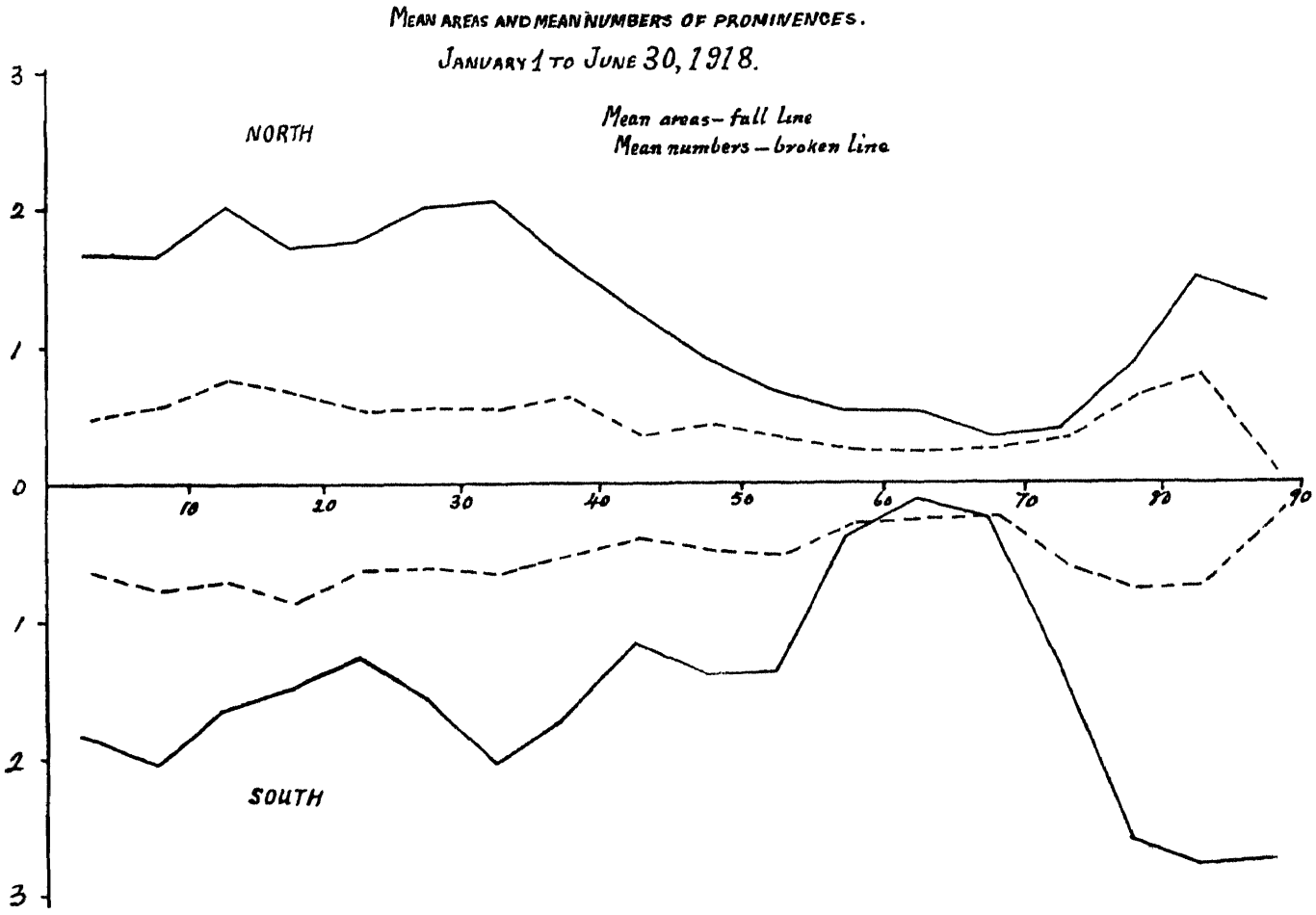
Kodaikanal Observatory.

BULLETIN No. LIX.

