SOLAR ACTIVITY CATALOGUE
VOLUME 4
CATALOGUE OF SOLAR ACTIVITY DURING 1959

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Report No. 00.650 8 June 1965

Prepared under Contract NAS 9-2469
with LTV Astronautics Division
LTV Aerospace Corporation

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INTRODUCTION

CATALOGUE OF SOLAR ACTIVITY FOR THE YEAR 1959

INTRODUCTION

The data compiled in this volume of the Catalogue covers the year 1959.

The solar activity data have been arranged in eight tables, or catalogues:

I. Catalogue of Major Solar Flares and Related Terrestrial Effects
II. Catalogue of Important Sunspot Groups
III. Catalogue of Important Plage Regions
IV. Catalogue of Outstanding Solar Radio Emissions
V. Catalogue of Geomagnetic Storms
VI. Catalogue of Important Solar-Terrestrial Effects
VII. Catalogue of Balloon Flights
VIII. Chronological Catalogue of Major Solar Events

There is a considerable amount of duplication between the different catalogues. This has been done to keep cross references at a minimum without making the number of columns unwieldy. Each of these catalogues is described in detail in the subsequent sections and in the description of the tables. The data have been obtained from many sources. These are listed in Table 4.5, of references, pages

This work has been carried out at LTV Astronautics Division under NASA Contract NAS 9-2469. Dr. Helen Dodson-Prince and Miss E. Ruth Hedeman prepared the data for the Chronological Catalogue (Table VIII). In addition, they have made valuable contributions to the other tables through discussions and data contributions. Their work was supported by the Office of Naval Research.

We wish to express our appreciation to Dr. Howard for use of the Mt. Wilson daily work sheets of sunspot magnetic classifications. Mr. P. S. Laurie, of the Solar Department, Royal Greenwich Observatory, supplied a copy of the General Catalogue of Sunspots and the list of all spots with corrected maximum areas greater than 500 millionths of the solar hemisphere for the year 1959, prior to publication. Many of the authors listed in the reference table have generously supplied reprints of their papers and in some cases have made unpublished data available. Other scientists throughout the world have made valuable contributions through discussions and helpful suggestions during the period when many of the data were being obtained and the idea of a solar activity catalogue was generated.

1. Major Solar Flares During 1959

The IAU Quarterly Bulletin (reference 19) lists 3414 solar flares during the year with importances ranging from 1 to 3+. Reference 47 shows a total of 3704 flares from a count of flares reported in reference 10 for the year 1959. A spot check of some of the flares listed in reference 10 shows that in some cases two or more flares originally listed as separate flares were combined as single flares in reference 19. Similarly, reference 13 lists 3387 flares for the year 1959 that were reported in the Quarterly Bulletin (reference 19) with importance of 1 or greater. Again we find that in some cases two separate flares in reference 19 have been considered to be a single flare in reference 13. Two examples exist in our catalogue.

Flares 29 and 30 with importances 3+ and 3, respectively, in our catalogue are combined as a single flare (number 1388) in the McMath-Hulbert working list (reference 13) with importance 3+ starting at 2102 UT on May 10 and lasting beyond 2610 UT.

Similarly, major flares 44 and 45 on July 10 with starting times 0206 and 0539 UT, respectively, are considered to be a single flare (source number 2015) of importance 3+ starting at 0206 UT and still in progress at 1000 UT in the McMath-Hulbert working list.

For the purpose of this catalogue, a flare is classified as a major flare if at least one observatory reported it with an importance 3, or 3+, or at least two observatories reported it with importance 2+.

Because of the lack of uniformity among observatories in classifying flares, we have included the importance assigned to the flare in the McMath-Hulbert working list (reference 13).

Importance In the Catalogue	Importance in McMath-Hulbert Working List			
	Unchanged	Reduced to 3	Reduced to 2+	Reduced to 2
3+	6	5		1
3	19 + 2*		12	15
2+	11			3
	36 + 2*	5	12	19

*Flares 30 and 45 with importance 3 in the catalogue combine with 29 and 44, respectively, in the McMath-Hulbert list.

TABLE 4.1
Comparison of Flare Importance in this Catalogue with the McMath-Hulbert Working List

The 19 major flares reduced to a minor flare classification in the McMath-Hulbert working list are listed in Table 1-A.

Table 1-B lists the flares that were reported by only one observatory and assigned an importance 2+ by the observatory.

Table 1-C lists other flares that have an importance of 2+ in the McMath-Hulbert working list that are not included in the catalogue of major flares.

2. Sunspots During 1959

Our catalogue of Important Sunspot Groups During 1959 includes:

All sunspot groups with a maximum area greater than 500 millionths of the visible solar hemisphere based on unpublished data from the Royal Greenwich Observatory

All sunspot groups with an average γ or $\beta\gamma$ magnetic classification in the Mt. Wilson data sheets

All sunspot groups irrespective of area or magnetic classification that produced one or more of the major flares listed in Table 1.

The Royal Greenwich Observatory General Catalogue assigned serial numbers to 599 sunspot groups that lasted for 2 or more days during 1959, and listed 191 that lasted one day only for a total of 790 sunspot groups. During the same period Mt. Wilson Solar Observatory assigned serial numbers to 823 sunspot groups. Our catalogue of Important Sunspot Groups During 1959 lists 103 spot groups. This includes: 84 spot groups that in the Greenwich data had a maximum area of 500 millionths of the visible solar hemisphere or greater. Sixty-four of the large spots did not produce a single major solar flare. The remaining 20 large spots produced 55 of the major flares; 16 small spot groups produced a total of 19 major flares. Nineteen spot groups were given an average magnetic classification of γ or $\beta\gamma$ during disk passage by Mt. Wilson; 15 of these also had a maximum area greater than 500 millionths during disk passage. Eight of these large magnetically complex groups did not produce a major flare during disk passage.

These data are summarized in Table 4.2.

Spot Type	Number of Spots	Number Major Flares per Spot	Total Number Major Flares
Large Spots (L)	56	0	0
	8	1	8
	2	2	4
	1	3	3
	1	5	5
	1	8	8
Large and Magnetically Complex L.M.	8	0	0
	4	2	8
	1	4	4
	1	7	7
	1	8	8
Total Large Spots with Major Flares	20		55
Small, Magnetically Complex (M)	3	0	0
	1	2	2
Small Spots	13	1	13
	2	2	4
Sunspots with Major Flare	36		74
Sunspots without Major Flares	67		0
	103		74

TABLE 4.2
Major Flare Distribution
Among Spot Groups During 1959

3. Important Plages During 1959

Our catalogue of important plage regions includes:

All plages that produced one or more major solar flares.

Plages that had an average maximum area equal to or greater than 10,000 millionths of the visible solar hemisphere (L).

Plages that during disk passage had an average brightness of 3.5 or greater (B).

Plages that produced 30 or more flares of importance 1 or greater during disk passage (N).

Fifty-six of the approximately 574 plages that crossed the central meridian during 1959 satisfy one or more of the requirements listed above and are included in the catalogue. Thirty-five of these produced one or more major flares. Thirty-one of the plage regions were flare productive; they produced 1545 flares of importance 1 or greater, approximately 45% of all flares reported in the IAU Quarterly Bulletin. Nineteen of the flare productive regions produced 56 of the major flares (approximately 75%) and 30% of all flares.

A summary of the flare productive regions by plage age is given in Table 4.3.

Age in Rotation	1	2	3	4	5	6	7	Total
Number Flare Productive Plage Regions	9	3	6	5	4	3	1	31
Number Major Flares in N Regions	10	8	5	15	13	5	0	56
Number All Flares	426	315	268	181	160	148	47	1545

TABLE 4.3
Summary of Flare Productive Plage Regions by Age

Age in Rotation	1	2	3	4	5	6	7	Total
Unproductive Plages With Major Flares	3	6	3	2	1	0	1	16
Major Flares Unproductive Plages	3	6	5	2	1	0	1	18
All Flares Unproductive Plages	25	96	51	41	26	0	2	241

TABLE 4.4
Major Flares Associated with Unproductive Plage Regions

Table 4.4 summarizes the association of the remaining 18 major flares with the unproductive plage regions by age in rotations.

4. Important Radio Emissions From the Sun During 1959

We have limited this portion of the catalogue to spectral observations Type II (slow drift) and Type IV (broad band continuum) and radio emissions at discrete frequencies between 167 Mc/s and 9400 Mc/s. Because of the gap between approximately 0600 and 1300 UT when there is no sweep frequency patrol of the sun, we have included available data on Type IV emissions derived by Pick-Gutmann (reference 38), and Sinno (reference 47) from fixed-frequency observation. The sweep frequency data have been obtained from the IAU Quarterly Bulletin (reference 19), lists prepared by CSIRO, Sydney, Australia, and Maxwell, et.al. at Fort Davis (reference 32). We wish to point out that there are no spectral Type II (slow drift) data for the period between approximately 0600 and 1300 UT.

Data for the fixed-frequency observations have been obtained from the IAU Quarterly Bulletin, and the Bulletin of Solar Phenomena published quarterly by the Tokyo Astronomical Observatory (reference 49).

5. Geomagnetic Storm During 1959

A comprehensive search of the literature fails to reveal a universal list of geomagnetic storms or agreement on starting times. In the case of moderately severe and severe sudden commencement storms the variation of starting times reported by the magnetic observatories seldom differ by more than a few minutes; on the other hand, some observatories will report a storm duration of two or more days, while others may report two

or more storms during the period. In the case of geomagnetic storms with a gradual beginning the start times may differ by several hours. The catalogue of geomagnetic storms has been limited to those storms that reached a planetary three-hour index K_p of 5 or greater. We have included, in some cases, a probable solar flare association. In each of these cases the storm-flare association has been given in the scientific literature as indicated in the reference or source column of the table.

6. Solar-Terrestrial Effects During 1959

This portion of the catalogue is limited to short wave radio fadeouts (SWF) selected geomagnetic storms, solar flare effects (SFE), polar-cap absorptions, and Forbush decreases.

6.1 Short Wave Radio Fadeouts

In the case of the SWF we have included those of importance 3 or greater that lasted for 30 minutes or more, and those that occurred at the time of a major flare, irrespective of their importance or duration.

6.2 Geomagnetic Storms

In general, the geomagnetic storms listed in this portion of the catalogue are limited to those that have been classified as moderately severe (K_p = 6 or 7) and severe (K_p = 8 or 9). A few moderate storms (K_p = 5) have been included if in the literature they have been associated with a flare (irrespective of the flare importance)or a polar-cap absorption.

6.3 Solar Flare Effects

Solar flare effects (SFE) (magnetic crochets) have been taken from reference 4. They are limited to those that were unmistakable or definitely SFE's.

6.4 Polar-Cap Absorptions

A number of papers in the scientific literature have discussed polar-cap absorption and their correlation with solar flares, solar radio emissions, Geomagnetic storm and other terrestrial effects. There is, in general, good agreement between the different investigators, although the choice of the flare responsible for the PCA is, in some cases, not unique. These are cases when two or more flares of importance 2 or greater take place within the acceptable time limit.

6.5 Forbush Decreases

The list of Forbush decreases in the catalogue were obtained from data published in references 27, 27a and 28, and unpublished data kindly supplied by Dr. Carmichael from the Chalk River Nuclear Laboratories (reference 41).

7. Catalogue of Balloon Flights

Of the 263 balloon flights during 1959 and reported to the IGY World Data Center A for cosmic rays, 164 were made within four days after a major solar flare, a solar spectral emission of Type II or Type IV, or a polar-cap absorption. Seventy-eight of the flights were made in the USSR. The USSR flights carried single Geiger-Muller counters.

8. Chronological Catalogue of Major Solar Events During 1959

This table summarized many of the data contained in Tables I through VI of the catalogue. However, Tables I through VI give many events and more detailed data than was possible in Table VIII. In Table VIII flares were limited to those of importance 3 or 3+ in the McMath-Hulbert working list (reference 13) and those of lower importance that were unquestionably associated with a flare effect.

The criteria for inclusion as a major event (indicated by an asterisk) are as follows:

8.1 Flares of importance 3 or 3+ in the McMath-Hulbert working list (reference 13).

8.2 Short-wave fades of importance 3 or 3+ that lasted for 30 minutes or more.

8.3 10 cm. radio emissions with a peak flux of 500 or more (units of 10^{-22} Wm^{-2} $(c/s)^{-1}$).

8.4 Plage Regions that were the sources of 30 or more flares (of all importances) during disk passage.

8.5 Sunspot Groups that had a mean area of 1000 millionth of the visible solar hemisphere, based on Greenwich Observatory data (reference 42) or had a $\beta\gamma$ or γ magnetic classification during disk passage.

8.6 Dynamic spectral emissions includes outstanding Type I and Type III bursts reported in the IAU Bulletin, and all Type II and Type IV bursts included in the Maxwell, Hughes and Thompson Catalogue of Type II and Type IV Solar Radio Bursts (reference 32).

8.7 Polar-cap absorptions included in Bailey's catalogue (reference 1) and those weak events generally reported in the literature from Riometer recordings.

In addition to these major events, the catalogue includes:

8.8 200 Mc/s radio emissions that occurred at the time of other solar events.

8.9 Radio emissions at other frequencies unquestionably associated with other solar events.

8.10 Geomagnetic storms.

8.11 All events of lower importance that are definitely or reasonably associated with one or more of the major events.

8.12 Notes and comments concerning some of the major solar-terrestrial events are given on pages 4.VIII-viii through 3.VIII-xiv.

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TABLE 4.5 SOURCES AND REFERENCES 1959 SOLAR ACTIVITY CATALOGUE

						SOLAR PHENOMENA			RADIO EMISSIONS			SOLAR-TERRESTRIAL EFFECTS					
Ref. No.	Author	Publication	Vol.	Year	Pages	Plage	Sun Spot	Flares	II	IV	Single Freq.	SWF	PCA	Forbush Decrease	Geomag. Storm	K_p	SFE
1	Bailey	Planet Space Sci.	12	1964	495-541								(X)				
2	Bailey	J. Phys. Soc. Japan	17-AI	1962	106-112			X				X	(X)				
3	Balloon Flight	Annals IGY	28		663-676												
4	Bartels, Romana, & Veldkamp	IAGA Bulletin	12n	1963	10-14, 63-64										(X)	(X)	(X)
5	Bartels	IAGA Bulletin	18	1962												(X)	
6	Besprozrannaya	J. Phys. Soc. Japan	17-AI	1962	146-149								(X)				
7	Boorman, et. al.	M.N. Royal Astron. Soc.	123	1961	87-96			X	(X)								
8	Caroubalos	Ann. Astrophys.	27	1964		*		X		X	X		X		X		
9	Collins, Jelley, & Matthews	Can. J. Phys.	39	1961	35-52								(X)				
10	CRPL	Solar Geophys. Data	174-185	1959		(X)		(X)	(X)	(X)	X	(X)				X	
11	CSIRO	Monthly Reports						X	(X)	(X)							
12	DeFeiter	Planet. Space Sci.	2	1960	223-227			X							(X)	X	
13	Dodson & Hedeman	IGY Solar Activity Report	15	1961				(X)									
14	Dodson & Hedeman	Plage Catalogue	To be published			(X)											
15	Dodson & Hedeman	Planet. Space Sci.	12	1964	393-418		X	X	X	X		(X)	X				
16	Dvoryashin, et. al.	Soviet Astron, A.J.	5	1961	311-325			X		X			X		(X)		
17	Haurwitz	J. Geophys. Res.	67	1962	2979-2982			X							X		
18	Hughes	J. Geophys. Res.	66	1961	651-653				(X)	(X)							
19	IAU	Quarterly Bulletin	125-128	1960		*		(X)	(X)	(X)	(X)						
20	Jelley & Collins	Can. J. Phys.	40	1962	706-7.8								(X)				
21	Jenkins & Paghis	Can. J. Phys.	41	1963	1056 1073								(X)				
22	Kahle	U. Alaska Geophys. Report	R-13	1961				X		(X)			(X)		X		
23	Laurie & Finch	Observatory	80	1960	78-80										(X)		
24	Leinbach	U. Alaska Geophys. Report	R-127	1962									(X)				
25	Lincoln	J. Geophys. Res.	64 65 66	1959 1960 1961	1357 281, 795, 1323 314										(X) (X) (X)		
26	Lincoln & Romana	J. Geophys. Res.	65	1960	1317, 1821, 2959										(X)	X	(X)
27a	Lockwood, & Razdan	J. Geophys. Res.	68	1963	1581-1591			X					X	(X)	X		
27	Lockwood	J. Geophys. Res.	65	1960	3859-3880			X					X	(X)	X		
28	Maeda, et. al.	Ann. Geophys.	18	1962	305-333			X			X	X		X	(X)		
29	Malitson	NASA-TR	R-169	1963	109-117			(X)		(X)			(X)		X		
30	Malville & Smith	J. Geophys. Res.	68	1963	3181-3185		X	X		(X)							

