SUPPLIED FOR THE PUBLIC SERVICE.

GREENWICH PHOTO-HELIOGRAPHIC RESULTS

1933.

SUPPLIED FOR THE PUBLIC SERVICE.

RESULTS OF MEASURES MADE AT THE ROYAL OBSERVATORY, GREENWICH, OF

PHOTOGRAPHS OF THE SUN

TAKEN AT GREENWICH, THE CAPE AND KODAIKÁNAL IN THE YEAR

1933

UNDER THE DIRECTION OF

H. SPENCER JONES, Sc.D., F.R.S.
ASTRONOMER ROYAL

Published by Order of the Board of Admiralty
in Obedience to His Majesty's Command

LONDON
PUBLISHED BY HIS MAJESTY'S STATIONERY OFFICE
To be purchased directly from H.M. STATIONERY OFFICE at the following addresses
Adastral House, Kingsway, London, W.C.2 ; 120, George Street, Edinburgh 2
York Street, Manchester 1 ; 1, St. Andrew's Crescent, Cardiff
80, Chichester Street, Belfast
or through any Bookseller

1934

Price 5s. od. Net

31—36--0—33

Blank page retained for pagination

GREENWICH PHOTO-HELIOGRAPHIC RESULTS, 1933.

INTRODUCTION.

§1. *Positions and Areas of Sun Spots and Faculæ for each Day in the Year* 1933.

The photographs from which these measures were made were taken at the Royal Observatories of Greenwich or of the Cape, and at the Kodaikánal Observatory, Southern India.

The photographs of the Sun obtained at Greenwich were generally taken with the Dallmeyer Photo-heliograph, of 4 inches aperture (usually stopped down to 2·9 inches), or with the Thompson Photo-heliograph of 9 inches aperture. The diameter of the Sun's image at the secondary focus in both instruments is $7\frac{1}{2}$ inches at the Earth's mean distance.

The photographs from the Cape Observatory were taken under the superintendence of His Majesty's Astronomer at the Cape, Dr. J. Jackson, and those from Kodaikánal under the superintendence of the Director, Dr. T. Royds. At the Cape Observatory the instrument employed was a Dallmeyer Photo-heliograph giving an image of the Sun about $7\frac{1}{2}$ inches in diameter; at Kodaikánal a Cooke photo-visual object-glass of 6 inches aperture was used, the image of the Sun being on about the same scale.

Photographs of the Sun were available for measurement upon each day in 1933, those finally selected for measurement being supplied by the different observatories as under :

Greenwich	254
Cape	99
Kodaikánal	12
Total	365

The names of those persons who measured the photographs for the year 1933 are as follows :

H. W. Newton
H. Barton
H. Howes
A. Carter
Lily Fine

At the principal focus of the Photo-heliographs, excepting that at Kodaikánal, two spider-lines are fixed by which the zero of position-angles on the photographs can be determined. These lines are inclined at an angle of 45° to the celestial equator in the Greenwich and Cape Photo-heliographs ; in the Kodaikánal Photo-heliograph there is one wire fixed parallel to the equator.

The zero of position-angles for the Photo-heliographs has been determined by the measurement of plates which have been exposed twice, with an interval of about 100 seconds between the two exposures, the instrument being firmly clamped. Two images of the Sun, overlapping each other by about a fifth part of the Sun's diameter, were therefore produced upon the plates, and the exposures having been so given that the line joining the cusps passed approximately through the centre of the plates, the inclination of the wires of the photo-heliograph to this line was measured with the position-micrometer, and a small correction for the inclination of the Sun's path was then applied.

At Greenwich and the Cape, transits of the Sun were also taken over the two wires ; the times of contact of the first and second limbs of the Sun with the two wires being noted. The ratio of the time taken by the Sun to pass over the NE—SW wire to that taken to pass over the SE—NW wire gives the tangent of the angle made by the Sun's path to the latter wire, the wires being assumed to be at right angles to each other. From this angle, when corrected for the Sun's motion in declination, the correction for the zero of position of the wires can be inferred.

The following table gives the correction for zero of position thus determined by the two independent methods for the 4-inch Greenwich and Cape Photo-heliographs.

Determination of Zero of Position-Angles.

Month, 1933.	Greenwich.		Cape.	
	Photographic.	Visual.	Photographic.	Visual.
	° ′	° ′	° ′	° ′
January	+2 11	+2 21	+0 13	+0 13
February	27	22	17	10
March	18	21	09	12
April	24	21	11	14
May	12	20	05	17
June	17	19	03	14
July	12	19	09	13
August	14	21	10	16
September	20	22	07	15
October	16	22	04	20
November	28	22	13	17
December	18	23	09	15

The Zero-corrections used during the year 1933 in the reduction of the photographs taken at Greenwich were as follows:

4-inch Photo-heliograph,	January 1 to May 31	+2°·35
	June 1 to August 31	+2·3
	September 1 to December 31 ..	+2·35
9-inch Photo-heliograph	January 1 to June 3	+2·35
	June 9 to June 30	+2·1
	July 1 to September 30	+2·0
	October 1 to November 16	+1·95
	November 17 to December 31 ..	+1·35

On June 3, the zero of this instrument was accidentally disturbed. On November 17 new spider threads were inserted.

The Zero-correction used in the reductions of the photographs taken at the Cape Observatory was +0°·2 throughout the year 1933.

The Zero-corrections adopted for the Kodaikánal photographs were:

January to March +0°·5; September to December +0°·3.

The measures of the photographs were made with a large position-micrometer constructed by Messrs. Troughton and Simms for the measurement of photographs

of the Sun up to 12 inches in diameter. In this micrometer the photograph is held with its film-side uppermost on three pillars fixed on a circular plate, which can be turned through a small angle, about a pivot in its circumference, by means of a screw and antagonistic spring acting at the opposite extremity of the diameter. The pivot of this plate is mounted on the circumference of another circular plate, which can be turned by screw-action about a pivot in its circumference, 90° distant from that of the upper plate, this pivot being mounted on a circular plate with a position-circle which rotates about its centre. By this means small movements in two directions at right angles to each other can be readily given, and the photograph can be accurately centred with respect to the position-circle. When this has been done, a positive eyepiece, having at its focus a glass diaphragm ruled with cross-lines into squares, with sides of one-hundredth of an inch (for measurement of areas), is moved along a slide diametrically across the photograph, the diaphragm being nearly in contact with the photographic film, so that parallax is avoided. The distance of a spot or facula from the centre of the disc is read off by means of a scale and vernier to 1/250th inch (corresponding to 0·001 of the Sun's radius for photographs having a solar diameter of 8 inches). The position-angle is read off on the large position circle which rotates with the photographic plate. The photograph is illuminated by diffused light reflected from white paper placed at an angle of 45° between the photograph and the plate below.

All photographs are measured independently by two persons, and the means taken.

In the case of large or complex groups of spots, the positions of the chief components are measured individually, and also for groups so near the east or west limbs of the Sun that the effects of foreshortening are appreciable. In other cases the position of the centre of a group is estimated in the micrometer. In this respect a difference had been made in the practice during years previous to 1916, where in this section components of groups are given separately and combined into groups in the Ledgers.

When required, corrections are applied to the measured distances and position-angles for differential refraction. The formula is given in the *Introduction* for 1909. It is seldom necessary, however, to apply this correction except to a few photographs taken at Greenwich in mid-winter.

The calculations of heliographic longitude and latitude are made by use of the formulæ given in " Researches on Solar Physics : Heliographical Positions and Areas of Sun Spots observed with the Kew Photo-heliograph during the years 1862 and 1863 ", by W. De La Rue, B. Stewart, and B. Loewy. *Phil. Trans.*, 1869. If r be the measured distance of a spot from the centre of the Sun's apparent disc, R the

measured radius of the Sun on the photograph, (R) the tabular semi-diameter of the Sun in arc, and ρ, ρ' the angular distances of a spot from the centre of the apparent disc as viewed from the Sun's centre and from the Earth respectively, ρ is obtained from the equations :

$$\rho' = \frac{r}{R}(R) \text{ ; and } \sin(\rho+\rho') = \frac{r}{R}$$

If D and ϕ are the heliographic latitudes of the Earth and the spot respectively referred to the Sun's equator, and l the heliographic longitude of the spot from the solar meridian passing through the centre of the disc, longitudes west of the centre being reckoned as positive, and χ the position-angle from the Sun's axis

$$\sin\phi = \cos\rho \sin D + \sin\rho \cos D \cos\chi$$
$$\sin l = -\sin\chi \sin\rho \sec\phi.$$

The position-angle ϕ is found from the position-angle from the north point by subtracting P, the position-angle of the N end of the Sun's axis, measured eastward from the North Point of the disc. The heliographic longitude of the spot is l+L, where L is the heliographic longitude of the centre of the disc. The three quantities P, D, and L for the time of the exposure of each photograph are derived from the Ephemeris for Physical Observations of the Sun given on p. 560 of the *Nautical Almanac* for 1933.

The inclination of the Sun's axis to the ecliptic is assumed to be 82°45′, the longitude of the ascending node of the Sun's equator on the ecliptic for 1933·0 to be 74°49′·5, and the period of the Sun's sidereal rotation to be 25·38 days ; the meridian which passed through the ascending node on 1854 January 1, Greenwich Mean Noon, being taken as the zero meridian.

§ 2. *General Catalogue of Groups of Sun Spots for* 1933.

The Catalogue contains every group of spots which lasted for two or more days, and the group numbers are in continuation of those given in 1932 and previous years. Groups seen only once are given with a distinctive numeration in a table which follows the Catalogue.

A number of " Revival " groups of spots have been tabulated in series in a table following the Catalogue and table of 1-day spots. The respective groups of each series are in the same heliographic position and were usually seen in consecutive rotations but with definite breaks in their history between each rotation. The latter feature excludes them from being classed as " Recurrent " groups ; they differ from " Intermittent " groups in their being of long period intermittency. When a

"Recurrent" series forms part of a "Revival" series, a reference is made in the last column of the table. Other groups which are given in detail in Ledger II are also indicated.

§ 3. *Ledgers of the Areas and Heliographic Positions of Groups of Sun Spots for* 1933.

Ledger I.—Recurrent Groups.—This Ledger supersedes the Catalogue of Recurrent Groups of Sun Spots given in years previous to 1916 of the *Greenwich Photo-Heliographic Results*, and the reference numbers of the series are in continuation of those given therein. The groups forming this Ledger have been abstracted from a general Ledger of all spot groups seen throughout the year and were selected upon the following plan, reference being made to the General Catalogue :—If any spot group when first seen was 60° or more to the east of the Central Meridian, then the Catalogue, and, if necessary, the Daily Results also, were searched some fifteen or sixteen days earlier, to ascertain whether a spot group of similar heliographic longitude and latitude was then near the west limb of the Sun. Similarly, if any spot group when last seen was 60° or more to the west of the Central Meridian, then the Catalogue was searched some fifteen or sixteen days later, to ascertain whether a spot group of similar heliographic longitude and latitude was then near the east limb of the Sun. Both the search forward and the search backward have been made in the case of every spot group that was observed close to either the east or west limbs, in order that no possible case of identity might be overlooked. When there appeared to be a case of probable identity between spot groups observed in two consecutive rotations of the Sun, the character of the second group has been carefully compared with that of the first in each of the three elements—area, longitude, and latitude—before accepting it as a Recurrent Group.

Besides the Ledgers of the groups, there have been printed in a similar manner important components of the principal groups. This has been done in all cases where it appeared probable that an individual component lasted to the second or third rotation after its first appearance.

In deriving the proper motions of spots in longitude in Ledgers I and II, the formula adopted as representing the Sun's daily sidereal motion is

$$\xi = 14^\circ{\cdot}37 - 2^\circ{\cdot}60 \sin^2\phi,$$

where ϕ is the latitude of the spot. *See Greenwich Photo-Heliographic Results*, 1924, § 5.

Ledger II.—Non-Recurrent Groups.—This Ledger contains the most important of those groups which do not last to a second rotation. Individual components are also given after their respective groups, where they are large and distinctive.

§ 4. *Total Areas of Sun Spots and Faculæ for each day, and Mean Areas and Mean Heliographic Latitude of Sun Spots and Faculæ for each Rotation of the Sun, and for the year* 1933.

Particulars relating to this section are given in the headings on pages C 38 and 42–43.

§ 5. *Observations of Solar Flocculi made with the Spectrohelioscope in the year* 1933.

This section contains measures of radial velocity of dark hydrogen flocculi seen on the Sun's disc near sunspots. The observations were made at Greenwich with a Spectrohelioscope lent by the Mount Wilson Observatory in the autumn of 1929 and set up in the south attic of the New Building. The observations were made by Mr. Newton and Mr. Barton.

H. SPENCER JONES.

Royal Observatory, Greenwich,
1934 August 9.

ROYAL OBSERVATORY, GREENWICH.

Positions and Areas of Sun Spots and Faculæ

For each Day in the Year

1933

GREENWICH PHOTO-HELIOGRAPHIC RESULTS, 1933.

Positions and Areas of Sun Spots and Faculæ for each Day in the Year 1933.

Col. 1. (1) Time when photograph was taken expressed in days and decimals of a day reckoning from midnight at commencement of year. (2) Place of observation—Greenwich (G), Cape of Good Hope (C), Kodaikánal (K). (3) Date of photograph.

Col. 2. Number of Spot Group in order of appearance and in continuation of the Group-numbers given in previous years. Groups seen on one day only are distinguished by the number of the Rotation during which they were observed and by a letter given in the order of their appearance. When there is no number in the second column it is to be understood that there is a Facula unaccompanied by a Spot.

Col. 3. Distance of Spot Group or Faculæ from Sun's centre in terms of the Sun's radius.

Col. 4. Position Angle of Spot Group or Faculæ measured from the North pole of the Sun's axis in the direction N., E., S., W., N.

Col. 5. Heliographic Longitude of the Spot Group derived from the measures.

Col. 6. Heliographic Latitude of the Spot Group similarly derived.

Col. 7. Area of Umbræ corrected for foreshortening in millionths of the Sun's visible hemisphere.

Col. 8. Area of Whole Spots composing the Group similarly expressed.

Col. 9. Area of each group of Faculæ similarly expressed. The positions of Faculæ relative to the Spots with which they are associated are indicated by the letters *n*, *s*, *p*, *f*, *c*, denoting respectively, north, south, preceding, following, concentric.

In line with the date of each day is given in brackets for the time of photograph the position angle of the Sun's axis from the north point: the heliographic longitude and latitude of the centre of the disc: the total areas of Spots and Faculæ for the day.

POSITIONS and AREAS of SUN SPOTS and FACULÆ for EACH DAY in the YEAR 1933.

G.M.T.	Group No.	Measures. Dist.	Measures. Pos. Angle.	Position. Long.	Position. Lat.	Area. Umbræ.	Area. Whole Spots.	Area. Faculæ.
1933.			°	°	°			
0·395		·992	279·0					290
G								
Jan. 1			(+2·0)	(70·4)	(−3·1)	(0)	(0)	(290)
Jan. 2		No spots or faculæ.						
2·330	11530	·972	78·9	329·5	+10·0	44	201	382*c*
C		·893	78·2					218
Jan. 3			(+1·0)	(44·9)	(− 3·4)	(44)	(201)	(600)
3·478	11530	·889	76·5	328·6	+10·3	35	210	979*f*
G	11531	·975	79·6	313·7	+ 9·3	25	92	637*nf*
		·894	86·5					124
Jan. 4			(+0·5)	(29·8)	(− 3·5)	(60)	(302)	(1740)
4·400		·883	274·7					243
		·757	281·0					174
C	11530	·773	73·8	329·0	+10·1	41	211	778*f*
	11531	·902	78·2	314·6	+ 9·0	35	142	595*f*
		·984	77·4					258
Jan. 5			(0·0)	(17·7)	(− 3·6)	(76)	(353)	(2048)
5·386		·970	275·4					123
		·858	279·3					349
G	11530	·624	68·1	328·8	+10·4	40	192	
	11531	·785	75·4	314·6	+ 9·0	28	143	949*f*
		·937	75·1					620
Jan. 6			(−0·5)	(4·7)	(− 3·7)	(68)	(335)	(2041)
6·461		·946	279·6					164
	11530	·437	56·9	328·8	+10·2	49	199	
G	11531	·613	69·8	315·0	+ 9·1	28	146	
		·825	72·4					656
Jan. 7			(−1·0)	(350·5)	(− 3·8)	(77)	(345)	(820)
7·372	11530	·296	34·1	328·8	+10·3	39	190	
C	11531	·453	60·6	315·0	+ 9·2	18	135	
		·736	68·6					138
Jan. 8			(−1·4)	(338·5)	(− 3·9)	(57)	(325)	(138)
8·425	11530	·256	343·4	328·9	+10·2	38	180	
G	11531	·282	35·6	315·2	+ 9·3	33	149	
Jan. 9			(−1·9)	(324·7)	(− 4·0)	(71)	(329)	(0)
1933.			°	°	°			
9·466	*1061a*	·402	288·2	333·4	+ 3·4	1	5	
	11530	·392	308·8	329·0	+10·3	46	163	
	1061b	·291	304·6	324·9	+ 5·5	2	6	
G	11531	·245	342·9	315·2	+ 9·4	37	142	
	1061c	·286	9·8	308·2	+12·2	2	7	
	1061d	·210	30·7	304·8	+ 6·3	2	5	
		·900	72·6					30
Jan. 10			(−2·4)	(311·0)	(− 4·1)	(90)	(328)	(30)
10·414	11530	·555	295·4	329·0	+10·1	17	205	
C	11531	·372	308·8	315·5	+ 9·4	31	146	
Jan. 11			(−2·9)	(298·5)	(− 4·2)	(48)	(351)	(0)
11·514	11530	·735	288·1	329·0	+10·1	38	189	370*p*
	11531	·564	293·7	315·4	+ 9·3	36	152	
G	*1061e*	·541	287·4	315·1	+ 5·5	1	4	
	11532	·235	60·0	272·3	+ 2·4	9	21	
		·970	77·5					65
Jan. 12			(−3·3)	(284·0)	(− 4·4)	(84)	(366)	(435)
12·424		·983	261·3					56
	11530	·852	284·4	328·6	+ 9·8	24	181	505*c*
C	11531	·714	287·6	315·4	+ 9·2	23	133	224*p*
	11533	·574	299·2	302·7	+12·4	5	20	
	11532	·115	350·3	273·1	+ 1·9	10	49	
Jan. 13			(−3·8)	(272·0)	(− 4·5)	(62)	(383)	(785)
13·505		·909	293·3					269
	11530	·955	281·9	329·1	+ 9·9	68	221	755*f*
G	11531	·863	283·5	315·8	+ 9·1	33	135	545*nf*
	11533	·763	291·1	304·5	+12·8	41	121	242*c*
	11532	·311	291·8	274·5	+ 2·2	16	54	
Jan. 14			(−4·3)	(257·8)	(− 4·6)	(158)	(531)	(1811)
14·149		·973	281·7					77
	11530	·987	281·0	328·8	+10·1	48	206	394*f*
K	11531	·926	282·0	315·7	+ 9·3	16	92	343*f*
	11533	·860	288·2	306·1	+13·1	19	92	606*f*
	11532	·438	283·8	274·4	+ 1·8	16	78	
Jan. 15			(−4·6)	(249·3)	(− 4·6)	(99)	(468)	(1420)
15·347		·899	285·6					193
	11531	·993	280·0	315·5	+ 9·3	16	85	333*f*
C	11533	·965	285·4	306·4	+13·5	11	34	403*c*
	11532	·663	277·2	274·5	+ 1·2	8	35	
		·957	82·0					318
Jan. 16			(−5·2)	(233·5)	(− 4·7)	(35)	(154)	(1247)

Group 11530. Jan. 3–15. Return of Group 11525; 3rd appearance. A regular spot followed by a considerable area of faculæ in which Group 11531 appears.
Group 11531. Jan. 4–16. A regular spot.
Group 11532. Jan. 12–17. A small stream.
Group 11533. Jan. 13–16. A small group in the wake of Groups 11530 and 11531.

POSITIONS and AREAS of SUN SPOTS and FACULÆ for EACH DAY in the YEAR 1933.