SUMMARY OF PROMINENCE OBSERVATIONS FOR THE FIRST HALF OF THE YEAR 1918.

The distribution of prominences observed and photographed during the half-year ending June 30, 1918, is represented in the accompanying diagram. 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 means are corrected for incomplete or imperfect observations, the total of 171 days being reduced to 151 effective days.



The most striking change since the previous half-year is the great increase in the south polar promi. nences ; there is also a further increase of latitude of the polar prominences, which are now shown to envelop

both poles. The regions of minimum activity between the polar and mid-latitude prominences are shown between 65° and 75° in the north and between 60° and 65° in the south. In this last zone the activity fell to a very low ebb. At the equator prominence activity shows a marked decrease compared with the previous half-year.

The mean daily areas and daily numbers corrected for imperfect records are given below .—

	Mean daily areas (square minutes)	Mean daily numbers.
North	2 28	8'77
South	2'72	9'39
Total ...	5'00	18'16

This indicates a very slight increase over the previous half-year in areas and a decrease of 9 per cent in numbers, but both areas and numbers are less than during the first six months in 1917. Owing to the great increase in activity of the south polar prominences and of the zone between 45° and 55° south, the southern hemisphere now shows a preponderance over the northern. During the years 1916 and 1917 the northern hemisphere has exceeded the southern in prominence activity

The monthly, quarterly and half-yearly frequencies and the mean height and extent of prominences are given in the following table. The frequencies are derived from the number of effective days :—

TABLE I —ABSTRACT FOR THE FIRST HALF OF 1918.

Month	Number of days of observation.		Number of prominences.	Mean daily frequency.	Mean height.	Mean extent.
	Total.	Effective.				
1918.					"	°
January	27	25	522	20·9	41·3	4·31
February	28	26	540	20·8	31·5	3 60
March	31	30	506	16·9	34·1	4·50
April	30	27	504	18 7	32 4	3 83
May	27	19	288	15 2	35 1	3·53
June	28	24	414	17 3	31·5	3 51
First quarter	86	81	1568	19·4	35 6	4·13
Second quarter	85	70	1206	17·2	32·7	3·65
First half-year	171	151	2774	18·4	34 3	3·92

The mean height of a prominence and the mean number of prominences have diminished. The mean extent has very slightly increased.

Distribution east and west of the sun's axis.

An excess of both areas and numbers had been noticed on the west limb in the second half of 1917. It continued and was greater in amount in the first half of 1918. The figures are given in the following table :—

1918 January to June	East.	West.	Percentage east.
Number observed	1323	1437	47·93
Total areas in square minutes	358 0	397·8	47 36

There is no marked difference in the mean brightness of an eastern or western prominence.

Metallic prominences.

The following metallic prominences were recorded in the half-year :—

TABLE II —LIST OF METALLIC PROMINENCES OBSERVED AT KODAIKANAL, JANUARY TO JUNE 1918.

