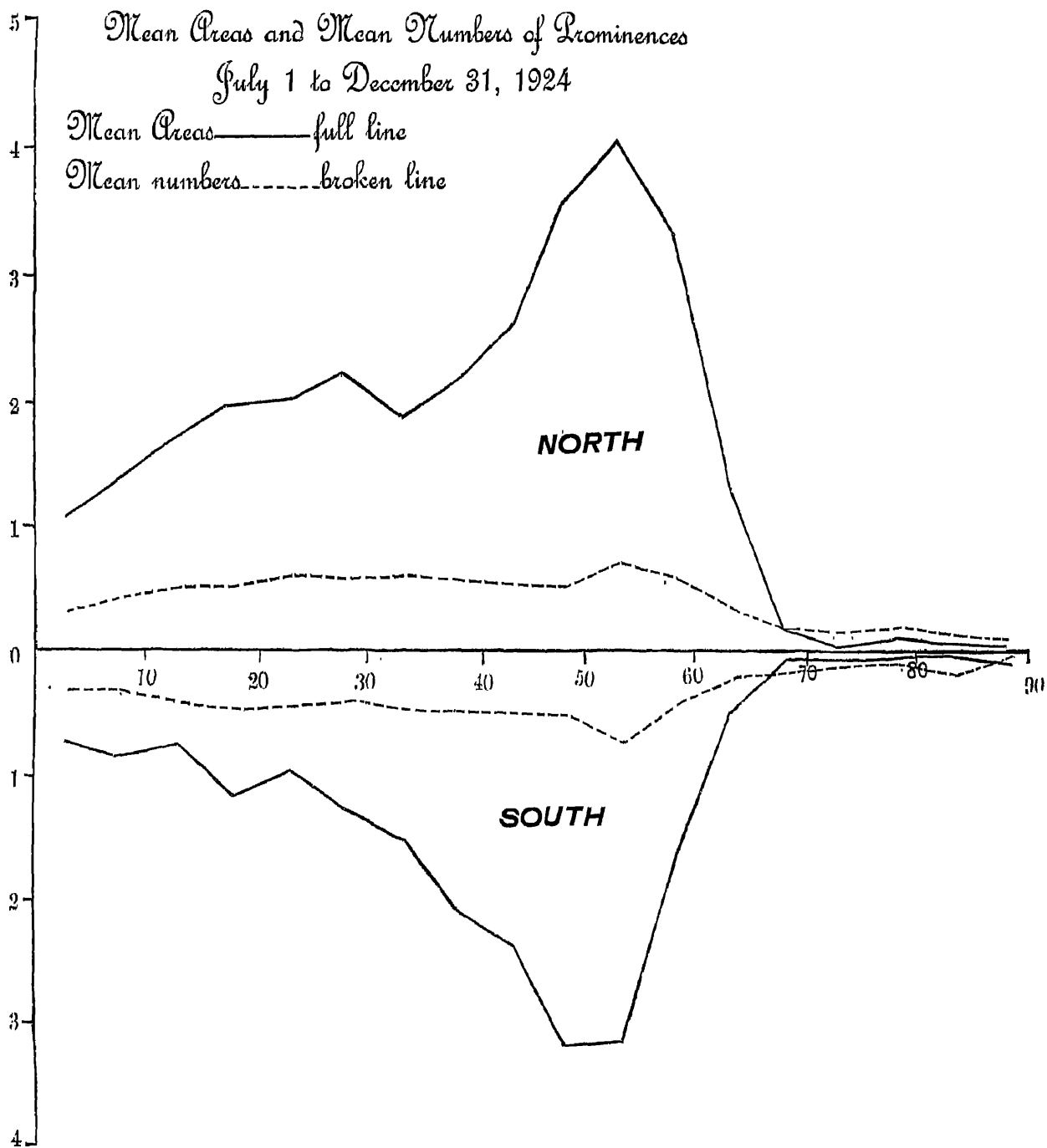
	Mean daily areas (square minutes).	Mean daily numbers.
North	2.97	7.66
South	2.06	6.37
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Total	5.03	14.03
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Compared with the previous half-year, areas have increased by 13 per cent in the northern hemisphere. In the case of numbers, there is a decrease amounting to 5 per cent in the northern hemisphere and 13 per cent in the southern. The activity was more pronounced in the northern hemisphere in the case of both areas and numbers.

