

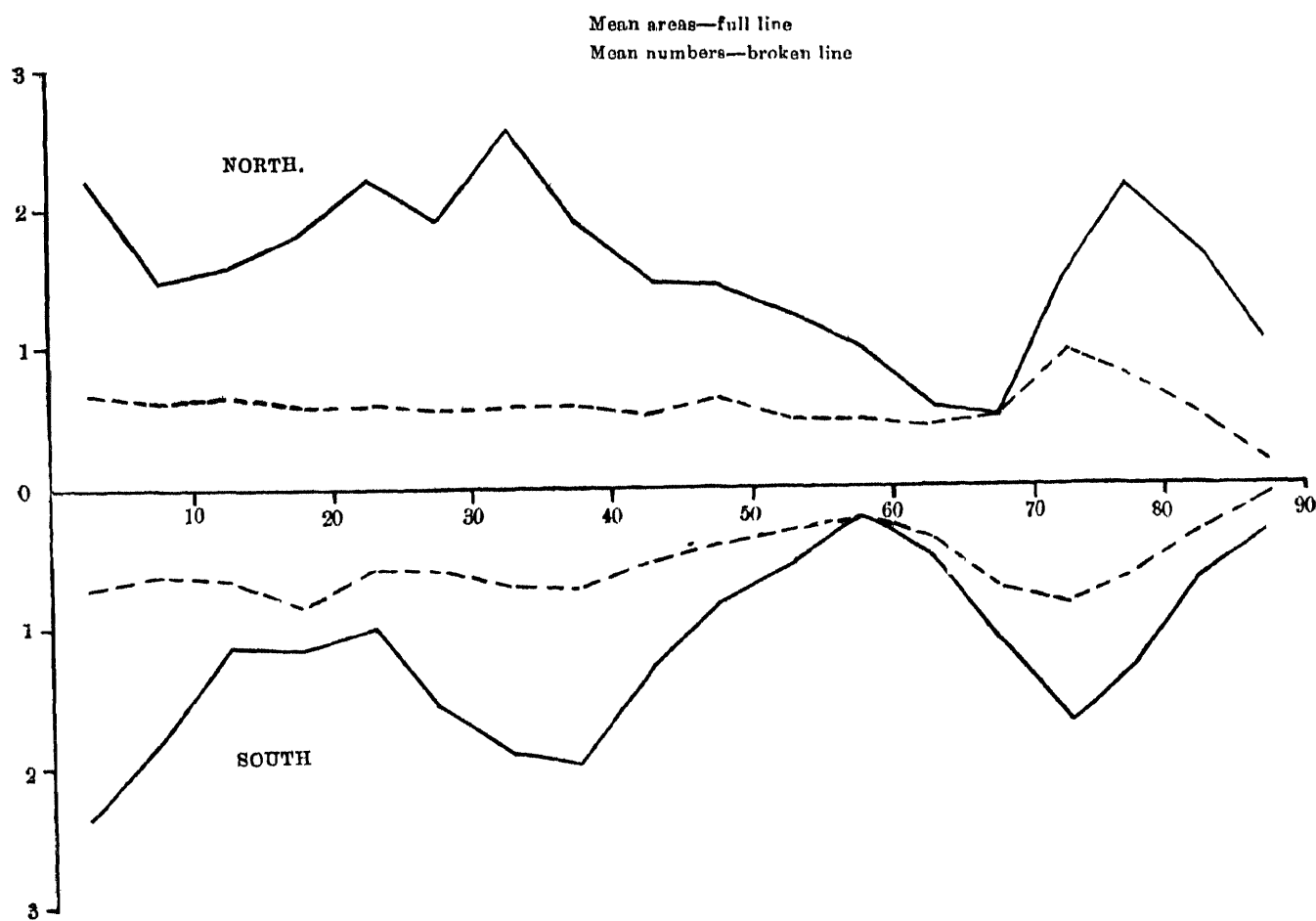
Kodaikanal Observatory.

BULLETIN No. LVIII.

SUMMARY OF PROMINENCE OBSERVATIONS FOR THE SECOND HALF OF THE YEAR 1917.