*Meudon Solar Regions

TABLE 4.5 1959 (CONTINUED)

						SOLAR PHENOMENA			RADIO EMISSIONS			SOLAR-TERRESTRIAL EFFECTS					
Ref. No.	Author	Publication	Vol.	Year	Pages	Plage	Sun Spot	Flares	II	IV	Single Freq.	SWF	PCA	Forbush Decrease	Geomag Storm	Kp	SFE
31	Matres & Pick	Ann. Astrophys.	25	1962	293-300		X	(X)			X						
32	Maxwell, Hughes & Thompson	J. Geophys. Res	68	1963	1347-1354			X	X	X							
33	Mt. Wilson Observ.	Microfilm					(X)										
34	Noyes	J. Phys. Soc. Japan	17-AII	1962	275-280		X	X					(X)		X		
35	Obayashi & Hakura	J. Geophys. Res.	65	1960	3143-3148			X		X			(X)		X		
36	Obayashi & Hakura	Rep. Ionosph. Space Res. Japan	14	1960	1-40					X			X		(X)		
37	Ortner et. al	J. Geophys. Res.	67	1962	4169-4186			X					X		X		
38	Pick-Gutmann	Ann. Astrophys.	24	1961	183-210					(X)	X						
39	Pisharoty & Srivastava	J. Geophys. Res.	67	1962	2189-2192										X		
40	Reid & Leinbach	J. Geophys. Res.	64	1959	1801-1805			X					(X)				
41	Robertson, R. & M. Kodama	Atomic Energy of Canada	Chalk River unpublished											(X)			
42	Royal Greenwich Observatory	To be published					(X)										
43	Sarabhai & Pai	J. Phys. Soc. Japan	17-AII	1962	286-289			X					X		X		
44	Science Council Japan	Cosmic Ray Intensities	7	1963										(X)			
45	Shafer & Sokolov	NASA TT	F-126	1964	187-193									(X)	(X)		
46	Shapley & Lincoln	Annals of IGY	16-3	1962	201-289			X		X		X		X	X	X	
47	Sano	J. Geomag. Geoel.	13	1961	1-10			X		X			X		(X)		
48	Smith, H. J.	AFCRL Res. Note	62-827	1962	38 pp			(X)									
49	Tokyo Astron. Obs.	Quart. Bull. Solar Phenom.	11				(X)	X			(X)						
50	Troitskava, et. al.	J. Phys. Soc. Japan	17-AII	1962	63-70										(X)		
51	Waldmeier	Pub. Eigenoss, Sternwarte Zurich	Sunspot Activity 1910-1960				(X)										
52	Waldmeier	Heliogr. Karten Photosphere	11		89-115	*	(X)										
53	Warwick, C.	IGY Solar Act. Rep.	To be published					(X)									
54	Warwick, C. & Haurwitz	J. Geophys. Res.	67	1962	1317-1332			X			X		(X)				
55	Weiss	Aust. J. Phys.	16	1963	240-271			X	(X)								

*Meudon Solar Regions

I. CATALOGUE OF MAJOR SOLAR FLARES DURING 1959

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TABLE I. CATALOGUE OF MAJOR SOLAR FLARES DURING 1959

The meaning of the various columns and a description of the data contained in Table I - Catalogue of Major Solar Flares, are given below.

A major flare is defined as a flare which has been reported with importance 3 or 3+ by at least one solar observatory, or with importance 2+ by at least two observatories and published in the Quarterly Bulletin of the IAU (reference 19).

Column 1 — Major Flare Serial Number.

Column 2 — Solar Event Serial Number. This is the event number assigned to the solar or terrestrial event in the Chronological Catalogue, Table V-T.

Column 3 — Greenwich Date of the Flare.

Column 4 — Beginning of the Flare U.T. This is the earliest time reported in the IAU Bulletin. If the observatory reported that the start of the flare was observed, the fact is indicated by underlining the start time.

Column 5 — End Time U.T. This is the latest reported end time in the IAU Bulletin. If the end of the flare was observed, the end time is underlined.

Column 6 — Time of Maximum. Since different observatories often report different maximum times for the same flare, the time (or in a few cases, times) entered in this column has been taken from reference 13.
In general, the tabulated time is the arithmetic mean of the reported times of maximum for all observations that covered the principal maximum of the flare. If a second time is given, there is an indication that a secondary maximum may have occurred as indicated by two well developed phases or that several observers reported them as two separate flares.

Column 7 — Position. The heliographic position given in the catalogue are arithmetic means of the values reported in the IAU Bulletin. A reported value is excluded in deriving the mean if the value deviates by a large amount from the other reported positions.

Column 8 — Plage Number. This is the serial number of the McMath plage in which the flare occurred.

Column 9 Active Region. This is the serial number assigned to active regions by the Meudon Observatory in the IAU Quarterly Bulletin. The numbering starts with one at the beginning of each quarter. It will be noted that there is not always a one to one correspondence between the plage and the active region; a plage may cover two or more regions.

Column 10 Mt. Wilson Serial Number of Sunspot Group Where the Flare Occurred. Occasionally a flare occurs between two groups and two spot numbers are recorded.

Column 11 Greenwich Serial Number of the Spot Group.

Column 12 Flare Importance. This is the maximum importance reported for the flare in the IAU Quarterly Bulletin.

Column 13 No. Rep./No. Max. This column gives the number of observatories reporting the flare in the IAU Bulletin and the number that reported it with the maximum importance. Occasionally an observer reports the same flare two or more times. These separate reports are all considered in the selection of the start, end, and maximum times use in Columns 4, 5, and 6, but only once for the number of reports. The number of observers reporting the flare with the importance shown in Column 12 is indicated by the second number in this column.

Column 14 This column gives the importance assigned to the flare in reference 13.

FLARE AREA SQUARE DEGREES

Column 15 The range of areas reported in the IAU Quarterly Bulletin: Smallest area and largest area.

Column 16 Number of Observatories Reporting an Area

Column 17 The Arithmetic Mean of the Reported Values

RELATED FLARE ACTIVITY

Column 18 Other Flares. This column lists the number of minor and major flares associated with the active region during disk passage (IAU active region, reference 19) before and after the major flare.

Column 19 This column gives the heliographic longitude (or central meridian distance) of the first flare associated with the region and the importance of the first flare. For example: E90/2 indicates that the first flare occurred at E90, and at least one observatory reported it with an importance 2.

Column 20 Short Wave Radio Fadeouts (S.W.F.). Short wave radio fadeouts associated with major flares are listed with the following notation: Beginning/Duration in minutes/ importance. Complete data for S.W.F.'s of importance ≥ 3 that lasted 30 minutes or more are given in Table VI, Catalogue of Solar-Terrestrial Effects.

Column 21 Solar Radio Emissions at 10 cm. Peak flux reported at approximately 10 cm. wave length. (The frequencies may be 2800, 2980, or 3000 Mc/s.) Detailed data for important solar radio emissions are given in Table IV, Catalogue of Solar Radio Emissions. The information given in Columns 21-23 is limited to an indication of the radio activity of the region at the time of the flare.

Column 22 Peak flux reported at 1.5 m. wave length (200 Mc/s). If the peak flux was reported as greater than the recorded flux, the recorded flux preceded by > . When the flux given in Columns 21 or 22 represents a smoothed flux (peak flux not reported), the value is enclosed in a bracket.

Column 23 Emissions at Other Wave Lengths. The notation cm. in this column indicates that emissions are reported (and given in Table IV at one or more frequencies greater than 600 Mc/s (except approximately 3000 Mc/s). Similarly, the notation m. indicates that emissions are reported at frequencies less than 600 Mc/s (except 200 Mc/s) and detailed data are given in Table IV.

Column 24 Dynamic Spectral Emissions. The notation II or IV in this column indicates that emissions of Type II (slow drift), or broad band continuum, Type IV, are reported by either the Sweep Frequency Observatory at Sydney, Australia, or the Harvard College Radio Observatory at Fort Davis, Texas.

If no spectral observations are reported, but a broad band continuum, Type IV, has been derived from discrete frequency observations by one or more of several investigators, the symbol has been enclosed in a bracket - (IV). (Detailed data are given in Table IV.)

SOLAR TERRESTRIAL EFFECTS

Column 25 Polar-Cap Absorption. Polar-cap absorptions reported within a reasonable time after a major flare (generally between one and seven hours) are listed. The data in this column are limited to: Greenwich day/beginning time U.T./absorption in db. Additional data, including references, are given in Table VI, Catalogue of Solar-Terrestrial Effects.

Column 26 Geomagnetic Storms. Geomagnetic storms with a maximum Kp $\geq 5-$ reported by three or more observatories within a reasonable time after the major flare (generally between twelve and seventy-two hours). The data in this column are limited to: Greenwich day/onset time, U.T./type/degree of activity/maximum reported Kp. Additional data, including: references, duration, number of reports, etc. are given in the Catalogue of Geomagnetic Storms, Table V, and the Catalogue of Solar-Terrestrial Effects, Table VI.

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TABLE I CATALOGUE OF MAJOR SOLAR FLARES DU

		MAJOR FLARE						SOLAR REGION				FLARE IMPORTANCE			FLARE AREA SQ-T	
Serial No.	Event No.	Date	Beg. UT	End UT	Max Time	Position		Flare No.	Active Region	Sunspot No. Mt.Wilson	Sunspot No. Green-wich	IAU	No Rpt. Max.	No Rpt. McM	Range	No Rpt.
1		Jan. 5	1040	1220	1105	N26	E27	4951	19	13641	19110	2+	7/2	2	2-9	5
2		21	1700	1750	1709	N10	E48	4976	41	13883	19146	3	2/1	3	9-10	2
3		22	1108	1147	1127	N08	W03	4973	37	13877	19140	3	6/1	2	2-33	6
4	12	26	0842	1030	0900	N16	W61	4969	34	13878	19141	3	9/1	3	5-13	7
5	13	26	1627	1315	1050	N16	W61	4969	34	13878	19141	3	8/2	3	3-20	8
6		27	1340	1520	1430	N08	W60	4973	37	13877	19140	2+	11/4	2+	4-24	10
7	15	Feb. 01	0357	0458	0423	N17	E83	4997	50	13913	19174	3	1/1	3	-	-
8	16	02	1015	1227	1039	N22	W30	4983	48	13897	19157	3	7/3	3	8-20	6
9	17	02	1816	2019	1824	N09	E60	4997	59	13913	19174	3	3/2	3	12-14	2
10		09	0735	1545	0955	N09	E88	5009	67	13929	19183	3	11/4	2+	-	-
11		10	0800	1530	-	N09	E73	5009	67	13929	19183	3	6/1	2	6-14	4
12	28	12	2301	2515	2325	N13	E48	5009	67	13929	19183	3+	2/1	3	24-35	2
13		18	1005	1020	-	N21	E76	5023	79	13940	19197	3	1/1	3	15	1
14		18	1142	1150	-	N21	E76	5023	79	13940	19197	3	1/1	3	15	1
15	36	19	2032	2244	2037	N11	W10	5016	73	13931	19188	3	3/1	3	7-13	3
16		Mar. 19	1035	1205	1053	N28	W18	5054	111	13984	19234	3	14/1	2+	5-21	12
17		21	0900	1127	0916	N15	W42	5052	109	13995	19236	3	16/1	2	2-19	13
18		24	0700	0908	0737	N19	W04	5060	118	14001	19246	3	8/1	2+	9-17	7
19	53	24	0958	1325	1015	N29	W77	5054	111	13984	19234	3	16/7	3	6-22	2
20	56	28	2115	2315	2126	N24	W33	5061	123	14004	19249	3	5/3	3	7-21	3
21		Apr. 04	0640	0956	0800	N15	W44	5071	5	14020	19258	3	12/2	2+	5-25	9
22	59	05	2316	2519	2327	N16	W67	5071	5	14020	19258	3+	4/2	3+	23-102	3
23	60	08	0903	1010	0921	N27	E85	5093	18	14050	19284	3	9/3	3	19	1
24		11	0807	0933	0838	N28	E46	5093	18	14050	19284	3	12/1	2	3-14	7
25		12	1104	1225	1117	N26	E30	5093	18	14050	19284	3	10/2	2+	8-30	9
26	65	13	0823	0935	0840	N27	E19	5093	18	14050	19284	3	16/2	3	2-19	13
27		May 08	2252	2322	2257	N23	E86	5148	60	14121	19335 19336	3	2/1	2+	-	-
28	74	09	0123	0212	0150	N20	E78	5148	60	14121	19335 19336	3	1/1	3	-	-
29	76	10	2055	2610	2140	N19	E47	5148	59	14121	19335 19336	3+	5/3	3+	75-109	3
30		10	2315	2520	-	N19	E51	5148	60	14121	19335 19336	3	2/2		24-27	2
31	78	11	2006	2150	2028	N10	E41	5148	59	14121	19335 19336	3+	4/1	3	7-36	3
32		12	0655	0801	0708	N10	W22	5146	53	14113	19325	2+	5/2	2	4-9	4
33		13	0457	0553	0514	N22	E26	5148	60	14121	19335 19336	2+	6/4	2+	9/13	4
34		13	0920	1256	0925	S10	E90	5156	65	14138	19344	3	5/1	2		-
35		13	1554	1650	1610	N14	E18	5148	59	14121	19335 19336	3	5/1	2	5-12	4
36		17	0523	0600	0527	N21	W30	5148	60	14121	19335 19336	3	2/1	2+	4	1
37		June 11	1802	2130	1807	N17	E78	5204	92	14211	19396	3	4/1	2	4-15	3
38		12	0734	1159	0851	N21	E65	5204	93	14211	19396	3	12/1	2+	5-36	9
39		15	0232	0420	0302	N20	E28	5204	92	14211	19396	3	3/1	2+	8-16	3
40	99	16	0618	0810	0643	N15	E15	5204	92	14211	19396	3	9/5	3	4-27	8