For comparison with bulletins issued prior to the co-operation of other observatories, the means based on Kodaikanal photographs alone are also given. 148 days of observation being counted as 125½ effective days.

	Mean daily areas (square minutes).	Mean daily numbers.
North (Kodaikanal photographs only)	3.23	8.14
South do.	2.33	6.92
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Total	5.56	15.06
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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. The distribution is practically similar to that during the previous half-year, except for an increase of activity in the northern hemisphere.



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 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 1924.

Months.	Number of days (effective).	Areas.	Numbers.	Daily Means.		Mean height.	Mean extent.
				Areas.	Numbers.		
1924						"	"
July	26½	99·6	331	3·8	12·5	36·1	4·22
August	26½	118·7	310	4·5	11·7	37·6	4·14
September	27	111·1	357	4·1	13·2	34·6	4·10
October	26½	170·1	436	6·4	16·5	37·2	5·32
November	26½	159·5	399	6·0	15·0	40·4	4·57
December	26	141·1	393	5·4	15·1	34·4	4·57
Third quarter	80	329·4	998	4·1	12·5	36·0	4·15
Fourth quarter	79	470·7	1228	6·0	15·5	37·3	4·84
Second half-year	159	800·1	2226	5·0	14·0	36·8	4·53

Distribution east and west of the Sun's axis.

There was an excess of prominence areas in the eastern hemisphere and of numbers in the western. The figures are given below :—

1924 July to December.	East.	West.	Percentage East.
Total number observed	1095	1131	49·2
Total areas in square minutes	423·8	376·3	53·0

Metallic prominences.

Details of the metallic prominences observed during the half-year are given in the following table :—

Table II.

TABLE II.—LIST OF METALLIC PROMINENCES OBSERVED AT KODAIKANAL, JULY TO DECEMBER 1924.

Date.	Time I.S.T.	Base.	Latitude.		Limb.	Height.	Lines.
			North.	South.			
1924	H. M.	°	"	"		"	
July	3 10 50	30	E	30	D ₁ , D ₂ .
September	21 8 47	..	20		W	20	L ₁ , b ₁ , b ₂ , D ₁ , D ₂ .
October	3 8 25	5	...	29.5	E	20	5016, b ₁ , b ₂ , b ₃ , b ₄ , 5316.8, D ₁ , D ₂ , 6677, 7065.
	4 9 48	1	33.5		E	10	b ₁ , b ₂ , b ₃ , b ₄ , D ₁ , D ₂ .
November	14 8 57	2	29		E	20	b ₁ , b ₂ , b ₃ , b ₄ , D ₁ , D ₂ .
	15 9 52	2	29		E	10	5018.6, b ₁ , b ₂ , b ₃ , b ₄ , 5316.8, D ₁ , D ₂ , 6677, 7065.
	18 8 55	...	30		E	15	b ₁ , b ₂ , b ₃ , b ₄ , D ₁ , D ₂ , 6677, b ₃ being very marked.
	29 8 42	2	27		W	20	4924.1, 5018.6, b ₁ , b ₂ , b ₃ , b ₄ , 5316.8, D ₁ , D ₂ .
December	1 8 56	...	24		W	15	4924.1 5016, b ₁ , b ₂ , b ₃ , b ₄ , 5316.8, 5363.0, D ₁ , D ₂ , 6677.
	6 8 55	..	22		E	25	4924.1, b ₁ , b ₂ , b ₃ , b ₄ , 5316.8, D ₁ , D ₂ , 6677.
	28 8 42	2	25		W	10	4924.1, 5016, 5018.6, b ₁ , b ₂ , b ₃ , b ₄ , 5234.8, 5316.8, D ₁ , D ₂ , 6677, 7065.
	29 9 10	3	25.5		W	10	5016, 5018.6, b ₁ , b ₂ , b ₃ , b ₄ , 5276.2, 5316.8, 5363.0, D ₁ , D ₂ .