The distribution of the prominences photographed at Kodaikanal during the half-year ending December 31, 1917, 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 photographs, the total of 157 days being reduced to 129 effective days.

MEAN AREAS AND MEAN NUMBERS OF PROMINENCES.
JULY 1 TO DECEMBER 31, 1917.



The diagram indicates three principal zones of activity, a well defined zone exactly coinciding with the equator, a mid-latitude zone with maxima between $\pm 30^\circ$ and 40° , and a high latitude zone with maxima between $\pm 70^\circ$ and 80° . This distribution is very similar to that recorded for the first half of the year, excepting that the high latitude zones have advanced in latitude to the near neighbourhood of the poles. The northern zone is shown to be 5° ahead of the southern in this movement and its position is practically that which is associated with sunspot maximum.

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

		Mean daily areas (square minutes)	Mean daily numbers.
North	...	2.83	10.28
South	...	2.12	9.70
Total	..	4.95	19.98

The mean total area is less than that recorded for the previous half-year by about 8 per cent, although the mean number has slightly increased.

The northern hemisphere has continued more active than the southern.

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 SECOND HALF OF 1917.

Month	Number of days of observations.		Number of prominences.	Mean daily frequency.	Mean height.	Mean extent.
	Total.	Effective				
1917					"	"
July	28	20	355	17.8	34.5	3.90
August	30	22	440	20.0	39.2	4.13
September	25	20	391	19.6	35.1	2.89
October	24	21	468	22.3	38.9	2.99
November	22	19	403	21.2	38.4	3.57
December	28	27	520	19.3	38.2	3.94
Third quarter	83	62	1186	19.1	36.4	3.65
Fourth quarter	74	67	1391	20.8	38.5	3.51
Second half-year	157	129	2577	20.0	37.5	3.58

The means differ but little from those found for the first half of the year, but the mean height and mean extent of the prominences have slightly diminished.

Distribution east and west of the sun's axis.

Both areas and numbers show an excess on the west limb as is seen in the table below :—

1917 July to December	East.	West	Percentage east.
Number observed	1258	1319	48.82
Total areas in square minutes	3070	3310	48.12

Metallic prominences.

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

TABLE II.—LIST OF METALLIC PROMINENCES OBSERVED AT KODAIKANAL, JULY TO DECEMBER 1917.

Date.	Hour I S T		Base	Latitude		Limb	Height	Lines
	h.	m.		North	South.			
1917.			°	°	°		"	
July	6	8 35	5	20.5		W	50	D ₁ , D ₂ , b ₁ , b ₂ , b ₃ , 5316.8, 6677.
September	16	8 47	5	39		W	40	D ₁ , D ₂ , b ₁ , b ₂ , b ₃ , b ₄ , 5316.8
	17	9 10		18		E	125	D ₁ , D ₂ , b ₁ , b ₂ , b ₃ , b ₄ , 6677.
October	9	8 45			16	W	120	D ₁ , D ₂ , b ₁ , b ₂
	24	8 31	5		17.5	W	40	D ₁ , D ₂ , b ₁ , b ₂ , b ₃ , b ₄ , 5316.8, 6677, the last line slightly.
November	3	8 45	2	Equator.		W	25	D ₁ , D ₂ , b ₁ , b ₂ , b ₃ , b ₄
	23	8 50		24		W	140	D ₁ , D ₂ , b ₁ , b ₂ , b ₃ , b ₄ , 5316.8
December	30	8 57		23		W	10	D ₁ , D ₂ , b ₁ , b ₂ , b ₃ , b ₄ , 5316.8, 6677.
	2	8 28	4	23		W	30	7065, 6677, D ₁ , D ₂ , b ₁ , b ₂ , b ₃ , b ₄ , 4924.1, 5016, 5018.6, 5197.2, 5234.8, 5276.2, 5284.3, 5316.8, 5326.2, 5328.1, 5363.0, 5397.3, 5404.4, 5405.9, 5425.4, 5429.0, 5447.1, 5535.1.
	5	8 24	3	31.5		W	40	D ₁ , D ₂ , b ₁ , b ₂ , b ₃ , b ₄ .
	18	8 45	17	1.5		W	35	4924.1, 5018.6, b ₁ , b ₂ , b ₃ , b ₄ , 5197.7, 5234.8, 5276.2, 5284.2, 5316.8, 5363.0, D ₁ , D ₂ , 6677.
	19	15 49		4		W	30	D ₁ , D ₂ , b ₁ , b ₂ , b ₃ , b ₄ , 6677.
	24	8 56			9	E	120	D ₁ , D ₂ , b ₁ , b ₂ , b ₃ , b ₄ , 5316.8.
	25	8 53	13	12.5		W	75	4924.1, b ₁ , b ₂ , b ₃ , b ₄ , 5197.7, 5234.8, 5316.8, D ₁ , D ₂ , 6677.
	26	8 53	16		21	W	55	D ₁ , D ₂ , b ₁ , b ₂ , b ₃ , b ₄ , 6677.
	27	8 55	15	14.5		E	30	D ₁ , D ₂ , b ₁ , b ₂ , b ₃ , b ₄ , 5316.8, 6677.
	27	9 3	3		14.5	W	100	4924.1, 5016, 5018.6, b ₁ , b ₂ , b ₃ , b ₄ , 5197.7, 5234.8, 5276.2, 5316.8, D ₁ , D ₂ , 6677.
	29	9 4	9	24.5		W	100	4924.1, 5016, 5018.6, b ₁ , b ₂ , b ₃ , b ₄ , 5276.2, 5284.2, 5316.8, D ₁ , D ₂ , 6677, 7065.
	31	9 4	3	18.5		W	90	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.