Date	Hour I.S.T.	Base	Latitude.		Limb.	Height.	Lines.
			North	South.			
1918	H	M	°	°	°		"	
January	1	8	25	1	19·5		W	35	4924·1, 5016, 5018·6, b_1, b_2, b_3, b_4, 5197·7, 5234·8, 5276·2, 5284·2, 5316·8, 5383·6, 5535·06, D_1, D_2, 6677.
	3	8	42	2	5		W	15	b_1, b_2, b_3, b_4, 5316·8, 5363·0, D_1, D_2, 6677
	8	8	45			11	W	110	4924·1, 5018·6, 5197·7, 5234·8, 5276·2, 5284·2, 5316·8, 5535·06, D_1, D_2, b_1, b_2, b_3, b_4. 6677 and 7065 slightly bright
	14	9	2			17	E	40	D_1, D_2, b_1, b_2, b_3, b_4, 5316·8, 4924·1.
	28	9	18			32	E	15	D_1, D_2, b_1, b_2, b_3, b_4, 5316·8, 6677.
	28	8	58	2	18		W	50	4924·1, 5018·6, 5234·8, 5276·2, 5316·8, D_1, D_2, 6677. All very bright.
	31	9	35	3	27·5		W	30	4924·1, 5016, 5018·6, b_1, b_2, 5197·7, 5208·7, 5234·8, 5276·2, 5314·8, 5363·0, 5535·06, D_1, D_2, 6677, 7065. All very bright.
February	1	8	36		12		E	15	D_1, D_2, b_1, b_2, b_3, b_4.
	10	8	27			13·5	E	35	b_1, b_2, b_3, b_4, 5316·8, D_1, D_2, 6677, 7065.
	11	8	42	4	2		E	20	4924·1, 5018·6, b_1, b_2, b_3, b_4, 5197·7, 5234·8, 5276·2, 5284·2, 5316·8, 5363·0, 5397·3, 5535·06, D_1, D_2. 6677, 7065.
	21	8	48	10	12		E	35	4924·1, 5016, 5018·6, b_1, b_2, b_3, b_4, 5197·7, 5234·8, 5276·2, 5284·2, 5316·8, 5363·0, 5535·06, D_1, D_2, 6677, 7065.
	26	8	44			21	W	30	D_1, D_2, b_1, b_2
	26	8	37	2	39·5		W	10	D_1, D_2, b_1, b_2, b_3.
March	9	9	00	2	25		E	25	D_1, D_2, b_1, b_2, b_3, b_4.
	19	8	37		21		W	50	D_1, D_2, b_1, b_2.
	21	8	27	10	20		W	65	6677, D_1, D_2, 5316·8, b_1, b_2, b_3, b_4, 5016.
	30	8	30	7	14·5		E	70	D_1, D_2, b_1, b_2, b_3, b_4, 5316·8
	31	8	32	6		16	E	125	D_1, D_2, b_1, b_2, b_3, b_4, 5316·8.
April	4	8	42	4	20		E	60	4924·1, 5016, 5018·6, b_1, b_2, b_3, b_4, 5234·8, 5276·2, 5316·8, D_1, D_2, 6677, 7065.
	7	8	38			21	W	15	D_1, D_2, b_1, b_2, b_3, b_4, 6677, 7065, 4924·1, 5016, 5316·8
	8	8	37	4	3		E	10	5016, b_1, b_2, b_3, b_4, 5234·8, 5276·2, 5316·8, 5363·0, D_1, D_2, 6677, 7065.
	9	8	29			18	E	45	D_1, D_2, b_1, b_2, b_3, b_4.
	10	8	42	1	22		E	20	4924·1, 5016, 5018·6, b_1, b_2, b_3, b_4, 5316·8, D_1, D_2, 6677, 7065.
	17	8	33			19	W	10	4924·1, 5016, 5018·6, b_1, b_2, b_3, b_4, 5197·7, 5316·8, D_1, D_2, 6677.
	21	8	16	1		24	E	20	D_1, D_2, b_1, b_2, b_3, b_4, 5316·8, 6677, 7065.
	22	8	28	2		19	W	10	4924·1, 5016, 5018·6, b_1, b_2, b_3, b_4, 5316·8, D_1, D_2, 6677, 7065.
	24	8	46	5		13·5	E	40	D_1, D_2, b_1, b_2, b_3, b_4.
May	2	8	48	16	15		E	80	4922·4, 4924·1, 5016, 5018·6, b_1, b_2, b_3, b_4, 5197·7, 5234·8, 5276·3, 5284·2, 5316·8, 5321·2, 5363·0, 5535·06, D_1, D_2, 6677, 7065.
	5	8	26	1		18	E	25	6677. Whole prominence seen in it.
	5	8	34	2		24	W	15	D_1, D_2, b_1, b_2, b_3, b_4, 5316·8, 6677.
	6	9	25			17	E	—	D_1, D_2, b_1, b_2, b_3, b_4.
	11	8	36			25·5	E	—	D_1, D_2, b_1, b_2, b_3, b_4, 6677.
	30	9	8	1	18·5		E	15	D_1, D_2. b_1, b_2, b_3, b_4, 5316·8, 4924·1, 5016, 6677.
June	10	8	45	5	23·5		W	20	4924·1, 5018·6, b_1, b_2, b_3, b_4, 5316·8.
	11	10	15		26		W	25	D_1, D_2. Slightly bright.