G.M.T.	Group No.	MEASURES. Dist.	MEASURES. Pos. Angle.	POSITION. Long.	POSITION. Lat.	AREA. Umbræ.	AREA. Whole Spots.	AREA. Faculæ.
1933.			°	°	°			
16·412		·978	282·9					228
	11532	·847	275·2	276·8	+ 1·7	8	16	275*f*
G		·855	81·2					144
		·915	77·5					225
Jan. 17			(−5·7)	(219·5)	(− 4·9)	(8)	(16)	(872)
17·449		·937	273·9					266
G		·748	74·6					202
		·937	115·1					66
Jan. 18			(−6·2)	(205·8)	(− 4·9)	(0)	(0)	(534)
18·509		·988	273·8					104
C								
Jan. 19			(−6·7)	(191·9)	(− 5·0)	(0)	(0)	(104)
Jan. 20	}	No spots or faculæ.						
Jan. 21	}							
21·374		·948	79·1					91
C								
Jan. 22			(−8·0)	(154·2)	(− 5·3)	(0)	(0)	(91)
22·352		·843	78·4					212
C		·963	83·0					199
Jan. 23			(−8·4)	(141·3)	(− 5·4)	(0)	(0)	(411)
23·109		·822	72·1					119
K		·898	79·7					238
Jan. 24			(−8·7)	(131·3)	(− 5·5)	(0)	(0)	(357)
24·444		·768	281·6					210
G		·942	172·7					88
Jan. 25			(−9·3)	(113·8)	(− 5·6)	(0)	(0)	(298)
25·524		·902	274·0					124
G		·854	282·1					271
		·958	79·1					342
Jan. 26			(−9·8)	(99·5)	(− 5·6)	(0)	(0)	(737)
1933.			°	°	°			
26·530		·939	279·5					187
G		·865	76·6					317
		·967	83·4					116
Jan. 27			(−10·2)	(86·3)	(− 5·7)	(0)	(0)	(620)
27·450	11534	·878	81·1	13·9	+ 4·9	10	29	167*c*
G		·763	73·5					350
		·974	98·0					165
Jan. 28			(−10·6)	(74·2)	(− 5·8)	(10)	(29)	(682)
28·379	11534	·749	78·8	14·6	+ 4·4	22	144	164*c*
C		·914	94·8					224
Jan. 29			(−11·0)	(61·9)	(− 5·9)	(22)	(144)	(388)
29·357	11534	·571	72·8	16·1	+ 4·7	31	166	
C	11535	·989	78·6	329·2	+10·3	13	108	262*n*
		·967	83·9					56
Jan. 30			(−11·4)	(49·1)	(− 5·9)	(44)	(274)	(318)
30·434	11534	·332	54·7	19·2	+ 5·2	33	160	
	11536	·408	60·9	14·0	+ 5·7	18	54	
C	11535	·925	76·0	329·2	+10·5	32	126	656*c*
		·892	84·5					184
Jan. 31			(−11·9)	(34·9)	(− 6·0)	(83)	(340)	(840)
31·121		·871	282·4					122
	11534	·217	26·3	20·3	+ 5·1	41	179	
K	11536	·284	43·1	14·6	+ 5·9	21	94	
	11535	·857	74·5	329·1	+ 9·9	27	120	579*c*
	11537	·984	73·0	308·4	+15·5	66	403	492*c*
Feb. 1			(−12·2)	(25·8)	(− 6·1)	(155)	(796)	(1193)
32·401		·971	275·7					156
		·875	283·9					222
	11534	·291	313·0	21·3	+ 5·3	48	249	
G	11536	·237	334·6	14·8	+ 6·1	25	134	
	11535	·683	68·7	329·0	+ 9·6	16	118	300*f*
	11537	·939	73·5	301·7	+13·1	266	1428	1696*c*
Feb. 2			(−12·7)	(9·0)	(− 6·2)	(355)	(1929)	(2374)

Group 11534. Jan. 28–Feb. 6. A stream led by a regular spot. Group 11536 develops closely following it on Jan. 31; afterwards the two groups are more clearly separated owing to the difference in inclination of their axes.
Group 11535. Jan. 30–Feb. 11. Return of Group 11530: 4th appearance. A regular spot with a tiny companion on Jan. 31, Feb. 1, 2 and 5.
Group 11536. Jan. 31–Feb. 4. A small stream following and developing with Group 11534.
Group 11537. Feb. 1–13. A very large stream of spots visible to the naked eye. The leader is the most stable spot, though this departs considerably from its regular formation. The following spot is the largest component when first the group appears around the eastern limb, but this spot breaks up after Feb. 4, the southern part becoming a regular spot. This is the largest group since 1931 February (Group 11355). Group 11533 indicates earlier activity in this area.

POSITIONS and AREAS of SUN SPOTS and FACULÆ for EACH DAY in the YEAR 1933.

G.M.T.	Group No.	Measures. Dist.	Measures. Pos. Angle.	Position. Long.	Position. Lat.	Area. Umbræ.	Area. Whole Spots.	Area. Faculæ.
1933.			°	°	°			
33·383		·962	278·3					79
	II534	·487	293·6	22·6	+ 5·7	37	201	
	II536	·398	304·1	15·4	+ 7·0	11	25	
G	II535	·522	59·6	329·0	+ 9·8	21	109	
	II537	·841	70·0	302·1	+13·1	297	1480	1057*c*
		·908	178·2					15
		·961	73·7					69
Feb. 3			(−13·1)	(356·1)	(− 6·2)	(366)	(1815)	(1220)
34·338	II534	·685	285·7	24·9	+ 6·0	27	143	
	II536	·569	291·9	15·5	+ 6·9	4	14	
C	II535	·367	42·3	329·1	+ 9·6	18	108	
	II537	·710	64·2	302·5	+13·2	264	1516	328*f*
	II538	·870	70·0	286·3	+13·9	2	4	72*f*
Feb. 4			(−13·5)	(343·5)	(− 6·3)	(315)	(1785)	(400)
35·491		·926	283·7					204
	II534	·856	281·5	25·6	+ 6·4	21	112	670*f*
G	II535	·276	358·1	328·8	+ 9·6	19	116	
	II537	·534	52·2	302·7	+13·3	267	1594	
	II538	·706	63·8	287·9	+13·3	7	22	114*c*
Feb. 5			(−13·9)	(328·3)	(− 6·4)	(314)	(1844)	(988)
36·442		·980	281·7					133
		·921	289·7					116
	II534	·950	279·3	26·3	+ 6·7	27	130	598*f*
G	II535	·352	320·4	328·9	+ 9·4	25	117	
	II537	·397	32·7	303·1	+13·2	256	1434	
	II538	·556	53·9	288·4	+13·4	11	28	
Feb. 6			(−14·3)	(315·8)	(−6·4)	(319)	(1709)	(847)
37·499		·967	277·5					550
		·962	285·9					70
	II539	·918	259·6	9·1	−12·1	13	35	93*c*
	II535	·521	300·1	329·0	+ 9·3	15	93	
G	II537	·342	353·7	304·1	+13·3	206	1213	
	II538	·386	32·1	289·8	+12·6	17	71	
Feb. 7			(−14·7)	(301·9)	(− 6·5)	(251)	(1412)	(713)
38·322		·988	276·6					78
	II539	·980	259·2	10·2	−11·8	5	20	174*f*
C	II535	·655	292·0	328·8	+ 9·0	19	92	
	II537	·403	326·0	304·3	+13·1	171	1054	
	II538	·321	0·6	290·8	+12·2	20	134	
Feb. 8			(−15·0)	(291·0)	(− 6·5)	(215)	(1300)	(252)
1933.			°	°	°			
39·323		·880	276·9					131
	II535	·801	286·6	328·7	+ 9·1	17	90	268*p*
C	II537	·546	306·7	304·5	+13·1	152	833	
	II538	·403	321·3	292·8	+11·9	60	254	
Feb. 9			(−15·4)	(277·9)	(− 6·6)	(229)	(1177)	(399)
40·473		·957	271·5					238
		·948	290·2					274
		·944	190·4					26
G	II535	·928	282·8	329·0	+ 9·3	25	92	287*c*
	1062a	·821	289·6	314·7	+11·9	2	3	214*c*
	II537	·739	295·2	306·0	+13·5	133	615	363*p*
	II538	·589	301·2	293·6	+12·1	60	310	
Feb. 10			(−15·8)	(262·7)	(− 6·6)	(220)	(1020)	(1402)
41·427		·929	284·1					181
	II535	·986	280·7	328·9	+ 9·3	26	102	248*p*
G	II537	·858	289·9	305·9	+13·3	106	579	894*c*
	II538	·733	293·1	293·5	+11·8	38	230	
Feb. 11			(−16·1)	(250·1)	(− 6·7)	(170)	(911)	(1323)
42·340	II537	·946	287·0	306·5	+13·6	116	500	1318*c*
C	II538	·862	287·6	294·9	+11·4	29	155	463*c*
Feb. 12			(−16·5)	(238·1)	(− 6·7)	(145)	(655)	(1781)
43·408	II537	·977	282·6	299·9	+10·7	44	189	900*c*
C	II538	·957	284·1	295·0	+11·3	26	150	591*nf*
		·965	89·1					55
Feb. 13			(−16·8)	(224·1)	(− 6·8)	(70)	(339)	(1546)
44·362		·985	286·4					699
C		·881	87·4					66
Feb. 14			(−17·2)	(211·5)	(− 6·8)	(0)	(0)	(765)
45·429	*1062b*	·761	84·4	148·4	− 0·2	0	2	56*c*
C								
Feb. 15			(−17·5)	(197·4)	(− 6·9)	(0)	(2)	(56)
Feb. 16	}	No spots or faculæ.						
Feb. 17	}							

Group 11538. Feb. 4–13. A stream with a complex leader spot closely following Group 11537.
Group 11539. Feb. 7–8. A small group near the west limb.

POSITIONS and AREAS of SUN SPOTS and FACULÆ for EACH DAY in the YEAR 1933.

G.M.T.	Group No.	MEASURES. Dist.	MEASURES. Pos. Angle.	POSITION. Long.	POSITION. Lat.	AREA. Umbræ.	AREA. Whole Spots.	AREA. Faculæ.
1933.			°	°	°			
48·509		·961	80·6					423
G								
Feb. 18			(−18·6)	(156·9)	(− 7·0)	(0)	(0)	(423)
49·381		·880	76·8					295
C								
Feb. 19			(−18·8)	(145·4)	(− 7·0)	(0)	(0)	(295)
50·444		·834	75·9					361
G		·875	90·3					71
Feb. 20			(−19·1)	(131·4)	(− 7·1)	(0)	(0)	(432)
Feb. 21		No spots or		faculæ.				
52·407		·891	77·3					130
G		·965	81·1					278
Feb. 22			(−19·7)	(105·5)	(− 7·1)	(0)	(0)	(408)
53·398		·922	79·1					477
G								
Feb. 23			(−20·0)	(92·5)	(− 7·1)	(0)	(0)	(477)
54·341		·757	73·7					179
C		·868	77·9					169
Feb. 24			(−20·3)	(80·1)	(− 7·1)	(0)	(0)	(348)
Feb. 25		No spots or		faculæ.				
56·106		·966	74·2					97
K								
Feb. 26			(−20·8)	(56·8)	(− 7·2)	(0)	(0)	(97)
57·494		·793	288·6					179
	11540	·912	79·6	334·3	+ 6·4	14	36	101*c*
G		·926	72·3					348
		·998	79·0					96
Feb. 27			(−21·2)	(38·6)	(− 7·2)	(14)	(36)	(724)

G.M.T.	Group No.	MEASURES. Dist.	MEASURES. Pos. Angle.	POSITION Long.	POSITION Lat.	AREA. Umbræ.	AREA. Whole Spots.	AREA. Faculæ.
1933.			°	°	°			
58·625		·906	282·8					287
	11540	·789	75·6	333·6	+ 6·7	3	18	32*c*
G	11541	·968	71·7	311·3	+15·6	25	141	741*c*
	11542	·996	78·4	300·5	+10·8	21	149	
		·829	67·7					191
Feb. 28			(−21·4)	(23·7)	(− 7·2)	(49)	(308)	(1251)
59·345		·972	282·1					111
		·895	281·0					164
C	11541	·919	69·6	311·0	+15·5	21	112	609*c*
	11542	·969	76·8	300·6	+10·8	16	80	545*c*
Mar. 1			(−21·6)	(14·2)	(− 7·2)	(37)	(192)	(1429)
60·513		·962	278·1					184
	11541	·797	64·1	310·9	+15·5	28	132	541*c*
C	11542	·875	72·9	300·5	+11·2	15	109	524*n*
		·955	70·8					217
Mar. 2			(−21·9)	(358·8)	(− 7·2)	(43)	(241)	(1466)
61·368	11541	·681	58·2	310·8	+15·2	29	156	
	11542	·771	69·3	300·4	+11·0	22	98	359*n*
C		·876	69·3					222
		·878	54·8					93
Mar. 3			(−22·1)	(347·5)	(− 7·2)	(51)	(254)	(674)
62·511		·900	283·8					237
		·787	283·7					258
G	11541	·520	45·0	310·2	+14·8	28	124	
	1063a	·491	55·4	308·4	+ 9·6	4	7	
	11542	·597	60·4	300·7	+11·0	20	95	
Mar. 4			(−22·4)	(332·5)	(− 7·2)	(52)	(226)	(495)
63·402		·972	278·3					184
		·905	283·2					166
G	11541	·414	25·2	310·2	+14·7	22	114	
	11542	·455	47·7	300·7	+10·9	16	84	
Mar. 5			(−22·6)	(320·7)	(− 7·3)	(38)	(198)	(350)
64·538		·975	277·9					137
G	11541	·381	348·9	310·1	+14·5	19	112	
	11542	·324	15·1	300·9	+10·9	12	71	
Mar. 6			(−22·9)	(305·8)	(− 7·3)	(31)	(183)	(137)

Group 11540. Feb. 27–28. A diminutive group.
Group 11541. Feb. 28–Mar. 12. Together with Group 11542, a return of Group 11537. A stable regular spot, with a tiny distant companion on Mar. 9.
Group 11542. Feb. 28–Mar. 10. Together with Group 11541, a return of Group 11537. A regular spot diminishing rapidly to a dot after Mar. 7. A tiny companion appears on Mar. 7 and 8.

POSITIONS and AREAS of SUN SPOTS and FACULÆ for EACH DAY in the YEAR 1933.

G.M.T.	Group No.	Measures. Dist.	Measures. Pos. Angle.	Position. Long.	Position. Lat.	Area. Umbræ.	Area. Whole Spots.	Area. Faculæ.
1933.			°	°	°			
65·393	11541	·454	324·7	310·2	+14·7	22	103	
G	11542	·330	340·9	300·8	+10·8	15	78	
Mar. 7			(−23·1)	(294·5)	(− 7·3)	(37)	(181)	(0)
66·398		·868	282·7					197
		·840	294·6					413
G	11541	·592	307·3	310·2	+14·7	23	103	
	11542	·450	313·7	300·5	+11·2	11	38	
Mar. 8			(−23·3)	(281·2)	(− 7·2)	(34)	(141)	(610)
67·625		·936	284·0					269
C	11541	·765	296·1	310·2	+14·6	29	112	260*p*
	11542	·645	296·9	300·8	+11·1	3	7	
Mar. 9			(−23·5)	(265·1)	(− 7·2)	(32)	(119)	(529)
68·389		·975	287·9					183
G	11541	·858	291·9	310·2	+14·6	21	102 }	1066*c*
	11542	·759	291·5	300·8	+11·1	3	10 }	
Mar. 10			(−23·7)	(255·0)	(− 7·2)	(24)	(112)	(1249)
69·385		·938	180·7					57
G		·789	301·1					205
	11541	·948	288·3	310·3	+14·8	20	96	1240*f*
Mar. 11			(−23·9)	(241·9)	(− 7·2)	(20)	(96)	(1502)
70·445		·903	299·9					131
G	11541	·995	285·5	309·9	+14·5	43	125	776*f*
	10636	·336	17·7	221·9	+11·4	0	2	
Mar. 12			(−24·1)	(227·9)	(− 7·2)	(43)	(127)	(907)
71·519		·980	285·8					280
G		·966	294·2					158
Mar. 13			(−24·2)	(213·8)	(− 7·2)	(0)	(0)	(438)
Mar. 14 to Mar. 16		No spots or faculæ.						
75·103		·931	159·6					190
K		·951	169·0					133
Mar. 17			(−24·8)	(166·5)	(− 7·1)	(0)	(0)	(323)
1933.			°	°	°			
76·404		·862	72·4					147
		·905	171·4					28
G		·942	83·3					103
		·951	75·0					141
Mar. 18			(−25·0)	(149·4)	(− 7·1)	(0)	(0)	(419)
77·431		·781	68·9					120
G								
Mar. 19			(−25·1)	(135·8)	(− 7·0)	(0)	(0)	(120)
Mar. 20		No spots or faculæ.						
79·391		·946	75·6					328
G								
Mar. 21			(−25·4)	(110·0)	(− 7·0)	(0)	(0)	(328)
80·385	11543	·980	84·3	19·2	+ 4·2	89	386	276*c*
G		·868	72·5					210
		·934	78·7					128
Mar. 22			(−25·5)	(96·9)	(− 6·9)	(89)	(386)	(614)
81·415	11543	·902	81·5	20·0	+ 4·6	107	481	290*c*
G								
Mar. 23			(−25·6)	(83·3)	(− 6·9)	(107)	(481)	(290)
82·429	11543	·772	77·9	20·9	+ 4·8	94	345	367*c*
G								
Mar. 24			(−25·7)	(69·9)	(− 6·9)	(94)	(345)	(367)
83·397	11544	·395	316·8	73·1	+10·1	7	24	
G	11543	·615	73·2	21·1	+ 4·7	60	253	
Mar. 25			(−25·8)	(57·2)	(− 6·8)	(67)	(277)	(0)
84·400		·960	186·7					48
	11544	·575	298·1	74·7	+ 9·8	22	67	
G	11543	·421	63·5	21·8	+ 4·5	41	252	
		·935	75·6					314
Mar. 26			(−25·9)	(43·9)	(− 6·8)	(63)	(319)	(362)

Group 11543. Mar. 22–Apr. 2. A group led by a spot with a prominent bright "bridge" across it, almost dividing the spot into two halves. After Mar. 27, the bridge diminishes and the spot assumes a regular outline. The other components of the group are usually very small and unstable.

Group 11544. Mar. 25–29. A small stream of unimportant spots.

POSITIONS and AREAS of SUN SPOTS and FACULÆ for EACH DAY in the YEAR 1933.

G.M.T.	Group No.	MEASURES. Dist.	MEASURES. Pos. Angle.	POSITION. Long.	POSITION. Lat.	AREA. Umbræ.	AREA. Whole Spots.	AREA. Faculæ.
1933.			°	°	°			
85·395		·926	280·5					159
		·832	279·9					188
	11544	·741	289·8	75·7	+ 9·8	27	105	161*c*
G	11543	·252	38·5	21·8	+ 4·7	40	215	
		·836	70·1					340
		·951	74·8					405
		·975	84·3					69
Mar. 27			(−26·0)	(30·8)	(− 6·7)	(67)	(320)	(1322)
86·393		·949	281·1					100
	11544	·877	285·3	76·7	+10·0	19	80	315*c*
	11543	·212	340·3	21·8	+ 4·8	43	217	
G		·875	70·2					160
		·925	80·9					109
		·967	60·1					179
		·970	71·5					446
Mar. 28			(−26·1)	(17·7)	(− 6·7)	(62)	(297)	(1309)
87·398	11544	·964	281·9	77·2	+ 9·6	11	41	235*c*
	11543	·367	302·2	22·5	+ 4·9	36	203	
		·836	78·7					131
G		·838	68·3					171
		·893	56·3					219
		·932	79·0					144
		·936	68·4					371
Mar. 29			(−26·1)	(4·4)	(− 6·6)	(47)	(244)	(1271)
88·384		·990	281·6					93
	11543	·552	289·7	22·7	+ 5·0	36	157	
G		·785	66·6					258
		·808	51·7					177
		·905	64·4					258
Mar. 30			(−26·2)	(351·4)	(− 6·6)	(36)	(157)	(786)
89·381		·910	284·3					111
G	11543	·723	283·2	23·0	+ 4·9	27	134	
Mar. 31			(−26·2)	(338·2)	(− 6·5)	(27)	(134)	(111)
90·415		·959	283·2					174
G	11543	·864	279·3	23·2	+ 4·6	27	131	386*f*
		·776	79·6					10
Apr. 1			(−26·3)	(324·6)	(− 6·5)	(27)	(131)	(570)
91·407	11543	·956	277·1	23·5	+ 4·8	27	150	353*f*
G								
Apr. 2			(−26·3)	(311·5)	(− 6·4)	(27)	(150)	(353)

G.M.T.	Group No.	MEASURES. Dist.	MEASURES. Pos. Angle.	POSITION. Long.	POSITION. Lat.	AREA. Umbræ.	AREA. Whole Spots.	AREA. Faculæ.
1933.			°	°	°			
92·391		·985	277·4					313
G								
Apr. 3			(−26·4)	(298·5)	(− 6·4)	(0)	(0)	(313)
93·444		·835	291·4					280
G								
Apr. 4			(−26·4)	(284·6)	(− 6·3)	(0)	(0)	(280)
94·402		·928	283·8					213
G		·914	294·6					149
		·806	288·8					196
Apr. 5			(−26·4)	(272·0)	(− 6·3)	(0)	(0)	(558)
95·386		·934	289·0					446
		·844	282·2					141
G		·811	300·8					324
	1064a	·322	297·4	275·6	+ 2·6	1	4	
Apr. 6			(−26·4)	(259·0)	(− 6·2)	(1)	(4)	(911)
96·396		·958	287·0					107
		·938	277·1					127
		·916	295·2					123
G		·912	305·9					102
		·840	286·0					179
		·796	301·4					279
Apr. 7			(−26·4)	(245·7)	(− 6·1)	(0)	(0)	(917)
97·401		·941	295·8					480
		·936	283·8					280
G		·924	264·2					28
		·830	298·5					217
Apr. 8			(−26·4)	(232·4)	(− 6·1)	(0)	(0)	(1005)
98·412		·972	287·6					234
G		·922	296·6					201
Apr. 9			(−26·4)	(219·1)	(− 6·0)	(0)	(0)	(435)
Apr. 10	}	No spots or faculæ.						
Apr. 11	}							
101·352		·955	278·9					28
C								
Apr. 12			(−26·3)	(180·3)	(− 5·8)	(0)	(0)	(28)

POSITIONS and AREAS of SUN SPOTS and FACULÆ for EACH DAY in the YEAR 1933.