4.1-1 0

IRING 1959 WITH ASSOCIATED PHENOMENA AND SELECTED EFFECTS

EC	RELATED FLARE ACTIVITY			S.W.F.	RADIO EMISSIONS				PCA	GEOMAGNETIC STORMS
Mean	Minor Major Before	After	1st Flare Pos/Imp	Beg Dur/Imp	Peak Flux 10 cm	1.5m	Other Wave Lengths	Dynamic II & IV	Gr Day Beg UT Abs db	Gr Day Beg UT Type Int Max K
5	0/0	5/0	E 27/2+				cm,m		Jan. 05 xxxx 1.6	
10	12/0	22/0	E 85/1+	1702/41/2+	600	230		II		
10	10/0	33/1	E 90/1+		475	500	cm, m			Jan. 25 0859 sc m 4+
9	24/0	1/1	E 64/1	0855/20/2	964	-	cm, m			
10	24/1	1/0	E 64/1		1099	-	cm m	(IV)		
9	37/1	6/0	E 90/1+	1428/27/2	(120)	-	cm			
-	1/0	19/1	E 90/2+	0422/28/3-	-	3500	cm, m			
14	15/0	3/0	E 76/1							
13	9/1	11/0	E 90/2+	1817/85/3	(120)	540	m	II		
-	2/0	41/2	E 90/2	0952/52/3	-	-	m			Feb. 11 0318, sc ms 6+
11	10/1	33/1	E 90/2		-	-	cm, m			
30	29/2	14/0	E 90/2	2308/40/2	-	470	cm, m	IV		14 1142, sc/ms 6-
15	0/0	12/1	E 76/3		-		cm, m			
15	0/1	12/0	E 76/3		-	-				
10	11/0	4/0	E 90/1	2030/40/1+	-	(200)	m	(IV)		22/0046/sc/m/4+
9	45/0	30/1	E 65/1	1058/27/2	-	-	cm, m			
7	35/0	13/0	E 90/1	0912/37/3	350	-	cm, m			
12	6/0	0/0	E 90/1	0738/41/3	371	100	cm. m	(IV)		
14	75/1	0/0	E 65/1	1002/107/3	1729	-	cm, m	(IV)		Mar. 26/0842/sc/s/8+
13	13/0	3/0	E 33/1+	2121/24/1+	(100)		cm			
13	14/0	20/1	E 48/1	0748/42/2			m			
51	24/1	6/0	E 48/1	2317/93/3+	-	-	cm			
19	0/0	35/3	E 85/3	0913/32/2+	2150	500000	cm, m			Apr. 09/1823/sc/s/8-
8	8/1	27/2	E 85/3	0839/26/2	429		cm, m			
12	10/2	25/1	E 85/3	1110/17/1+	370	500	cm, m			
10	15/3	20/0	E 85/3	0835/25/2	314	-	cm, m			
-	6/0	39/4	E 90/2+	2258/22/2	1500	(2200)	cm, m	II, (IV)		
-	9/1	36/1	E 90/2+		-	3200	-			
70	9/0	6/2	E 89/1+	2110/560/3+	(2500)	1050	cm, m	II, IV	May 10/2300/15	May 11/2328/sc/s/8+
26	21/2	24/2	E 90/2+							
18	10/1	5/1	E 89/1+	2015/67/3-	(900)	1600	m	II, (IV)		
7	11/0	11/0	E 54/1	0705/39/2	-	350	cm,			
11	31/3	14/1	E 90/2+	0511/36/2	-	1800	cm, m	II, IV		15/0703/sc/ms/6o
-	0/0	9/0	E 90/2		-	-	cm, m			
9	11/2	4/0	E 89/1+	1600/30/1+			cm, m			
4	39/4	6/0	E 90/2+	0525/35/2+		17000	cm	(IV)		
9	8/0	52/5	E 90/2	1803/122/2+	(110)	500	cm, m			
15	0/0	3/0	E 65/3	0755/83/1	396	1200	cm, m			
16	21/1	40/4	E 90/2	0235/35/2	-	-	cm.			
18	30/3	30/3	E 90/2	0623/34/2	-	-	cm	(IV)		

4.11 (2)

		MAJOR FLARE						SOLAR REGION				FLARE IMPORTANCE			FLARE AREA SQ-D		
										Sunspot No.							
Serial No.	Event No.	Date	Beg Time UT	End Time UT	Time Max.	Position		Plage No.	Active Region	Mt. Wilson	Green-wich	IAU	No Rpt/No Rpt Max.	McM	Range	No Rpt.	M
41		17	1421	1604	1441	N16	W02	5204	92	14211	19396	3	15/1	2	3-15	13	
42	100	18	1134	1300	1148	N16	W12	5204	92	14211	19396	3+	7/1	3+	22-40	6	
43		22	1010	1140	1035	N18	W37	5204	92	14211	19396	3	11/1	2	5-54	8	
44	109	July 10	0206	0538	0230	N20	E63	5265	20	14284	19448	3+	4/4	3+	32-74	4	
45		10	0539	1000	-	N19	E58	5265	20	14284	19448	3	5/3		3-65	5	
46		12	2134	2420	2230	N19	E24	5265	20	14264	19448	3	6/[illegible]	2+	7-21	6	
47	112	13	0255	0605	0410	N15	E18	5265	20	14284	19448	3	1/1	3	45	1	
48	113	14	0325	1121	0349 0527	N17	E04	5265	20	14284	19448	3+	20/7	3+	2-72	17	
49	115	14	1400	1730	1452	S25	E37	5273	24	14290	19452	3+	14/1	3	5-28	12	1
50	117	16	1525	1715	1616	N14	W27	5265	20	14284	19448	3+	8/1	3	6-21	8	1
51	118	16	2114	2430	2128	N16	W30	5265	20	14284	19448	3+	3/1	3+	22-40	3	2
52		20	0559	0621	0604	N20	W87	5265	17	14284	19448	3	5/1	1	-	-	-
53	124	27	2050	2250	2115	N27	E26	5291	35	14314	19466	3	6/2	3	4-21	6	1
54		29	2020	2234	2047	N[illegible]	E21	5294	42	14320	19470	3	3/1	2	5-21	3	1
55	126	29	2117	2243	2120	N15	E22	5294	42	14320	19470	2+	3/2	2+	3-12	3	
56		Aug. 04	1028	1113	1048	N04	W12	5300	45	14330	19477	3	4/1	2	2-21	4	
57	130	11	1203	1234	1209	N20	W24	5315	57	14343	19487	3	6/1	2	2-19	6	
58	137	18	1014	1411	1030	N12	W33	5323	66	14356	19498	3	17/2	3	3-30	14	1
59		18	1654	1822	1725	N05	E16	5329	72	14366	19503	2+	5/4	2+	8-17	5	1
60		24	2233	2332	2239	N17	E28	5339	79	14382	19518	2+	2/2	2+	9-21	2	1
61		25	0457	0522	0502	N00	W64	5329	72	14366	19503	3	2/1	2	10-48	2	2
62		25	0623	0740	0634	N20	E01	5336	77	14378	19512	3+	10/1	2	6-35	8	1
63		31	2222	2332	2252	S08	W46	5340	82	14389	19522	2+	3/3	2+	5-20	3	1
64		Sept. 01	1648	1832	1705	S12	W52	5340	82	14389	19522	3	8/2	2+	6-25	6	1
65	148	01	1923	2216	1948	N12	E60	5354	-	14414	19537	2+	3/3	2+	7-21	2	1
66	150	02	0720	0954	0745	N10	W10	5344	90	14400	19529	3	13/4	2	3-13	11	
67	151	02	1602	1645	1606	N25	W77	5339	80	14396	19519	2+	8/2	2	-	-	-
68		Oct. 10	0457	0624	0501	S18	W53	5401	6	14485	19583	3	4/1	2	3-27	4	1
69	184	Nov. 26	0923	1156	0937	S15	W17	5467	51	14571	19646	2+	8/4	2+	4-21	7	1
70	186	28	2006	2130	2018	N12	E31	5476	56	14579	19651	3	3/2	3	11	1	1
71	187	29	1816	2012	1848	N09	E18	5476	56	14579	19651	2+	4/2	2+	7	1	
72	190	30	1720	1906	1744	N07	E06	5476	56	14579	19651	3	5/4	3	12	1	1
73	192	Dec. 01	1638	2035	1709	N09	W05	5476	56	14579	19651	2+	4/2	2+	-	-	-
74	194	02	1219	1412	1229	N07	W16	5476	56	14579	19651	2+	2/2	2+	9-14	2	1

4.1-2 0

.E I 1959 (CONTINUED)

EG	RELATED FLARE ACTIVITY			S.W.F.	RADIO EMISSIONS				PCA			GEOMAGNETIC STORMS				
	Minor Major															
ean	Before	After	1st Flare Pos Imp	Beg Dur Imp	Peak Flux 10 cm	1.5m	Other Wave Lengths	Dynamic II & IV	Gr Day	Beg UT	Abs db	Gr Day	Beg UT	Type	Max Int	Kp
8	36 3	24/2	E 90, 2	1430, 45 2-			cm, m									
26	41 4	19/1	E 90/2	1138, 22 2+	(1225)	-	cm	(IV)								
17	59/5	1/0	E 90/2	1028 30/2	383	-	cm									
4	9 0	55/6	E 88/1+	0200/190/3+	-	-	cm, m	II, (IV)	July 10/0400/15			July 11/1625/sc/ms 7-				
23	9/1	55/5	E 88/1+	0605/155. 3+	-	-			10 0700/20							
12	25/2	40/4	E 88/1+	2220, 100/2-	(80)	-	cm									
45	25/3	40/3	E 88/1+		346		-									
25	30/4	35/2	E 88/1+	0328/180/3+	-	10000	cm, m	II, IV	14/0730/23.7			15/0803/sc/s/9o				
6	9/0	2/0	E 78/1+	1355/105/2+	(85)	-	cm									
1	52/5	13/1	E 88/1+	1610/28/2-	(350)	200	cm, m	II								
8	52/5	13/0	E 88/1+	2118/177/3+	(6500)	1100	cm, m	IV	16/2250/15			17/1638/sc/s/9-				
	10/0	2/0	E 56/1													
2	6/0	6/0	E 52/1	2105/23/1+	(75)	450	m	II								
0	18/0	12/1	E 90/1+	2023/42/2-	(15)		-									
8	18/1	12/0	E 90/1+	2120/45/2	(790)	405	m	(IV)								
9	14/0	4/0	E 67/1	1031/11/2	286	-	cm									
5	12/0	4/0	E 55/1		320	630	cm, m									
1	26/0	9/0	E 80/1+	1025/120/3	985	4800	cm, m	(IV)	Aug. 18/1130/15			Aug. 20/0412/sc/ms/6-				
2	9/0	18/1	E 38/1	1700/49/1+	(17)	-	-	IV								
5	1/0	3/0	E 50/1	2240/60/2+	(150)	-	cm									
0	27/1	0/0	E 38/1		-	-	m									
2	23/0	11/0	E 80/1+	0630/33/1+	-	-	cm									
1	33/0	12/1	E 90/2	2242/32/2+	-	-	cm									
2	35/1	10/0	E 90/2	1655/87/3-	(70)	-	-									
4	0/0	2/0	E 60/2+	1945/73/2	(50)	-	m	II, IV				Sept. 03/2159/ c/ms/7+				
8	27/0	27/0	E 90/1	0725/73/2	430	320	cm									
	24/0	1/0	E 68/1+	1605/26/2	417	1500	cm, m	II								
3	6/0	2/0	E 59/1	0500/62/1+	-	270	cm									
	1/0	5/0	W05/1	0930/46/1+	530	-	cm, m					Nov. 27/2351/sc/s/8o				
	13/0	45/4	E 85/1	2010/35/2	(225)	-	m	II, (IV)								
7	20/1	38/3	E 85/1	1843/59/2+	(175)	-	m	II, (IV)								
2	26/2	32/2	E 85/1	1735/47/3-	(175)	-	m	II , IV								
	31/3	27/1	E 85/1	1705/115/3	-	-	m	II, IV								
2	35/4	23/0	E 85/1	1246/76/2+	(875)	1300	cm, m	(IV)				Dec. 05/0649/sc/s/8-				

4.1-2 (2)

TABLE IA IAU MAJOR FLARES (TABLE I) 1959, REDUCED TO IMPORTANCE ≤ 2 IN THE McMATH WORKING LIST

Serial No.	McM Serial	Date	Beg UT	Position	Importance IAU	Importance McM	Obs. Reporting Max. Importance	Other Importances Reported
		Jan.						
1	[illegible]	05	1040	N26 E27	2+	2	Uccle and Nera	2,2,2,2,1
3	[illegible]	22	1108	N08 W03	3	2	Kharkov	2,2,2,1+,1
		Feb.						
11	755	10	0800	N09 E73	3	2	Arcetri	2+,2,2,1,1,
		Mar.						
17	755	21	0900	N15 W42	3	2	Uccle	2,2,2,2,2,2,2 2,2,2,2-,1+,1+,1,1
		Apr.						
24	1030	11	0807	N28 E46	3	2	Kanzelhohe	2,2,2,2,2,2-,1+,1+,1+,1,1
		May						
32	1410	12	0655	N10 W22	2+	2	Capri S. and Locarno	2,2,1
34	1448	13	0820	S10 E90	3	2	Kharkov	2,1+,1+,1+
35	1456	13	1554	N14 E18	3	2	Uccle	2,2,2,1+
		June						
37	1742	11	1302	N17 E78	3	2	Huancayo	1+,1+,1
41	1793	17	1421	N16 W02	3	2	Nera	2+, 2+, 2,2,2,2,2,2,2,2,2,1+, 1+, 1+, 1
43	1847	22	1010	N18 W67	3	2	Kharkov	2,2,2,2,2,2,2,2,2,1+, 1+
		July						
52	2156	20	0559	N20 W87	3	1	Abastumani	1,1,1,1
54	2238	29	2020	N10 E21	3	2	Honolulu	2,2
		Aug.						
56	2309	04	1028	N04 N12	[illegible]	?	Bakou	2,1,1
57	2400	11	1203	N20 W24	3	2	Kharkov	2,1+,1,1,1
61	2543	25	0457	N00 W64	3	2	Alma Ata	2
62	2545	25	0623	N20 E01	3+	2	Kanzelhohe	3,2,2,2,2,2,2,1+,?
		Sept.						
67	2715	02	1602	N25 W77	2+	2	Uccle and Schauinsland	2,2,1+,1,1,1
		Oct.						
68	2923	10	0437	S18 W53	3	2	Sydney	2,2,1

4.1.3 0

TABLE IB FLARES REPORTED BY ONLY ONE OBSERVATORY - IAU IMPORTANCE 2+

McM Serial	Date	Beg UT	End UT	Max UT	Position	McM Plage No.	Observatory	Remarks
93	Jan. 14	1406	1516	1410	N28 W12	4959	U.S.Naval	
352	Feb. 10	0216	0228	0226	N10 E75	5009	Mitaka	McM Reduced to 2
1223	May 01	2124	2140	-	N29 W76	5110	Honolulu	McM Reduced to 1
2801	Sept. 15	0303	0602	0558	S17 W73	5367	Alma Ata	McM Reduced to 2 with starting time < 0558
3143	Nov. 17	0008	0200	0048	N14 E22	5461	Honolulu	
3213	30	0247	0356	0250	N08 E16	5476	Mitaka	
3302	Dec. 10	0512	0537	0518	N15 W70	5478	Sydney	

TABLE IC IMPORTANCE 2+ FLARES NOT LISTED AS MAJOR FLARES

Date	Beg. UT	End UT	Max UT	Position	IAU Max.	Imp. Reported By Other Sta.	McM Imp.	Total Sta. Reported	Plage No.	AREA Range	AREA No. Rept.	AREA Mean
April 10	1021	1110	1040	N26 E54	2+	2,2,1+,1+	2+	5	5093	6 - 16	4	10
June 02	1808	1908	1824	S15 E27	2+	2,1+,1	2+	5	5179	4 - 13	4	7
Dec. 04	1814	2100	1823	N06 W44	2+	2	2+	2	5476	-	-	-

4.1-3 (2)

II

II. CATALOGUE OF IMPORTANT SUNSPOTS DURING 1959

TABLE II. CATALOGUE OF IMPORTANT SUNSPOT GROUPS DURING 1959

This catalogue will list all sunspot groups that, during disk passage, meet one or more of the following requirements:

(a) All sunspot groups with a maximum area, during disk passage, equal to or greater than 500 millionths of the solar hemisphere, as recorded in Royal Greenwich Observatory Bulletins (reference 42).

(b) All sunspot groups that have a γ or $\beta\gamma$ magnetic classification as reported by Mt. Wilson Observatory in reference 33.

(c) All sunspot groups associated with the major solar flares catalogued in Table I.

The column headings together with any necessary explanations follow:

Column 1 Catalogue Serial Number.

Column 2 Mt. Wilson Sunspot Number.

Column 3 Greenwich Sunspot Number. In a few cases the identification of a Mt. Wilson spot with a Greenwich spot was difficult and may be subject to change. Occasionally two Mt. Wilson groups correspond to one Greenwich group and vice versa. The associations given in this catalogue were obtained by studying microfilm of the Mt. Wilson sunspot drawings and the Zurich maps and spot positions given in reference 52.

Column 4 Catalogue Classification from a, b, or c Above. A sunspot with a maximum area greater than 500 millionths is designated in this column by a letter L. If the entry is due to the magnetic classification, the letter M is used. If the sunspot groups are associated with a major flare, the flare serial number or numbers are used. There will be cases where all three symbols may appear in the column, as well as more than one major flare.

Column 5 McMath Plage Number.

Column 6 Sunspot Mean Latitude During Disk Passage.

Column 7 Sunspot Mean Longitude During Disk Passage.

Column 8 Time of Central Meridian Passage. This date is given to the nearest one-hundredth of a day if the group crossed the central meridian. If the spot was last seen east of the central meridian or was first seen west of the central meridian, the CMP time is estimated and given to the nearest tenth of a day.

Column 9 Spots in the Plage. We have given the Mt. Wilson numbers for all sunspots in the plage during disk passage, these are from McMath-Hulbert unpublished data.