The nineteen metallic prominences recorded were distributed in latitude as shown below:—

	Number.	Mean latitude.	Extreme latitudes.
North	13	19.6	39, 1.5
South	5	15.6	21, 9
Equator	1

The number recorded is small considering the general activity of the sun, but this is partly explained by the unfavourable observing conditions. It may be noted that more than half the total number were observed in the month of December which was also a magnetically active month, a "great" storm being recorded by the Observatory magnetographs from the 16th to the 24th inclusive and "moderate" storms were recorded on six days.

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.	
July 1917.	1	8 10		23	E	A	A	A	
	2	10 12	9		W	1	1		
	4	9 44	76		W	Slight			No prominence.
		9 12	05		E			Slight	
	5	9 16		80.5	E		Slight		
		10 10		9.5	W	0.5			
	6	8 56	29		E	0.5			Over whole prominence except near base
	8	8 35	20		W	1	3		Metallic
		8 37	17		W	3			
	16	8 45		24	E		1		On upper part.
		9 7		80	E	Slight			No prominence
	18	9 7		83.5	E	Do			Do.
		8 57	6.5		W	0.5			Over long cloudlet at top.
	19	8 45		30	E	Slight			At base
		8 40		68.5	E	Do.			
	20	9 33	64.5		E		0.5		
		9 43	8		E			0.5	
	24	9 45		15	E		Slight		
		9 58	38		E	0.5			Over the whole prominence.
	August	1	9 7	26		E		1	
2		9 16		74	E		2		At top at north end.
		8 35	6		W		Slight		At north end.
3		8 55	10		W	0.5			
		8 55	30		E	Slight			At top
5		8 44		16	W	0.5			
		9 4	7		E	Slight			
6		8 48		17	W	0.5			
		8 40		17	E	2.5			
8		9 4		19	E			2	
		8 35		14	E	Slight			
10		9 15		11	E	2	1		Displacement towards violet at base and towards red over the rest of the prominence.
		9 17		11	E	3			
10		8 55		64.5	W		Slight		
		8 47	14		W		1		
19		8 50	12		W	2	Slight		
		8 47	16.5		W	4	3		
21		9 48		20	W	Slight			
26		8 49	58.5		W		Slight		
		8 44	82.5		W		1		At base.
28	11 8	30		E		0.5			
	11 5		3	E	1.5	0.5			
29	10 56		16	W	Slight				
	9 36	28		E		0.5			
30	9 40		8.5	E		2		1	To violet at south end, both ways over southern half of the prominence.
	9 55		35.5	E		Slight			
31	9 50	3 to	3	E	3				
	9 40	20		E	2				
September 8	9 46	54.5		W	Slight	1		Red and violet at different places	
	9 25	75		E		0.5		At top	
9	9 10		8	W	Slight				
	8 31	10		W		Slight			
11	9 2		3	W		0.5		At top.	
	8 47	62		W		Slight		No prominence.	
12	8 55	24		E	Slight			Do.	
14	9 51	21		E		0.5		At top. Not seen at 9 ^h 56 ^m .	