G.M.T.	Group No.	MEASURES. Dist.	MEASURES. Pos. Angle.	POSITION. Long.	POSITION. Lat.	AREA. Umbræ.	AREA. Whole Spots.	AREA. Faculæ.
1933.			°	°	°			
102·332		·937	352·3					127
G								
Apr. 13			(−26·3)	(167·3)	(− 5·7)	(0)	(0)	(127)
103·365		·884	70·0					76
G		·973	79·2					58
Apr. 14			(−26·2)	(153·7)	(− 5·6)	(0)	(0)	(134)
104·412		·889	76·9					29
G		·944	72·4					108
Apr. 15			(−26·2)	(139·8)	(− 5·5)	(0)	(0)	(137)
105·348		·852	67·0					48
G		·940	173·2					81
Apr. 16			(−26·1)	(127·5)	(− 5·5)	(0)	(0)	(129)
106·111	11545	·648	68·9	79·8	+ 9·1	8	32	
K		·930	78·5					100
Apr. 17			(−26·0)	(117·4)	(− 5·4)	(8)	(32)	(100)
107·497	11545	·424	53·3	79·0	+ 9·6	10	56	
		·898	82·7					97
G		·949	89·5					135
		·969	81·1					111
Apr. 18			(−25·9)	(99·1)	(− 5·3)	(10)	(56)	(343)
108·353	*1064b*	·123	358·9	87·9	+ 1·8	2	29	
	11545	·303	31·5	78·6	+ 9·8	7	29	
		·809	79·7					137
G		·856	87·1					155
		·917	80·3					200
		·933	71·3					107
Apr. 19			(−25·9)	(87·8)	(− 5·2)	(9)	(58)	(599)
109·585	11545	·286	336·9	78·0	+10·1	5	14	
G		·778	77·5					71
Apr. 20			(−25·7)	(71·5)	(− 5·1)	(5)	(14)	(71)
110·375	11545	·384	310·8	78·2	+ 9·7	4	11	
G		·950	74·9					36
Apr. 21			(−25·7)	(61·1)	(− 5·0)	(4)	(11)	(36)
1933.			°	°	°			
111·426		·917	73·3					211
C								
Apr. 22			(−25·5)	(47·2)	(− 4·9)	(0)	(0)	(211)
112·341		·881	72·3					119
G		·984	74·4					38
Apr. 23			(−25·4)	(35·1)	(− 4·9)	(0)	(0)	(157)
113·433		·872	284·3					203
C		·951	73·4					86
		·959	63·1					68
Apr. 24			(−25·3)	(20·7)	(− 4·8)	(0)	(0)	(357)
114·444		·958	281·8					131
		·810	61·0					133
C		·916	78·6					155
		·929	57·0					94
		·947	68·5					151
Apr. 25			(−25·2)	(7·3)	(− 4·7)	(0)	(0)	(664)
115·331		·993	280·8					94
		·868	52·4					102
G		·890	64·4					234
		·971	64·0					185
Apr. 26			(−25·0)	(355·6)	(− 4·6)	(0)	(0)	(615)
116·483		·942	283·8					106
		·762	55·8					160
G		·880	59·2					118
		·947	95·7					182
Apr. 27			(−24·9)	(340·4)	(− 4·5)	(0)	(0)	(566)
117·405		·981	279·2					55
C		·844	280·5					250
		·850	95·2					41
Apr. 28			(−24·8)	(328·2)	(− 4·4)	(0)	(0)	(346)
118·352		·945	277·0					263
G	11546	·429	295·3	338·6	+ 6·5	1	5	
Apr. 29			(−24·6)	(315·7)	(− 4·3)	(1)	(5)	(263)
Apr. 30		No spots or	faculæ.					

Group 11545. Apr. 17–21. A small stream with the largest component following.
Group 11546. Apr. 29–May 2. Intermittent. A pair of small spots seen only on Apr. 29 and May 2.

POSITIONS and AREAS of SUN SPOTS and FACULÆ for EACH DAY in the YEAR 1933.

G.M.T.	Group No.	MEASURES. Dist.	MEASURES. Pos. Angle.	POSITION. Long.	POSITION. Lat.	AREA. Umbræ.	AREA. Whole Spots.	AREA. Faculæ
1933.			°	°	°			
120·348		·829	288·6					137
G								
May 1			(−24·2)	(289·3)	(− 4·1)	(0)	(0)	(137)
121·400		·899	290·8					168
C	11546	·911	279·4	340·0	+ 6·8	5	24	68*c*
		·970	89·0					36
May 2			(−24·0)	(275·4)	(− 4·0)	(5)	(24)	(272)
122·654		·989	278·2					148
G		·956	284·6					108
May 3			(−23·8)	(258·8)	(− 3·8)	(0)	(0)	(256)
123·345		·785	302·3					173
G								
May 4			(−23·7)	(249·7)	(− 3·8)	(0)	(0)	(173)
124·447		·961	298·4					110
		·919	307·0					152
C		·914	286·3					268
		·884	296·9					136
May 5			(−23·5)	(235·1)	(− 3·7)	(0)	(0)	(666)
125·488		·962	295·0					81
G								
May 6			(−23·2)	(221·4)	(− 3·5)	(0)	(0)	(81)
126·380		·967	293·6					102
C								
May 7			(−23·0)	(209·6)	(− 3·4)	(0)	(0)	(102)
May 8		No spots or		faculæ.				
128·452	11547	·412	95·7	158·0	− 5·3	3	9	
G								
May 9			(−22·6)	(182·2)	(− 3·2)	(3)	(9)	(0)
129·440	11547	·159	105·6	160·3	− 5·5	1	3	
G								
May 10			(−22·3)	(169·1)	(− 3·1)	(1)	(3)	(0)

G.M.T.	Group No.	MEASURES. Dist.	MEASURES. Pos. Angle.	POSITION. Long.	POSITION. Lat.	AREA. Umbræ.	AREA. Whole Spots	AREA. Faculæ
1933.			°	°	°			
May 11		No spots or		faculæ.				
131·343		·865	277·5					41
G		·904	76·1					93
May 12			(−21·9)	(144·0)	(− 2·9)	(0)	(0)	(134)
132·352		·854	74·6					66
C								
May 13			(−21·6)	(130·6)	(− 2·8)	(0)	(0)	(66)
		·913	76·2					97
133·552								
G			(−21·3)	(114·7)	(− 2·7)	(0)	(0)	(97)
May 14								
134·348		·954	191·8					15
G		·821	72·0					142
		·961	78·7					113
May 15			(−21·1)	(104·2)	(− 2·6)	(0)	(0)	(270)
May 16		No spots or		faculæ.				
May 17								
137·370		·963	81·6					355
G								
May 18			(−20·2)	(64·2)	(− 2·2)	(0)	(0)	(355)
138·417	11548	·377	306·3	68·3	+10·8	6	18	
		·850	80·1					182
C		·925	79·7					129
		·948	70·9					45
		·958	91·5					31
May 19			(−19·9)	(50·4)	(− 2·1)	(6)	(18)	(387)
139·410	11548	·559	293·6	68·6	+11·2	12	93	
		·741	79·2					266
G		·828	77·8					162
		·911	70·8					272
		·961	80·0					140
May 20			(−19·6)	(37·2)	(− 2·0)	(12)	(93)	(840)

Group 11547. May 9–10. One or two tiny spots.
Group 11548. May 19–23. A small stream of typical formation.

POSITIONS and AREAS of SUN SPOTS and FACULÆ for EACH DAY in the YEAR 1933.

G.M.T.	Group No.	MEASURES. Dist.	MEASURES. Pos. Angle.	POSITION. Long.	POSITION. Lat.	AREA. Umbræ.	AREA. Whole Spots.	AREA. Faculæ.
1933.			°	°	°			
140·422		·890	270·0					45
	11548	·733	287·6	69·2	+11·4	20	103	
G	11549	·850	78·5	326·7	+ 8·7	2	2	149*f*
		·803	71·1					133
May 21			(−19·3)	(23·9)	(− 1·9)	(22)	(105)	(327)
141·353		·965	274·0					107
		·962	267·1					115
		·929	280·9					122
G	11548	·863	284·0	69·9	+11·1	27	120	294*c*
	11549	·757	75·4	323·7	+ 9·7	4	8	143*c*
		·949	73·5					339
May 22			(−19·0)	(11·5)	(− 1·8)	(31)	(128)	(1120)
142·355		·929	180·5					24
		·857	283·6					113
	11548	·953	282·5	69·7	+11·4	11	38	380*c*
G	11549	·529	69·9	328·2	+ 9·0	5	14	
		·822	72·1					227
		·935	73·2					70
May 23			(−18·7)	(358·3)	(− 1·6)	(16)	(52)	(814)
143·352		·991	282·3					134
G		·941	282·9					150
	11549	·366	59·0	326·6	+ 9·4	10	32	
May 24			(−18·3)	(345·1)	(− 1·5)	(10)	(32)	(284)
144·352	11549	·204	20·0	327·9	+ 9·6	5	14	
G								
May 25			(−18·0)	(331·9)	(− 1·4)	(5)	(14)	(0)
145·480		·953	282·1					142
G	11549	·234	309·6	327·3	+ 7·2	1	4	
May 26			(−17·6)	(316·9)	(− 1·3)	(1)	(4)	(142)
146·354	*1066a*	·746	285·1	352·3	+10·4	2	5	84*c*
G								
May 27			(−17·3)	(305·4)	(− 1·2)	(2)	(5)	(84)
147·357		·888	279·9					211
G		·784	286·0					119
May 28			(−17·0)	(292·1)	(− 1·0)	(0)	(0)	(330)

G.M.T.	Group No.	MEASURES. Dist.	MEASURES. Pos. Angle.	POSITION. Long.	POSITION. Lat.	AREA. Umbræ.	AREA. Whole Spots.	AREA. Faculæ.
1933.			°	°	°			
148·443		·972	277·5					201
G		·920	280·2					202
		·796	285·2					272
May 29			(−16·6)	(277·7)	(− 0·9)	(0)	(0)	(675)
149·438		·982	282·4					166
G		·916	294·6					182
		·889	282·4					221
May 30			(−16·2)	(264·6)	(− 0·8)	(0)	(0)	(569)
150·378		·959	281·3					124
C								
May 31			(−15·9)	(252·1)	(− 0·7)	(0)	(0)	(124)
151·343		·902	289·7					163
G								
June 1			(−15·5)	(239·4)	(− 0·6)	(0)	(0)	(163)
152·340		·926	284·0					35
G	11550	·966	96·2	151·4	− 6·1	4	10	358*f*
June 2			(−15·1)	(226·2)	(− 0·4)	(4)	(10)	(393)
153·348	11550	·893	98·1	150·0	− 7·4	5	10	479*f*
G								
June 3			(−14·8)	(212·8)	(− 0·3)	(5)	(10)	(479)
154·362	11550	·753	98·8	151·1	− 6·7	5	8	512*f*
G								
June 4			(−14·4)	(199·4)	(− 0·2)	(5)	(8)	(512)
155·399	11550	·566	101·6	151·9	− 6·5	3	5	
G								
June 5			(−14·0)	(185·7)	(− 0·1)	(3)	(5)	(0)
156·332	11550	·396	107·0	151·0	− 6·6	3	9	
G	*1066b*	·844	80·3	116·3	+ 8·2	2	5	48*f*
June 6			(−13·6)	(173·3)	(0·0)	(5)	(14)	(48)

Group 11549. May 21–26. A small indefinite spot on May 21–22: a small stream afterwards.
Group 11550. June 2–7. A fair-sized area of faculæ containing one or two small spots.

POSITIONS and AREAS of SUN SPOTS and FACULÆ for EACH DAY in the YEAR 1933.

G.M.T.	Group No.	MEASURES. Dist.	MEASURES. Pos. Angle.	POSITION Long.	POSITION Lat.	AREA. Umbræ.	AREA. Whole Spots.	AREA. Faculæ.
1933.			°	°	°			
157·353	11550	·294	123·4	145·5	− 9·1	3	7	
G		·706	77·5					67
		·935	85·4					228
June 7			(−13·2)	(159·8)	(+ 0·2)	(3)	(7)	(295)
158·339		·963	77·1					178
G								
June 8			(−12·8)	(146·8)	(+ 0·3)	(0)	(0)	(178)
159·332		·872	76·0					186
G								
June 9			(−12·4)	(133·6)	(+ 0·4)	(0)	(0)	(186)
June 10		No spots or		faculæ.				
161·527		·717	256·3					188
G								
June 11			(−11·5)	(104·6)	(+ 0·7)	(0)	(0)	(188)
162·586		·852	259·2					345
G		·837	84·4					63
June 12			(−11·0)	(90·6)	(+ 0·8)	(0)	(0)	(408)
163·439		·929	260·7					596
G	11551	·714	84·5	34·0	+ 4·5	29	99	57*c*
June 13			(−10·7)	(79·3)	(+ 0·9)	(29)	(99)	(653)
164·342		·972	259·2					280
	11551	·531	82·1	35·6	+ 5·0	42	150	
G		·943	82·2					68
		·974	90·7					76
June 14			(−10·3)	(67·3)	(+ 1·0)	(42)	(150)	(424)
165·344	11551	·319	76·3	35·9	+ 5·3	32	161	
G		·881	85·7					320
June 15			(−9·9)	(54·0)	(+ 1·1)	(32)	(161)	(320)
166·359		·850	269·2					69
G	11551	·108	42·5	36·4	+ 5·7	21	114	
		·959	65·0					59
June 16			(−9·4)	(40·6)	(+ 1·2)	(21)	(114)	(128)
1933.			°	°	°			
167·340		·947	266·8					22
G		·943	273·9					58
	11551	·181	296·8	36·9	+ 6·0	14	85	
June 17			(−9·0)	(27·6)	(+ 1·4)	(14)	(85)	(80)
168·546	11551	·433	281·1	36·9	+ 6·1	20	109	
G		·943	90·9					102
June 18			(−8·5)	(11·7)	(+ 1·5)	(20)	(109)	(102)
169·352	11551	·590	278·4	36·8	+ 6·3	17	103	
G		·887	91·7					79
		·908	70·3					60
June 19			(−8·1)	(1·0)	(+ 1·6)	(17)	(103)	(139)
170·598	11551	·796	277·2	37·0	+ 6·7	15	100	182*f*
G								
June 20			(−7·6)	(344·5)	(+ 1·7)	(15)	(100)	(182)
171·423	11551	·896	276·8	37·0	+ 6·9	13	93	219*f*
G								
June 21			(−7·2)	(333·6)	(+ 1·8)	(13)	(93)	(219)
172·332		·872	282·3					128
G	11551	·970	277·0	37·4	+ 7·2	18	103	186*f*
June 22			(−6·8)	(321·6)	(+ 1·9)	(18)	(103)	(314)
June 23		No spots or		faculæ.				
174·382		·919	277·1					23
C								
June 24			(−5·9)	(294·4)	(+ 2·2)	(0)	(0)	(23)
June 25 to June 28		No spots or		faculæ.				
179·485		·942	98·2					163
G								
June 29			(−3·6)	(226·9)	(+ 2·8)	(0)	(0)	(163)

Group 11551. June 13–22. A stream of normal type developing rather rapidly. The leader, a regular spot, alone remains on and after June 17.

POSITIONS and AREAS of SUN SPOTS and FACULÆ for EACH DAY in the YEAR 1933.

G.M.T.	Group No.	Measures. Dist.	Measures. Pos. Angle.	Position. Long.	Position. Lat.	Area. Umbræ.	Area. Whole Spots.	Area. Faculæ.
1933.			°	°	°			
180·360		·881	100·6					170
G								
June 30			(−3·2)	(215·3)	(+ 2·9)	(0)	(0)	(170)
181·334		·790	102·6					103
G								
July 1			(−2·7)	(202·4)	(+ 3·0)	(0)	(0)	(103)
July 2		No spots or	faculæ.					
183·329		·909	98·3					165
G		·939	91·7					73
		·966	171·3					27
July 3			(−1·8)	(176·0)	(+ 3·2)	(0)	(0)	(265)
July 4		No spots or	faculæ.					
185·339	11552	·997	83·1	63·8	+ 7·2	23	91	309*p*
G								
July 5			(−0·9)	(149·4)	(+ 3·4)	(23)	(91)	(309)
186·397	11552	·942	83·5	65·0	+ 7·3	13	54	335*p*
G								
July 6			(−0·4)	(135·4)	(+ 3·5)	(13)	(54)	(335)
187·372	11552	·850	83·2	64·4	+ 7·7	13	30	486*p*
G	11553	·985	83·7	42·3	+ 6·8	14	45	126*c*
July 7			(0·0)	(122·5)	(+ 3·6)	(27)	(75)	(612)
188·334	11552	·718	83·2	63·9	+ 7·5	5	16	
G	11553	·922	83·9	42·5	+ 7·1	6	29	196*sf*
		·966	165·9					34
July 8			(+0·5)	(109·7)	(+ 3·7)	(11)	(45)	(230)
189·350	11552	·536	81·9	64·1	+ 7·5	5	22	
G	11553	·807	84·3	42·5	+ 6·8	4	8	85*f*
July 9			(+0·9)	(96·3)	(+ 3·8)	(9)	(30)	(85)
190·406		·918	257·3					190
C	11552	·314	77·2	64·4	+ 7·7	6	34	
July 10			(+1·4)	(82·3)	(+ 3·9)	(6)	(34)	(190)
1933.			°	°	°			
191·627	11552	·083	29·9	63·8	+ 8·1	2	12	
G	11554	·988	94·7	345·7	− 4·0	0	6	255*c*
July 11			(+2·0)	(66·2)	(+ 4·0)	(2)	(18)	(255)
192·473	11552	·180	290·1	64·8	+ 7·5	0	9	
G	11554	·933	95·7	346·7	− 3·8	7	19	311*c*
July 12			(+2·3)	(55·0)	(+ 4·1)	(7)	(28)	(311)
193·372	11554	·833	97·7	347·5	− 4·0	0	4	308*c*
C								
July 13			(+2·7)	(43·1)	(+ 4·2)	(0)	(4)	(308)
194·356		·906	63·8					37
G								
July 14			(+3·2)	(30·0)	(+ 4·3)	(0)	(0)	(37)
195·433		·846	273·8					145
C		·763	275·0					172
July 15			(+3·7)	(15·8)	(+ 4·4)	(0)	(0)	(317)
196·403		·941	275·1					118
G		·889	276·0					145
July 16			(+4·1)	(3·0)	(+ 4·5)	(0)	(0)	(263)
197·398		·968	276·3					127
G								
July 17			(+4·5)	(349·8)	(+ 4·6)	(0)	(0)	(127)
198·561		·914	277·6					22
G		·963	120·0					59
July 18			(+5·0)	(334·4)	(+ 4·7)	(0)	(0)	(81)
199·359		·926	124·1					105
G		·937	86·4					58
July 19			(+5·4)	(323·8)	(+ 4·8)	(0)	(0)	(163)
200·476		·819	129·1					70
G		·913	86·5					45
July 20			(+5·9)	(309·1)	(+ 4·9)	(0)	(0)	(115)

Group 11552. July 5–12. A pair of spots that later become a small cluster in the following part of an area of faculæ.
Group 11553. July 7–9. Probable return of Group 11551. A small spot.
Group 11554. July 11–13. A single small spot in appreciable faculæ.

POSITIONS and AREAS of SUN SPOTS and FACULÆ for EACH DAY in the YEAR 1933.