The metallic prominences recorded above were distributed as follows :—

——	Number	Mean latitude	Extreme latitudes.
		°	° °
North	19	18 1	2, 39 5
South	16	19 3	11, 32

Twenty were recorded in the eastern hemisphere and fifteen in the western.

Displacements of the hydrogen lines.

Particulars of the displacements observed in the prominences or chromosphere are given in Table III.

TABLE III.—DISPLACEMENTS OF THE HYDROGEN LINES.

Date.	Hour I S.T	Latitude		Limb.	Displacement.			Remarks.
		North.	South.		Red.	Violet.	Both ways	
1918.	H. M	°	°		A	A.	A	
January 1	8 36		10	W			Slight	
1	8 25	19 5		W	Slight			
3	8 26		21·5	E	0 5			
3	8 25		30	E	Slight			
3	8 42	5		W		Slight		
4	9 17	11·5		E		0 5		
4	9 2	47		W	0 5			
5	8 47	15		E	2			
5	8 35		60	E	Slight			
5	8 30		75	W	Do.			
6	8 39	80		E		Slight		At base.
6	9 3	57		E	1	0·5		To red at top ; to violet at base.
6	8 56		47·5	W		Slight		At base.
6	8 53		10·5	W		0 5		Do
6	8 52	10		W	Slight			At top
7	8 50		40·5	E	Do.			
7	9 0	35		W		0·5		
8	8 44		8·5	W	0 5			
9	8 55		8	E		Slight		
10	8 50	60		E		Do.		
10	9 1		13·5	E	Slight	Do.		To red at top ; to violet at base.
10	9 7		61·5	E	0·5			
12	8 25	79		E		Slight		
12	8 37	61		E	Slight			Over upper part.
12	8 42	18		E	0 5	0·5		At different points.
12	8 32	26		W	Slight			
14	8 37		41	E	2	3		To red at base ; to violet at top.
14	8 3		85·5	W			Slight	
17	8 58	24·5		W	Slight	Slight		
20	8 55	40		E	Do.			
20	9 0		8	E		Slight		
20	9 3		16	E	1			
20	8 45	70·5		W	0·5			
22	9 2	10		E	0·5			
22	9 23		57 5	W	Slight			
22	8 52	19		W	1			
22	8 50	52		W	Slight			
22	8 50	61		W		Slight		At base.
22	8 40	89		W		Do.		Do.
28	9 18		32	E			Slight	
28	9 5		28·5	W	2			At top
28	8 58	18		W		0·5		
28	8 52	45		W		Slight		At northern end
30	8 25	78 5		E	0·5			
30	8 25	75		E	Slight			
30	8 24	70		E		Slight		