Column 10 Plage Catalogue Serial Numbers. If the plage is included in the Table III catalogue, detailed data for the sunspots listed in Column 9 are given in that table.

Column 11 Maximum Area. Only maximum areas for the whole spot with a maximum area greater than 500 millionths were available. These were supplied in advance of publication through the courtesy of the Astronomer Royal.

Column 12 The positions of maximum area are not available.

Column 13 Greenwich Day of Maximum Area for spots with maximum area greater than 500 millionths.

Column 14 Flare Day. This is the date of the major flare associated with the sunspot.

Column 15 Mean Area. This is the corrected value given in the Greenwich general catalogue of sunspots supplied in advance of publication through the courtesy of the Astronomer Royal. The first number is the mean umbra area, the second number gives the corrected mean area for the whole spots.

Column 16 Mean Magnetic Class. The value given in reference 33 is used.

Column 17 Mean Magnetic Strength. The values in units of 100 Gauss have been taken from reference 33. The value is enclosed in a bracket if the strength is estimated in reference 33.

Column 18 Disk Passage Data. The five lines in this column give the following data:

Top Line - The left hand number gives the data on which the sunspot was first seen; the right hand number gives the date on which the sunspot was last seen. These data have been taken from the three references 42, 33, and/or 52.

Second Line - The left hand number gives the longitude from the central meridian where the spot was first seen; the right hand number gives the longitude distance from the central meridian where the spot was last seen.

Third Line - This line gives the Zurich classification of the spot for each day (on which a classification was made) during disk passage as recorded in reference 52.

Fourth Line - The Mt. Wilson magnetic classification of the sunspot on each day that a classification was made during disk passage. If the classification is an estimate, the symbol is enclosed in brackets. The data for this line are taken from a microfilm of Mt. Wilson daily work sheets. (Reference 33).

Last Line - This gives the magnetic field strength in units of 100 gauss for each day on which the field strength was measured and shown on the Mt. Wilson daily sunspot maps. The values given on this line are the maximum values shown on the map.

Column 25 Recurrent Spots. If the sunspot group is the return of a previous group determined by Mt. Wilson, the serial number, or numbers, of the groups during the previous rotation or rotations are given.

TABLE II CATALOGUE OF IM

POSITION DATA										MAXIMUM AREA DA			
Serial	Mt. Wilson	Green-wich	Category	Plage	Lat.	Long.	C.M.P.	All Spots in Plage	Plage Serial No. Table III	Umb.	Whole Spot	Position	Gr. Da
1	13829	19103	L	4951	N17	297	Jan. 07.27	13829 13841 13844 13849	1		8*8		Ja 05
2	13841	19110	1,L	4951	N23	299	07.15	Same as No. 1					
3	13834	19100	L	4947	S16	305	06.66	13834 13820			624		06
4	13842	19109	L	4953	N12	249	10.93	13842 13851 13857 13861	2		2803		08
5	13870	19136	L	4969	N12	114	21.16	13870 13869 13871 13874 13878 13880 13892	3		548		15
6	13877	19140	3,L 6	4973	N09	90	23.01	13877 13888	5		2502		24
7	13878	19141	4,L,M, 5	4969	N17	106	21.81	Same as No. 5			1400		21
8	13883	19146	2,L	4976	N11	58	25.48	13883 13884 13890 13894 13895 13898 13899	6		1886		20
9	13897	19157	8	4983	N19	345	30.96	13897 13904	7				
10	13913	19174	7, 9	4997	N10	254	Feb. 06.92	13913 13916 13928	8		590		Fe 01
11	13922	19179	L	5003	N19	209	10.34	13922 13921 13923			506		07
12	13929	19183	10,L 11, 12	5009	N08	137	15.82	13929	9		1064		15
13	13931	19188	15	5016	N12	83	19.72	13931	10				

*Maximum whole spot areas available for large spots only.
Umbra area and position of maximum arear not available.

4. E-1 0

IPORTANT SUNSPOTS DURING 1959

TA*	Major Flare Day	SUNSPOT MEAN DATA: Umb.	Whole Spot	Mt. Wilson Mag. Cl.	H	DISK PASSAGE DATA: Days Seen, Position Seen, Zurich Class, Mag. Class, Magnetic Strength	RETURN SEQUENCE: Greenwich and/or Mt. W.
		144	858	lβpl	31	Jan. 01 — Jan. 13 E76 — W81 E E E E E E E E E E E D - βp (βp) βp (βp) - (βp) (βp) βp (βp) βp (βp) (βp) (αp) - - - - - - - 31 - 18 - - -	
	Jan. 05	52	318	dpl	25	Jan. 04 — Jan. 13 E41 — W82 C C C D D D D D C - (p) - (βp) (βp) βp (βp) βp (βp) (βp) - - - - - 25 - 16 - - -	
		90	482	dβl	(25)	Jan. 01 — Jan. 13 E70 — W83 B D D E E E G G G G G G - β (β) β (β) - (β) (βp) β (β) βp (β) (β) (αf) - - - - - - - - - 12 - - -	
		361	2408	lβpl	37	Jan. 04 — Jan. 17 E81 — W82 - F F F F F F F F F F E - (αp) - (βp) (β) βp (βp) βp (βp) (βp) (βp) (βp) βp (βp) - - - - - 36 - 36 - - - - - - -	
		34	226	lβl	(15)	Jan. 15 — Jan. 27 E73 — W77 β (βp) β (βp) (β) (βp) β (βf) (βf) (βf) (αf) (αf) (αf) - - - - - - - - - - - - -	19080, 19050
	22 27	330	1917	lβl	(25)	Jan. 16 — Jan. 29 E83 — W81 - E E E F F F F F F F F F (αp) β (β) (β) (β) (β) (β) (β) (β) (β) (β) (β) (β) (αf) - - - - - - - - - - - - -	
	26 26	122	945	dβrl	(25)	Jan. 17 — Jan. 27 E59 — W73 A D E E E E E E E E (αc) (βf) (βf) (βr) βr (βr) (βr) (βr) (βr) (βr) (βr) - - - - 19 - - - - - -	
	21	221	1476	lαpl	(30)	Jan. 19 — Jan. 31 E80 — W77 - H H H H G E E E E G H H (αp) (αp) αp (αp) (αp) (αp) (αp) (αp) (αp) (αp) (αp) (αp) (αp) - - 24 - - - - - - - - - -	
	Feb. 02	17	113	lβpd	(10)	Jan. 25 — Feb. 01 E71 — W17 J J C C C B B A (αp) (βp) (βp) (βp) (βp) (βp) (αp) - - - - - - - - -	
b.	01 02	22	248	lβd	(10)	Feb. 01 — Feb. 07 E75 — W04 D D D C C B B (β) (βp) (β) βr (β) βr - - - - - - - -	19109
		49	311	lβpl	(15)	Feb. 04 — Feb. 16 E77 — W79 J J D D D D D D D D C J - αp (αp) βp - (βp) (β) (βp) - (βp) αp (βp) - - - - - - - - - - - - - - -	
	09 10 12	142	866	lβpl	22	Feb. 09 — Feb. 22 E83 — W84 - H H E E E E E G G G G H - (αp) (βp) - (βp) βp (βp) - - - - βp (αp) - - - - - - - - - - - - - 35 - - -	
	19	23	144	lβfl	22	Feb. 13 — Feb. 26 E80 — W73 - C C C C J J J J J J A A (βp) (βf) - - - - βf (βf) - (βf) βf (βf) (αf) - - - - - - 23 - - - 18 - -	

4.II-1

TABLE II 195

POSITION DATA										MAXIMUM AREA D			
Serial	Mt. Wilson	Green-wich	Category	Plage	Lat.	Long.	C.M.P.	All Spots in Plage	Plage Serial No. Table III	Umb	Whole Spot	Position	
14	13936	19190	L,M	5018	N17	67	21.14	13936 13938 13939 13942	11		1538		
15	13938	19191	L	5018	N10	56	21.91	Same as No. 14			613		
16	13940	19197	13, 14	5023	N21	26	24.20	13940 13945	12				
17	13942	19201	L	5018	N28	55	22.10	Same as No. 14			678		2
18	13946	19200	L	5025	N22	355	26.58	13946 13955	13		1364		
19	13962	19217	L	5039	S11	239	Mar. 07.36	13962			794		0
20	13963	19233	L,M	5052	N11	103	17.72	13963 13991 13995 13996 14005	14		1563		1
21	13984	19234	16,L,M 19	5054	N26	94	18.37	13984 13989 13998 14008	15		2274		2
22	13992	19240	L	5058	N17	63	20.77	13992 13993 13997			1030		2
23	13995	19238	17	5052	N12	94	18.42	Same as No. 20					
24	14001	19246	18,L	5060	N18	15	24.40	14001 14000 14006	16		782		2
25	14004	19249	20,L	5061	N24	344	26.73	14004	17		511		2

*Maximum whole spot areas available for large Spots only.
Umbra area and position of maximum areas not available.

9 (CONTINUED)

ATA* Gr. Day	Major Flare Day	SUNSPOT MEAN DATA Umb.	Whole Spot	Mt. Wilson Mag. CL.	H	DISK PASSAGE DATA Days Seen, Position Seen, Zurich Class, Mag. Class, Magnetic Class	RETURN SEQUENCE Greenwich and/or Mt. W.
8		174	1266	βγl	29	Feb. 15 / E77 D E E E E E E E E E E E - - - - βγ (βγ) - (βγ) γ (γ) (βγ) (βγ) - - - - 28 - - - 29 - - -	Feb. 26 / W69
7		98	517	lαpl	30	Feb. 16 / E74 H H H H H H H H H H H H - - - - αp (αp) - (αp) αp (αp) (αp) αp (αp) - - - - 30 - - - 28 - - 25 - -	Feb. 28 / W84 19146 13883
	Feb. 16 18	38	221	lαpl	18	Feb. 18 / E76 J J C C C C C C C C J J - - βp (βp) - (αp) βp (αp) (αp) αp (αp) αp (αp) (αp) - 18 - - - 19 - - 14 - 14 - -	Mar. 02 / W79
6		46	360	dβl	18	Feb. 22 / W04 B C D D E E - (βp) (βp) (β) (β) β (β) (αf) - 19 - - 12 - -	Feb. 28 / W74
Mar. 3		81	599	dβl	13	Feb. 21 / E68 J A A B D E E E E E E E - - β (β) (β) β (β) β (βf) βf (βf) (βf) - - 2 - - 14 - 13 - - - -	Mar. 0[illegible] / W73
6		91	554	dβpl	18	Mar. 02 / E66 A C E E E E E G G G G G - βp β (βp) βp (β) (βp) (βp) (βp) (βp) (βp) βp (βp - 2 14 - 19 - - - - - - 14 - -	Mar. 14 / W84
5		167	1271	lγl	17	Mar. 11 / E61 - E E E E E E E E E E E E (χ) γ γ γ γ (γ) (γ) βp (βp) (β) βp (βp) (βp) - - - 16 - - - - - - 18 - -	Mar. 23 / W76
3	Mar. 19 24	269	1732	lβγl	(25)	Mar. 12 / E75 D E E E E F F F F F F F - αp α βγ (βγ) (βγ) (βγ) βγ (βγ) (βγ) βγ (βγ) (βγ) (χ) - - - - - - - - - 17 - - -	Mar. 24 / W78 19196 13941
		120	689	lαpl	32	Mar. 14 / E61 - H H H H H H H H H H H H - (αp) αp (αp) (αp) αp (αp) (αp) αp (αp) (αp) (αp) (αp) (αp) - - - - - 32 - - 23 - - - - - -	Mar. 27 / W82 13936
	21	14	108	dβl	(15)	Mar. 13 / E68 B B B B C D B B B B A - - βp (β) (β) βγ (βf) (αp) βγ (β) (β) - - - - - - - - 09 - -	Mar. 23 / W65
0	24	83	510	lβpl	(15)	Mar. 18 / E80 H H H H H E E D D D C B - (χ) βp (βp) βp (αc) (χ) (βp) (βp) αp (αp) -p (αp) (αp) - - - - - - - - - - 08 - -	Mar. 30 / W73
4	28	56	341	lβl	18	Mar. 20 / E88 - H H H H H H H H J J J J (βp) β (β) (β) (β) (β) βf (βf) β (βp) (β) (β) (αc) - - - - - - - - 19 - - - -	Apr. 01 / W75 13946

POSITION DATA										MAXIMUM AREA		
Serial	Mt. Wilson	Green-wich	Category	Plage	Lat.	Long.	C.M.P.	All Spots in Plage	Plage Serial No. Table III	Umb	Whole Spot	Position
26	14007	19250	L	5063	S08	337	27.26	14007	17		642	
27	14011	19252	L	5066	N08	305	29.70	14011 14023			525	
28	14014	19256	L	5068	N25	287	31.05	14014 14013 18024	18		1915	
29	14016	19260	L	5071	N14	275	31.95	14016 14017 14019 14020 14026	19		746	
30	14020	19258	21,M 22	5071	N17	273	Apr. 01.14	Same as No. 29				
31	14037	19274	L	5083	N13	147	10.63	14037			743	
32	14044	19276	L	5088	S21	159	09.73	14044			523	
33	14045	19278	L	5089	S16	104	13.91	14045 14049 14055 14061	20		692	
34	14046	19282	L	5090	N10	106	13.73	14046			501	
35	14047	19283	L	5076	N16	325	04.80	14047 14042 14028			513	
36	14050	19284	23,L,M 24, 25, 26	5093	N26	91	14.80	14050 14051 14052 14062 14068	21		1113	
37	14070	19298	L	5100	N18	43	18.52	14070			623	
38	14079	19304	L	5098	N17	8	21.20	14079			575	

*Maximum whole spot areas available for large spots only.
Umbra area and position of maximum areas not available.

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(CONTINUED)

DATA* Gr. Day	Major Flare Day	SUNSPOT MEAN DATA Umb.	Whole Spot	Mt. Wilson Mag. Cl.	H	DISK PASSAGE DATA Days Seen, Position Seen, Zurich Class, Mag. Class, Magnetic Class	RETURN SEQUENCE Greenwich and/or Mt. W.
27		56	351	dβpl	20	Mar. 21 Apr. 02 E77 W82 A A C D D L E E E D C C - (βp)(βp)(βp)(β)(βp) βp (βp) βp (βp)(βp)βp (βp) - 21 19	
Apr. 03		88	481	lαpl	32	Mar. 23 Apr. 04 E81 W75 - J H H H H H H H H H H H (αp)(αp)(αp)αp (αp)αp (αp)(αp)αp (αp)(αp)(αp)(αp) 21 32	13972
Mar. 30		243	1499	lβpl	30	Mar. 25 Apr. 06 E72 W76 D E E E F F F F F F G G - (βp)βp (βp)βp βγ (βγ)βp (βp)(βp)(βp)(βp)(βp) - 30	
Apr. 01		59	490	lαl	15	Mar. 26 Apr. 06 E77 W76 C C E E E E E E E E E D αp (αp)αp αp (αp)αp αp (αp)(αp)(αp)(αp) - 16 14	
09	Apr. 04 03	33	184	lβrl	15	Mar. 25 Apr. 05 E81 W58 - C D D D D D D D D B B - β (β) γ γ (βγ)βγ βγ(βγ)(βγ)(β) (β) - 2 16	
09		73	420	lβfl	13	Apr. 05 Apr. 16 E70 W76 D D E E E E G G G G G G (β) - βf βf (βf)(βf) β β (βf) β (β) (αf) 14	
09		59	325	dβpl	16	Apr. 06 Apr. 16 E42 W83 B D E E E E D D C J - - β βp (βp)(βp)βp βp (βp) βp (αp) - 17	
15		81	494	lβpl	(20)	Apr. 07 Apr. 20 E84 W85 - D D D D D C C E E D D J - (βp)βp (βp)(βp) βp βp (βp)βp (βp) βp (βp)(βp)(αp)(αp)	
08		41	264	lβd	(15)	Apr. 08 Apr. 17 E72 W52 (α) (β) βf (βf) β β (β) βp (α) α (α)	
10		42	361	dβpl	(12)	Apr. 09 Apr. 11 W61 W81 A B D - βp (βp) (βp) -	
10	08 11 12 13	101	649	lγl	(15)	Apr. 09 Apr. 20 E70 W72 H H H H H H D D D D D C γ (γ) γ γ (γ) γ (γ) γ (γ) (γ) (α) (α)	19234, 19198 13984, 13941
23		60	371	dβpl	(20)	Apr. 16 Apr. 24 E01 W79 A D D D D D D β (βp)βp (βp)(βp)(βp)(βp)	
24		77	428	dβfl	(15)	Apr. 22 Apr. 27 W16 W76 A L E E D - (βf)(β) (βf) - (βf)(αf)	