G.M.T.	Group No.	MEASURES. Dist.	MEASURES. Pos. Angle.	POSITION. Long.	POSITION. Lat.	AREA. Umbræ.	AREA. Whole Spots.	AREA. Faculæ.
1933.			°	°	°			
201·437		·782	261·5					138
G		·809	87·1					36
		·948	59·1					136
July 21			(+6·3)	(296·4)	(+ 5·0)	(0)	(0)	(310)
202·346		·892	264·2					288
		·781	263·9					164
		·885	81·6					36
G		·894	57·0					97
		·944	3·6					27
		·963	16·3					117
July 22			(+6·7)	(284·3)	(+ 5·1)	(0)	(0)	(729)
203·371		·976	266·8					76
G		·960	261·5					65
		·787	51·3					79
July 23			(+7·1)	(270·8)	(+ 5·1)	(0)	(0)	(220)
July 24		No spots or		faculæ.				
205·347		·951	272·6					58
G								
July 25			(+8·0)	(244·6)	(+ 5·3)	(0)	(0)	(58)
July 26		No spots or		faculæ.				
207·354		·973	356·7					45
G								
July 27			(+8·8)	(218·1)	(+ 5·5)	(0)	(0)	(45)
July 28		No spots or		faculæ.				
209·463		·925	285·7					17
C								
July 29			(+9·7)	(190·2)	(+ 5·6)	(0)	(0)	(17)
July 30		No spots or		faculæ.				
July 31								

G.M.T.	Group No.	MEASURES. Dist.	MEASURES. Pos. Angle.	POSITION. Long.	POSITION. Lat.	AREA. Umbræ.	AREA. Whole Spots.	AREA. Faculæ.
1933.			°	°	°			
212·375		·942	83·9					101
G								
Aug. 1			(+10·9)	(151·7)	(+ 5·8)	(0)	(0)	(101)
213·347		·846	82·4					160
G		·940	84·8					167
Aug. 2			(+11·2)	(138·8)	(+ 5·9)	(0)	(0)	(327)
214·571		·926	280·2					54
G		·818	83·7					148
Aug. 3			(+11·7)	(122·6)	(+ 6·0)	(0)	(0)	(202)
Aug. 4		No spots or		faculæ.				
Aug. 5								
217·354		·916	103·0					62
G								
Aug. 6			(+12·8)	(85·8)	(+ 6·2)	(0)	(0)	(62)
Aug. 7		No spots or		faculæ.				
Aug. 8								
220·355	*1068a*	·464	95·8	18·7	+ 3·0	1	4	
G								
Aug. 9			(+13·9)	(46·1)	(+ 6·4)	(1)	(4)	(0)
Aug. 10		No spots or		faculæ.				
222·410		·884	274·3					164
C								
Aug. 11			(+14·7)	(19·0)	(+ 6·5)	(0)	(0)	(164)
223·328	*1068b*	·597	237·4	37·8	−13·1	3	6	
G								
Aug. 12			(+15·0)	(6·8)	(+ 6·5)	(3)	(6)	(0)
Aug. 13 to Aug. 22		No spots or		faculæ.				
234·382		·967	84·1					114
G								
Aug. 23			(+18·7)	(220·7)	(+ 7·0)	(0)	(0)	(114)

POSITIONS and AREAS of SUN SPOTS and FACULÆ for EACH DAY in the YEAR 1933.

G.M.T.	Group No.	MEASURES. Dist.	MEASURES. Pos. Angle.	POSITION. Long.	POSITION. Lat.	AREA. Umbræ.	AREA. Whole Spots.	AREA. Faculæ.
1933.			°	°	°			
235·352		·891	85·1					80
G								
Aug. 24			(+18·9)	(207·9)	(+ 7·0)	(0)	(0)	(80)
236·351		·766	86·0					200
G								
Aug. 25			(+19·2)	(194·7)	(+ 7·1)	(0)	(0)	(200)
Aug. 26	}	No spots or	faculæ.					
Aug. 27	}							
239·345		·962	13·3					77
G								
Aug. 28			(+20·1)	(155·2)	(+ 7·1)	(0)	(0)	(77)
Aug. 29	}	No spots or	faculæ.					
Aug. 30	}							
242·346		·941	7·3					36
G								
Aug. 31			(+20·9)	(115·5)	(+ 7·2)	(0)	(0)	(36)
243·427		·928	4·5					33
G								
Sept. 1			(+21·2)	(101·3)	(+ 7·2)	(0)	(0)	(33)
244·369	11555	·965	86·2	13·8	+ 5·5	4	13	119*nf*
G		·957	111·6					70
		·989	82·6					89
Sept. 2			(+21·4)	(88·8)	(+ 7·2)	(4)	(13)	(278)
245·349	11555	·884	87·5	13·6	+ 5·6	2	5	85*c*
G		·886	116·7					34
		·932	84·1					99
Sept. 3			(+21·7)	(75·9)	(+ 7·2)	(2)	(5)	(218)
246·357	11555	·753	89·1	13·7	+ 5·5	2	3	154*c*
G		·765	119·0					122
		·819	85·1					166
Sept. 4			(+21·9)	(62·6)	(+ 7·2)	(2)	(3)	(442)
247·339		·904	264·7					66
G								
Sept. 5			(+22·1)	(49·6)	(+ 7·2)	(0)	(0)	(66)
248·358		·945	352·4					30
		·939	356·0					13
G	11556	·358	213·2	47·5	−10·3	12	33	
		·953	85·1					44
		·969	92·2					32
Sept. 6			(+22·4)	(36·1)	(+ 7·2)	(12)	(33)	(119)
249·432		·923	273·4					53
G	11556	·523	237·0	48·3	−10·1	35	133	
Sept. 7			(+22·6)	(22·0)	(+ 7·2)	(35)	(133)	(53)
250·337		·979	274·6					55
G	11556	·671	246·5	48·5	− 9·8	23	92	
Sept. 8			(+22·8)	(10·0)	(+ 7·3)	(23)	(92)	(55)
251·356	11556	·828	253·1	49·7	− 9·6	20	67	245*c*
G								
Sept. 9			(+23·0)	(356·5)	(+ 7·2)	(20)	(67)	(245)
252·300	11556	·925	256·6	48·9	− 9·4	7	24	376*c*
G		·880	141·2					15
Sept. 10			(+23·2)	(343·3)	(+ 7·2)	(7)	(24)	(391)
253·344		·982	258·7					236
G								
Sept. 11			(+23·4)	(330·3)	(+ 7·2)	(0)	(0)	(236)
Sept. 12		No spots or	faculæ.					
255·630		·945	274·1					130
G								
Sept. 13			(+23·9)	(300·1)	(+ 7·2)	(0)	(0)	(130)
256·346		·966	276·8					34
G								
Sept. 14			(+24·0)	(290·6)	(+ 7·2)	(0)	(0)	(34)
257·340		·956	178·2					34
G								
Sept. 15			(+24·2)	(277·5)	(+ 7·2)	(0)	(0)	(34)

Group 11555. Sept. 2–4. A single small spot.
Group 11556. Sept. 6–10. A small group of stream type showing the usual initial separation in longitude of the leading and following spots.

POSITIONS and AREAS of SUN SPOTS and FACULÆ for EACH DAY in the YEAR 1933.

G.M.T.	Group No.	MEASURES. Dist.	MEASURES. Pos. Angle.	POSITION. Long.	POSITION. Lat.	AREA. Umbræ.	AREA. Whole Spots.	AREA. Faculæ.
1933.			°	°	°			
258·405		·970	187·2					22
G		·866	275·1					55
Sept. 16			(+24·3)	(263·5)	(+ 7·2)	(0)	(0)	(77)
259·381		·881	275·9					76
G								
Sept. 17			(+24·5)	(250·6)	(+ 7·2)	(0)	(0)	(76)
Sept. 18 to Sept. 20		No spots or faculæ.						
263·340	II557	·357	65·7	178·7	+15·1	1	2	
C								
Sept. 21			(+25·1)	(198·3)	(+ 7·1)	(1)	(2)	(0)
264·356	II557	·159	35·4	179·5	+14·4	18	59	
G								
Sept. 22			(+25·2)	(184·9)	(+ 7·0)	(18)	(59)	(0)
265·357	II557	·199	311·6	180·5	+14·5	7	30	
C		·907	96·1					51
		·938	86·9					24
Sept. 23			(+25·3)	(171·7)	(+ 7·0)	(7)	(30)	(75)
266·353	II557	·425	290·2	182·9	+14·8	2	8	
G								
Sept. 24			(+25·5)	(158·6)	(+ 7·0)	(2)	(8)	(0)
Sept. 25		No spots or faculæ.						
Sept. 26								
269·346		·874	283·1					121
C	II558	·164	211·0	123·9	− 1·1	2	2	
		·924	102·0					41
Sept. 27			(+25·8)	(119·1)	(+ 6·9)	(2)	(2)	(162)
270·424		·955	284·6					149
G	II558	·356	249·1	124·1	− 0·9	7	36	
Sept. 28			(+25·9)	(104·8)	(+ 6·8)	(7)	(36)	(149)

G.M.T.	Group No.	MEASURES. Dist.	MEASURES. Pos. Angle.	POSITION. Long.	POSITION. Lat.	AREA. Umbræ.	AREA. Whole Spots.	AREA. Faculæ.
1933.			°	°	°			
271·426	II558	·556	257·6	124·4	− 1·1	8	60	
G								
Sept. 29			(+26·0)	(91·6)	(+ 6·8)	(8)	(60)	(0)
272·308	II558	·701	262·2	123·8	− 0·6	3	19	192c
C								
Sept. 30			(+26·0)	(80·0)	(+ 6·7)	(3)	(19)	(192)
273·364		·860	264·5					243
C								
Oct. 1			(+26·1)	(66·0)	(+ 6·7)	(0)	(0)	(243)
274·361		·960	266·4					220
C								
Oct. 2			(+26·2)	(52·9)	(+ 6·6)	(0)	(0)	(220)
Oct. 3		No spots or faculæ.						
276·357		·947	355·3					51
G								
Oct. 4			(+26·3)	(26·5)	(+ 6·5)	(0)	(0)	(51)
277·432		·955	353·3					22
G		·940	338·0					29
		·929	56·9					9
Oct. 5			(+26·3)	(12·4)	(+ 6·5)	(0)	(0)	(60)
278·453		·972	284·3					27
G								
Oct. 6			(+26·3)	(358·9)	(+ 6·4)	(0)	(0)	(27)
Oct. 7		No spots or faculæ.						
Oct. 8								
281·384		·937	9·9					44
G								
Oct. 9			(+26·4)	(320·2)	(+ 6·2)	(0)	(0)	(44)

Group II557. Sept. 21–24. A small stream.
Group II558. Sept. 27–30. A small equatorial stream of tiny components.

POSITIONS and AREAS of SUN SPOTS and FACULÆ for EACH DAY in the YEAR 1933.

G.M.T.	Group No.	MEASURES. Dist.	MEASURES. Pos. Angle.	POSITION. Long.	POSITION. Lat.	AREA. Umbræ.	AREA. Whole Spots.	AREA. Faculæ.
1933.			°	°	°			
282·621 G	*1071a*	·367	350·0	308·0	+27·2	1	2	
Oct. 10			(+26·4)	(303·9)	(+ 6·1)	(1)	(2)	(0)
283·445 G		·945	276·2					33
Oct. 11			(+26·4)	(293·0)	(+ 6·1)	(0)	(0)	(33)
284·384 G	*1071b*	·364	292·2	300·8	+13·5	1	5	
Oct. 12			(+26·4)	(280·6)	(+ 6·0)	(1)	(5)	(0)
285·404 G		·948	0·2					31
		·982	18·2					47
Oct. 13			(+26·4)	(267·2)	(+ 6·0)	(0)	(0)	(78)
Oct. 14 to Oct. 16		No spots or faculæ.						
289·428 G		·967	90·2					60
Oct. 17			(+26·2)	(214·1)	(+ 5·6)	(0)	(0)	(60)
290·382 G		·932	359·4					150
		·884	92·2					93
		·938	90·2					70
		·943	9·4					59
Oct. 18			(+26·2)	(201·5)	(+ 5·6)	(0)	(0)	(372)
291·385 G		·935	357·5					92
Oct. 19			(+26·1)	(188·3)	(+ 5·5)	(0)	(0)	(92)
292·388 G		·944	354·5					47
Oct. 20			(+26·1)	(175·1)	(+ 5·4)	(0)	(0)	(47)
Oct. 21 to Oct. 25		No spots or faculæ.						

G.M.T.	Group No.	MEASURES. Dist.	MEASURES. Pos. Angle.	POSITION. Long.	POSITION. Lat.	AREA. Umbræ.	AREA. Whole Spots.	AREA. Faculæ.
1933.			°	°	°			
298·626 G	11559	·100	43·8	88·8	+ 9·0	36	131	
Oct. 26			(+25·4)	(92·8)	(+ 4·9)	(36)	(131)	(0)
299·401 C	11559	·142	303·6	89·5	+ 9·3	50	231	
Oct. 27			(+25·3)	(82·6)	(+ 4·8)	(50)	(231)	(0)
300·452 G		·901	225·4					27
	11559	·367	282·4	89·9	+ 8·9	46	205	
Oct. 28			(+25·2)	(68·7)	(+ 4·7)	(46)	(205)	(27)
301·427 G		·961	231·3					32
	11559	·563	278·7	90·0	+ 8·7	50	224	
	1071c	·229	280·7	68·9	+ 6·9	2	7	
	1071d	·685	148·7	31·3	−31·5	8	15	
Oct. 29			(+25·1)	(55·9)	(+ 4·6)	(60)	(246)	(32)
302·427 C	11559	·743	277·5	90·7	+ 8·6	29	191	214*c*
Oct. 30			(+24·9)	(42·7)	(+ 4·5)	(29)	(191)	(214)
303·629 G	11559	·907	277·6	92·0	+ 8·7	31	145	497*c*
Oct. 31			(+24·7)	(26·8)	(+ 4·4)	(31)	(145)	(497)
304·147 K	11559	·952	277·6	92·3	+ 8·5	32	130	276*c*
Nov. 1			(+24·6)	(20·0)	(+ 4·3)	(32)	(130)	(276)
Nov. 2		No spots or faculæ.						
Nov. 3								
307·464 G		·873	229·1					131
Nov. 4			(+24·1)	(336·3)	(+ 4·0)	(0)	(0)	(131)
Nov. 5		No spots or faculæ.						
Nov. 6								

Group 11559. Oct. 26–Nov. 1. A moderate-sized group of the usual stream type.

POSITIONS and AREAS of SUN SPOTS and FACULÆ for EACH DAY in the YEAR 1933.

G.M.T.	Group No.	MEASURES. Dist.	Pos. Angle.	POSITION. Long.	Lat.	AREA. Umbræ.	Whole Spots.	Faculæ.
1933.			°	°	°			
310·436		·929	351·7					20
G								
Nov. 7			(+23·4)	(297·1)	(+ 3·7)	(0)	(0)	(20)
311·412		·933	276·1					38
G		·866	126·6					31
Nov. 8			(+23·2)	(284·2)	(+ 3·5)	(0)	(0)	(69)
Nov. 9		No spots or		faculæ.				
313·449		·969	88·0					62
G								
Nov. 10			(+22·8)	(257·4)	(+ 3·3)	(0)	(0)	(62)
314·410		·881	87·7					58
C								
Nov. 11			(+22·5)	(244·7)	(+ 3·2)	(0)	(0)	(58)
Nov. 12	}	No spots or		faculæ.				
Nov. 13								
317·475		·927	16·3					22
G		·932	89·8					23
Nov. 14			(+21·7)	(204·3)	(+ 2·8)	(0)	(0)	(45)
Nov. 15		No spots or		faculæ.				
319·400		·981	83·3					86
C								
Nov. 16			(+21·2)	(178·9)	(+ 2·6)	(0)	(0)	(86)
320·494		·927	358·3					17
G		·910	355·3					11
		·926	81·3					371
Nov. 17			(+20·9)	(164·5)	(+ 2·5)	(0)	(0)	(399)
321·410		·798	80·5					279
C		·884	80·3					378
Nov. 18			(+20·6)	(152·4)	(+ 2·4)	(0)	(0)	(657)

G.M.T.	Group No.	MEASURES. Dist.	Pos. Angle.	POSITION. Long.	Lat.	AREA. Umbræ.	Whole Spots.	Faculæ.
1933.			°	°	°			
322·421		·745	80·9					229
G								
Nov. 19			(+20·3)	(139·1)	(+ 2·3)	(0)	(0)	(229)
Nov. 20 to Nov. 25	}	No spots or		faculæ.				
329·374		·848	279·2					148
C								
Nov. 26			(+18·0)	(47·4)	(+ 1·4)	(0)	(0)	(148)
330·447		·896	279·8					363
C								
Nov. 27			(+17·6)	(33·3)	(+ 1·3)	(0)	(0)	(363)
331·426		·963	280·1					498
C								
Nov. 28			(+17·3)	(20·4)	(+ 1·1)	(0)	(0)	(498)
Nov. 29 to Dec. 3	}	No spots or		faculæ.				
337·339		·960	170·4					48
C								
Dec. 4			(+15·0)	(302·5)	(+ 0·4)	(0)	(0)	(48)
Dec. 5 to Dec. 7	}	No spots or		faculæ.				
341·500		·942	98·1					110
G								
Dec. 8			(+13·3)	(247·6)	(— 0·1)	(0)	(0)	(110)
342·358		·842	97·9					125
C								
Dec. 9			(+12·9)	(236·3)	(— 0·3)	(0)	(0)	(125)
Dec. 10		No spots or		faculæ.				

POSITIONS and AREAS of SUN SPOTS and FACULÆ for EACH DAY in the YEAR 1933.

G.M.T.	Group No.	MEASURES. Dist.	MEASURES. Pos. Angle.	POSITION. Long.	POSITION. Lat.	AREA. Umbræ.	AREA. Whole Spots.	AREA. Faculæ.
1933.			°	°	°			
344·414	*1073a*	·414	86·6	184·9	+ 0·9	7	23	
C								
Dec. 11			(+12·0)	(209·2)	(− 0·5)	(7)	(23)	(0)
Dec. 12	}	No spots or		faculæ.				
Dec. 13	}							
347·443		·853	75·0					99
G		·936	76·3					182
Dec. 14			(+10·6)	(169·3)	(− 0·9)	(0)	(0)	(281)
348·503		·776	73·8					94
G		·870	75·1					165
Dec. 15			(+10·2)	(155·4)	(− 1·0)	(0)	(0)	(259)
349·454		·748	74·1					196
G		·954	173·5					36
		·966	63·2					36
Dec. 16			(+9·7)	(142·8)	(− 1·2)	(0)	(0)	(268)

G.M.T.	Group No.	MEASURES. Dist.	MEASURES. Pos. Angle.	POSITION. Long.	POSITION. Lat.	AREA. Umbræ.	AREA. Whole Spots.	AREA. Faculæ.
1933.			°	°	°			
Dec. 17	}	No spots or		faculæ.				
to	}							
Dec. 19	}							
353·509		·867	15·6					33
C								
Dec. 20			(+7·8)	(89·4)	(− 1·7)	(0)	(0)	(33)
354·534		·848	8·4					24
G								
Dec. 21			(+7·4)	(75·9)	(− 1·8)	(0)	(0)	(24)
Dec. 22	}	No spots or		faculæ.				
to	}							
Dec. 31	}							

Blank page retained for pagination

ROYAL OBSERVATORY, GREENWICH.

General Catalogue of Groups of Sun Spots

for the Year

1933

GREENWICH PHOTO-HELIOGRAPHIC RESULTS 1933

General Catalogue of Groups of Sun Spots for the Year 1933.

Groups of Sun Spots, lasting for two or more days, are numbered in the *first* column in continuation of the Group-numbers given in 1932 and the previous years. Groups seen only once are not included in this Catalogue but are given with a distinctive enumeration in a following table on p. C 24.

The *second* column gives the Greenwich Mean Time of the central meridian passage of each group as deduced from its mean longitude (given in the *tenth* column). For those groups, which are in existence at the time of the central meridian passage of their longitude, the time is given to $0^d{\cdot}01$, corresponding to $0°{\cdot}13$ of solar longitude. In other cases, in which groups disappear before or appear after the central meridian, the deduced time is given to $0^d{\cdot}1$.

The *third* column gives the duration of each group in days. Intermittent Groups, *i.e.*, groups which are not seen upon the photographs of every day between their first and last appearances, are indicated by a fraction, the numerator of which represents the number of days on which they are actually observed ; the denominator being the interval in days between the extreme limits of observation.

The *fifth* and *seventh* columns, headed " Longitude from Central Meridian", give, for the days on which each Group was first and last seen respectively, the heliographic longitude from the meridian passing through the centre of the Sun's disc at the observation ; longitudes west of the centre being reckoned as positive.

The Mean Areas for Umbræ and Whole Spots entered in the *eighth* and *ninth* columns are corrected for the effect of foreshortening and are expressed in millionths of the Sun's visible hemisphere.

The *tenth* and *eleventh* columns give the mean heliographic position of the Group in longitude and latitude respectively.

The *twelfth* column gives reference to all Groups contained in Ledgers I and II ; for a Group in Ledger I both its recurrent series number and its order in the series are also given.

With reference to the identification both of Recurrent and Revival Groups, it should be noted that longitudes are based on the ephemeris given in the *Nautical Almanac*, assuming a solar rotation period, constant at all latitudes. After an interval of one rotation, recurring groups will, therefore, show in general—apart from any proper motion they may have of their own—apparent drifts in longitude varying in amount according to their respective latitudes. The following table derived from the formula $\xi = 14°{\cdot}37 - 2°{\cdot}60 \sin^2\phi$ gives the apparent drift in longitude appropriate to corresponding latitudes after an interval of 27 days.

Latitude.	Drift. *forwards.*	Latitude.	Drift. *backwards.*
0°	5°	20°	3°
5°	4·5	25°	7·5
10°	3	30°	12·5
15°	0·5	35°	18

GENERAL CATALOGUE OF SUN SPOTS.