Date		Hour I S T	Latitude North	Latitude South.	Limb.	Displacement. Red	Displacement. Violet	Displacement. Both ways.	Remarks
1918.		H M	°			A	A	A	
January—	30	8 41		16	W			1	
cont.	30	8 33	57 5		W			0 5	
	31	9 20	54		E		1		
	31	9 35	27 5		W	1·5	0·5		
February	1	8 45	18 5		E			1	Symmetrically
	1	8 50		25	W		3·5		
	2	8 40	37		E		0·5		
	2	8 50		32	E	Slight			
	2	8 52		46·5	E			0·5	
	2	8 55		56 5	E	Slight			
	2	8 37	7		W	0 5			
	2	8 28	59 5		W	0 5			
	2	8 27	66·5		W	Slight			
	2	8 24	84		W		Slight		
	3	9 15		20	W		1 5		
	3	9 18		10	W		2		
	4	8 35		11	W	0 5			
	4	8 34	11		W		Slight		
	5	8 47	17		E		0 5		
	8	8 50		19	E		1		
	9	8 43		49	E		Slight		
	9	8 50		71	W	0·5			
	10	8 30	15		E	Slight	Slight		To red at top ; to violet at base.
	10	8 27		13 5	E			Slight	
	10	8 17		73	W	0·5			
	10	8 18		78 5	W	Slight			
	11	8 30	62		E		Slight		
	11	8 42	11		E			Slight	At northern end.
	11	8 10		19	W		Slight		
	12	8 22	83		E		Do.		
	12	8 15	68		E		Do		At base
	12	9 10		25	E		Do		At top.
	12	9 5		47 5	W			Slight	
	12	9 0		31	W	Slight			
	12	8 50	26		W		Slight		
	12	8 50	22·5		W	0·5			
	13	8 45	33 5		E	3	2		To red at top , to violet at base.
	13	8 43	6·5		E	Slight	Slight		Do.
	18	8 43		3 5	E		0·5		
	18	8 42		51·5	W	1·5			
	19	8 46	2		W	Slight			
	19	8 39	80		W	0·5			
	19	8 38	86		W	Slight			
	21	8 48	12		E	4	2		
	21	8 27		19·5	W		Slight		
	22	11 30	20		E	1			
	22	14 20	19		W	1·5			
	23	9 11		59·5	E	Slight			
	24	8 3	7		W	Do.			
	25	8 32		52 5	W		1		
	25	8 39	71·5		W	0·5			
	25	9 3		55	E	0·5			
	25	8 44		22	W	0 5			
	25	8 25	34		W		Slight		
	25	8 32	55 5		W		1		
	28	8 39	62 5		E		0 5		
	28	8 52	28		W		Slight		
	28	8 27	55·5		W	1			
March	2	8 32	51 5		E		2		At top
	2	8 55	51 5		E	0·5			At base.
	2	8 44	13·5		W		Slight		At top.
	3	8 46		76	E	1	1·5		To red at top ; to violet at base.
	3	8 43		74·5	W			Slight	
	3	8 30		22	W		1		At top.
	3	8 28		17 5	W	0·5			Do.

Date	Hour I.S.T.	Latitude		Limb	Displacement.			Remarks
		North	South.		Red.	Violet.	Both ways.	
1918.	H. M	°	°		A	A	A	
March—*cont.* 4	8 49	83		E		Slight		
4	8 36		20	E	Slight			
5	9 23	57 5		E			1	
5	8 57		41·5	E		0 5		
5	9 4		72	W		Slight		
5	8 40	9		W		Do		
5	8 30	71 5		W	Slight			
7	8 29	69		E		Slight		
7	9 24	60		E	Slight			
7	8 59	17		E	1	0 5		
7	9 10		7	E	Slight			At base
7	9 10		4 5	E			Slight	Over the whole base (13°).
7	9 15		13 5	E	Slight			
7	8 55		39 5	W		0 5		At base over 4°
7	8 50		19	W	Slight			Over almost the whole prominence (30″ high).
7	8 45	10		W		Slight		
7	8 42	26		W	Slight	1		To red at base, to violet at top.
7	8 39	50·5		W	1	1		
8	9 6	16		E		1 5		
9	8 38	46		E		Slight		At base
9	9 00	25		E	0 5	0·5		To red at base; to violet at top.
9	8 54		7	W	1 5	Slight		
9	8 46	75·5		W		Do		
10	8 36	25 to 33		E		1		
10	9 00	Equator		E	1			
10	9 10		73	E	1			
10	8 20		11	W		1		
10	8 20		10 and 8	W	0 5			
10	8 20		4	W			1	
10	8 49	37 5		W		0 5		At base.
12	8 38	82·5		E	Slight.			
12	8 42	80		E	0 5			
12	8 57	36		E		Slight		
12	8 58	29		E		Do		
12	9 6		57·5	W	Slight			
12	9 7		53·5	W	2			
12	8 54		22	W	0 5			
14	9 2	11		E	0 5			
14	9 2	8		E		Slight		
14	9 19		38	W		0 5		
14	9 9		21	W	0 5			
14	8 59	45 5		W	1			
16	8 14	81·5		E		Slight		
16	8 40	72·5		E	0·5			
17	8 30	74 5		E		Slight		
17	9 2		82·5	E	0·5			At base.
17	8 38	12·5		W			0·5	
17	8 35	49·5		W			0·5	
17	8 33	69		W		0 5		At base.
18	8 39	30		W		Slight		At top
19	8 37	9		E	1			
19	8 37	24		E	Slight			
19	8 59		15	E	Do.	Slight	2	
19	9 4		82	E	0·5			
19	9 6		65 5	W		0 5		
19	8 40	8		W		Slight		
19	8 41	4		W	0 5			
19	8 37	27		W	2	0 5		
19	8 35	45		W	Slight			
20	8 31	18		W		0 5		
21	8 23		50 5	W		Slight		
21	8 25	7·5		W	0 5	1		
21	8 27	20		W	1			
21	8 29	31		W	1			At top.
21	9 6		9 5	E	Slight			Do