Date	Hour I S T	Latitude		Limb.	Displacement.			Remarks.
		North	South		Red.	Violet.	Both ways	
1917								
September 14	11 M 9 53	°	63	E	A	A	A	
--continued.	9 26		19	W	0.5	0.5		
	9 16	31		W		1		
	9 14	36		W	Slight			At top.
16	8 38		13	E	Do.			
17	9 10	12		E			Slight	
	9 10	18		E			1	Ghosts at a distance of 6 A on both sides of "C"
	9 11	15		E	0.5			
	8 52	23		W	Slight			
	9 0	71		W		Slight		At base
19	9 5		69	E	0.5			At base.
	9 2		70.5	W		Slight		At top.
20	9 4		18	E	Slight			
22	8 45		16	E	Do.			
28	11 19		15	W	2	2		Red and violet displacements at different places.
October 2	14 16		3	W	Slight			
	14 3			W		Slight		At base.
3	8 52	33		E	Slight			
5	8 59	8		E		Slight		
6	8 38		83.5	E	Slight			
7	8 39		6	W		Slight		
8	9 4		25	W	0.5			At top
	9 8		12	W	1.5			Do.
	9 10	1		W	1.0			Do.
9	9 3	28.5		E		0.5		
	9 5	4		E	1.5			At base.
	9 8		13	E		Slight		
	9 11		41.5	E	1			No prominence.
	8 45		16	W	0.5	0.5		Red and violet displacements at different places
	8 42		1.5	W		Slight		
10	8 27	23.5		E		Do.		
	8 39		24	W		0.5		
13	10 1	36		E	5			At top.
15	8 29	54.5		E	Slight			
	9 41	2		E	0.5	0.5		To red at base : to violet at top.
	9 49		14	E	1.5	0.5		
	9 7		17	W	1			
16	9 0		25	E		0.5		Over streaks.
	8 45		77	W			Slight	Over streaks.
23	8 42		24.5	E	Slight.			
24	8 27	12.5		W		Slight		
26	10 50	82.5		W	Slight			
29	9 8	23		E	Do.			
	9 9	17		E		Slight		
	9 9	11		E	0.5			At base.
	9 12		0.5	E	Slight			
	8 18	18		W	1.5			
31	8 41		6.5	E	Slight			At base.
	8 34		47.5	E	Do.			
	8 51		83	W	0.5		Slight	To red at top : to violet at base.
November 1	8 53		12	E			1	0.5 A both ways at several places and 1 A both ways at one place.
	8 30		28	W	1			
4	9 5		19	W	0.5			At the top of a jet
5	8 52	Equator		E		Slight		
	8 56	21.5		E		1		
7	11 18	41		W	0.5			At top.
9	9 40		18.5	E	0.5			Do.
10	8 50		6.4	W		1		Do.
15	8 40	14		E		Slight		
	8 40	9		E		Do.		
	8 52		11	W		1		
16	8 37	35.5		W		Slight		
19	8 47	12		W	0.5			
22	8 43		53	W	Slight			