No. of Group.	Time of Central Meridian Passage.	Duration in Days.	First Seen.		Last Seen.		Mean Area Corrected for Foreshortening.		Mean Position of Group.		Reference to Ledger.
			Date.	Longitude from Central Meridian.	Date.	Longitude from Central Meridian.	Umbræ.	Whole Spots.	Longitude.	Latitude.	
	1933.		1933.	°	1933.	°			°	°	
11530	Jan. 9·10	13	Jan. 3	−75	Jan. 15	+80	41	196	328·9	+10·1	I. 1125 (3)
31	10·15	13	4	−76	16	+82	29	134	315·1	+ 9·2	I. 1126 (2)
32	13·25	6	12	−12	17	+57	11	42	274·3	+ 1·9	II.
33	10·9	4	13	+31	16	+73	19	67	304·9	+13·0	
34	Feb. 1·53	10	28	−60	Feb. 6	+71	30	151	20·5	+ 5·4	II.
11535	5·44	13	30	−80	11	+79	21	107	329·0	+ 9·6	I. 1125 (4)
36	1·95	5	31	−21	4	+32	16	64	14·9	+ 6·3	II.
37	7·34	13	Feb. 1	−77	13	+76	203	1167	303·9	+13·3	I. 1127 (1)
38	8·30	10	4	−57	13	+71	27	136	291·3	+12·4	II.
39	2·4	2	7	+67	8	+79	9	28	9·6	−12·0	
11540	Mar. 4·4	2	27	−64	28	−50	8	27	334·0	+ 6·6	
41	6·18	13	28	−72	Mar. 12	+82	24	117	310·5	+14·9	} I. 1127 (2)
42	6·92	11	28	−83	10	+46	13	67	300·7	+11·0	
43	28·08	12	Mar. 22	−78	Apr. 2	+72	52	244	21·8	+ 4·7	II.
44	24·0	5	25	+16	Mar. 29	+73	17	63	75·5	+ 9·9	II.
11545	Apr. 20·04	5	Apr. 17	−38	Apr. 21	+17	7	28	78·7	+ 9·7	II.
46	27·6	2/4	29	+23	May 2	+65	2	7	339·3	+ 6·6	
47	May 11·19	2	May 9	−24	May 10	− 9	2	6	159·2	− 5·4	
48	18·0	5	19	+18	23	+71	15	74	69·1	+11·2	II.
49	25·74	6	21	−57	26	+10	4	12	326·7	+ 8·9	II.
11550	June 8·1	6	June 2	−75	June 7	−14	4	8	150·2	− 7·1	II.
51	16·68	10	13	−45	22	+76	22	112	36·4	+ 6·0	I. 1128 (1)
52	July 11·76	8	July 5	−86	July 12	+10	6	25	64·3	+ 7·6	II.
53	13·4	3	7	−80	9	−54	5	18	42·5	+ 7·0	I. 1128 (2)
54	17·6	3	11	−81	13	−56	4	12	347·1	− 3·9	
11555	Sept. 8·1	3	Sept. 2	−75	Sept. 4	−49	3	7	13·7	+ 5·5	
56	5·4	5	6	+11	10	+66	19	70	48·6	− 9·8	II.
57	22·70	4	21	−20	24	+24	7	25	180·4	+14·7	
58	27·0	4	27	+ 5	30	+44	5	29	124·0	− 0·9	
59	Oct. 26·80	7	Oct. 26	− 4	Nov. 1	+72	39	180	90·5	+ 8·8	II.

GENERAL CATALOGUE OF SUN SPOTS—*continued.*

SUNSPOTS SEEN ON ONE DAY ONLY, 1933.

The groups of sunspots tabulated below were seen on one day only and appear in the *Daily Results* with a distinctive enumeration, comprising the number of the Rotation during which each was observed and a letter given in order of appearance. These short-lived groups are usually composed of one or two very small spots. The deduced time of central meridian passage of each spot is given in the fourth column of the table.

No. of Group.	Date.	Longitude from Central Meridian.	Time of Central Meridian Passage.	Area Corrected for Foreshortening.		Position of Group.	
				Umbræ.	Whole Spots.	Longitude.	Latitude.
		°				°	°
1061a	Jan. 10	+22·4	Jan. 8·8	1	5	333·4	+ 3·4
b	10	+13·9	9·4	2	6	324·9	+ 5·5
c	10	− 2·8	10·7	2	7	308·2	+12·2
d	10	− 6·2	10·9	2	5	304·8	+ 6·3
e	12	+31·1	10·2	1	4	315·1	+ 5·5
1062a	Feb. 10	+52·0	Feb. 6·5	2	3	314·7	+11·9
b	15	−49·0	19·2	0	2	148·4	− 0·2
1063a	Mar. 4	−24·1	Mar. 6·3	4	7	308·4	+ 9·6
b	12	− 6·0	12·9	0	2	221·9	+11·4
1064a	Apr. 6	+16·6	Apr. 5·1	1	4	275·6	+ 2·6
b	19	+ 0·1	19·3	2	29	87·9	+ 1·8
1066a	May 27	+46·9	May 23·8	2	5	352·3	+10·4
b	June 6	−57·0	June 10·6	2	5	116·3	+ 8·2
1068a	Aug. 9	−27·4	Aug. 11·4	1	4	18·7	+ 3·0
b	12	+31·0	10·0	3	6	37·8	−13·1
1071a	Oct. 10	+ 4·1	Oct. 10·3	1	2	308·0	+27·2
b	12	+20·2	10·9	1	5	300·8	+13·5
c	29	+13·0	28·4	2	7	68·9	+ 6·9
d	29	−24·6	31·3	8	15	31·3	−31·5
1073a	Dec. 11	−24·3	Dec. 13·3	7	23	184·9	+ 0·9

REVIVAL GROUPS of SUN SPOTS, 1933.

Groups of spots occupying the same heliographic position in consecutive rotations of the Sun but with definite breaks in their history are termed " Revivals". Such groups have been abstracted from the preceding Catalogue and are grouped in series in the following table. When a "Recurrent" series forms part of a "Revival" series, a reference is given in the last column of the table. Groups that are given in detail in Ledger II. are also indicated.

No.	No. of Group.	Time of Central Meridian Passage.	Rotation.	Duration in days.	First Seen.		Last Seen.		Area.	Mean Position.		Reference to Ledger.
					Date.	Longitude from Central Meridian.	Date.	Longitude from Central Meridian.		Longitude.	Latitude.	
		1933.			1933.	°	1933.	°		°	°	
1	11527	Dec. 14·51	1060	5/9	Dec. 12	−29	Dec. 20	+79	66	306	+12	II.
	33	Jan. 10·9	1061	4	Jan. 13	+31	Jan. 16	+73	67	305	+13	
	37	Feb. 7·34	1062	13	Feb. 1	−77	Feb. 13	+76	1167	304	+13	I. 1127
	41	Mar. 6·18	1063	13	Feb. 28	−72	Mar. 12	+82	117	310	+15	I. 1127
	42	Mar. 6·92	1063	11	Feb. 28	−83	Mar. 10	+46	67	301	+11	I. 1127
2	11540	Mar. 4·4	1063	2	Feb. 27	−64	Feb. 28	−50	27	334	+ 7	
	46	Apr. 27·6	1065	2/4	Apr. 29	+23	May 2	+65	7	339	+ 7	
3	11544	Mar. 24·0	1063	5	Mar. 25	+16	Mar. 29	+73	63	75	+10	II.
	45	Apr. 20·04	1064	5	Apr. 17	−38	Apr. 21	+17	28	79	+10	II.

ROYAL OBSERVATORY, GREENWICH.

Ledgers of Groups of Sun Spots

for the Year

1933

Ledger I.—Recurrent Groups

GREENWICH PHOTO-HELIOGRAPHIC RESULTS 1933

Ledger I.—Recurrent Groups of Sun Spots for the Year 1933.

The Greenwich Mean Time at which the photograph was taken is expressed in the *first* column by the Day of the Year and decimal of a day reckoned from Greenwich Mean Midnight.

The place where the photograph was taken is also indicated in the *first* column. A photograph taken at Greenwich is indicated by the letter G, and those taken at the Cape and Kodaikánal by the letters C and K respectively.

The Projected Area of the Umbræ and Whole Spots, given in the *second* and *third* columns, is the area as it is measured on the photograph, uncorrected for the effect of foreshortening, and expressed in millionths of the Sun's apparent disc.

The area corrected for foreshortening given in the *fourth* and *fifth* columns is expressed in millionths of the Sun's visible hemisphere.

The longitude given in the *sixth* column is based on the ephemeris given in the *Nautical Almanac*, assuming a daily sidereal motion of 14°·18, due to the Sun's rotation, constant at all latitudes ; this corresponds to Carrington's assumed rotation period of 25·38 days.

The proper motion given in the *seventh* column is derived from the difference of longitude thus computed from the measured positions on any given day and the first day on which the group of spots or single spot is visible, after the correction for the motion appropriate to the latitude has been applied according to the formula, $\xi = 14°{\cdot}37 - 2°{\cdot}60 \sin^2 \phi$. A *plus* sign indicates a motion forwards ; a *minus* sign a motion backwards relative to the position on the first day.

The remaining columns correspond to those with similar headings in the preceding Section.

When a group is 80° or more from the Sun's central meridian, the measures for that day are not included in taking the mean area, longitude, and latitude of the group. In such cases of close proximity to the Sun's limb, the addition of brackets denotes that only part of the group is visible.

LEDGER I.—RECURRENT GROUPS of SUN SPOTS for the YEAR 1933.

No. 1125. Latitude +9°·6.
Group 11523 in Rotation 1059.
,, 11525 ,, ,, 1060.
,, 11530 ,, ,, 1061.
,, 11535 ,, ,, 1062.

Group 11523. 1932, November 14–22. A large stream of spots developing rapidly, a tiny spot on November 14 and 16 being the precursor of the group. The leader, *a*, that subsequently develops comes from a cluster of small spots on November 19.

Date G.M.T. Place.	Projected Area Umbræ	Projected Area Whole Spots.	Corrected Area Umbræ	Corrected Area Whole Spots.	Longitude and Proper Motion.	Latitude.	Long. from C.M.
d					°	°	°
48·357 C	2	4	1	2	316·7	0·0	+ 7·0	−26·7
47·404 G	0	0	0	0	..	..	..	..
46·494 G	4	7	2	4	314·8	−2·2	+ 9·9	− 0·4
45·400 C	55	128	28	66	314·6	−2·5	+ 9·3	+11·3
44·306 C	101	577	55	316	314·7	−2·5	+ 9·0	+23·3
43·306 C	119	590	78	380	316·4	−0·9	+ 8·6	+38·2
42·381 C	159	893	138	771	318·3	+0·9	+ 8·7	+54·3
41·467 G	147	816	208	1155	318·9	+1·4	+ 9·3	+69·2
40·433 C	45	249	(119	638	315·9	..	+ 8·9)	+79·0
Means ..	..	..	64	337	316·3	..	+ 8·8	..

Spot *a*.

43·306 C	48	204	33	139	320·2	0·0	+ 8·9	+42·0
42·381 C	71	420	67	395	321·9	+1·6	+ 9·0	+57·9
41·467 G	50	283	88	498	323·3	+2·8	+10·3	+73·6

Group 11525. 1932, December 6–18. A very large spot (*a* of Group 11523) regular in outline until about December 13, when the *nf* portion becomes detached and remains as a small satellite. The remaining and larger part assumes a regular outline after the separation has taken place.

26·541 G	26	78	138	415	326·5	..	+10·1	−84·5
25·488 G	85	321	144	546	325·9	+3·6	+10·1	−72·6
24·443 G	104	590	104	590	326·5	+4·0	+10·1	−59·5
23·400 C	194	831	144	615	326·8	+4·2	+10·1	−46·5
22·403 C	180	924	110	564	327·1	+4·4	+10·1	−33·0
21·375 C	209	1028	113	555	327·2	+4·4	+10·0	−20·1
20·437 G	225	1032	115	526	327·0	+4·1	+10·0	− 6·3
19·603 G	207	1016	108	530	327·2	+4·1	+ 9·7	+ 9·2
18·462 G	185	939	99	507	327·2	+4·0	+ 9·8	+20·5
17·365 C	134	700	81	426	327·5	+4·2	+ 9·8	+32·8
16·107 K	119	659	82	455	327·6	+4·2	+10·1	+42·6
15·410 C	88	439	89	443	327·5	+4·0	+ 9·8	+59·7
14·420 C	46	228	81	404	327·7	+4·1	+ 9·8	+73·2
Means ..	..	..	106	513	327·1	..	+10·0	..

No. 1125.—*continued*.

Group 11530. 1933, January 3–15. A regular spot (*a* of Group 11523) followed by a considerable area of faculæ in which Group 11531 appears.

d					°	°	°	°
2·330 C	21	96	44	201	329·5	+4·0	+10·0	−75·4
3·478 G	32	194	35	210	328·6	+3·0	+10·3	−61·2
4·400 C	52	270	41	211	329·0	+3·2	+10·1	−48·7
5·386 G	63	299	40	192	328·8	+2·9	+10·4	−35·9
6·461 G	88	356	49	199	328·8	+2·8	+10·2	−21·7
7·372 C	75	366	39	190	328·8	+2·7	+10·3	− 9·7
8·425 G	74	347	38	180	328·9	+2·7	+10·2	+ 4·2
9·466 G	86	301	46	163	329·0	+2·6	+10·3	+18·0
10·414 C	29	341	17	205	329·0	+2·5	+10·1	+30·5
11·514 G	52	259	38	189	329·0	+2·4	+10·1	+45·0
12·424 C	25	191	24	181	328·6	+1·9	+ 9·8	+56·6
13·505 G	41	133	68	221	329·1	+2·3	+ 9·9	+71·3
14·149 K	16	68	48	206	328·8	+1·9	+10·1	+79·5
Means ..	..	..	41	196	328·9	..	+10·1	..

Group 11535. January 30–February 11. A regular spot (*a* of Group 11523) with a tiny companion on January 31, Feb., 1, 2 and 5.

29·357 C	4	33	13	108	329·2	+0·5	+10·3	−79·9
30·434 C	25	97	32	126	329·2	+0·4	+10·5	−65·7
31·121 K	28	125	27	120	329·1	+0·2	+ 9·9	−56·7
32 401 G	24	173	16	118	329·0	−0·1	+ 9·6	−40·2
33·383 G	35	185	21	109	329·0	−0·2	+ 9·8	−27·2
34·338 C	34	200	18	108	329·1	−0·2	+ 9·6	−14·4
35·491 G	37	222	19	116	328·8	−0·6	+ 9·6	+ 0·5
36·442 G	48	221	25	117	328·9	−0·6	+ 9·4	+13·1
37·499 G	26	160	15	93	329·0	−0·7	+ 9·3	+27·1
38·322 C	29	139	19	92	328·8	−1·0	+ 9·0	+37·8
39·323 C	21	109	17	90	328·7	−1·2	+ 9·1	+50·8
40·473 G	19	69	25	92	329·0	−1·0	+ 9·3	+66·3
41·427 G	9	35	26	102	328·9	−1·2	+ 9·3	+78·8
Means ..	..	..	21	107	329·0	..	+ 9·6	..

No. 1126. Latitude +8°·8.
Group 11528 in Rotation 1060.
,, 11531 ,, ,, 1061.

Group 11528. 1932, December 15–20. A small spot on December 15; a group forming in its place on December 18–20 in the area of faculæ *f* Group 11525.

17·365 C	0	6	0	3	318·3	0·0	+ 6·7	+23·6
16·107 K	0	0	0	0	..	..	..	..
15·410 C	0	0	0	0	..	..	..	..
14·420 C	25	67	26	72	315·9	−2·8	+ 8·6	+61·4
13·577 G	15	80	32	169	314·5	−4·3	+ 8·7	+75·2
12·424 C	4	13	29	96	314·1	..	+ 7·8	+86·0
Means ..	..	..	12	49	316·2	..	+ 8·0	..

LEDGER I.—RECURRENT GROUPS of SUN SPOTS for the YEAR 1933—*continued.*

No. **1126.**—*continued.*

Group 11531. January 4–16. A regular spot.

Date G.M.T. Place.	Projected Area Umbræ	Projected Area Whole Spots.	Corrected Area Umbræ	Corrected Area Whole Spots.	Longitude and Proper Motion.		Lati-tude.	Long. from C.M.
d					°	°	°	°
3·478 G	11	41	25	92	313·7	−7·2	+ 9·3	−76·1
4·400 C	31	124	35	142	314·6	−6·4	+ 9·0	−63·1
5·386 G	35	179	28	143	314·6	−6·5	+ 9·0	−50·1
6·461 G	45	231	28	146	315·0	−6·3	+ 9·1	−35·5
7·372 C	33	241	18	135	315·0	−6·4	+ 9·2	−23·5
8·425 G	63	286	33	149	315·2	−6·3	+ 9·3	− 9·5
9·466 G	71	273	37	142	315·2	−6·5	+ 9·4	+ 4·2
10·414 C	58	270	31	146	315·5	−6·3	+ 9·4	+17·0
11·514 G	58	250	36	152	315·4	−6·5	+ 9·3	+31·4
12·424 C	33	187	23	133	315·4	−6·6	+ 9·2	+43·4
13·505 G	34	138	33	135	315·8	−6·4	+ 9·1	+58·0
14·149 K	12	70	16	92	315·7	−6·6	+ 9·3	+66·4
15·347 C	4	21	16	85	315·5	..	+ 9·3	+82·0
Means ..	..	..	29	134	315·1	..	+ 9·2	..

No. **1127.** Latitude +13°·1.
Group 11537 in Rotation 1062.
,, 11541 } ,, ,, 1063.
,, 11542 }

Group 11537. February 1–13. A very large stream of spots visible to the naked eye. The leader, *a*, is the most stable spot, though this departs considerably from its regular formation. The following spot is the largest component when first the group appears around the eastern limb, but the spot breaks up after February 4, the southern part becoming a regular spot *b*. Spots *d* and *e* are the two chief spots in the middle of the stream. This is the largest group since 1931, February (Group 11355). Group 11533 indicates earlier activity in this area.

31·121 K	24	147	(66	403	308·4	..	+15·5)	−77·4
32·401 G	192	991	266	1428	301·7	0·0	+13·1	−67·3
33·383 G	324	1603	297	1480	302·1	+0·3	+13·1	−54·0
34·338 C	373	2129	264	1516	302·5	+0·7	+13·2	−41·0
35·491 G	452	2674	267	1594	302·7	+0·8	+13·3	−25·6
36·442 G	471	2619	256	1434	303·1	+1·2	+13·2	−12·7
37·499 G	385	2266	206	1213	304·1	+2·1	+13·3	+ 2·2
38·322 C	311	1919	171	1054	304·3	+2·3	+13·1	+13·3
39·323 C	255	1391	152	833	304·5	+2·4	+13·1	+26·6
40·473 G	181	827	133	615	306·0	+3·8	+13·5	+43·3
41·427 G	112	595	106	579	305·9	+3·7	+13·3	+55·8
42·340 C	73	327	116	500	306·5	+4·2	+13·6	+68·4
43·408 C	19	82	(44	189	299·9	..	+10·7)	+75·8
Means ..	..	..	203	1167	303·9	..	+13·3	..

No. **1127.**—*continued.*

Spot *a*.

Date G.M.T. Place.	Projected Area Umbræ	Projected Area Whole Spots.	Corrected Area Umbræ	Corrected Area Whole Spots.	Longitude and Proper Motion.		Lati-tude.	Long. from C.M.
d					°	°	°	°
31·121 K	24	147	66	403	308·4	0·0	+15·5	−77·4
32·401 G	84	363	92	399	309·1	+0·6	+15·1	−59·9
33·383 G	96	501	76	396	309·6	+1·1	+15·2	−46·5
34·338 C	126	617	82	401	309·9	+1·3	+14·8	−33·6
35·491 G	141	755	80	430	310·0	+1·4	+14·7	−18·3
36·442 G	165	742	89	400	310·3	+1·6	+14·9	− 5·5
37·499 G	112	782	60	422	310·5	+1·7	+14·9	+ 8·6
38·322 C	118	697	67	397	310·6	+1·8	+14·8	+19·6
39·323 C	97	538	62	344	310·8	+1·9	+14·8	+32·9
40·473 G	73	410	60	336	310·9	+2·0	+15·2	+48·2
41·427 G	43	282	49	321	310·8	+1·8	+15·1	+60·7
42·340 C	42	164	81	317	310·5	+1·5	+15·2	+72·4

Spot *b*.

34·338 C	80	441	61	335	297·2	0·0	+10·5	−46·3
35·491 G	76	475	46	290	297·0	−0·3	+10·4	−31·3
36·442 G	104	569	57	313	296·8	−0·5	+10·4	−19·0
37·499 G	91	546	48	289	296·9	−0·5	+10·8	− 5·0
38·322 C	88	565	47	299	297·1	−0·3	+10·7	+ 6·1
39·323 C	78	391	44	219	297·6	+0·1	+10·5	+19·7
40·473 G	52	264	34	172	298·2	+0·7	+10·7	+35·5
41·427 G	54	239	43	191	298·7	+1·1	+10·5	+48·6
42·340 C	29	155	32	170	298·9	+1·2	+10·7	+60·8
43·408 C	19	82	44	189	299·9	+2·2	+10·7	+75·8

Spot *c*.