Date		Hour I S T	Latitude		Limb.	Displacement.			Remarks
			North	South.		Red.	Violet.	Both ways	
1918		H. M	°	°		A	A	A	
March	23	8 52		29 5	W		0·5		
	25	8 32		47 5	W	1			
	26	9 59	82		E	Slight			
	26	10 9	23		W		2		
	30	8 30	14 5		E	2			
	31	8 27		17	W		Slight		
April	1	8 27		21	E	0 5			
	1	8 36		19	W		Slight		
	1	8 35	34·5		W	0 5			
	4	8 42	18		E	1	0 5		
	6	8 45		8	W		Slight		
	8	8 37	3		E	Slight			At top.
	8	8 42		11	E	2			Do.
	8	8 47		80·5	E	0 5			At base.
	9	8 30	17		W		1·5		
	9	8 37	1		W		3		At top
	10	8 40	66 5		E		Slight		
	10	8 42	22		E	0·5			
	11	8 54	40·5		E	Slight			
	11	8 55	37		E		0·5		At top.
	11	8 59		26	E			0 5	
	12	8 17	18 5		W	Slight			
	13	8 37	84·5		—		Slight		
	13	8 44	7		W		0 5		
	13	8 43	20		W			Slight	
	14	8 25		53	W		0·5		
	14	8 20	20		W		0·5		At top
	15	9 00	58		E		0·5		
	15	8 43		84	W	1			
	15	8 40		42·5	W		0·5		
	15	8 38		17·5	W		0 5		At base.
	16	8 25	57 5		E		0·5		
	16	8 20		66 5	W		1		
	17	8 46	8		W	1 5			At top.
	18	9 24	Equator		E		0 5		
	18	8 58		1	W	0·5			
	18	8 55	29 to 33		W	0·5			At top.
	18	8 55	26		W		2		At base.
	19	7 58	69		E		0·5		
	19	8 3		1·5	W		Slight		At base.
	20	8 56	49·5		E		0·5		
	20	8 50		42	E		Slight		At top.
	20	8 36	10		W	2	1		
	20	8 33	32		W				
	21	8 18	26		E	Slight			
	21	8 16		23	E	0·5			At top.
	21	8 25	49·5		W		Slight		
	22	8 20	25		E	3			
	22	8 21	18		E	2			
	22	8 33	10		E	1			
	22	8 34	2		E	3			
	22	8 28		19	W	1	2		
	23	8 38		10	E	0·5			
	23	8 46	71 5		W		Slight		
	24	8 27	29		E		0·5		
	24	8 33	30		W	1·5			At top.
	25	8 45	20·5		E	Slight			
	25	8 49	Equator		E		Slight		
	25	8 51		20	E		0 5		At top.
	25	8 33	84		W	Slight			
	26	8 47	10		W	2			
	28	8 30		46 5	E		Slight		At top.
	28	8 46	9·5		E	Slight			Do.
	28	8 53	13 5		W		Slight		