4.II-5 (2)

TABLE II 1959

POSITION DATA										MAXIMUM ARE		
Serial	Mt. Wilson	Green-wich	Category	Plage	Lat.	Long.	C.M.P.	All Spots in Plage	Plage Serial No. Table III	Umb.	Whole Spot	Position
39	14083	19306	L	5117	N11	270	28.61	14083 14082			721	
40	14090	19313	L	5120	N13	256	29.69	14090	22		500	
41	14111	19328	L	5146	N11	114	May 10.43	14111 14113 14120 14135	25		824	
42	14112	19324	L	5144	S18	104	11.16	14112			742	
43	14113	19325	32	5146	N13	103	11.27	Same as 41				
44	14114	19326	L,M	5147	N26	93	11.98	14114 14118 14131	26		696	
45	14121**	19335 19336	27,L,M 28, 29, 30, 31, 33, 35, 36	5148	N15 N19	60 53	14.52 15.07	14121 14122 14125 14126 14132 14141	27		806 1552	
46	14122	19337	M	5148	N09	54	14.92	Same as 45				
47	14141	19346	M	5148	N18	40	16.05	Same as 45				
48	14138	19344	34	5156	S06	344	20.26	14138 14146 14149	28			
49	14139	19352	L	5157	N17	335	20.96	14139 14140 14150	29		872	
50	14155	19360	L	5166	N02	266	26.10	14155			772	
51	14157	19361	L	5167	S16	257	26.79	14157			1227	

*Maximum whole spot areas available for large spots only.
Umbra area and position of maximum areas not available.
** 19335 is the leading part of 14121, and 19336 is the following part

4.II-4

(CONTINUED)

CA DATA*		SUNSPOT MEAN DATA				DISK PASSAGE DATA	RETURN SEQUENCE
Gr. Day	Major Flare Day	Umb.	Whole Spot	Mt. Wilson Mag. Cl.	H	Days Seen, Position Seen, Zurich Class, Mag. Class, Magnetic Class	Greenwich and/or Mt. W.
25		73	431	lβpl	27	Apr. 22 — May 04 E83 — W77 - C C D D E G G G H H J - αp (βp)(βp) - (βf) βr βp αp βp - (x) (αp)(αp) - - - - - 26 27 26 - - - - -	
29		53	332	dβfl	14	Apr. 24 — May 05 E72 — W78 A B C D D E E D D C A - (αp) - (βf) βf βf (βf) βf - (βp)(βp) βp (x) - - - 15 16 - - - - - - -	
May 12		103	596	dβpl	15	May 06 — May 16 E57 — W80 A D E E E E E E D C - βp (βp) βp (βp)(βp) βp (βp)(βp) βp (βp)(αp) - - 16 - - - - - - - -	
11		70	395	lβl	13	May 05 — May 17 E78 — W80 J J J C D E E E E D D D - (αp) αp (αp) β (β) (β) βr (βr)(βr) β (β) (βf) (αf) - - - 14 - - - - - - - -	19278 14045
		18	93	lβpd	13	May 05 — May 13 E79 — W28 - C C C J J J A A (β) βp (βp) βp (αp)(αp) αp (αp) - - - - 14 - - - - -	
07		68	416	lβrl	14	May 05 — May 17 E81 — W72 - C E E E E D D C C J J J (x) r (r) βr (βr)(βr) βr (βr)(βr) β (αp) αp (αp) - - - 15 - - - - - - - -	19284 14050
09 11	May 08 09 10 10 11 13 13 17	76 136	563 947	lβrl	(15)	May 08 — May 21 E78 — W82 - E E E E E E E D C C C B - (βr)(βr)(βr)βr (βr)(βr)βr (βr) βr (βr)(βr)(βr)(β)(β) - - - - - - - - - - - - - -	
		41	246	lrd	(15)		
		32	161	dβrl	(15)	May 09 — May 20 E72 — W72 A C E E D D D D D D C B (αp)(βp) r (r) (r) r (r) βr (βr)(βr)(β) (βp) - - - - - - - - - - - -	14057
	13	19	106	lαpd	(15)	May 14 — May 24 E80 — W53 J J J C C J C C B A A αp (αp) αp (αp) αp (αp) βp β - (αf) (αf) - - - - - - - - - - -	19308 14086
24		84	508	dβpl	(15)	May 17 — May 27 E45 — W81 A A C C E E E E E E - β βp (βp) βp βp - (βp)(βp) βp (βp) - - - - - - - - - - - -	
27		69	399	lβpl	28	May 20 — June 01 E76 — W85 - C C C C E E E G G H H - αp βp - (βp)(βp) βp βp (βp)(βr)(βp) αp (αp) - - - - - - 22 - - 28 - 24 - -	
27		174	949	lβpl	34	May 20 — June 02 E80 — W81 - B D E E E E E E E G G G - (x) β - (βp)(βp) βr βr (β) (βp) β (βp)(βp)(βp)(αp) - - - - - - - - 24 - 20 - - -	

4.II-4

2

POSITION DATA										MAXIMUM AREA D		
Serial	Mt. Wilson	Green wich	Category	Plage	Lat.	Long.	C.M.P.	All Spots in Plage	Plage Serial No. Table III	Umb.	Whole Spot	Position
52	14173	19370	L,M	5179	S13	142	June 04.48	14173 14174 14184 14192	30		1140	
53	14191	19384	L	5194	S22	74	09.64	14191	31		898	
54	14201	19390	L	5197	N13	34	12.70	14201			501	
55	14211	19396	37,L,M 38, 39, 40, 41, 42, 43	5204	N17	330	17.46	14211 14207 [illegible]	32		1111	
56	14224	19410	L	5219	N10	260	22.76	14224 14232	33		2385	
57	14234	19416	L	5225	N09	223	25.57	14234	34		641	
58	14239	19418	L	5228	N19	195	27.70	14239			874	
59	14263	19435	L	5244	N06	110	July 04.09	14263 14269	35		557	
60	14269	19433	L	5244	N13	99	04.94	Same as 59			1435	
61	14284	19448	44,L,M 45, 46, 47, 48, 50, 51, 52	5265	N16	330	14.66	14284 14280 14282 14285 14292 14297	36		1981	
62	14287	19449	L	5271	N08	62	07.80	14287			721	
63	14288	19451	L	5264	S14	361	12.36	14288 14289 14301			738	
64	14290	19452	49	5273	S23	296	17.24	14290 14299	37			

*Maximum whole spot areas available for large spots only.
Umbra area and position of maximum areas not available.

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(CONTINUED)

ATA* Gr. Day	Major Flare Day	SUNSPOT MEAN DATA Umb.	Whole Spot	Mt. Wilson Mag. Cl.	H	DISK PASSAGE DATA Days Seen, Position Seen, Zurich Class, Mag. Class, Magnetic Class	RETURN SEQUENCE Greenwich and/or Mt. W.
June 02		122	777	lβrl	23	May 29 E81 June 10 W77 - C E E E E E E E E E - (x) βp βr (βr)(βr)βr βp (βr)(βr) βp (βp)(βp)(β) - 19 20 - - 20 24 - - 20 - - -	
09		125	577	lαpd	22	June 03 E81 June 15 W74 - H H H G E E E E G G H H α αp (αp)(αp) βp (βp) (βp)(βp) (βp) (βp) αp (αp) (αp) 17 23 - - 22 - - - - - 22 - -	
10		51	257	dβd	6	June 07 E70 June 17 W62 - (βp)(β) (β) (β) (β) βr (β) (β) (βp) (αp) - - - - - - 18 - - - -	
12	June 11 12 15 16 17 18 22	145	856	lrl	23	June 11 E80 June 23 W79 - E E E G G G G G G H H - (r) (r) r (r) (r) (r) (r) (r) r (r) r (r) (r) - - 24 - - - - - 23 - - - -	19352 14139
18		284	1682	lβpl	30	June 16 E83 June 29 W83 - F F F F F F F F F G G G - (βr)(βr)(βr) βp (βp)(βp)(βp) (βp)(βp)(βp) βp (βp)(βp) - - - - 35 - - - - - - - - -	
28		58	351	lβl	(15)	June 20 E67 July 01 W76 B B A B D E E E E E D D (βp)(βp) β (β)(βδ)(βδ β (β) (β) β (β) (x) - - - - - - - - - 11 - -	
22		102	487	lβpl	22	June 21 E83 July 03 W75 - D E E E D C C C C J J J (x βp (βp)(βp)(βp) βp βp (βp) βp (βp)(αp)(αp)(αp) - - - - - - - - 23 - - - -	
July 08		61	355	dβpl	(15)	June 29 E57 July 10 W84 J J J J A D E E E D C - βp (β) (βp)(βp) βp (βp)(βp)(β) (β) (β)(βp)(x) 2 - - - - - - - - - - -	
09	July 10 10 12	89	609	dβl	(20)	June 29 E74 July 11 W84 A B A A C D E E E E E E - - - (αp)(β) βδ (β) (βp)(βδ)(β) (β) (βp)(βp)(x) - - - - - - - - - - - - -	
17	13 14 16 16 20	274	1412	lrl	27	July 08 E84 July 21 W85 - H H H H H H H H E E E E - (r)(r) (r) (r) r (r) (r) (r) (r) (r) r (r) (r) - - - - - 21 - - - - - 27 - - -	19396, 19352 14211, 14139
13		49	326	dβpl	11	July 10 W33 July 14 W83 B B D E - (βp)(βδ) βp (βp) - - - 12 - -	
3		76	460	dβpl	17	July 11 E12 July 17 W69 C E E E G G G (βp) βp (βp)(βp) (βp) (βp) (βp) - 18 - - - - -	
	14	5	32	lαd		July 1[illegible] E 15 July 17 W02 J J B B A A - (αc) α (αc) - - - - - 8 - - - - -	

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POSITION DATA										MAXIMUM AR		
Serial	Mt. Wilson	Greenwich	Observers	Plage	Lat.	Long.	M.P.	All Spots in Plage	Plage Serial No. Table III	Umb.	Whole Spot	Positi
65	14296	19457	L	5280	N11	291	19.89	14296 14298 14307 14308 14315			548	
66	14314	19466	53	5291	N24	137	29.27	14314 14328 14329 14335	38			
67	14320	19470	54,L,M 55	5294	N12	107	31.53	14320 14319 14326	39		1802	
68	14321	19472	M	5292	N36	106	31.63	14321				
69	14330	19477	56,L	5300	N04	70	Aug 03.34	14330 14327 14337 14336	40		710	
70	14343	19487	57,L	5315	N21	345	09.74	14343 14344 14348 14350 14351 14352 14353 14359	41			
71	14339	19493	L	5310	N11	28	06.50	14339			680	
72	14347	19491	L	5314	N02	13	07.65	14347			812	
73	14348	19492	L	5315	N15	328	11.03	Same as 70			504	
74	14356	19498	58,L	5323	N13	260	16.16	14356 14355 14357 14362 14370 14371	42		1119	
75	14366	19503	59,1 61	5329	N06	209	20.08	14366 14365	43		1093	
76	14378	19512	62,L	5336	N16	141	25.19	14379 14390 14391	44		1913	
77	14382	19518	63	5339	N17	120	26.76	14382 14386 14392 14396	45			

*Maximum whole spot areas available for large spots only.
Umbra area and position of maximum areas not available.

FA DATA*		SUNSPOT MEAN DATA				DISK PASSAGE DATA	RETURN SEQUENCE
Gr. Day	Major Flare Day	Umb.	Whole Spot	Mt. Wilson Mag. Cl	H	Days Seen, Position Seen, Zurich Class, Mag. Class, Mainetti Class	Greenwich and or Mt. W
16		71	392	$l\alpha pl$	20	July 13 E86 — July 26 W85 - H H C C C C C H C C H H - αp αp αp αp αp αp αp αp αp αp αp αp αp αp - - - - - 21 - - - - - 8 -	19410 14224
	27	48	272	$l\alpha pl$	20	July 22 E87 — Aug. 04 W78 - G G G G C G G J J J J J - (αp) (βp) (βp) βp βp βp βp αp αp αp αp αp αp (αp) - - - 21 18 - - 19 - - - - - -	
Aug. 02	29 29	219	1576	$l\beta rl$	22	July 24 E87 — Aug. 07 W83 - E E E F F F F F F F F F F - (β) βp βr (βr) (βr) βr βr (βr) (βr) βp βp (βr) (βr) (βr) - - 19 22 - - 21 - - - 22 - - - - -	
		34	205	lrd	13	July 25 E79 — Aug. 05 W5[illegible] H H H H H H H C J C A A r r (r) (r) r (r) (α) (α) α α (α) (α) 16 14 - 14 - - - 10 10 - -	
02	Aug. 04	65	428	$l\beta pl$	17	July 28 E82 — Aug. 09 W83 - C D E E F E E C H H J - - 7 - - - 17 - - - 18 - - -	
	11	63	311	$l\beta pl$	26	Aug. 03 E79 — Aug. 16 W85 J J J H H H H H H C C C J - (α) (βp) (βp) βp βp (βp) αp βp (βp) (βp) (αp) (αp) (αp) (αp) - - - 2[illegible] - - 26 25 - - - - - -	
11		22	162	$d\beta pl$	16	Aug. 01 E72 — Aug. 12 W79 (χ) βp (βp) (βf) (β) β (βf) (αp) βp βp (βp) (βp) - 5 - - - - - - 17 15 - -	
09		91	527	$d\beta pl$	21	Aug. 05 E32 — Aug. 13 W80 D E E E E E E D C βp βp (βp) (βp) βr βp (βp) (βp) (χ) 16 19 - - 22 15 - - -	
05		29	193	lxd	15	Aug. 05 E76 — Aug. 14 W47 (χ) α (α) (χ) β α (α) (β) (c) (o) - 16 - - 12 6 - - - -	19448, 19396, 19352 14284, 14211, 14139
18	18	123	745	$l\beta l$	(15)	Aug. 10 E75 — Aug. 22 W85 D E E E E E E E E E E E - βp (β) (βp) (βp) (βp) (β) r (r) (r) (β) (βs) βf (χ) 13 - - - - - - - - - - - -	14296
24	18 25	143	901	$l\beta l$	(20)	Aug. 13 E83 — Aug. 26 W77 - D E E E E F F F F F F F - (β) (β) (β) β (β) (β) (β) (βf) βr (βs) (βr) (βr) (βp) (αf) - - - - - - - - - - - - -	
21	25	177	1193	$l\beta pl$	(25)	Aug. 18 E87 — Aug. 31 W84 - F F F F F F F E E E E C A (χ) (βp) (βp) βr (βr) (βr) (βr) βp (βr) βp βp (βp) (βp) (χ) - - - - - - - 17 - - - - - -	
	24	19	113	$l\beta d$	(12)	Aug. 20 E85 — Sept. 01 W78 - B B B B B B B A B B B A (χ) βp (β) (β) (β) (β) (βp) - - - - - - - - - - - - - - - - - -	

POSITION DATA										MAXIMUM AREA D.		
Serial	Mt. Wilson	Green-wich	Category	Plage	Lat.	Long.	C.M.P.	All Spots in Plage	Plage Serial No. Table III	Umb.	Whole Spot	Position
78	14389	19522	63.L,M 64	5340	S10	94	28.77	14389	46		2363	
79	14390	19519	67.L	5339	N25	112	27.38	Same as 77			1271	
80	14399	19528	L,M	5344	N09	53	31.89	14399 14400 14408	47		1011	
81	14400	19529	66.L	5344	N12	40	Sept. 01.86	Same as 80			670	
82	14404	19531	L	5348	N18	21	03.32	14404			872	
83	14414	19537	65	5354	N12	355	05.30	14414 14415 14432 14434	48			
84	14424	19544	L	5361	S17	275	11.34	14424			594	
85	14425	19546	L,M	5360	N06	274	11.43	14428 14423 14426 14429 14441			1520	
86	14431	19551	L	5365	S17	292	10.00	14431			725	
87	14453	19563	L	5361	S09	102	24.46	14453 14458 14467 14472			575	
88	14485	19583	68	5401	S17	293	Oct. 07.20	14485 14478 14479 14491	49		565	
89	14487	19584	L,M	5405	N05	275	08.62	14487 14483			689	
90	14507	19601	L	5427	S00	105	21.45	14507 14515			533	

*Maximum whole spot areas available for large spots only. Umbra area and position of maximum areas not available.