All the metallic prominences were in high latitudes as will be seen from their distribution in latitude given below :—

	11°-20°	21°-30°	31°-40°	Mean latitude.	Extreme latitudes.
North	1	8	1	26°.5	20° and 33°.5
South	2	...	29°.8	29°.5 and 30°

Seven were on the east limb and five on the west.

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.	Hour I.S.T.	Latitude.		Limb.	Displacement.			Remarks.
		North.	South.		Red.	Violet.	Both ways.	
1924	H. M.	°	°		A.	A.	A.	
July	2 8 59		50	E	1			In chromosphere.
	2 9 26		36	W	2			At top.
	3 8 46	33		W		Slight		At base.
	3 8 43	43.5		W		Do.		Do.
	3 8 38	86.5		W	0.5			At top.
	4 10 16	82		E		Slight		
	6 8 56	20		E	1			At base.

Date.	Hour I.S.T.		Latitude.		Limb.	Displacement.			Remarks.
			North	South.		Red.	Violet.	Both ways.	
1924	H.	M.	°	'		A.	A.	A.	
July	6	9 3			E		Slight		At top.
	6	8 44	84.5	78.5	W	1			Do.
	7	8 38	53		W	Slight			Do.
	26	11 21	49.5		E		0.5		Do.
	29	8 41	47		W		Slight		
	29	8 37	70		W		2		
	31	10 32		54	E	1			At top.
August	1	8 51	35		W		Slight		
	3	9 16	5.5		E		1		At top.
	4	11 45	24		W	0.5			Do.
	18	10 50		17.5	W	1	0.5		To red at top ; to violet at base.
	18	10 45	74.5		W		0.5		At base.
	18	10 42	78		W	1			At top.
	19	9 32		14	W	3	1.5		
	25	8 48	70		W		Slight		At base.
	28	10 33	61		E		1		At top.
	29	8 45	30.5		W	2			
	31	10 22	51		W		0.5		At base.
	31	10 20	81		W	0.5			At top.
September	1	9 36	81.5		W		0.5		At base.
	5	11 19		65	W		Slight		Do.
	5	11 12		67	W	0.5			At top.
	6	9 40	21		W	0.5	1		To red at top ; to violet at base.
	7	9 0	62		E	Slight			
	7	9 7	13		E		0.5		At top.
	7	9 14	20		W	1			Do.
	7	8 55	26		W	4			No prominence.
	10	9 7	11		W	0.5			At top.
	11	9 10		28	W	1			Do.
	11	9 0	40		W		Slight		At base.
	12	8 45		42.5	E		Do.		
	16	8 41	49.5		W	Slight			
	21	9 6	71.5		E		Slight		
	21	8 28	67		W	0.5			
21	8 34	78.5		W	Slight				
28	8 14		33.5	W	Do.				
October	2	8 50	Axis.		...	1			At top.
	3	8 25		32	E	2			At base.
	3	8 25		27	E		1		At top.
	4	9 40		4.5	E		Slight		
	4	9 30		27.5	E	1	1		To red at base ; to violet at top.
	4	9 27		37	E		Slight		At base.
	5	8 48	19		W		Do.		No prominence.
	5	8 46	36		W	1			At top.
	6	9 50	14		W	1			Do.
	10	8 34	79		E		Slight		No prominence.
	10	8 54		74	W	1			At top.
	10	8 52		37.5	W	1			Do.
	12	8 38	64.5		W		0.5		At base.
	14	8 44	36		W	1			At top.
	19	9 2		34	W	Slight			Do.
	20	8 34	8.5		W	Do.			
	23	9 4		64.5	W		Slight		
23	8 55	63		W	Slight			At top.	
24	9 2	7		W		0.5			
November	7	8 46		40.5	W		Slight		At base.
	10	10 9	67		W	1			At top.
	13	11 50	20		E	1.5			Do.
	14	8 47		62	E	Slight			
	15	9 39	22		E		1		At top.
	15	9 39	20		E		0.5		Do.
	18	8 55	30		E	6	2		