Date.	Hour I.S.T	Latitude. North.	Latitude. South.	Limb	Displacement Red	Displacement Violet	Displacement Both ways	Remarks.
1918.	H. M	°	°		A	A	A	
May 2	8 28	40		E	0 5			
2	8 48	15		E	2	Slight		To red at base, to violet at top.
2	8 40		85	E		0 5		
4	12 14	13		E		Slight		
4	8 26		18	E			0 5	
4	8 20		39	E	Slight			
6	9 20	23 5		E	Do			
6	9 21	3		E	Do.			
6	9 10		14	W		Slight		
14	9 6	16		E	0 5			
14	9 8	5 5		E			Slight	
14	8 57	19		W		1		
14	8 55	42		W	Slight			
15	9 3		16	E	Do			
15	9 16	11		W	1 5			
28	8 0	71		E	0 5			
30	9 3	10		E		Slight		
31	9 30		13 5	W		1·5		
June 1	8 42	46		W			0·5	
4	9 11		32	E	0 5	0 5		In different places.
4	9 10		35	E		1		
4	9 15		86	E			0·5	
6	8 43		61	W		1		
7	8 55	61		E		1·5		
8	8 26	65		E	2			At top
8	8 38		11	W	Slight			Do.
9	8 39		35	E	1			
10	8 45	23·5		W	2			At top.
10	8 40	65		W		0·5		
11	10 15	26		W		1		
12	9 5	5		W			0·5	
16	8 22		68	E	0 5	1		To red at base, to vrolet at top.
17	8 52	9		E		1		At top.
17	8 56	Equator		E	3			At base.
17	8 47		51	W		1		
18	8 34		7	E	Slight			
18	8 43		74	W	0 5			
18	8 15	71		W	Slight			
19	8 38		65	E	Do.			
27	8 45		11 5	W	0 5			
28	9 0		2 5	W	1			

The total number of displacements was large, namely 281. Four of these were on the equator, the rest were distributed as follows :—

Latitude	North	South
1° to 30°	86	59
31 to 60	39	32
61 to 90	39	22
Total	164	113
East limb	136	
West limb	143	
At pole	2	

There were 146 displacements towards red and 135 towards violet ; these include 25 in which the shifts were in both directions in the same prominence. The preponderance towards red is less than the average of recent years.

Reversals and displacements of the C line on the disc.

252 bright reversals of the Hα line, 35 darkenings of the D_3 line, and 97 displacements of the Hα line were recorded. They were distributed as follows :—

	North	South.	East.	West.	Percentage east.
Bright reversals of Hα	125	127	126	126	50·0
Dark reversals of D_3	19	16	17	18	48·6
Displacements of Hα	58	39	42	55	43·3

Of the displacements 57 were towards the red, 27 towards the violet and 13 both ways simultaneously.