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(CONTINUED)

ATA*		SUNSPOT MEAN DATA				DISK PASSAGE DATA	RETURN SEQUENCE
Gr. Day	Major Flare Day	Umb.	Whole Spot	Mt. Wilson Mag. Cl.	H	Days Seen, Position Seen, Zurich Class, Mag. Class, Magnetic Class	Greenwich and or Mt. W.
31	Aug. 31 Sept. 01	283	1549	lβγl	22	Aug. 22 Sept. 04 E79 W81 - D E E E F F F F F E - (x)(β)(β) βγ (βγ) βγ βp (βγ)(βγ)(βγ)(βγ)(βγ)(βγ)(x) - - - 15 - - - - - - - - - -	
30	02	112	587	dβpl	(25)	Aug. 21 Sept. 03 E75 W85 A B B B B C E F E E G G - - - - - (x) (βp) βp βp (βp) (βp) βp (βp)(βp)(x) - - - - - - - - - - - - -	
Sept. 04		98	536	lβγl	15	Aug. 26 Sept. 07 E75 W84 J J C D C C C C H H H H - (β) βp βp (βp)(βp) βγ (βγ)(βγ)(γ) (β) β (β)(α) - - - - - - - - - - 17 - -	
Aug. 27	02	57	239	lβpl	11	Aug. 26 Sept. 07 E82 W78 - D D D C D D D C B C J - (α) βp βγ (βp)(βp) βp (βp)(βf) (β)(βp) βp (αp)(αp) - - - - - - - - - - 12 - -	
Sept. 03		141	710	lβpl	32	Aug. 28 Sept. 09 E77 W78 H G G G G G G G G G H H - βp(βp)(βp)βp (βp)(βp)(αp)(βp) βp (αp)(αp)(αp)(αp) - - - - - - - - - 32 - - - -	
	01	15	28	dβd	(5)	Aug. 31 Sept. 07 E68 W31 A B B A A A - - β (β) (βf)(o) (β) βf (o)(x) - - - - - - - -	
06		71	416	lαpl	17	Sept. 05 Sept. 17 E76 W77 H H H H H H H H H H H J - β (β) (β) βp (βp) αp (αp)(αp)(αp)(αp) αp(αp) - 16 - - - - 18 - - - - - - -	14379
10		164	961	lβγl	35	Sept. 06 Sept. 17 E67 W79 C D E E E E E E E E E - βp(βp) βγ (βγ) βγ (βγ)(βγ) (βγ)(βγ) βp (βp) - - - - - 34 - - - - - - -	
15		53	307	lβpd	10	Sept. 08 Sept. 16 E27 W82 - - A B D D D D - (αp)(βp) β (βp)(αp)(βp)(βp) αp (αp) - - 10 - - - - - -	
20		54	358	lαpl	21	Sept. 18 Sept. 30 E81 W77 - J H H C C C H H C J J - (αp) αp (αp)(αp)(αp) γ (γ) (αp)(αp) αp (αp) (αp)(αp) - 18 - - - 22 - - - - - - - -	14389
Oct. 06	Oct. 10	42	268	dβpl	(15)	Oct. 04 Oct. 12 E38 W68 C D D C C C H J C βf (βp)(βp) βp (βp)(βp)(αp)(αp)(αp) - - - - - - - - -	
?		64	440	dβγl	(15)	Oct. 04 Oct. 14 E59 W77 A C D E E E E E E E E (αf)(β)(βp) βγ (βγ)(βγ)(βγ) βγ (βγ)(βp)(βp) - - - - - - - - - - -	
0		75	463	lβpl	(30)	Oct. 15 Oct. 2[illegible] E83 W83 - H H H G G G G H H H H - (αp) βp βγ (βp) βp (βp)(βp)(βp) βp (βp)(βp)(βp) βp - - - - - - - - 25 - - - - -	

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TABLE II 195

POSITION DATA										MAXIMUM AREA		
Serial	Mt. Wilson	Greenwich	Category	Plage	Lat.	Long.	C.M.P.	All Spots in Plage	Plage Serial No. Table III	Umb.	Whole Spot	Position
91	14514	19607	L M	5433	N08	44	26.09	14514 14513			1240	
92	14525	19617	L	5439	N15	354	29.87	14526			672	
93	14543	19628	L	5452	S17	193	Nov. 11.13	14543 14552	50		1559	
94	14547	19633	L	5454	S16	167	13.08	14547 14545			633	
95	14567	19643	L	5468	N15	360	25.76	14567 14569 14575 14578			1527	
96	14571	19646	69	5467	S17	10	24.96	14571 14574 14577	51			
97	14573	19648	L	5471	N21	310	29.52	14573 14583 14586			515	
98	14579	19651	70,L,M 71, 72, 73, 74	5476	N09	284	Dec. 01.53	14579 14581 14584 14595	52		2622	
99	14585	19654	L,M	5478	N10	231	05.54	14585 14591	53		1624	
100	14600	19666	L	5491	N19	104	15.16	14600 14610 14615	55		1413	
101	14620	19677	L	5501	N11	14	22.00	14620			640	
102	14630	19683	L	5505a	N09	321	26.01	14630			1262	
103	14641	19691	L	5512	N07	223	Jan. 02.12	14641			859	

*Maximum whole spot areas available for large spots only.
Umbra area and position of maximum areas not available.

9 (CONTINUED)

DATA*		SUNSPOT MEAN DATA				DISK PASSAGE DAT	... TURN SEQUENCE
Gr. Day	Major Flare Day	Umb.	Whole Spot	Mt. Wilson Mag. Cl.	H	Days Seen Position Seen Zurich Class, Mag. Class, Magnetic Strength	Greenwich ... Mt. W
26		145	840	lβrl	25	Oct. 19 ~ Oct. 31 E87 W72 - E E E E E E E E G H (αp)(βp)(βp)(βp) βr (βr)(βr)(βr) βr (βr) (βp) - (αp) - - - - 25 - - - 24 - - - -	
Nov. 04		58	303	lβpl	(20)	Oct. 27 Nov. 05 E33 W83 B C C C D D E E D - βp (βp)(βp) - (βp) (βp) (βp) (βp)(βp)(χ) 6 - - - - - - - - -	
12		186	1100	lβpl	(25)	Nov. 05 Nov. 17 E77 W79 C D D E E F F F F F F F - (βp)βp (β) (β) βp (βp)(βp)(βp)(βp)(βp)(βp)(βp)(χ) - - - - - - - - - - - - -	
09		82	445	lβpl	(20)	Nov. 06 Nov. 19 E84 W84 - G G G G G G G G G G J - αp (βp)(βp)βp βp (βp)(βp)(βp) βr (βr)βp (βp)(αp) - - - - - - - - - - - - -	14519
20		154	1010	lαpl	26	Nov. 19 Dec. 02 E84 W85 - H H H H H H H H H H H H - (α) (αp)(αp) αp (αp)(αp)(βp)(βp)(αp)(αp)αp (αp)(αp) - - - 26 - - - - - - - - - -	
	Nov. 26	28	177	dβl	(15)	Nov. 22 Nov. 30 E36 W76 - A A C C J C J - β (β) (β) (βp)(βp)(βp) (βp)βp (αp) 6 - - - - - - - -	
23		39	248	lβpd	(20)	Nov. 23 Dec. 05 E81 W77 (βp)(βp)(βp)(βp)(βp)(βp) αp (βp)βp (αp)(αp) - - - - - - - - - - - - -	
29	28 29 30 01 02	279	1948	lβpl	(25)	Nov. 25 Dec. 07 E82 W80 - F F F F F F F F F F E - (βp)(βp)(βp)(βp) βr (βr) βr (βr)(βr) βp (βp)(βp) - - - - - - - - - - - - -	
Dec. 07		144	937	lβrl	(25)	Nov. 29 Dec. 12 E84 W87 - D D E E E E F F F F E - - βp(βp) βr (βr) (βr)βr (βr) (βr) - - (βr) (βr)(χ) - - - - - - - - - - - - - - -	
09		175	1034	lβpl	31	Dec. 08 Dec. 21 E83 W81 - E E E E E E E G H H H - - (βp)(βp) βp (βp)(βp)(βp) (βp) βp (βp)βp βp - (αp) - - - - - - - - 31 - - - - -	
22		71	455	dβl	(25)	Dec. 19 Dec. 28 E37 W85 C D E E E E E D C - (βp) - (βp)(βp)(β) - - - β (βf) - - - - - - - - - - -	
29		72	569	dβl	(20)	Dec. 23 Jan. 01, 1960 E37 W80 - - - βf (βf) (β) βr (βp)(βp) - - - - - - - - - - -	
Jan. 07		47	259	lβfl	(15)	Dec. 29 Jan. 08 E50 W81 βf (β) (o) (o) (β) (β) βf (βf)βf (βr) (χ) - - - - - - - - - - -	

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III

III. CATALOGUE OF PLAGE DATA FOR 1959

TABLE III. CATALOGUE OF IMPORTANT PLAGE DATA FOR 1959

The data in this catalogue include plage regions associated with major solar flares, plages with average maximum areas equal to or greater than 10,000 millionths of the solar hemisphere, plages with an average brightness greater than 3.0 during disk passage, and plages where 30 or more flares of all importance equal to or greater than 1 occurred during disk passage. The categories are indicated in Column 4 by the symbols L = large, B = bright, and N = 30 or more flares. These data were obtained from the McMath-Hulbert unpublished plage catalogue (reference 14).

Column 1 Catalogue Serial Number.

Column 2 McMath Plage Number.

Column 3 The Major Flare or Flares Serial Number and/or Plage Category.

Column 4 Mean Latitude During Disk Passage.

Column 5 Greenwich Date of Central Meridian Passage.

Column 6 Life in Rotations.

Column 7 Date First Seen.

Column 8 Number of Days Seen.

Column 9 Average Maximum Area.

Column 10 Intensity. Three regions are used, E/C/W, where:
E = E90° to E45°
C = E45° to W45°
W = W45° to W90°
The intensity is estimated on a scale of 1 = faint to 5 = very bright.

Column 11 Number of Flares During Disk Passage E/C/W.
E = E90° to E45°
C = E45° to W45°
W = W45° to W90°

Column 12 Total Number of Flares During Disk Passage.

Column 13 Life Histories. If the plage region is the return of a plage or plages from the previous rotation or rotations, the McMath plage numbers are given in the return sequence.

ASSOCIATED SUNSPOTS - COLUMNS 14-17

Column 14 Mt. Wilson Sunspot Numbers of All Spots Covered by the Plage.

Column 15 Mt. Wilson Mean Magnetic Classification of the Spots.

Column 16 Field Strength in Units of 100 gauss. A bracket indicates an estimated value.

Column 17 Days Seen.

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TABLE III CATALOGUE OF IN

	IDENTIFICATION			PLAGE POSITION				DISK PASS		
Serial No.	McM. Plage No.	Maj. Flare Serial No.	Category	Mean Lat.	Date C.M.D.	Life Rotations	1st Seen	Days Seen	Average Max. Area	In E.
1	4951	1		N20	Jan. 07.5	1	Jan. 01	13	9000	3/
2	4953		L,B	N14	10.5	2	04	14	11000	3.
3	4969	4,5	B,N	N17	21	3	13	14	13000	3/
4	4972		L	S15	23.5	5	16	14	10000	3.
5	4973	3,6	B,N	N08	23	1	16	14	7000	3.
6	4976	2	B,N	N17	25	6	18	14	7500	3.
7	4983	8		N21	31	2	24	13	4500	3.
8	4997	7,9	L	N12	Feb. 07	3	31	14	13000	3/
9	5009	10,11,12	N	N12	16	1,4	Feb. 09	14	4000	3/
10	5016	15		N09	19.5	2	13	13	4000	2.
11	5018		L,N	N18	21.5	7	15	14	10000	3/
12	5023	13,14		N19	24	3	17	14	6000	3/
13	5026		N	N22	26.5	3	20	13	6000	2
14	5052	17	B,N	N10	Mar. 18	3	Mar. 11	14	9000	3.
15	5054	16,19	L,B,N	N28	18.5	5	11	14	10000	3.
16	5060	18		N15	24.5	4	17	14	6000	3/
17	5061	20		N22	26	4	19	14	6000	3.
18	5068		N	N23	31	1	24	13	4500	3.
19	5071	21,22	B,N	N17	Apr. 01	5	26	14	6000	3.
20	5089		B	S16	13.5	2	Apr. 07	14	3000	3

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MPORTANT PLAGES DURING 1959

PLAGE PLAGE DATA			LIFE HISTORY	ASSOCIATED SUNSPOTS			
Intensity C/W	Flare E/C/W No.	Total Flares	Plage No's. Previous Rotations	Mt. Wilson No.	Mag. Class	Intensity 100 guass	Days Seen
							Jan.
3.5/3	0/ 9/6	15	New	13829	lβpl	31	31 - 12
				13841	dβpl	25	04 - 12
				13844	dβfd	(10)	06 - 09
				13849	dβpl	(12)	08 - 13
5/3.5/3	10/11/2	23	4919	13842	lβpl	37	04 - 16
				13851	dβfd	(5)	08 - 09
				13857	dβpd	2	10 - 13
				13861	dαd	(2)	12 - 12
3/3	8/18/13	39	4932, 4961 4902 4892	13869	lαpd	(5)	14 - 15
				13870	lβl	(15)	14 - 27
				13871	lβpd	(10)	14 - 21
				13874	dαd	(2)	16 - 16
			(4892 is new in the postion of old 4846)	13878	dβγl	(25)	17 - 27
				13880	dβpd	(15)	18 - 26
				13892	dβd	(2)	22 - 22
5/3/2	9/2/0	11	4934,4897,4849,4817	13876	lβpd	(15)	16 - 22
				13879	lβpd	(10)	17 - 26
				13881	dβd	(3)	18 - 18
5/3/3.5	5/32/9	46	New	13877	lβl	(23)	16 - 29
				13888	dβd	(3)	21 - 24
5/3.5/3	12/18/4	34	4936-4898-4854-4805-4744	13883	lαpl	(30)	19 - 31
				13884	lβpl	(15)	19 - 31
				13890	dαd	(3)	21 - 28
				13894	dxd	(2)	23 - 27
				13895	dβpd	(10)	24 - 31
				13898	dβd	(5)	27 - 27
				13899	dβpd	(5)	26 - 26
5/3/2.5	8/10/1	19	4943	13897	lβpd	(10)	24 - 31
				13904	dαpd	(7)	27 - 29
							Feb.
3/2.5	13/9/0	22	4953 (See No. 2)	13913	lβd	(10)	31 - 06
				13916	lαpl	(15)	02 - 09
				13928	dαd	2	09 - 09
3/3	29/10/4	43	Mostly new, part of 4969 (See No. 3)	13929	lβpl	22	09 - 26
5/2.5/1.5	3/7/1	11	4973	13931	lβfl	22	13 - 25
3.5/3	16/23/16	55	4976 (See No. 6)	13936	βγl	29	19 - 26
				13938	lαpl	30	19 - 27
				13939	xd	(1)	19 - 19
				13942	dβl	18	23 - 28
							Mar.
3/3	4/14/1	19	Part of 4979-4939	13940	lαpl	18	19 - 02
				13945	dβpl	14	23 - 02
3/3.5	0/17/17	34	4983 (See No. 7)	13946	dβl	13	23 - 04
				13955	dβl	(5)	27 - 04
5/3.5/3	11/25/1	37	5013 } 4973 5016 }	13983	lγl	17	11 - 23
				13991	dαd	(1)	14 - 14
				13995	dβ	(15)	15 - 23
				13996	dβd	(3)	15 17
				14005	dβd	(2)	20 - 20
5/3.5/3.5	4/60/16	60	5011-Part of 4969 (See No. 3)	13984	dβγl	(25)	11 - 24
				13989	lβd	8	13 - 16
				13998	dβd	(2)	16 - 16
				14008	dβl	(4)	22 - 25
3/2.5	5/15/0	20	5023 (See No. 12) 5025, 4982, 4954	14000	αpd	8	17 - 23
				14001	lβpl	(15)	18 - 30
				14006	αpd	(1)	21 - 24
3/2.5	0/18/3	21	5026 (See No. 13)	14004	lβl	18	19 - 01
3/3	17/21/4	42	Mostly new, part of 5032	14013	lαd	(2)	24 - 24
				14014	lβpl	30	24 - 05
				14024	dαd	(1)	29 - 30
5/3.5/3	5/25/16	46	5035, 4997 (See No. 8)	14016	lαl	15	25 - 05
				14017	lβfl	(15)	25 - 05
				14019	dαfd	(2)	26 - 01
				14020	lβγl	15	26 - 05
				14026	dαpd	(2)	29 - 30
							Apr.
5/3.5/3	9/11/1	21	5053	14045	dβpl	(20)	07 - 20
				14049	dβpd	(3)	08 - 14
				14055	dxd	(2)	11 - 13
				14061	dαd	(1)	13 13