Date.	Hour I.S.T.	Latitude.		Wind.	Displacement.			Remarks.	
		North.	South.		Red.	Violet.	Both ways.		
1924 November									
	20	9 33	°		A.	A.		In atmosphere.	
	21	9 35	80	°	2	Slight			
	23	9 17	88.5	68.5	1	0.5			
	24	9 8	83	51	0.5	0.5			
	24	8 50	51		0.5				
	25	9 12	63	60	Slight	Slight			
	25	9 9	63	3	1	0.5			
	25	8 54	20		1	0.5			
	29	8 43	27		0.5	0.5			
	29	8 38	50		0.5	0.5			
	29	8 35	78.5		0.5	0.5			
	30	9 20	25		0.5	0.5			
	30	10 12		59					
	30	10 14		75					
	30	10 18		75					
	30	10 18			4	1			
	30	9 9	23		1	2			
	December	1	8 56	22		2			
		1	8 56	20					
		1	8 47	12					
		2	8 44	20		0.5			
		2	8 46	24					
		2	8 34	73					
		3	9 9	31	78	0.5	0.5		
		3	9 9	32		1	0.5		
		3	8 37	59		1	1		
		4	8 45	32	16				
		4	8 41	78					
		4	8 39	22		0.5			
		4	8 35	22		2	0.5		
5		8 49	76	85.5					
6		8 48	28.5						
6		8 33	38						
9		8 47	25		Slight	Slight			
9		8 30	25		Slight	0.5			
10		9 11	38		Slight	0.5			
10		8 56	26						
11		8 58	6						
11		8 58	28.5						
13		8 34	5	7.5					
13		8 53	38		Slight	Slight			
17		8 50	84.5						
18		8 46	85.5						
18		8 46	42						
21		8 42	44.5						
23		8 55	20		1	Slight			
23		8 52	29.5		1	0.5			
23		8 50	15		1	0.5			
24	8 50	5							
24	8 43	77							
25	9 0	30	19						
25	8 52	65		1	Slight				
26	9 10	53		Slight	Slight				
26	9 10	29		1	0.5				
27	8 35	74							
28	8 25	86.5							
28	8 38	36							
29	9 10	25							
29	9 10	26.5							
29	9 10	30							
30	8 8	79.5							
31	8 18	82							

The total number of displacements was 141, which were distributed as follows :—

Latitude	North.	South.
1°—30°	41	17
31°—60°	24	16
61°—90°	30	13
Total	95	46

East limb	49
West limb	91
Pole	1
Total	141

Eighty displacements were towards the red, 60 towards the violet and one both ways simultaneously.

Reversals and displacements on the disc.

One hundred and fifteen bright reversals of the H α line, 49 dark reversals of the D $_3$ line and 34 displacements of the H α line were observed on the disc during the half-year under report.

Their distribution is given below :—

	North	South.	East.	West.
Bright reversals of H α	94	21	61	54
Dark reversals of D $_3$	13	6	32	17
Displacements of H α	30	4	18	16

Of the displacements, 23 were towards the red, 8 towards the violet and three both ways simultaneously.

Prominences projected on the disc as absorption markings.