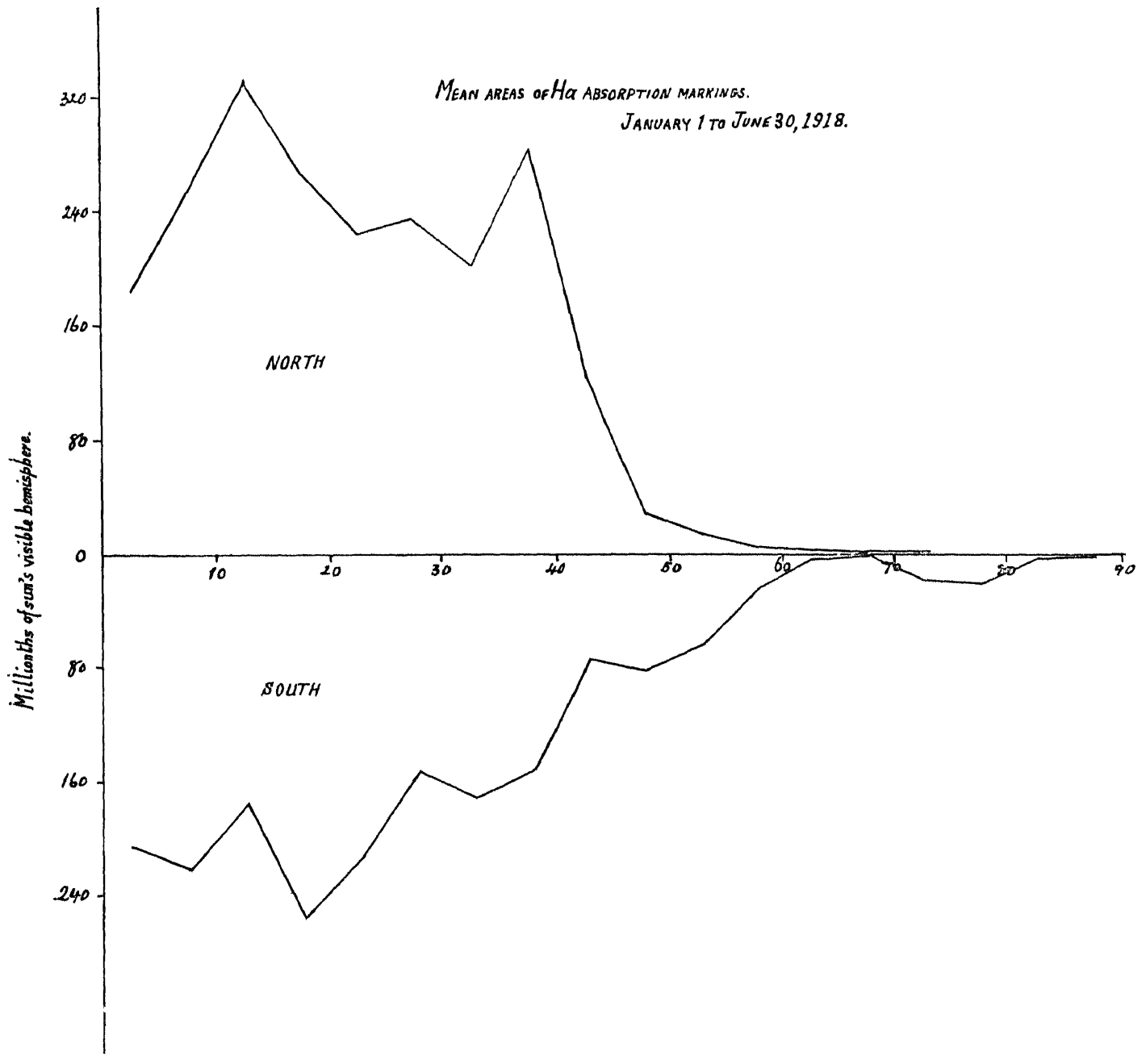
Prominences projected on the disc as absorption markings.

Photographs of the sun's disc in Hα light were obtained on 144 days counted as 135 effective days. The mean daily areas in millionths of the sun's visible hemisphere corrected for foreshortening, and the mean daily numbers are given below :—

	Areas	Numbers
North	2149	13·9
South	1837	12·5
Total ..	3986	26·4

Both areas and numbers have continued to increase.

The distribution of the absorption markings in latitude is shown in the accompanying diagram.



The curves are much less flat than in the previous half-year, well marked maxima having developed in the regions + 10° to + 15°, +35° to + 40°, and −15° to −20°. Regarding these markings as representing the denser prominences, it is seen that only the equatorial and mid-latitude prominences are in general dense enough to appear on the disc as absorption markings, whilst the polar prominences although so conspicuous in the number and area curves for this period must be of very low density since they have not been recorded as dark markings in the northern polar region, and are only feebly represented in the south.

Unlike prominences at the limb these markings still show an excess on east of the meridian, the percentage east being 52·03 in the case of areas and 51·66 in the case of numbers. The most probable excess due to chance is 0·56 per cent on either side. There has been a steady fall in the eastern excess since the second half of 1916 when the percentage east of areas was 55·8. In the case of prominences at the limb there has been during thiss ame interval of two years a gradual change from an eastern to a western excess.

KODAIKANAL OBSERVATORY,
28th August 1918.

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