4.III-1 (2)

	IDENTIFICATION			PLAGE POSITION				DISK PASSAGE PLA		
Serial No.	McM Plage No.	Maj. Flare Serial No.	Category	Heat Lat.	Date C.M.P.	Life Rotations	1st Seen	Days Seen	Average Max. Area	Intensity E C W
21	5093	23,24,25,26	N	N24	15	6.4	06	14	9000	3 3 2.5
22	5120		N	N14	30	1	24	12	2000	2.5 3 3
23	5129		B	S08	May 05	1	29	13	1600	3.5 3.5, 3
24	5133		B,N	S14	09.5	3	May 02	14	2500	3 3.5, 3.5
25	5146	32		N13	11	5	05	13	300[illegible]	2.5, 3, 2.5
26	5147		N	[illegible]26	12	7	05	14	6000	[illegible] 3 3
27	5148	27,28,29,30, 31,33,35,36	L,B,N	N14	15	2,10	0[illegible]	15	14000	3.5/3.5/3
28	5155	34		S08	20	3	13	14	4000	2.5/2.5/2
29	5157		N	N20	21.5	3	14	14	4500	1.5/3/3
30	5179		L,B,N	S12	June 05	1,4	29	14	10000	3.5/3.5/3.5
31	5194		B	S25	10	2	June 03	14	4000	3.5/3.5/3.5
32	5204	37,38,39,40, 41,42,43	B,N	N19	17.5	4	10	14	9000	3.5/3.5/3.5
33	5219		L,N	N13	23	2,3	16	14	10000	3.5/3/3
34	5225		B	N08	25.5	1	19	13	2500	2/3.5/3.5
35	5244		N	N11	July 04.5	2,7	28	13	4500	3/3/3.5
36	5265	44,45,46,47, 48,50,51,52	L,B,N	N16	14	2,5	July 06	15	12000	3/3.5/3.5
37	5273	49		S24	17.5	2	11	13	4000	3.5/3/2.5
38	5291	53		N25	29.5	1	22	14	4000	3/2.5/2.5
39	5294	54,55	L,B,N	N13	31.5	3,8	24	15	12500	3.5/3.5/3.5
40	5300	56		N08	Aug. 03	2	28	13	7000	3.5/3/2.5

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GE DATA		LIFE HISTORY	ASSOCIATED SUNSPOTS			
Flare E C W No.	Total Flares	Plage No's. Previous Rotations	Mt. Wilson No.	Mag. Class	Intensity 100 Class	Days Seen
13 26 2	41	5054 (See No 15) Part of 5052 (See No. 14)	14050	lrl	(15)	08 - 20
			14051	lαpd	(5)	09 - 11
			14052	dαfd	(2)	10 - 15
			14062	dαd	(1)	12 - 12
			14068	dβrl	(10)	17 - 20
5 15 19	39	New	14090	dβfl	14	24 - 05
-	-	New	14100	dβpd	(10)	29 - 09
						May
4, 20, 25	49	Part of 5089 (See No. 20)	14102	lαpd	(2)	02 - 03
			14106	dβpl	15	04 - 15
			14124	dβd	(2)	09 - 09
6, 19, 1	26	Part of 5090, 5052 (See No. 14) Part of 5093 (See No. 21)	14111	dβpl	15	05 - 16
			14113	lβpd	13	05 - 12
			14120	dβd	(10)	08 - 14
			14135	dαfd	(7)	14 - 16
34/10/3	47	5093 (See No. 21)	14111	lβrl	14	05 - 17
			14118	lβpd	6	06 - 12
			14131	dβfd	(2)	13 - 14
44, 46, 7	97	5095, 5058, 5018, 4976 (See No. 6) 5109	14121	lβrl	(15)	08 - 21
			14122	lrd	(15)	08 - 20
			14125	lαpl	(25)	09 - 21
			14126	dβd	(10)	10 - 14
			14132	dxd	(2)	13 - 13
			14141	dβrl	(15)	16 - 21
9/1/0	10	5103, 5063	14138	lαpd	(15)	14 - 24
			14146	dxd	(2)	17 - 17
			14149	dαd	(8)	18 - 21
1/13/16	30	5105, 5070	14139	dβpl	(15)	15 - 26
			14140	lαpd	(5)	15 - 21
			14150	dβpl	(15)	19 - 26
17/33, 6	56	Part new Part of 5133 (See No. 24)	14172	lβrl	23	29 - 10
			14174	dβfd	16	30 - 05
			14184	dβfd	5	01 - 06
			14192	dβpd	5	04 - 09
						June
1/3/1	5	5162	14191	lαpd	22	03 - 15
19/43/7	69	5157 (See No. 29)	14207	lαpd	15	10 - 21
			14211	lrl	23	11 - 23
			14225	dxd	(2)	17 - 17
16/14/3	33	5165, 5120 (See No. 22) 5166	14224	lβpl	36	16 - 28
			14232	dβpl	(10)	19 - 28
						July
0/13/4	17	New	14234	lβl	(15)	19 - 01
0/27/18	45	Part of 5185, 5146 (See No. 25)	14263	dβpl	(15)	29 - 10
			14269	dβl	(20)	01 - 11
16/60/20	96	5218 5204 (See No. 32)	14280	dβd	(7)	07 - 14
			14282	dαpd	(2)	08 - 14
			14284	lrl	27	08 - 20
			14285	dβpl	13	09 - 20
			14292	dαd	(2)	12 - 16
			14297	dxd	(2)	14 - 15
9/3/0	12	5242	14290	lαd	7	11 - 13
			14299	dαd	2	15 - 20
1/12/3	13	New	14314	lαpl	20	22 - 08
			14328	dαd	(1)	28 - 28
			14329	dαd	(1)	28 - 28
			14335	dxd	(2)	31 - 31
						Aug.
26/47/6	79	5244 (See No. 35) 5246, 5180	14319	lαpd	9	24 - 01
			14320	lβrl	22	24 - 06
			14326	dβpd	8	27 - 06
2/21/0	23	5271	14327	lβpd	(10)	27 - 06
			14330	lβpl	17	28 - 09
			14337	dxd	(2)	01 - 01
			14338	dαd	(2)	01 - 01

TABLE III 1959 (C

	IDENTIFICATION			PLAGE POSITION				DISK P		
Serial No.	M&M Plage No.	Ma Serial No.	Category	Mean Lat.	Date C.M.P.	Life Rotations	1st Seen	Days Seen	Average Max. Area	Inte E C
41	5315	57	L,N	N18	10	6	Aug. 02	15	12000	3 3, 3
42	5323	58	N	N14	16	4	19	14	6000	3, 3 3
43	5329	59,61	N	N08	20	1	13	14	6500	3/3/3
44	5336	62	N	N18	25	1	18	15	9500	3/3.5
45	5339	60,67	N	N19	27	2,3,4	20	15	8000	3/3/3
46	5340	63.64	N	S12	28.5	1	22	14	4500	3/3.5
47	5344	66		N10	Sept. 01.5	4,1	25	15	8000	3/3/2
48	5354	65		N15	05.5	7	30	13	1200	2/1.5
49	5401	68		S15	Oct. 06.5	2	Sept. 30	13	4500	3.5/3
50	5452		N,B	S19	Nov. 11	1	05	13	4500	3.5/3
51	5467	69		S13	24.5	2	18	14	3500	2.5/3
52	5476	70,71,72,73, 74	N	N07	Dec. 01.5	4	25	14	8500	3/3.5
53	5478		N,B	N12	05.5	1	29	13	5000	3.5/3
54	5482		L	S18	08.5	2	Dec. 01	15	10000	3/3/2
55	5491		B	N15	15	1	08	14	5200	3.5/3
56	5500		B	S15	22	3	15	9	3200	3.5/3

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GE PLAGE DATA			LIFE HISTORY	ASSOCIATED SUNSPOTS			
ity W	Flare E (W No.	Total Flares	Plage No's. Previous Rotations	Mt. Wilson No.	Mag. Class	Intensity 100 guass	Days Seen
	14 36, 2	52	5265 (See No. 36)	14343	lβpl	26	03 - 16
				14344	lβd	10	03 - 14
				14348	lxd	15	04 - 15
				14350	dβd	(5)	05 - 09
				14351	dxd	(2)	06 - 08
				14352	dαd	2	09 - 09
				14353	dxd	6	09 - 13
				14359	dxd	2	10 - 11
	10/32, 6	48	5280, 5219 (See No. 33)	14355	lβfd	3	09 - 11
				14356	lβl	(15)	19 - 22
				14357	lβal	(15)	09 - 22
				14362	dxd	(2)	11 - 11
				14370	lαd	(2)	15 - 18
				14371	dβl	(7)	15 - 21
	0/32/4	36	New	14365	lβfd	(7)	13 - 15
				14366	lβl	(20)	13 - 26
3	14/14/6	34	New	14378	lβpl	(25)	18 - 31
				14390	dαd	(2)	23 - 23
				14391	dαd	(2)	23 - 23
	8/27/9	44	5292 Part of 5241	14382	lβd	(12)	20 - 26
			5293	14386	dβfl	11	21 - 02
			5298	14392	dαd	(2)	23 - 23
			Part of 5294 (See No. 39)	14396	dβpl	(25)	25 - 03
							Sept.
/3	4/25/13	42	New	14389	lβγl	14	22 - 04
:	-	-	5310, 5260, 5198	14399	lβγl	15	25 - 07
			New	14400	lβpl	11	26 - 07
				14408	dαd	(2)	30 - 30
/1.5	1/1/0	2	Part of 5315 (See No. 41)	14414	dβd	(5)	31 - 07
				14415	dαfd	(2)	31 - 31
				14432	dβpd	(2)	09 - 09
				14434	dαpl	(3)	10 - 10
							Oct.
/3	4/8/13	25	5367	14478	lβpl	(15)	30 - 11
				14479	lαpd	(8)	30 - 11
				14485	dβpl	(15)	03 - 12
				14491	dαd	(2)	07 - 07
							Nov.
.5/3.5	13/23/8	44	Primary New	14543	lβpl	(25)	05 - 17
				14552	dβpd	(5)	08 - 12
/2.5	0/4/2	6	5438	14571	dβl	(15)	22 - 30
				14574	dxd	(2)	23 - 24
				14577	dxd	(2)	24 - 24
							Dec.
/3	9/45/10	64	5443, 5405, 5360	14579	lβpl	(25)	24 - 06
				14581	dxd	(2)	27 - 28
				14584	dαd	(2)	29 - 29
				14595	dβpd	(2)	03 - 03
.5/3	0/34/10	44	New	14585	lβγl	(25)	29 - 11
				14591	lβfd	(12)	02 - 11
:.5	2/2/3	7	5452	14589	lβd	(10)	01 - 11
				14597	dβd	(5)	03 - 04
				14601	dαd	(2)	10 - 11
.5/3.5	2/3/1	6	New	14600	lβpl	31	09 - 21
				14610	dαd	(2)	15 - 16
				14615	dαd	(1)	18 - 18
.5/-	2/5/3	10	5467 (See No. 51)	14609	lαpl	(20)	14 - 27
				14612	dβfd	(10)	15 - 23

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(2)

IV

IV. CATALOGUE OF IMPORTANT RADIO EMISSIONS FROM THE SUN DURING 1959

TABLE IV. CATALOGUE OF IMPORTANT RADIO EMISSIONS FROM THE SUN DURING 1959

This table will include all important radio emissions from the sun that occur within an acceptable time of:

(a) The major flares reported in Table I

(b) All reported spectral emissions of the Type II (slow drift bursts) and Type IV (broad band continuum).

(c) All important radio emissions at frequencies between 9400 Mc/s and 62 Mc/s that occurred at the time of a major flare or a spectral emission of Type II or Type IV.

In order to make this phase of the catalogue as complete and useful as possible, we have included emissions for a wide range of frequencies from 9500 Mc/s to 167 Mc/s, and whenever significant fluxes were reported at low frequencies, data are also included. These single frequency data have been taken from reference 19.

All fluxes at single frequencies are reported in units of 10^{-22} Wm^{-2} $(c/s)^{-1}$.

The following symbols, singly or in groups, illustrated on page 4-IV-iv are used to describe single frequency reports of outstanding occurrences:

S = simple rise and fall of intensity.

C = complex variation of intensity.

A = appears to be part of general activity.

D = distinct from (apparently superposed upon) the general background.

M = multiple peaks separated by relatively long periods of quietness.

F = multiple peaks separated by relatively short periods of quietness.

E = sudden commencement of rise of activity.

ECD = a complex distinct disturbance with very sharp rise.

CD = complex distrubance of moderately sharp rise.

Not all emissions reported in reference 19 at the time of the flare are included in the catalogue, and no general minimum flux has been used as a cutoff point. Occasionally more than one report at a given frequency is included.

In general the peak flux, if reported, is given. If the peak flux is not available, the smoothed flux is used, and indicated by enclosing the value in a bracket ( ).

Table IV is arranged in three general columns.

(a) FLARE, if any, associated with the radio emission.

(b) RADIO EMISSIONS OF THE SPECTRAL TYPE

(c) RADIO EMISSIONS AT SINGLE FREQUENCIES

The column headings together with any necessary explanations follows:

FLARE DATA - (Columns 1 through 7)

Column 1 Date.

Column 2 Beginning Time UT. If the start of the flare was observed, the time is underlined.

Column 3 End Time UT. When the end of the flare was observed the time is underlined.

Column 4 Maximum Time UT.

Column 5 Heliographic Position. The position of the flare is taken as the arithmetic mean of the values reported in the IAU Bulletin.

Column 6 Importance. The method used for major flares has already been described in connection with Table I. The minor flares are reported as 2+, 2, 1+, 1 as the highest importance given reference 28, subflares are denoted with importance 1-.

Column 7 Flare Serial Number. This is the serial numbers of the major flare in Table 4.I.

SPECTRAL EMISSIONS

Outstanding spectral emissions of Types I, II, III and IV are given in Table VIII. The entries in this table will be limited to emissions of Type II and Type IV reported by CSIRO Sydney (Syd). The Harvard Radio Astronomy Observatory (Har) at Fort Davis.

We have also included spectral emissions of the Type IV that have been derived from Pick-Gutman (reference 38) or Sinno (reference 47) from single frequency observations.

TYPE II SLOW DRIFT BURSTS (Columns 8 through 12)

Column 8 Beginning Time UT.

Column 9 End Time UT.

Column 10 Maximum Intensity.

Column 11 Frequency Range.

Column 12 Observatory or Reference.

TYPE IV BROAD BAND CONTINUUM (Columns 13 through 17)

Column 13 Beginning Time.

Column 14 End Time.

Column 15 Intensity.

Column 16 Frequency Range.

Column 17 Observatory or Reference.

RADIO EMISSIONS AT SINGLE OR DISCRETE FREQUENCIES (Columns 18 through 24)

Selected frequencies between 9500 Mc/s and 167 Mc/s associated in time with the major solar flares, solar-terrestrial events, or spectral emissions are tabulated in a descending order of frequency with the following data.

Column 18 Frequency.

Column 19 Type.

Column 20 Beginning Time.

Column 21 End Time.

Column 22 Time of Maximum Flux.

Column 23 Peak Flux (or smoothed flux)

Column 24 Observatory.