Date	Hour L.S.T.	Latitude.		Limb.	Displacement.			Remarks
		North	South		Red	Violet	Both ways.	
1917.					A	A	A	
November 22	8 35	15		W	0.5			
—continued	8 35	8		W	0.5			
	8 36	Equator		W	1			
	9 10	75		W		Slight		
23	8 30		58	E	Slight			No prominence.
	8 27		80.5	W	0.5			
30	8 43		18.5	E	Slight			
	8 56	17.5		W	1			
	8 57	21		W	0.5			
December 1	8 40		89		Slight			
	8 55	21		W	1			
2	8 28	23		W	2			At different places. 1 A to violet also at some positions.
3	8 54		28	W		Slight		
	8 55		5.5	W	Slight			At top
4	8 23	83		E	Do.			
	9 16		48	E	Do.			
5	8 45	12		E		Slight		
	8 50		26	E		1.5		
	9 30		17.5	W	1	1		1 A to red at southern end and 1 A to violet over the rest of the prominence Prominence 7° broad
	8 22	39.5		W	1	Slight		
	9 16	62.5		W	Slight			
8	9 12	20		E		Slight		
	9 14	2		E		Do		
10	9 35		19	E	Slight			
12	10 55	12		E	Do.			At top
	10 55	18		E				At base
16	8 38		25	E	Slight	3.5		
18	8 45	1.5		W				
19	15 45		19	W	1.5			At base.
	15 49	4.5		W	1			
20	9 19	36.5		E		Slight		
	9 24		12	E		Do.		
	9 24		16	E			Slight	
21	8 51		8	E		Slight		
24	8 56	9		E	Slight			
25	8 46		13.5	W	Do			At top.
	8 55	12.5		W	0.5			
	8 53	12.5		W			0.5	
26	8 43	31		W	Slight			
	8 53		21	W	Do			
	8 55		53.5	W	Do			
27	8 49		13	E	Do.			
	9 3		14.5	W	0.5			At top
28	8 38		23	E		Slight		
29	8 55	37.5		E	Slight	Do		To red at top, to violet at base.
	8 47		69	E	Do.			
	9 4	20		W			Slight	
	9 4	29		W	0.5			
30	8 40		28	E	Slight			
30	8 35	32		W	Do			At top.
31	8 48		74.5	W			Slight	
31	9 4	18.5		W			0.5	

The total number observed was 172, of which 83 were in the northern hemisphere, 5 on the equator, and 84 in the southern hemisphere. Eighty-nine were on the eastern limb or 52 per cent of the whole. One hundred and four displacements were towards red, 69 towards violet, and 14 both ways simultaneously. One hundred and eighteen displacements were observed between the equator and latitude 30° , twenty-two from 31° to 60° and twenty-seven from 61° to the poles.

Reversals and displacements on the disc.

Two hundred and thirty-nine bright reversals of the $H\alpha$ line, 18 dark reversals of D_3 and 61 displacements of $H\alpha$ were recorded. These figures are approximately the same as for the previous half-year taking into

consideration the smaller number of effective days in the last half of the year compared with the first. The distribution east and west of the meridian of these phenomena was as follows.—

	East.	West
Bright reversals of $H\alpha$	119	120
Dark reversals of D_3 .. .	11	7
Displacements of $H\alpha$	26	35

Of the displacements 38 were towards red, 15 towards violet and 8 both ways simultaneously.

Prominences projected on the disc as absorption markings.