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

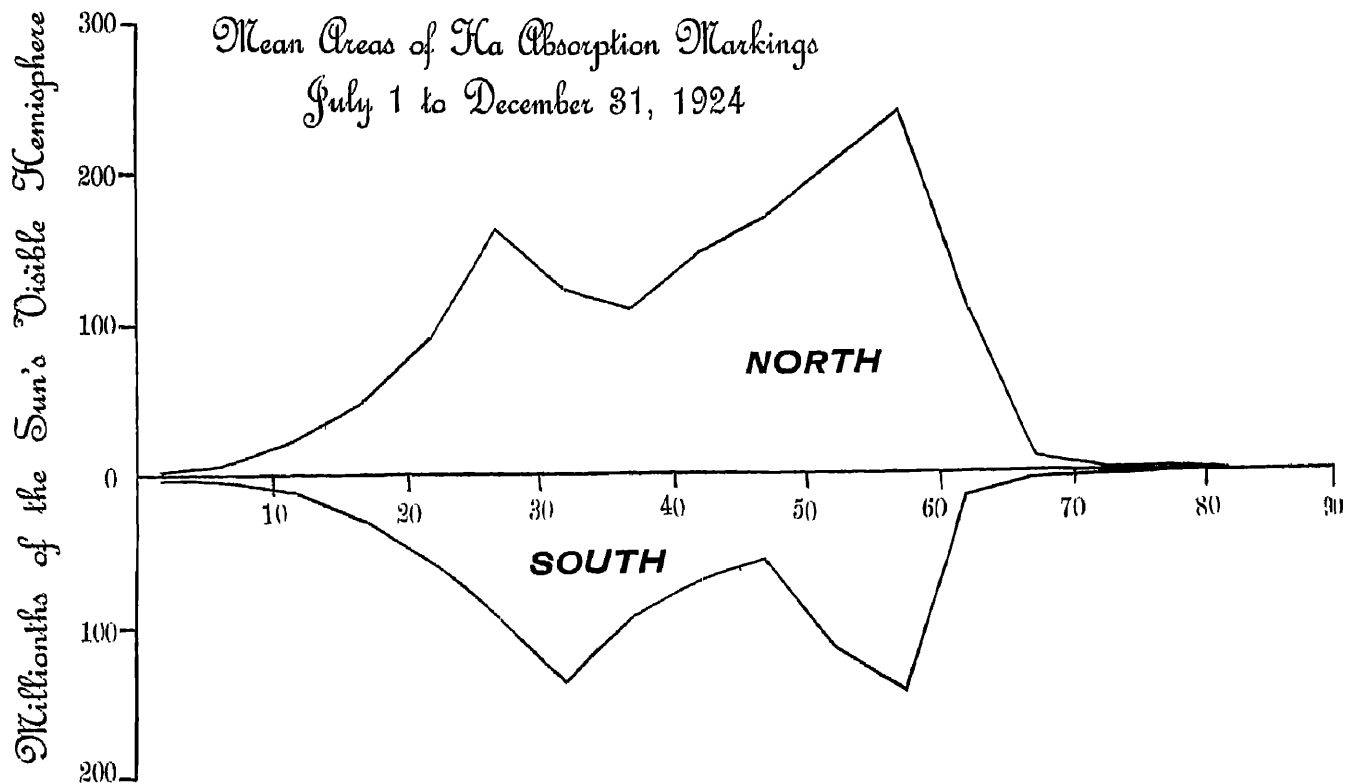
	Mean daily areas.	Mean daily numbers.
North	1470	10.8
South	828	6.1
Total	2298	16.9

The above figures indicate a large increase of both areas and numbers in the northern hemisphere compared with the previous half-year. This change has resulted in a preponderance of activity in this hemisphere as in the case of prominences at the limb.

For comparison with bulletins issued prior to the co-operation of other observatories, the means based on Kodaikanal photographs alone are also given, 133 days of observation being counted as 124 effective days

	Mean daily areas.	Mean daily numbers.
North (Kodaikanal photographs only)	1584	11.7
South do.	908	6.3
Total	2492	18.0

The distribution of the mean daily areas in latitude is shown in the following diagram. The curve is markedly different from that of the previous half-year and shows a well defined secondary maximum at latitude 25° to 35° in addition to the primary maximum at 55° to 60° in the two hemispheres.



Both areas and numbers of the absorption markings show an excess in the eastern hemisphere, the percentage east being 51.8 for areas and 50.4 for numbers.

THE OBSERVATORY, KODAIKANAL,
26th September 1925.

A. A. NARAYANA AYYAR,
Assistant in Charge, Kodaikanal Observatory.