32·401 G	30	177	44	257	301·8	0·0	+14·7	−67·2
33·383 G	57	246	52	226	302·5	+0·6	+14·7	−53·6
34·338 C	48	370	34	259	304·0	+2·1	+15·0	−39·5
35·491 G	65	352	38	208	304·7	+2·7	+15·1	−23·6
36·442 G	48	326	26	179	305·3	+3·3	+15·0	−10·5
37·499 G	52	251	28	136	305·8	+3·7	+14·5	+ 3·9
38·322 C	21	202	12	111	306·2	+4·1	+14·2	+15·2
39·323 C	25	128	15	78	306·2	+4·0	+14·2	+28·3

Spot *d*.

35·491 G	48	280	27	160	306·1	0·0	+11·1	−22·2
36·442 G	78	358	41	190	306·4	+0·2	+11·2	− 9·4
37·499 G	43	307	23	163	306·9	+0·7	+11·5	+ 5·0
38·322 C	27	193	15	106	307·0	+0·7	+11·6	+16·0
39·323 C	13	122	8	73	306·9	+0·6	+11·4	+29·0
40·473 G	24	78	18	58	307·4	+1·0	+11·7	+44·7
41·427 G	9	39	9	39	307·6	+1·2	+11·7	+57·5
42·340 C	2	8	3	13	307·5	+1·0	+12·1	+69·4

LEDGER I.—RECURRENT GROUPS of SUN SPOTS for the YEAR 1933—*continued.*

No. 1127.—*continued.*

Group 11541. February 28–March 12. A stable regular spot (*a* of Group 11537) with a tiny distant companion on March 9.

Date G.M.T. Place.	Projected Area Umbræ	Projected Area Whole Spots.	Corrected Area Umbræ	Corrected Area Whole Spots.	Longitude and Proper Motion.		Latitude.	Long. from C.M.
d					°	°	°	°
58·625 G	13	72	25	141	311·3	+1·3	+15·6	−72·4
59·345 C	17	89	21	112	311·0	+1·0	+15·5	−63·2
60·513 C	34	161	28	132	310·9	+0·8	+15·5	−47·9
61·368 C	42	229	29	156	310·8	+0·7	+15·2	−36·7
62·511 G	48	215	28	124	310·2	0·0	+14·8	−22·3
63·402 G	40	207	22	114	310·2	0·0	+14·7	−10·5
64·538 G	35	207	19	112	310·1	−0·2	+14·5	+ 4·3
65·393 G	39	184	22	103	310·2	−0·2	+14·7	+15·7
66·398 G	37	166	23	103	310·2	−0·2	+14·7	+29·0
67·625 C	38	145	29	112	310·2	−0·3	+14·6	+45·1
68·389 G	22	105	21	102	310·2	−0·3	+14·6	+55·2
69·385 G	13	62	20	96	310·3	−0·3	+14·8	+68·4
70·445 G	9	26	43	125	309·9	..	+14·5	+82·0
Means ..	..	..	24	117	310·5	..	+14·9	..

Group 11542. February 28–March 10. A regular spot (*b* of Group 11537) diminishing rapidly to a dot after March 7. A tiny companion appears on March 7 and 8.

58·625 G	4	28	21	149	300·5	..	+10·8	−83·2
59·345 C	8	40	16	80	300·6	+2·0	+10·8	−73·6
60·513 C	15	106	15	109	300·5	+1·8	+11·2	−58·3
61·368 C	28	125	22	98	300·4	+1·7	+11·0	−47·1
62·511 G	33	153	20	95	300·7	+1·9	+11·0	−31·8
63·402 G	29	150	16	84	300·7	+1·8	+10·9	−20·0
64·538 G	22	134	12	71	300·9	+2·0	+10·9	− 4·9
65·393 G	28	149	15	78	300·8	+1·8	+10·8	+ 6·3
66·398 G	20	68	11	38	300·5	+1·5	+11·2	+19·3
67·625 C	4	11	3	7	300·8	+1·7	+11·1	+35·7
68·389 G	4	13	3	10	300·8	+1·7	+11·1	+45·8
Means ..	..	..	13	67	300·7	..	+11·0	..

No. 1128. Latitude +6°·2.
Group 11551 in Rotation 1066.
,, 11553 ,, ,, 1067.

Group 11551. June 13–22. A stream of normal type developing rather rapidly. The leader, *a* (a regular spot), alone remains on and after June 17.

d					°	°	°	°
163·439 G	41	139	29	99	34·0	0·0	+ 4·5	−45·3
164·342 G	71	256	42	150	35·6	+1·5	+ 5·0	−31·7
165·344 G	60	307	32	161	35·9	+1·6	+ 5·3	−18·1
166·359 G	43	228	21	114	36·4	+1·9	+ 5·7	− 4·2
167·340 G	28	166	14	85	36·9	+2·3	+ 6·0	+ 9·3
168·546 G	37	199	20	109	36·9	+2·1	+ 6·1	+25·2
169·352 G	28	166	17	103	36·8	+1·9	+ 6·3	+35·8
170·598 G	18	122	15	100	37·0	+1·9	+ 6·7	+52·5
171·423 G	12	83	13	93	37·0	+1·7	+ 6·9	+63·4
172·332 G	9	51	18	103	37·4	+2·0	+ 7·2	+75·8
Means ..	..	..	22	112	36·4	..	+ 6·0	..

Spot *a*.

164·342 G	53	180	31	104	36·9	0·0	+ 5·5	−30·4
165·344 G	46	231	24	120	36·9	−0·2	+ 5·6	−17·1
166·359 G	34	192	17	96	36·9	−0·3	+ 6·0	− 3·7
167·340 G	28	166	14	85	36·9	−0·5	+ 6·0	+ 9·3
168·546 G	37	199	20	109	36·9	−0·7	+ 6·1	+25·2
169·352 G	28	166	17	103	36·8	−0·9	+ 6·3	+35·8
170·598 G	18	122	15	100	37·0	−0·9	+ 6·7	+52·5
171·423 G	12	83	13	93	37·0	−1·0	+ 6·9	+63·4
172·332 G	9	51	18	103	37·4	−0·8	+ 7·2	+75·8

Group 11553. July 7–9. A small spot, *a* of Group 11551.

187·372 G	5	16	14	45	42·3	..	+ 6·8	−80·2
188·334 G	5	23	6	29	42·5	+1·8	+ 7·1	−67·2
189·350 G	5	9	4	8	42·5	+1·6	+ 6·8	−53·8
Means ..	..	..	5	18	42·5	..	+ 7·0	..

Blank page retained for pagination

ROYAL OBSERVATORY, GREENWICH.

Ledgers of Groups of Sun Spots

for the Year

1933

Ledger II.—Non-Recurrent Groups

GREENWICH PHOTO-HELIOGRAPHIC RESULTS 1933

LEDGER II.—NON-RECURRENT GROUPS OF SUN SPOTS for the YEAR 1933.

The Greenwich Mean Time at which the photograph was taken is expressed in the *first* column by the Day of the Year and decimal of a day, reckoned from Greenwich Mean Midnight.

The place where the photograph was taken is also indicated in the *first* column. A photograph taken at Greenwich is indicated by the letter G, and those taken at the Cape and Kodaikánal by the letters C and K, respectively.

The projected Area of the Umbræ and Whole Spots, given in the *second* and *third* columns, is the area as it is measured on the photograph, uncorrected for the effect of foreshortening, and expressed in millionths of the Sun's apparent disc.

The area corrected for foreshortening given in the *fourth* and *fifth* columns is expressed in millionths of the Sun's visible hemisphere.

The longitude given in the *sixth* column is based on the ephemeris given in the *Nautical Almanac*, assuming a daily sidereal motion of 14°·18, due to the Sun's rotation, constant at all latitudes; this corresponds to Carrington's assumed rotation period of 25·38 days.

The proper motion given in the *seventh* column is derived from the difference of longitude thus computed from the measured positions on any given day and the first day on which the group of spots or single spot is visible, after the correction for the motion appropriate to the latitude has been applied according to the formula, $\xi = 14°\cdot37 - 2°\cdot60 \sin^2\phi$. A *plus* sign indicates a motion forwards, a *minus* sign a motion backwards relative to the position on the first day.

The remaining columns correspond to those with similar headings in the preceding Section.

When a group is 80° or more from the Sun's central meridian, the measures for that day are not included in taking the mean area, longitude, and latitude of the group. In such cases of close proximity to the Sun's limb, the addition of brackets denotes that only part of the group is visible.

LEDGER II.—NON-RECURRENT GROUPS of SUN SPOTS for the YEAR 1933.

Group 11532.

January 12–17. A small stream.

Date G.M.T. Place.	Projected Area Umbræ	Projected Area Whole Spots.	Corrected Area Umbræ	Corrected Area Whole Spots.	Longitude and Proper Motion.		Latitude.	Long. from C.M.
d					°	°	°	°
11·514 G	17	39	9	21	272·3	0·0	+ 2·4	−11·7
12·424 C	20	96	10	49	273·1	+0·6	+ 1·9	+ 1·1
13·505 G	30	103	16	54	274·5	+1·8	+ 2·2	+16·7
14·149 K	28	140	16	78	274·4	+1·6	+ 1·8	+25·1
15·347 C	12	52	8	35	274·5	+1·5	+ 1·2	+41·0
16·412 G	9	17	8	16	276·8	+3·6	+ 1·7	+57·3
Means ..	..	..	11	42	274·3	..	+ 1·9	..

Group 11534.

January 28–February 6. A stream led by a regular spot, *a*. Group 11536 develops closely following it on January 31 ; afterwards, the two groups are more clearly separated owing to the difference in inclination of their axes.

27·450 G	10	28	10	29	13·9	0·0	+ 4·9	−60·3
28·379 C	30	192	22	144	14·6	+ 0·5	+ 4·4	−47·3
29·357 C	52	274	31	166	16·1	+ 1·9	+ 4·7	−33·0
30·434 C	63	302	33	160	19·2	+ 4·8	+ 5·2	−15·7
31·121 K	82	349	41	179	20·3	+ 5·8	+ 5·1	− 5·5
32·401 G	90	475	48	249	21·3	+ 6·6	+ 5·3	+12·3
33·383 G	64	349	37	201	22·6	+ 7·7	+ 5·7	+26·6
34·338 C	40	210	27	143	24·9	+ 9·8	+ 6·0	+41·4
35·491 G	22	117	21	112	25·6	+10·4	+ 6·4	+57·3
36·442 G	17	82	27	130	26·3	+10·9	+ 6·7	+70·5
Means ..	..	..	30	151	20·5	..	+ 5·4	..
Spot *a*.								
29·357 C	33	186	19	110	18·5	0·0	+ 4·6	−30·6
30·434 C	36	180	19	95	20·5	+1·8	+ 5·4	−14·4
31·121 K	40	209	20	107	21·6	+2·8	+ 5·3	− 4·2
32·401 G	45	238	24	126	23·3	+4·3	+ 5·3	+14·3
33·383 G	44	251	26	146	24·2	+5·0	+ 5·6	+28·1
34·338 C	40	210	27	143	24·9	+5·6	+ 6·0	+41·4
35·491 G	22	117	21	112	25·6	+6·1	+ 6·4	+57·3
36·442 G	17	82	27	130	26·3	+6·6	+ 6·7	+70·5

Group 11536.

January 31–February 4. A small stream following and developing with Group 11534.

30·434 C	34	98	18	54	14·0	0·0	+ 5·7	−20·9
31·121 K	40	181	21	94	14·6	+0·5	+ 5·9	−11·2
32·401 G	47	259	25	134	14·8	+0·5	+ 6·1	+ 5·8
33·383 G	20	46	11	25	15·4	+1·0	+ 7·0	+19·3
34·338 C	6	23	4	14	15·5	+0·9	+ 6·9	+32·0
Means ..	..	..	16	64	14·9	..	+ 6·3	..

Group 11538.

February 4–13. A stream, with a complex leader spot, closely following Group 11537.

d					°	°	°	°
34·338 C	2	4	2	4	286·3	0·0	+13·9	−57·2
35·491 G	11	31	7	22	287·9	+1·5	+13·3	−40·4
36·442 G	18	46	11	28	288·4	+2·0	+13·4	−27·4
37·499 G	31	130	17	71	289·8	+3·3	+12·6	−12·1
38·322 C	39	251	20	134	290·8	+4·2	+12·2	− 0·2
39·323 C	109	462	60	254	292·8	+6·2	+11·9	+14·9
40·473 G	97	503	60	310	293·6	+6·9	+12·1	+30·9
41·427 G	52	312	38	230	293·5	+6·7	+11·8	+43·4
42·340 C	29	158	29	155	294·9	+8·0	+11·4	+56·8
43·408 C	15	88	26	150	295·0	+8·1	+11·3	+70·9
Means ..	..	..	27	136	291·3	..	+12·4	..

Group 11543.

March 22–April 2. A group led by a spot (*a*), with a prominent bright "bridge" across it, almost dividing the spot into two halves. After March 27, the "bridge" diminishes and the spot assumes a regular outline. The other components of the group are usually very small and unstable.

80·385 G	35	155	89	386	19·2	0·0	+ 4·2	−77·7
81·415 G	93	417	107	481	20·0	+0·6	+ 4·6	−63·3
82·429 G	120	439	94	345	20·9	+1·3	+ 4·8	−49·0
83·397 G	95	401	60	253	21·1	+1·4	+ 4·7	−36·1
84·400 G	75	456	41	252	21·8	+1·9	+ 4·5	−22·1
85·395 G	78	414	40	215	21·8	+1·7	+ 4·7	− 9·0
86·393 G	83	426	43	217	21·8	+1·6	+ 4·8	+ 4·1
87·398 G	66	376	36	203	22·5	+2·1	+ 4·9	+18·1
88·384 G	60	262	36	157	22·7	+2·1	+ 5·0	+31·3
89·381 G	38	186	27	134	23·0	+2·2	+ 4·9	+44·8
90·415 G	27	132	27	131	23·2	+2·3	+ 4·6	+58·6
91·407 G	16	89	27	150	23·5	+2·4	+ 4·8	+72·0
Means ..	..	..	52	244	21·8	..	+ 4·7	..
Spot *a*.								
80·385 G	24	119	55	274	20·2	0·0	+ 4·6	−76·7
81·415 G	80	355	90	398	20·7	+0·3	+ 4·9	−62·6
82·429 G	107	404	83	315	21·3	+0·7	+ 4·9	−48·6
83·397 G	84	372	53	234	21·6	+0·9	+ 4·8	−35·6
84·400 G	71	420	39	231	22·0	+1·1	+ 4·5	−21·9
85·395 G	70	370	36	192	22·2	+1·1	+ 4·6	− 8·6
86·393 G	66	351	34	179	22·4	+1·2	+ 4·8	+ 4·7
87·398 G	57	354	31	191	22·7	+1·3	+ 4·9	+18·3
88·384 G	56	231	34	139	23·0	+1·4	+ 4·9	+31·6
89·381 G	36	182	26	131	23·0	+1·2	+ 4·9	+44·8
90·415 G	27	132	27	131	23·2	+1·3	+ 4·6	+58·6
91·407 G	16	89	27	150	23·5	+1·4	+ 4·8	+72·0

LEDGER II.—NON-RECURRENT GROUPS of SUN SPOTS for the YEAR 1933—*continued*.

Group 11544.

March 25–29. A small stream of unimportant spots.

Date G.M.T. Place.	Projected Area Umbræ	Projected Area Whole Spots.	Corrected Area Umbræ	Corrected Area Whole Spots.	Longitude and Proper Motion.		Lati-tude.	Long. from C.M.
d					°	°	°	°
83·397 G	13	44	7	24	73·1	0·0	+10·1	+15·9
84·400 G	37	111	22	67	74·7	+1·5	+ 9·8	+30·8
85·395 G	36	141	27	105	75·7	+2·4	+ 9·8	+44·9
86·393 G	18	77	19	80	76·7	+3·3	+10·0	+59·0
87·398 G	6	22	11	41	77·2	+3·6	+ 9·6	+72·8
Means ..	..	..	17	63	75·5	..	+ 9·9	..

Group 11545.

April 17–21. A small stream with the largest component following.

106·111 K	12	48	8	32	79·8	0·0	+ 9·1	−37·6
107·497 G	18	101	10	56	79·0	−1·0	+ 9·6	−20·1
108·353 G	13	54	7	29	78·6	−1·5	+ 9·8	− 9·2
109·585 G	9	27	5	14	78·0	−2·2	+10·1	+ 6·5
110·375 G	7	20	4	11	78·2	−2·1	+ 9·7	+17·1
Means ..	..	..	7	28	78·7	..	+ 9·7	..

Group 11548.

May 19–23. A small stream of typical formation.

138·417 C	11	33	6	18	68·3	0·0	+10·8	+17·9
139·410 G	20	154	12	93	68·6	+0·2	+11·2	+31·4
140·422 G	27	139	20	103	69·2	+0·7	+11·4	+45·3
141·353 G	28	121	27	120	69·9	+1·3	+11·1	+58·4
142·355 G	6	23	11	38	69·7	+1·0	+11·4	+71·4
Means ..	..	..	15	74	69·1	..	+11·2	..

Group 11549.

May 21–26. A small indefinite spot on May 21–22; a small stream afterwards.

140·422 G	2	2	2	2	326·7	0·0	+ 8·7	−57·2
141·353 G	5	11	4	8	323·7	−3·1	+ 9·7	−47·8
142·355 G	9	23	5	14	328·2	+1·3	+ 9·0	−30·1
143·352 G	18	60	10	32	326·6	−0·5	+ 9·4	−18·5
144·352 G	9	27	5	14	327·9	+0·7	+ 9·6	− 4·0
145·480 G	2	7	1	4	327·3	0·0	+ 7·2	+10·4
Means ..	..	..	4	12	326·7	..	+ 8·9	..

Group 11550.

June 2–7. A fair-sized area of faculæ containing one or two small spots.

d					°	°	°	°
152·340 G	2	5	4	10	151·4	0·0	− 6·1	−74·8
153·348 G	4	9	5	10	150·0	−1·6	− 7·4	−62·8
154·362 G	7	10	5	8	151·1	−0·6	− 6·7	−48·3
155·399 G	5	9	3	5	151·9	0·0	− 6·5	−33·8
156·332 G	5	16	3	9	151·0	−1·0	− 6·6	−22·3
157·353 G	5	14	3	7	145·5	−6·7	− 9·1	−14·3
Means ..	..	..	4	8	150·2	..	− 7·1	..

Group 11552.

July 5–12. A pair of spots that later become a small cluster in the following part of an area of faculæ.

185·339 G	4	16	23	91	63·8	..	+ 7·2	−85·6
186·397 G	9	37	13	54	65·0	0·0	+ 7·3	−70·4
187·372 G	14	32	13	30	64·4	−0·7	+ 7·7	−58·1
188·334 G	7	23	5	16	63·9	−1·4	+ 7·5	−45·8
189·350 G	9	37	5	22	64·1	−1·3	+ 7·5	−32·2
190·406 C	11	65	6	34	64·4	−1·2	+ 7·7	−17·9
191·627 G	5	23	2	12	63·8	−2·0	+ 8·1	− 2·4
192·473 G	0	18	0	9	64·8	−1·1	+ 7·5	+ 9·8
Means ..	..	..	6	25	64·3	..	+ 7·6	..

Group 11556.

September 6–10. A small group of stream type showing the usual initial separation in longitude of the leading and following spots.

248·358 G	22	61	12	33	47·5	0·0	−10·3	+11·4
249·432 G	60	227	35	133	48·3	+0·7	−10·1	+26·3
250·337 G	34	136	23	92	48·5	+0·8	− 9·8	+38·5
251·356 G	22	76	20	67	49·7	+1·9	− 9·6	+53·2
252·360 G	5	18	7	24	48·9	+0·9	− 9·4	+65·6
Means ..	..	..	19	70	48·6	..	− 9·8	..

LEDGER II.—NON-RECURRENT GROUPS of SUN SPOTS for the YEAR 1933—*continued*.

Date G.M.T. Place.	Projected Area Umbræ	Projected Area Whole Spots.	Corrected Area Umbræ	Corrected Area Whole Spots.	Longitude and Proper Motion.	Lati-tude.	Long. from C.M.
Group 11559.							
October 26–November 1. A moderate-sized group of the usual stream type, with *a* and *b* as the leader and follower respectively.							
d					°	°	°
298·626 G	71	261	36	131	88·8	0·0	+ 9·0	− 4·0
299·401 C	100	460	50	231	89·5	+0·6	+ 9·3	+ 6·9
300·452 G	86	380	46	205	89·9	+0·9	+ 8·9	+21·2
301·427 G	83	370	50	224	90·0	+0·8	+ 8·7	+34·1
302·427 C	40	256	29	191	90·7	+1·4	+ 8·6	+48·0
303·629 G	26	124	31	145	92·0	+2·6	+ 8·7	+65·2
304·147 K	20	79	32	130	92·3	+2·8	+ 8·5	+72·3
Means ..	..	..	39	180	90·5	..	+ 8·8	..
Spot *a*.							
298·626 G	22	62	11	31	91·5	0·0	+ 8·7	− 1·3
299·401 C	28	127	14	65	92·7	+1·1	+ 8·5	+10·1
300·452 G	33	130	18	72	94·1	+2·4	+ 8·4	+25·4
Group 11559—*continued*.							
Spot *a*—*continued*.							
d					°	°	°
301·427 G	22	97	14	62	94·7	+2·8	+ 8·2	+38·8
302·427 C	8	72	6	58	94·9	+2·9	+ 8·2	+52·2
303·629 G	9	31	12	42	95·7	+3·6	+ 8·2	+68·9
304·147 K	8	45	15	82	94·6	+2·4	+ 8·1	+74·6
Spot *b*.							
298·626 G	40	164	20	82	87·7	0·0	+ 9·1	− 5·1
299·401 C	64	301	32	150	87·7	−0·1	+ 9·1	+ 5·1
300·452 G	44	224	23	119	88·1	+0·2	+ 9·1	+19·4
301·427 G	48	242	28	143	88·4	+0·3	+ 8·9	+32·5
302·427 C	28	167	20	120	88·7	+0·5	+ 9·0	+46·0
303·629 G	13	73	14	78	89·2	+0·9	+ 9·2	+62·4
304·147 K	10	22	14	30	88·9	+0·5	+ 9·4	+68·9

Blank page retained for pagination

ROYAL OBSERVATORY, GREENWICH.