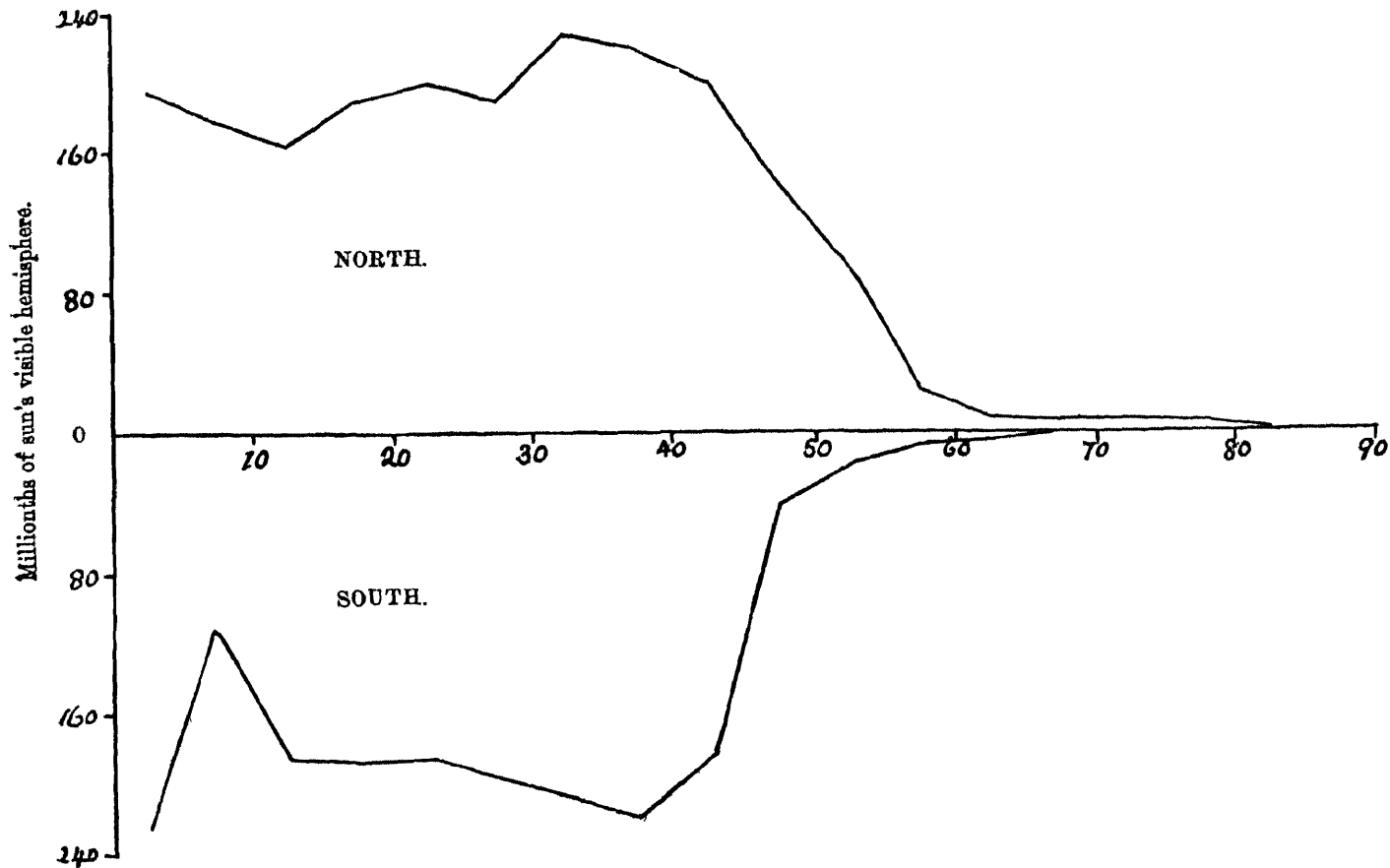
Photographs of the sun's disc in $H\alpha$ light were obtained on 117 days counted as 107 effective days. The mean daily areas in millionths of the sun's visible hemisphere corrected for foreshortening, and the mean daily numbers are given below :—

	Areas	Numbers.
North	2033	123
South	1771	118
Total	3804	241

Both areas and numbers show a large increase compared with the previous half-year although the prominences at the limb show a decrease of mean area. This indicates an increase of density of the prominences, excepting only those in the high latitude zones of activity above latitude 60° which have seldom given evidence of their presence on the disc.

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

**MEAN AREAS OF $H\alpha$ ABSORPTION MARKINGS.
JULY 1 TO DECEMBER 31, 1917**



The regions of the greatest activity here indicated are the same as shown by the prominences at the limb (excepting the high latitude prominences), viz., at the equator and between latitude 30° to 35° north and 35° to 40° south.

The distribution east and west of the central meridian shows the usual excess at the east side the percentage east being 52.67 in the case of areas and 52.76 in the case of numbers. This is the same order of difference between east and west as was found for the first half of the year. If the figures for the entire year are added there results a total of 4725 absorption markings of which 52.81 per cent of areas and 53.08 per cent of numbers were east of the meridian. The most probable excess due to chance is 0.49 per cent on either side, while the chances of excesses of 2.81 per cent and 3.08 per cent on either side are respectively 1700 times and 7700 times less likely than equality on both sides.

KODAIKANAL OBSERVATORY,
2nd March 1918.

J. EVERSHED,
Director.