Total Areas of Sun Spots and Faculæ

Projected and Corrected for Foreshortening
for each Day, and

Mean Areas and Mean Heliographic Latitude of Sun Spots and Faculæ

for each Rotation of the Sun
and for the Year

1933

GREENWICH PHOTO-HELIOGRAPHIC RESULTS, 1933.

TOTAL AREAS of SUN SPOTS and FACULÆ for EACH DAY in the YEAR 1933.

The Greenwich Mean Time at which the photograph was taken is expressed by the month, day of month, and decimal of a day, reckoned from Greenwich Mean Midnight.

The place where the photograph was taken is indicated in the second column. A photograph taken at Greenwich is indicated by the letter G, and those taken at the Cape and Kodaikánal, by the letters C and K respectively.

The Projected Area is the area as it is measured on the photograph, uncorrected for the effect of foreshortening and expressed in millionths of the Sun's apparent disc.

The Area Corrected for Foreshortening is expressed in millionths of the Sun's visible hemisphere.

Greenwich Mean Time.		Place.	Projected Area.			Area Corrected for Foreshortening.			Greenwich Mean Time.		Place.	Projected Area.			Area Corrected for Foreshortening.		
			Umbræ.	Whole Spots.	Faculæ.	Umbræ.	Whole Spots.	Faculæ.				Umbræ.	Whole Spots.	Faculæ.	Umbræ.	Whole Spots.	Faculæ.
1933.	d								1933.	d							
January	1·395	G	0	0	76	0	0	290	February	8·322	C	381	2317	105	215	1300	252
	2·361	C	0	0	0	0	0	0		9·323	C	385	1962	430	229	1177	399
	3·330	C	21	96	381	44	201	600		10·473	G	299	1403	1259	220	1020	1402
	4·478	G	43	235	1142	60	302	1740		11·427	G	173	942	1161	170	911	1323
	5·400	C	83	394	1936	76	353	2048		12·340	C	102	485	1490	145	655	1781
	6·386	G	98	478	1886	68	335	2041		13·408	C	34	170	852	70	339	1546
	7·461	G	133	587	853	77	345	820		14·362	C	0	0	311	0	0	765
	8·372	C	108	607	187	57	325	138		15·429	C	0	2	74	0	2	56
	9·425	G	137	633	0	71	329	0		16·438	G	0	0	0	0	0	0
	10·466	G	171	616	26	90	328	30		17·502	G	0	0	0	0	0	0
	11·414	C	87	611	0	48	351	0		18·509	G	0	0	239	0	0	423
	12·514	G	129	554	497	84	366	435		19·381	C	0	0	284	0	0	295
	13·424	C	86	507	832	62	383	785		20·444	G	0	0	470	0	0	432
	14·505	G	158	529	1741	158	531	1811		21·433	G	0	0	0	0	0	0
	15·149	K	76	372	1187	99	468	1420		22·407	G	0	0	267	0	0	408
	16·347	C	22	91	701	35	154	1247		23·398	G	0	0	373	0	0	477
	17·412	G	9	17	742	8	16	872		24·341	C	0	0	405	0	0	348
	18·449	G	0	0	505	0	0	534		25·343	C	0	0	0	0	0	0
	19·509	C	0	0	33	0	0	104		26·106	K	0	0	51	0	0	97
	20·346	C	0	0	0	0	0	0		27·494	G	11	30	580	14	36	724
	21·492	G	0	0	0	0	0	0		28·625	G	21	122	959	49	308	1251
	22·374	C	0	0	59	0	0	91									
	23·352	C	0	0	339	0	0	411									
	24·109	K	0	0	348	0	0	357	March	1·345	C	25	129	1062	37	192	1429
	25·444	G	0	0	329	0	0	298		2·513	C	49	267	1420	43	241	1466
	26·524	G	0	0	592	0	0	737		3·368	C	70	354	754	51	254	674
	27·530	G	0	0	510	0	0	620		4·511	G	88	381	526	52	226	495
	28·450	G	10	28	686	10	29	682		5·402	G	69	357	231	38	198	350
	29·379	C	30	192	403	22	144	388		6·538	G	57	341	62	31	183	137
	30·357	C	56	307	138	44	274	318		7·393	G	67	333	0	37	181	0
	31·434	C	122	497	664	83	340	840		8·398	G	57	234	646	34	141	610
										9·625	C	42	156	497	32	119	529
										10·389	G	26	118	1250	24	112	1249
February	1·121	K	174	802	955	155	796	1193		11·385	G	13	62	1301	20	96	1502
	2·401	G	353	1898	1998	355	1929	2374		12·445	G	9	30	587	43	127	907
	3·383	G	443	2183	1230	366	1815	1220		13·519	G	0	0	197	0	0	438
	4·338	C	455	2566	487	315	1785	400		14·431	G	0	0	0	0	0	0
	5·491	G	522	3044	1119	314	1844	988		15·413	C	0	0	0	0	0	0
	6·442	G	554	2968	720	319	1709	847		16·371	C	0	0	0	0	0	0
	7·499	G	452	2584	400	251	1412	713		17·103	K	0	0	224	0	0	323

TOTAL AREAS of SUN SPOTS and FACULÆ for EACH DAY in the YEAR 1933—*continued*.

Greenwich Mean Time.		Place.	Projected Area.			Area Corrected for Foreshortening.		
			Umbræ.	Whole Spots.	Faculæ.	Umbræ.	Whole Spots.	Faculæ.
1933.	d							
March	18·404	G	0	0	332	0	0	419
	19·431	G	0	0	150	0	0	120
	20·435	G	0	0	0	0	0	0
	21·391	G	0	0	216	0	0	328
	22·385	G	35	155	418	89	386	614
	23·415	G	93	417	240	107	481	290
	24·429	G	120	439	448	94	345	367
	25·397	G	108	445	0	67	277	0
	26·400	G	112	567	253	63	319	362
	27·395	G	114	555	1208	67	320	1322
	28·393	G	101	503	949	62	297	1309
	29·398	G	72	398	1046	47	244	1271
	30·384	G	60	262	782	36	157	786
	31·381	G	38	186	93	27	134	111
April	1·415	G	27	132	537	27	131	570
	2·407	G	16	89	256	27	150	353
	3·391	G	0	0	111	0	0	313
	4·444	G	0	0	311	0	0	280
	5·402	G	0	0	515	0	0	558
	6·386	G	2	7	856	1	4	911
	7·396	G	0	0	870	0	0	917
	8·401	G	0	0	795	0	0	1005
	9·412	G	0	0	269	0	0	435
	10·451	G	0	0	0	0	0	0
	11·337	G	0	0	0	0	0	0
	12·352	C	0	0	17	0	0	28
	13·332	G	0	0	90	0	0	127
	14·365	G	0	0	99	0	0	134
	15·412	G	0	0	99	0	0	137
	16·348	G	0	0	106	0	0	129
	17·111	K	12	48	74	8	32	100
	18·497	G	18	101	228	10	56	343
	19·353	G	17	112	561	9	58	599
	20·585	G	9	27	90	5	14	71
	21·375	G	7	20	23	4	11	36
	22·426	C	0	0	170	0	0	211
	23·341	G	0	0	127	0	0	157
	24·433	C	0	0	294	0	0	357
	25·444	C	0	0	527	0	0	664
	26·331	G	0	0	430	0	0	615
	27·483	G	0	0	511	0	0	566
	28·405	C	0	0	335	0	0	346
	29·352	G	2	9	180	1	5	263
	30·392	G	0	0	0	0	0	0
May	1·348	G	0	0	154	0	0	137
	2·400	C	4	20	224	5	24	272
	3·654	G	0	0	109	0	0	256
	4·345	G	0	0	216	0	0	173
	5·447	C	0	0	531	0	0	666
	6·488	G	0	0	45	0	0	81
	7·380	C	0	0	53	0	0	102
	8·371	G	0	0	0	0	0	0
May	9·452	G	5	16	0	3	9	0
	10·440	G	2	5	0	1	3	0
	11·331	G	0	0	0	0	0	0
	12·343	G	0	0	121	0	0	134
	13·352	C	0	0	70	0	0	66
	14·552	G	0	0	80	0	0	97
	15·348	G	0	0	236	0	0	270
	16·618	G	0	0	0	0	0	0
	17·590	G	0	0	0	0	0	0
	18·370	G	0	0	194	0	0	355
	19·417	C	11	33	340	6	18	387
	20·410	G	20	154	847	12	93	840
	21·422	G	29	141	349	22	105	327
	22·353	G	33	132	934	31	128	1120
	23·355	G	15	46	692	16	52	814
	24·352	G	18	60	140	10	32	284
	25·352	G	9	27	0	5	14	0
	26·480	G	2	7	87	1	4	142
	27·354	G	2	7	114	2	5	84
	28·357	G	0	0	344	0	0	330
	29·443	G	0	0	588	0	0	675
	30·438	G	0	0	417	0	0	569
	31·378	C	0	0	71	0	0	124
June	1·343	G	0	0	142	0	0	163
	2·340	G	2	5	169	4	10	393
	3·348	G	4	9	371	5	10	479
	4·362	G	7	10	595	5	8	512
	5·399	G	5	9	0	3	5	0
	6·332	G	7	21	51	5	14	48
	7·353	G	5	14	260	3	7	295
	8·339	G	0	0	97	0	0	178
	9·332	G	0	0	184	0	0	186
	10·141	K	0	0	0	0	0	0
	11·527	G	0	0	265	0	0	188
	12·586	G	0	0	432	0	0	408
	13·439	G	41	139	525	29	99	653
	14·342	G	71	256	215	42	150	424
	15·344	G	60	307	305	32	161	320
	16·359	G	43	228	107	21	114	128
	17·340	G	28	166	53	14	85	80
	18·546	G	37	199	69	20	109	102
	19·352	G	28	166	125	17	103	139
	20·598	G	18	122	231	15	100	182
	21·423	G	12	83	219	13	93	219
	22·332	G	9	51	238	18	103	314
	23·326	G	0	0	0	0	0	0
	24·382	C	0	0	18	0	0	23
	25·355	C	0	0	0	0	0	0
	26·544	G	0	0	0	0	0	0
	27·362	G	0	0	0	0	0	0
	28·345	G	0	0	0	0	0	0
	29·485	G	0	0	111	0	0	163
	30·360	G	0	0	162	0	0	170

TOTAL AREAS of SUN SPOTS and FACULÆ for EACH DAY in the YEAR 1933—*continued.*

Greenwich Mean Time.		Place.	Projected Area.			Area Corrected for Foreshortening.			Greenwich Mean Time.		Place.	Projected Area.			Area Corrected for Foreshortening.		
			Umbræ.	Whole Spots.	Faculæ.	Umbræ.	Whole Spots.	Faculæ.				Umbræ.	Whole Spots.	Faculæ.	Umbræ.	Whole Spots.	Faculæ.
1933.	d								1933.	d							
July	1·334	G	0	0	127	0	0	103	August	24·352	G	0	0	73	0	0	80
	2·273	G	0	0	0	0	0	0		25·351	G	0	0	260	0	0	200
	3·329	G	0	0	204	0	0	265		26·334	G	0	0	0	0	0	0
	4·330	G	0	0	0	0	0	0		27·364	G	0	0	0	0	0	0
	5·339	G	4	16	116	23	91	309		28·345	G	0	0	43	0	0	77
	6·397	G	9	37	266	13	54	335		29·344	G	0	0	0	0	0	0
	7·372	G	19	48	622	27	75	612		30·344	G	0	0	0	0	0	0
	8·334	G	12	46	152	11	45	230		31·346	G	0	0	25	0	0	36
	9·350	G	14	46	92	9	30	85									
	10·406	C	11	65	152	6	34	190									
	11·627	G	5	25	81	2	18	255	September	1·427	G	0	0	25	0	0	33
	12·473	G	5	32	213	7	28	311		2·369	G	2	7	127	4	13	278
	13·372	C	0	4	339	0	4	308		3·349	G	2	5	184	2	5	218
	14·356	G	0	0	32	0	0	37		4·357	G	2	4	551	2	3	442
	15·433	C	0	0	379	0	0	317		5·339	G	0	0	57	0	0	66
	16·403	G	0	0	215	0	0	263		6·358	G	22	61	72	12	33	119
	17·398	G	0	0	65	0	0	127		7·432	G	60	227	41	35	133	53
	18·561	G	0	0	50	0	0	81		8·337	G	34	136	23	23	92	55
	19·359	G	0	0	121	0	0	163		9·356	G	22	76	288	20	67	245
	20·476	G	0	0	118	0	0	115		10·360	G	5	18	320	7	24	391
	21·437	G	0	0	303	0	0	310		11·344	G	0	0	91	0	0	236
	22·346	G	0	0	670	0	0	729		12·122	K	0	0	0	0	0	0
	23·371	G	0	0	168	0	0	220		13·630	G	0	0	86	0	0	130
	24·348	G	0	0	0	0	0	0		14·346	G	0	0	18	0	0	34
	25·347	G	0	0	36	0	0	58		15·340	G	0	0	20	0	0	34
	26·329	G	0	0	0	0	0	0		16·405	G	0	0	67	0	0	77
	27·354	G	0	0	21	0	0	45		17·381	G	0	0	72	0	0	76
	28·352	G	0	0	0	0	0	0		18·428	G	0	0	0	0	0	0
	29·463	C	0	0	13	0	0	17		19·385	G	0	0	0	0	0	0
	30·370	G	0	0	0	0	0	0		20·373	G	0	0	0	0	0	0
	31·373	G	0	0	0	0	0	0		21·340	C	2	4	0	1	2	0
										22·356	G	35	116	0	18	59	0
										23·357	C	13	59	60	7	30	75
August	1·375	G	0	0	69	0	0	101		24·353	G	4	14	0	2	8	0
	2·347	G	0	0	287	0	0	327		25·350	G	0	0	0	0	0	0
	3·571	G	0	0	213	0	0	202		26·355	G	0	0	0	0	0	0
	4·406	G	0	0	0	0	0	0		27·346	C	4	4	151	2	2	162
	5·409	G	0	0	0	0	0	0		28·424	G	13	67	90	7	36	149
	6·354	G	0	0	50	0	0	62		28·426	G	13	100	0	8	60	0
	7·397	G	0	0	0	0	0	0		30·308	C	4	26	270	3	19	192
	8·381	G	0	0	0	0	0	0									
	9·355	G	2	7	0	1	4	0									
	10·331	G	0	0	0	0	0	0	October	1·364	C	0	0	251	0	0	243
	11·410	C	0	0	155	0	0	164		2·361	C	0	0	125	0	0	220
	12·328	G	5	9	0	3	6	0		3·442	G	0	0	0	0	0	0
	13·301	G	0	0	0	0	0	0		4·357	G	0	0	33	0	0	51
	14·305	C	0	0	0	0	0	0		5·432	G	0	0	40	0	0	60
	15·374	G	0	0	0	0	0	0		6·453	G	0	0	13	0	0	27
	16·350	G	0	0	0	0	0	0		7·470	G	0	0	0	0	0	0
	17·413	C	0	0	0	0	0	0		8·400	G	0	0	0	0	0	0
	18·344	G	0	0	0	0	0	0		9·384	G	0	0	31	0	0	44
	19·463	G	0	0	0	0	0	0		10·621	G	2	4	0	1	2	0
	20·347	G	0	0	0	0	0	0		11·445	G	0	0	22	0	0	33
	21·351	G	0	0	0	0	0	0		12·384	G	2	9	0	1	5	0
	22·391	G	0	0	0	0	0	0		13·404	G	0	0	38	0	0	78
	23·382	G	0	0	59	0	0	114		14·142	K	0	0	0	0	0	0

TOTAL AREAS of SUN SPOTS and FACULÆ for EACH DAY in the YEAR 1933—*continued.*

Greenwich Mean Time.		Place.	Projected Area.			Area Corrected for Foreshortening.		
			Umbræ.	Whole Spots.	Faculæ.	Umbræ.	Whole Spots.	Faculæ.
1933.	d							
October	15·362	G	0	0	0	0	0	0
	16·374	G	0	0	0	0	0	0
	17·428	G	0	0	31	0	0	60
	18·382	G	0	0	287	0	0	372
	19·385	G	0	0	66	0	0	92
	20·388	G	0	0	31	0	0	47
	21·120	K	0	0	0	0	0	0
	22·365	C	0	0	0	0	0	0
	23·410	G	0	0	0	0	0	0
	24·437	C	0	0	0	0	0	0
	25·352	C	0	0	0	0	0	0
	26·626	G	71	261	0	36	131	0
	27·401	C	100	460	0	50	231	0
	28·452	G	86	380	24	46	205	27
	29·427	G	98	405	18	60	246	32
	30·427	C	40	256	286	29	191	214
	31·629	G	26	124	440	31	145	497
November	1·147	K	20	79	183	32	130	276
	2·613	G	0	0	0	0	0	0
	3·469	G	0	0	0	0	0	0
	4·464	G	0	0	128	0	0	131
	5·487	G	0	0	0	0	0	0
	6·400	C	0	0	0	0	0	0
	7·436	G	0	0	15	0	0	20
	8·412	G	0	0	59	0	0	69
	9·445	C	0	0	0	0	0	0
	10·449	G	0	0	31	0	0	62
	11·410	C	0	0	55	0	0	58
	12·522	G	0	0	0	0	0	0
	13·472	G	0	0	0	0	0	0
	14·475	G	0	0	34	0	0	45
	15·506	C	0	0	0	0	0	0
	16·400	C	0	0	34	0	0	86
	17·494	G	0	0	305	0	0	399
	18·410	C	0	0	693	0	0	657
	19·421	G	0	0	305	0	0	229
	20·400	G	0	0	0	0	0	0
	21·400	C	0	0	0	0	0	0
	22·350	C	0	0	0	0	0	0
	23·351	C	0	0	0	0	0	0
	24·348	C	0	0	0	0	0	0
	25·472	G	0	0	0	0	0	0
	26·374	C	0	0	157	0	0	148
	27·447	C	0	0	324	0	0	363
	28·426	C	0	0	272	0	0	498
	29·441	G	0	0	0	0	0	0
	30·418	C	0	0	0	0	0	0
December	1·417	C	0	0	0	0	0	0
	2·414	C	0	0	0	0	0	0
	3·375	C	0	0	0	0	0	0
	4·339	C	0	0	27	0	0	48
	5·374	C	0	0	0	0	0	0
	6·427	C	0	0	0	0	0	0
	7·432	C	0	0	0	0	0	0
	8·500	G	0	0	75	0	0	110
	9·358	C	0	0	136	0	0	125
	10·382	C	0	0	0	0	0	0
	11·414	C	12	42	0	7	23	0
	12·405	C	0	0	0	0	0	0
	13·416	C	0	0	0	0	0	0
	14·443	G	0	0	234	0	0	281
	15·503	G	0	0	282	0	0	259
	16·454	G	0	0	303	0	0	268
	17·103	K	0	0	0	0	0	0
	18·446	G	0	0	0	0	0	0
	19·397	C	0	0	0	0	0	0
	20·509	C	0	0	33	0	0	33
	21·534	G	0	0	26	0	0	24
	22·361	C	0	0	0	0	0	0
	23·353	C	0	0	0	0	0	0
	24·385	C	0	0	0	0	0	0
	25·394	C	0	0	0	0	0	0
	26·336	C	0	0	0	0	0	0
	27·408	C	0	0	0	0	0	0
	28·401	C	0	0	0	0	0	0
	29·353	C	0	0	0	0	0	0
	30·324	C	0	0	0	0	0	0
	31·385	C	0	0	0	0	0	0

MEAN AREAS of SUN SPOTS and FACULÆ for each ROTATION of the SUN, from 1933 January 7 to December 26.

The Mean Areas have been formed by taking the means of the Areas for each day of observation throughout each Rotation of the Sun, the Projected Areas being the Areas as measured on the photographs and expressed in millionths of the Sun's apparent disc, and the Areas Corrected for Foreshortening being expressed in millionths of the Sun's visible hemisphere.

The Rotations adopted in the following table (which is in continuation of those for the years 1873-1932 printed in the Greenwich Observations for 1884 and succeeding years) correspond to the synodic rotation of the Sun, and the commencement of each is defined by the coincidence of the assumed prime meridian with the central meridian, the assumed prime meridian being that meridian which passed through the ascending node of the Sun's equator on the ecliptic at mean noon on January 1, 1854, and the assumed period of the Sun's sidereal rotation being 25·38 days. The numeration of the rotations is in continuation of Carrington's series (*Observations of Solar Spots made at Redhill* by R. C. Carrington, F.R.S.), No. 1 being the rotation commencing 1853 November 9. The dates of commencement of the rotations are given in Greenwich Mean Time, reckoning from midnight.

No. of Rotation.	Date of Commencement of each Rotation.	No. of Days on which Photographs were taken.	Mean of Daily Areas.					
			Projected.			Corrected for Foreshortening.		
			Umbræ.	Whole Spots.	Faculæ.	Umbræ.	Whole Spots.	Faculæ.
1061	January 6·74	27	69	328	530	54	263	611
1062	February 3·08	27	143	774	531	101	537	651
1063	March 2·42	28	46	218	463	36	162	539
1064	March 29·73	27	8	36	293	6	28	346
1065	April 26·00	27	4	19	221	3	14	262
1066	May 23·23	28	14	60	229	8	35	276
1067	June 19·43	27	4	21	147	5	25	174
1068	July 16·63	27	0	1	87	0	0	101
1069	August 12·85	27	5	16	57	3	10	66
1070	September 9·09	27	4	18	73	3	11	88
1071	October 6·37	28	16	71	52	10	46	64
1072	November 2·66	27	0	0	89	0	0	102
1073	November 29·97	27	0	2	41	0	1	43

MEAN AREAS of SUN SPOTS and FACULÆ for the YEAR 1933.

The Mean Projected Areas are expressed in millionths of the Sun's apparent disc.

The Mean Areas Corrected for Foreshortening are expressed in millionths of the Sun's visible hemisphere.

Year.	No. of Days on which Photographs were taken.	Mean of Daily Areas.					
		Projected.			Corrected for Foreshortening.		
		Umbræ.	Whole Spots.	Faculæ.	Umbræ.	Whole Spots.	Faculæ.
1933	365	24	120	225	18	88	267

MEAN HELIOGRAPHIC LATITUDE of SUN SPOTS for each ROTATION of the SUN, from 1933 January 7 to December 26.

The numbers given in the accompanying table have been formed as follows :—

The Heliographic Latitude of each Spot for each day has been multiplied by its Area (corrected for foreshortening), and the sum of the products, for Spots North of the Equator, has been divided by the sum of the corresponding Areas to form Mean Heliographic Latitude of Spotted Area North of Equator ; similarly for Spots South of the Equator. In forming the Mean Heliographic Latitude of entire Spotted Area, the algebraic sum of the products for Spots North and South of the Equator has been divided by the sum of the Areas ; and for the Mean Distance from the Equator for all Spots the numerical sum of the products, without regard to the sign of the latitude, has been similarly divided.

The Mean Areas have been formed by dividing the sum of the Daily Areas (corrected for foreshortening) by the number of days of observation for each Rotation of the Sun and are expressed in millionths of the Sun's visible hemisphere.

No. of Rotation.	Date of Commencement of each Rotation.		No. of Days on which Photographs were taken.	Spots North of the Equator.		Spots South of the Equator.		Mean Heliographic Latitude of entire Spotted Area.	Mean Distance from Equator of all Spots.
				Mean of Daily Areas.	Mean Heliographic Latitude.	Mean of Daily Areas.	Mean Heliographic Latitude.		
					°		°	°	°
1061	January	6·74	27	263	9·83	0	..	+ 9·83	9·83
1062	February	3·08	27	535	12·51	2	11·58	+12·41	12·51
1063	March	2·42	28	162	8·67	0	..	+ 8·67	8·67
1064	March	29·73	27	28	5·59	0	..	+ 5·59	5·59
1065	April	26·00	27	14	10·80	0·4	5·42	+10·30	10·64
1066	May	23·23	28	33	6·04	2	7·00	+ 5·38	6·08
1067	June	19·43	27	24	7·11	1	3·90	+ 6·63	6·97
1068	July	16·63	27	0·1	3·00	0·2	13·10	− 6·70	9·10
1069	August	12·85	27	1	5·52	10	10·00	− 8·83	9·66
1070	September	9·09	27	4	14·51	8	4·72	+ 1·48	7·87
1071	October	6·37	28	45	8·84	1	31·50	+ 8·37	9·10
1072	November	2·66	27	0	..	0	..	..	..
1073	November	29·97	27	1	0·90	0	..	+ 0·90	0·90

MEAN HELIOGRAPHIC LATITUDE of SUN SPOTS for the YEAR 1933.

Year.	No. of Days on which Photographs were taken.	Spots North of the Equator.		Spots South of the Equator.		Mean Heliographic Latitude of entire Spotted Area.	Mean Distance from Equator of all Spots.
		Mean of Daily Areas.	Mean Heliographic Latitude.	Mean of Daily Areas.	Mean Heliographic Latitude.		
1933	365	86	10°·60	2	8°·35	+10°·23	10°·56

Blank page retained for pagination

Blank page retained for pagination

ROYAL OBSERVATORY, GREENWICH.

Observations of Solar Flocculi

Made with the

Spectrohelioscope

In the Year

1933

Blank page retained for pagination

OBSERVATIONS OF SOLAR FLOCCULI MADE WITH THE SPECTROHELIOSCOPE IN THE YEAR 1933.

The following observations relate to dark filaments or flocculi visible on the sun's disc in the light of $H\alpha$ in the immediate vicinity of sunspots, the object of the measures being to determine the motion of these hydrogen flocculi in the line of sight*.

The observations were made at the Royal Observatory, Greenwich, with a spectrohelioscope lent by the Mount Wilson Observatory and described by Dr. Hale in the *Astrophysical Journal*, **70**, 265–311, 1929. The spectrum is formed by a Rowland grating ruled with 14,438 lines to the inch, the observations being made in the light of $H\alpha$. The first order spectrum was used throughout the year, the scale being approximately 1 mm. = 4 A. The width of the second slit was usually 0·1 mm., *i.e.*, about one-third of the width of the $H\alpha$ line in the first order spectrum. The diameter of the monochromatic image of the sun's disc at the second slit is about 50 mm., of which a strip 6 mm. wide and 28 mm. long is rendered visible by the rotating rectangular prisms. The eyepiece used magnifies twice.

Measures of radial velocity are taken with the "line-shifter," whose scale from 0–10 divisions = 0·37 A. = 17 km./sec. at $H\alpha$. The zero of the $H\alpha$ line is determined from measures of the darkest part of the line in an undisturbed portion of the sun near the centre of the disc. The purpose of the observations being to locate large radial velocities, measured displacements are interpreted as being due to Doppler effects.

The probable error of a single measure of radial velocity, as determined from a number of successive readings, is about 3 km./sec., including the probable error of the zero determination. Three or four measures being generally made on each flocculus, the probable errors of the tabulated values in the third column of the following Table do not usually exceed 2 km./sec., except, perhaps in the case of the larger velocities which have accordingly been rounded off to the nearest 5 km./sec.

*A summary of observations made at Greenwich during 1930–33 of dark flocculi associated with sun spots is published in *Monthly Notices*, **94**, 472, 1934.

The systematic error for the smallest velocities observed is less than 1/2 km./sec., as is shown by measures of the Sun's equatorial rotation taken at the limbs.

In the following Table, the headings of which are self-explanatory, particulars are given of each dark flocculus as follows—

(1) The measured component of the radial velocity in km./sec., + indicating motion inwards to the sun and – outwards from the sun.

Where two values are given it is to be understood, unless otherwise stated in the footnotes, that different velocities were observed along the length of the flocculus, and that the tabulated values are the extreme velocities measured, which in nearly all cases correspond to the opposite ends of the marking. In those cases in which one end of a flocculus, showing progressive velocities along its length, appeared to touch a sunspot, the radial velocity observed at that extremity of the flocculus is printed in heavy type.

(2) (*a*) The apparent length of the flocculus in minutes of arc, read by means of a scale inserted in the field. An asterisk denotes that the marking was small and roughly circular in shape; during 1933 the diameters of these circular markings ranged from about 5″ to 15.″

(*b*) The apparent least distance in minutes of arc from the centre of the nearest sunspot or group of spots. In several cases, the position of the associated group was not located in the field, on account of the smallness of the spots or poor definition.

(*c*) The position of the flocculus relative to the group of associated sunspots or to a single component of the group. In cases where a sunspot has been designated in the *Ledgers* in the preceding *Results*, the letter *a* (the leader of the group) or *b* (the follower) has been appropriately added. The abbreviations *n*, *s*, *f*, *p*, *c*, stand respectively for, north, south, following, preceding, central.

(3) Particulars of the associated group of sunspots, abstracted from the General Catalogue, including the longitude from the Sun's central meridian at the time of observing the flocculus (deduced from the mean longitude of the sunspots).

A few notes have been added of unusual features seen at the time of observation. Flocculi which were apparently descending into sunspots with progressive velocities and which showed a definite curvature of shape are also noted.

OBSERVATIONS OF SOLAR FLOCCULI made with the SPECTROHELIOSCOPE in the YEAR 1933.

Dark Hα Flocculi.								Associated Group of Sunspots.					
Reference Number.	Date and Time.			Measured Radial Velocity km/sec.	Length.	Least Distance from Sunspot.	Position relative to Sunspot or Group.	Number of Group.	Longitude from Central Meridian.	Central Meridian. Passage.		Latitude.	Area.
		d	h		′	′			°			°	
1	Jan.	4	11·8	− 4	3·5	1·1	*sp*	11530	−61	Jan.	9·10	+10	196
2		6	10·1	−41	*	0·3	*p*	31	−49		10·15	+ 9	134
3		6	10·3	+37	*	0·2	*p*	31	−49				
4		6	10·3	−30	*	0·7	*np*	31	−49				
5	Jan.	9	10·7	−38	0·2	0·6	*np*	11531	− 9	Jan.	10·15	+ 9	134
5		9	10·8	−35 to +32	*	0·6	*np*	31	− 9				
6		9	11·2	+32	0·2	0·5	*f*	30	+ 5		9·10	+10	196
7		9	11·4	−30	0·2	0·7	*np*	30	+ 5				
8		9	12·5	+26	*	0·6	*np*	30	+ 6				
9		12	12·5	−12 to +3	2·0	0·4	*nf*	31	+31		10·15	+ 9	134
10	Jan.	28	10·6	+ 7 to +**48**	0·7	0·0	*c*	11534	−54	Feb.	1·53	+ 5	151
11		29	12·0	+34	*	0·4	*np*	34	−40				
12	Feb.	2	10·1	− 3 to −**43**	2·2	0·2	*na*	37	−65		7·35	+13	1117
13		2	10·3	+24 to +58	..	..	*f*	37	−65				
14		2	11·0	+19 to +**60**	1·0	0·0	*fa*	37	−64				
15	Feb.	2	11·7	+14	0·8	1·0	*nf*	11535	−39	Feb.	5·44	+10	107
16		2	11·8	+28	0·2	0·1	*f*	37	−64		7·35	+13	1117
17		2	11·9	− 4	0·7	1·5	*pa*	37	−64				
18		2	14·6	+18 to +43	0·4	0·3	*f*	37	−62				
18		2	14·8	+57				37	−62				
19		2	14·9	+23	0·2	0·5	*f*	37	−62				
20	Feb.	10	12·3	+80	1·0	1·5	*na*	11537	+42	Feb.	7·35	+13	1117
20		10	12·4	−36 to +90				37	+42				
21		11	9·8	−28	*	1·9	*n*	37	+54				
22		11	10·3	− 2	1·0	..	*p*	35	+79		5·44	+10	107
23		11	10·4	− 8	0·7	..	*f*	35	+79				
24		11	10·6	− 3	1·5	1·8	*nf a*	37	+54		7·35	+13	1117
25	Mar.	4	13·1	− 7	4·5	1·1	*f*	11541	−22	Mar.	6·18	+15	117
26		5	10·7	− 4	1·5	2·0	*nf*	41	−10				
27		5	10·9	− 1	2·5	0·8	*f*	41	−10				
28		6	14·9	0	3·5	1·5	*f*	41	+ 6				
29		7	9·6	− 2	3·3	0·7	*f*	41	+16				
30	Mar.	7	9·9	+25 to +**50**	0·7	0·1	*f*	11541	+16	Mar.	6·18	+15	117
31		8	9·8	− 3	4·3	0·7	*nf*	41	+29				
32		10	9·7	+37	*	0·3	*n*	41	+56				
33		10	10·0	− 1	3·2	0·3	*nf*	41	+56				
34		10	10·1	+12	2·5	1·0	*sf*	41	+56				
34		10	10·4	+27				41	+56				
34		10	10·9	−25				41	+56				
34		10	11·2	−13				41	+57				
35	Mar.	11	9·7	− 3	3·0	0·3	*nf*	11541	+69	Mar.	6·18	+15	117
36		23	9·8	+ 4 to +**39**	0·5	0·1	*np*	43	−62		28·08	+ 5	244
37		23	10·3	−43	0·3	0·8	*pa*	43	−61				
38		24	10·7	− 5	0·5	0·3	*nf a*	43	−48				
39		24	10·8	− 6	1·2	2·1	*sf*	43	−48				

OBSERVATIONS OF SOLAR FLOCCULI made with the SPECTROHELIOSCOPE in the YEAR 1933.

Dark Hα Flocculi.							Associated Group of Sunspots.					
Reference Number.	Date and Time.		Measured Radial Velocity km/sec.	Length.	Least Distance from Sunspot.	Position relative to Sunspot or Group.	Number of Group.	Longitude from Central Meridian.	Central Meridian. Passage.		Latitude.	Area.
	d	h		′	′			°			°	
40	Mar. 24	12·8	+34	0·4	0·6	*n a*	11543	−47	Mar.	28·08	+ 5	244
41	25	9·9	−17 to +60	1·0	..	*c*	44	+19		24·0	+10	63
42	27	9·7	−27 to +**35**	0·8	0·1	*p*	44	+45				
43	27	10·9	+37	0·8	0·8	*c*	44	+46				
44	28	10·0	0	0·3	0·7	*f a*	43	+ 5		28·08	+ 5	244
45	Mar 29	9·9	+ 5	0·8	0·4	*nf a*	11543	+18	Mar.	28·08	+ 5	244
46	29	9·9	− 1	1·0	0·7	*f a*	43	+18				
47	29	13·8	− 1	1·6	0·7	*sp a*	43	+20				
48	30	11·0	−25 to +32	1·0	1·0	*f a*	43	+31				
49	30	12·3	−35 to +48	0·5	0·6	*sf a*	43	+32				
50	Mar. 30	15·5	+32	*	0·7	*s a*	11543	+34	Mar.	28·08	+ 5	244
51	30	15·5	0	1·0	1·5	*sf a*	43	+34				
52	31	10·0	+ 9	2·0	0·9	*f a*	43	+44				
53	31	10·2	+29	*	0·6	*nf a*	43	+44				
54	31	10·6	+28	*	0·3	*sf a*	43	+44				
55	Mar. 31	11·1	+36	*	0·2	*nf a*	11543	+45	Mar.	28·08	+ 5	244
56	May 19	11·1	+ 4	0·2	0·5	*nf*	48	+19	May	18·0	+11	74
56	19	11·4	− 3 to +33				48	+20				
57	20	10·1	+30	*	0·5	*n*	48	+32				
58	22	9·0	−26	0·6	0·8	*c*	48	+58				
59	22	9·0	+36	0·5	0·4	*c*	48	+58				
60	May 22	9·1	+ 2	1·5	0·6	*p*	11548	+58	May	18·0	+11	74
61	23	8·8	− 1	0·2	..	*c*	49	−31		25·74	+ 9	12
62	23	9·0	0	0·7	1·3	*nf*	49	−31				
63	June 3	9·2	− 3	1·2	..	*c*	50	−62	June	8·1	− 7	8
64	6	8·9	− 1	2·1	..	*s*	50	−23				
64	6	9·3	− 6 to +14				50	−22				
65	June 14	9·5	+ 5 to +27	0·8	0·6	*c*	11551	−30	June	16·68	+ 6	112
66	July 7	9·5	0	1·2	..	*s*	52	−58	July	11·76	+ 8	25
67	8	9·4	+23	*	..	*n*	53	−67		13·4	+ 7	18
68	9	10·3	+ 1	1·2	..	*s*	52	−31		11·76	+ 8	25
69	9	11·3	− 6 to +24	0·5	..	*nf*	52	−30				
70	Sept. 6	9·3	+ 2	0·2	..	*c*	11556	+13	Sept.	5·4	−10	70
71	6	14·7	−14 to −80	2·5	1·5	*sf*	56	+16				
72	6	14·9	+17 to +**65**	1·2	0·0	*s*	56	+16				
72	6	15·4	+23 to +**65**				56	+16				
73	6	15·1	+37	2·5	0·5	*sf*	56	+16				
74	6	15·1	+37	2·0	3·5	*s*	56	+16				
75	Sept. 8	10·5	+ 3	1·0	0·3	*s*	11556	+40	Sept.	5·4	−10	70
76	9	9·3	+ 2	1·1	0·4	*s*	56	+52				
77	22	8·8	−16 to +41	1·0	0·2	*f*	57	− 4		22·70	+15	25
78	22	8·9	+21	0·7	0·7	*s*	57	− 4				
79	24	10·2	− 9 to + 4	1·2	..	*f*	57	+23				
80	Oct. 26	10·3	+32	0·9	0·0	*c a*	11559	− 5	Oct.	26·80	+ 9	180
81	26	10·4	−65	1·1	1·0	*p a*	59	− 5				
82	26	10·6	+18 to +**50**	0·5	0·0	*f a*	59	− 5				
83	26	11·9	− 6 to +**65**	1·5	0·0	*c*	59	− 4				
84	28	11·6	0 to +28	1·2	0·8	*nf a*	59	+22				

OBSERVATIONS OF SOLAR FLOCCULI made with the SPECTROHELIOSCOPE in the YEAR 1933.

NOTES.

Reference Number

2, 3, 4. Small circular dark markings associated with a small bright eruption 0′·6 *np* sunspot 11531.

5. First observed at $10^h\ 40^m$ when there were no signs of a + component which became visible at $10^h\ 45^m$; the position of the marking at +32 km./sec. was slightly north-east of that at −35 km./sec. At $11^h\ 2^m$, the markings have practically disappeared.

6. The marking lasts only 5 minutes. The region around sunspots 11530 and 11531 was kept under continuous observation from $10^h\ 26^m$ to $12^h\ 43^m$.

12. At the line-shifter reading = −43 km./sec., the dark marking appears to touch the penumbra of the sunspot. The direction of motion is contrary to that generally observed for a dark marking of this character in the immediate vicinity of a sunspot.

16, 18, 19. On February 2 a small bright eruption occurred *np* the following sunspot at $9^h\ 58^m$ and lasted for about ½ hour. At $14^h\ 55^m$ another short-lived bright eruption occurred in about the same place. The large group of spots was under almost continuous observation from $9^h\ 55^m$ to $12^h\ 0^m$.

20. This prominent dark marking was first seen at $12^h\ 18^m$ and had disappeared 22^m later. At the setting of the line-shifter = +80 km./sec. it appeared denser than the umbra of the large leading sunspot; at this time ($12^h\ 20^m$) it was not visible in the middle of the Hα line.

Reference Number

25. The radial velocity of −7 km./sec. applies to the marking as a whole; the *n* end of the marking had a velocity of +15 km./sec.

30. Direction of motion—inwards, counter-clockwise to the sunspot.

25, 26 & 27, 28, 29, 31, 33, 35. These measures refer to one marking that undergoes slight variation from day to day. On Mar. 10 at $9^h\ 48^m$ some very bright points of Hα flocculi appear for about ½ hour between Nos. 33 and 34.

34. The measure of radial velocity at $10^h\ 55^m$ showed quite clearly a change from + to − velocities.

36. Direction of motion—inwards counter-clockwise to small sunspot in the rear of the group.

65. On June 12 at 13^h, the region of this spot was represented by a patch of bright Hα flocculus containing a dark flocculus with measured radial velocity of +32 km./sec. to −52 km./sec. No sunspot was visible on the direct photograph of the sun taken at $14^h\ 4^m$ but the definition was rather poor.

72. Direction of motion—inwards clockwise to the following component of the group of sunspots.

74. This flocculus has been associated with sunspot 11556 because, although its position was well away from the spot and the associated bright flocculi, its appearance coincided with that of other dark flocculi Nos. 71, 72 and 73 that were obviously so associated.

83. As the line-shifter is turned from reading = −6 to +65 km./sec. a circular marking splits into two small components that appear to move in opposite directions each into a sunspot.

Printed under the Authority of HIS MAJESTY'S STATIONERY OFFICE, by C. TINLING & Co., LTD., Liverpool, London and Prescot.
Wt330/862 11.34 185 CT&CoLtd Gp330.

SUPPLIED FOR THE PUBLIC SERVICE.

GREENWICH PHOTO-HELIOGRAPHIC RESULTS

1933.