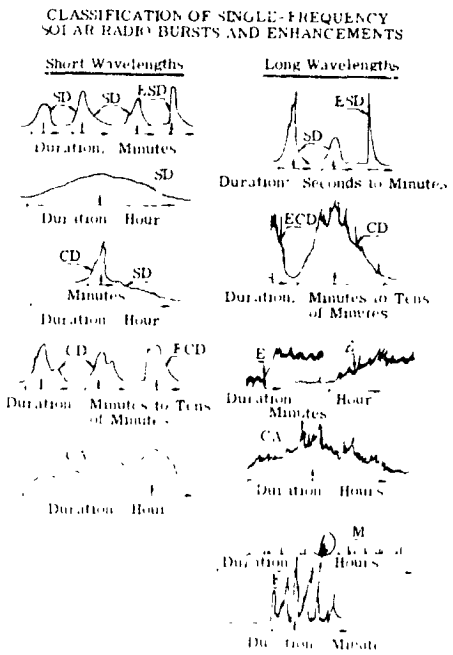

TABLE 4.IV-i NORMAL OBSERVING TIMES UT SOLAR RADIO OBSERVATORIES

			Mc/S	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Astrophys Obs. Potsdam Tremsdorf	Potsdam	AOP	23	08 - 14	09 - 14	09 - 15	09 - 15
			231	9 - 15	09 - 14	09 - 15	09 14
Chalmers Inst. Techn.	Gothenburg	CIT	150	06 - 18	06 - 18	06 - 18	
Univ. Hawaii	Honolulu	Haw	200	-	-	-	
Heinrich Hertz. Inst.	Berlin	HHI	1500	06 - 18	06 - 18	06 - 18	
			3000	06 - 18	06 - 18	06 - 18	
			9400	06 - 18	06 - 18	06 - 18	
Hiraiso Radiowave Obs.	Nakaminto-shi Ibaraki-Ken, Japan	Hir	200	21 - 09	21 - 09	00 - 09	00 - 09
I.R.S A.C .D.S. - Bukava	Belgian Congo	IRS	169	06 - 15	06 - 15		
Jodrel Bank Exp. Sta.		Jod	200	21 - 09			
			3000	09 - 18			
Res. Inst. Atmos. Nagoyu Univ.	Toyokawa, Japan	Nag	1000	23 - 06	23 - 08	22 - 08	22 - 07
			2000	23 - 06	23 - 08	22 - 08	23 - 07
			3750	23 - 06	23 - 08	22 - 08	23 - 07
			4000	00 - 04	00 - 04	00 - 06	00 - 04
			9400	23 - 06	23 - 08	22 - 08	23 - 07
Obs. Paris Meudon	Nacay Field Sta	Nay	169	11 - 13	11 - 13	11 - 13	11 - 13
NBS CRPL	Boulder	NBS	167	14 - 23	14 - 23	14 - 23	14 - 23
Radio Astron. P.T.T.	Nederhorst (Nera)	Ned	200	09 - 15	04 - 19	05 - 18	07 - 16
			250	09 - 12	09 - 12	09 - 12	09 - 15
			545	09 - 15	04 - 19	08 - 15	07 - 16
			2980	09 - 15	04 - 19	08 - 15	07 - 16
	Hollandia	Hol	200	21 - 08	21 - 08	21 - 08	21 - 08
			545	21 - 08	21 - 08	21 - 08	21 - 08
	Paramaribo	Par	200	10 - 21	10 - 21	10 - 21	10 - 21
			540	10 - 21	10 - 21	10 - 21	10 - 21
Inst. Teoret. Ap., Univ Blindern	Oslo	Osl	200	06 - 17	04 - 19	04 - 19	09 - 14
Nat. Res. Council	Ottawa	Ott	2800	12 - 21	11 - 24	11 - 24	12 - 22
Astron. Inst. Czech.	Ondrejou Prague	Pra	231	06 - 15	06 - 15	04 - 15	06 - 15
			536	06 - 15	06 - 15	04 - 15	06 - 15
			808		06 15	04 - 15	06 - 15
Radio Phys Lab	Sydney, Australia	Syd	600		-	21 - 07	21 - 07
			1420		21 - 07	21 - 07	21 - 07
Tokyo Astron. Obs.	Mitaka	Tok	07	00 - 06	00 07	00 - 07	00 - 07
			100	00 - 06	00 - 07	00 - 07	00 - 07
			200	00 - 07	00 - 07	00 - 06	23 - 07
			3000	00 - 06	00 - 06	00 - 06	00 - 06
			9500	23 - 07	23 - 09	00 - 06	22 - 07
Astron. Obs. N. Copernicus Univ.	Torun, Poland	Tor	127	06 - 15	06 - 15	06 15	06 - 15
Obs. Royal Belgique	Uccle, Bruxelles	Ucc	169	06 - 16	-		
			600	07 - 16	06 - 18	04 - 19	06 - 16
Nat. Committee for IGY USSR	Abastumani	Aba	209	06 - 12	06 - 12	06 - 12	06 - 12
	Cracow	Cra	810	09 - 12	09 - 12	07 - 12	09 - 12
	Ussurinsk	Uss	208	-	-	21 - 24	22 - 01
	Gorky	Gor	207	-	06 - 12	-	
			3000	06 - 12	06 - 12	-	
			9375	06 - 12	06 - 12	06 12	06 - 12
			19000	-	06 - 12	06 - 12	06 - 12
	Irkutsk	Irk	208	03 - 07	00 - 06	02 - 09	01 - 06
	Kislovadsk	Kis	178	07 - 12	06 - 12	07 - 12	07 - 12
	Moscow	Mos	209	06 - 12	06 - 12	06 - 12	06 - 12
			545	06 - 12	06 - 12	06 - 12	06 - 12
	Simferopol	Sim	208	06 - 12	09 - 12	09 - 12	09 - 12
			3000		09 - 12	09 - 12	09 - 12
	Bjurakan	Bju	203		06 - 09	06 - 09	06 - 09
	Vorushilov	Vor	208		21 - 03	21 03	21 - 03
SPECTRAL OBSERVATIONS							
Harvard Radio Astron. Sta.	Ft. Davis	Har	100-580	13 - 25	13 - 25	14 - 24	14 - 24
Radio Phys. Lab. Sydney	Dapto, Australia	Syd	25-210	23 - 07	-	-	
			40-200	-	23 - 06	23 - 06	23 - 06

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TABLE IV CATALOGUE OF IMPORTANT RADIO EMISSIONS DURING 1959

FLARE							SPECTRUM OBSERVATIONS TYPE II					SPECTRUM OBSERVATIONS TYPE IV					SINGLE-FREQUENCY RADIO EMISSIONS						
Date	Beg. UT	End UT	Max. UT	Position	Imp.	Flare Serial No.	Beg. UT	End UT	Max. Int.	Frequency Range	Ref. Obs.	Beg. UT	End UT	Max. Int.	Frequency Range	Ref. Obs.	Frequency	Type	Beg. UT	End UT	Max. UT	Flux	Obs.
Jan. 03	1617	1702	1638	S12 W90	1+		1610	1613	2	150 - 100	Har						2800	M	1550	1720	1652	(225)	Ott
04	No Flare Reported											0311				38	9500	CD	0309	0314	0311.5	1470	Tok
																	9500	SD	0317	0318	0317.3	468	Tok
																	3000	SD	0317	0318	0317.4	296	Tok
																	200	F	0315	0320	0319	6000	Tok
																	200	CD	0319.5	0321.8	0320.7	1090	Hir
																	200	CD	0310	0312	0311	350	Tok
05	1040	1220	1105	N26 E27	2+	1	0245	0247			Syd						600	ECDF	1102.5	1107		110	Uee
																	231	F	1021	1055	1044	500	AOP
																	169	ECDF	1143	1146	-	610	Uee
07	0215	0404	0240	S15 W10	2+												545	CA	0215	0325	-	170	Hol
																	200	CA	0250	0315	0305	2400	Tok
14	No Flare Reported											2130					2800	-	2130	2145	-	≈2000	Ott
21	1700	1750	1709	N10 E48	3	2	1718	1743	3	140 - 25	Har					38	2800	SD ECD	1702	1728.5	1708	500	Ott
																	200	CD	1706	1708	-	230	Par
22	1108	1147	1127	N08 W03	3	3											9400	F	1125	1130.5	1125.2	41[illegible]	HHI
																	2980	CD	1125	1129	-	475	Ned
																	600	ECD	1123	1134	-	720	Uee
																	231	ECD	1108.2	1111	1108.2	5000	AOP
																	211	C	1115	1136	1126	3000	AOP
																	208	CD	1109	1[illegible]0	1125	5[illegible]4	Sim
																	200	CD	1109	1110.5	-	≈500	Ned
																	200	CD	1125	1130	-	300	Ned
22	2050	2145	2059	N08 W08	2		2102	2112	2	180 - 25	Har						2800	SD	2050.5	2059.5	2057.5	(145)	Ott
																	500	CD	2056.5	2059.5	-	≈600	Par
																	167	CD	2056	2110	2058	≈1000	NHS
25	1406	1550	1414	N18 W50	2							1411				38	2800	CD	1408	1420.7	1412	(325)	Ott
																	600	CA	1408	1423	-	145	Uee
																	167	CA	1416	1450	-	≈100	NHS
26	0842	1030	0900	N16 W01	3	4											9400	CD	0836	1158	0856	663	HHI
																	3000	M	0852	1201	1036	964	HHI
																	2980	CD	0855	0907.5	-	380	Ned
																	1500	CD	0855	0900	0858.5	344	HHI
																	231	ECD	090[illegible]	0912.8	0904.9	800	AOP
26	1027	1315	1050	N16 W61	3	5											2980	CD	1032	1106	-	1090	Ned
																	1500	CD	1025	1038.5	1037	765	HHI
																	536	CD	1030	1105	1041	245	Pra
																	169	CA	103[illegible]	1036.5	-	270	Uee
27	1340	1520	1430	N08 W60	2+	6						1032				38	9400	SD	1420	1441	1430	683	HHI
																	2800	SD ECD	1428	1500	1431	(120)	Ott
																	1500	SD	1428	14[illegible]	1431	458	HHI
																	600	ECD	1430	1431.8	-	235	Uee
Feb. 01	0352	0458	0423	N12 E63	3	7											9500	ESD	0408	0409	0409.7	496	Tok
																	9500	CD	0420	0424	0422	≈1391	Tok
																	9400	CD	0406	0425	0422	(1250)	Nar
																	3750	CD	0408	0425	0422	(550)	Nar
																	2000	CD	0408	0424	0422	(270)	Nar
																	545	SD	0420	0425	-	110	Hol
																	200	ECD	0420.5	0426.5	0423.6	3500	Tok

TABLE IV 1959 (CONTINUED)

FLARE								SPECTRUM OBSERVATIONS TYPE II					SPECTRUM OBSERVATIONS TYPE IV					SINGLE-FREQUENCY RADIO EMISSION						
Date	Beg. UT	End UT	Max. UT	Position		Imp.	Flare Serial No.	Beg. UT	End UT	Max. Int.	Frequency Range	Ref. Obs.	Beg. UT	End UT	Max. Int.	Frequency Range	Ref. Obs.	Frequency	Type	Beg. UT	End UT	Max UT	Flux	Obs.
Feb. 02	1816	2019	1824	N09	E60	3	9	1853	1903	3	180 - 40	Har						2800	CD	1819	1917	1910.3	(120)	Ott
																		200	CD	1854	1855	-	≈540	Par
																		167	SD	1858	1858.2	1858	≈100	NBS
07	2318	2324	-	N17	W58	1+		2334	2341	2	240 - 100	Har						1000	CD	2329	2333	2331.2	(75)	Nag
																		200	FD	2334	2336.5	-	220	Hol
																		167	CD	2334	2347.5	2339	≈100	NBS
08	1242	1516	1410	N26	W69	1+							1342		B		38	9400	SD	1343	1349.4	1346	283	HHI
																		3000	CD	1340.5	1351.6	1343.2	453	HHI
																		1500	CD	1342	1349	1346	645	HHI
																		606	ECD	1343	1350.3	-	350	Uee
																		234	CD	1343	1350.9	1347	1900	AOP
																		169	ECD	1344	1355	-	≈83	IRS
09	0058	0246	0157	N10	E90	2		0208	0245			Syd.	0200		B		38	9500	CD	0152.8	0201.8	0159.7	510	Tok
													0215	0317			Syd	9500	ECD	0204	0209	0204.5	541	Tok
																		3000	CD	0157	0209	0203	303	Tok
																		2000	-	0157	0207	0203	(280)	Nag
																		1000	CD	0139	0208	0205	(660)	Nag
																		545	CD	0209	0217		120	Hol
																		200	CA	0205	0245	0220	200	Tok
																		200	ECD	0207.8	0213.8	0209.5	14000	Tok
																		200	CD	0211	0217.5	0212	≈4300	Hol
09	0735	1545	0955	N09	E88	3	10											234	ESD	0813.3	0813.4	0813.3	500	AOP
																		169	ECD	0812.8	0814.1	-	1575	Uee
09	1230	1441	-	N09	E87	2+							1308				38	3000	CA	1310	1339.7	1318	430	HHI
																		2800	SD	1313	1343	1318	(160)	Ott
																		1500	ESD	1312	1340.3	1318	342	HHI
																		200	CA	1312	1357	-	300	Ned
10	0800	1530	-	N09	E73	3	11											9400	SD	0825.1	0828	0826	280	HHI
																		1500	SD	0825	0826	0825.5	212	HHI
																		536	M	0808	0841	0808	180	Pra
12	2301	2515	2325	N13	E48	3+	12						2250		A		38	9400	CD	2257	2357	2313	(345)	Nag
													2303	2409	3	580 - 50	Har	3750	CD	2250	2400	2313	(440)	Nag
																		2000	CD	2250	2345	2314	(335)	Nag
																		1000	F	2304	2344	2333	(325)	Nag
																		545	CD	2303	2343	-	350	Hol
																		200	CA	2330	2350	2335	470	Tok
																		167	CD	2310	2350	2320	≈1000	NBS
18	No Flare Reported							0508	0523			Syd												
18	1005	1020	-	N21	E76	3	13											600	ECD	1032	1033	-	100	Uee
																		234	CD	1032.1	1033.4	1032.6	3500	AOP
																		208	M	1024	1037	1031	650	Mon
																		169	ECD	1032	1033.5	-	1600	Uee
18	No Flare Reported							2241	2251	3	150 - 50	Har												
19	2032	2244	2037	N11	W10	3	15						2030				38	2800	SD	2030	2150	-	≈(200)	Ott
																		167	CA	2030	2233	-	≈100	NBS
																		167	F	2059	2100	2059	≈100	NBS
20	1735	1905	1752	N23	E06	1+		1753	1804	3	180 - 40	Har	1813	1824	3	280 - 60	Har	2800	CD	1813	1856	1816	(105)	OTT
																		167	M	1754	2018.5	1817	≈100	NBS

TABLE IV 1959 (CONTINUED)

FLARE							Flare Serial No.	SPECTRUM OBSERVATIONS TYPE II					SPECTRUM OBSERVATIONS TYPE IV					SINGLE-FREQUENCY RADIO EMISSIONS						
Date	Beg. UT	End UT	Max. UT	Position		Imp.		Beg. UT	End UT	Max. Int.	Frequency Range	Ref. Obs.	Beg. UT	End UT	Max. Int.	Frequency Range	Ref. Obs.	Frequency	Type	Beg. UT	End UT	Max. UT	Flux	Obs.
Mar. 09	1715	1757	1727	N14	W67	2		1724	1727	3	200 - 50	Har						2800	CD	1719	1725	1721.3	(60)	Ott
13	No Flare Reported							0441	0457		-	Syd						208	ECD	0440	0455	0440	39	Irk
19	1035	1205	1053	N28	W18	3	16											9400	SD	1039.7	1042.3	1041	348	HHI
																		53[illegible]	CD	1056	1058.5	1057	115	Pra
21	0900	1127	0916	N15	W42	3	17											9400	SD	0905	1127.8	0907	375	HHI
																		3000	SD	0907	0910	0910	350	HHI
																		208	SD	0900	0914	0901	57	Sim
24	0700	0908	0737	N19	W04	3	18						0734		B		38	9500	SD	0741	0745	0744.1	487	T
																		9500	SD	0750	0759	0755	512	T[illegible]
																		9400	SD	0740	0755	0745	(22)	Nag
																		3750	CD	0733	0753	0745	(115)	Nag
																		2980	CD	0734	0759	-	371	Ned
																		200	CD	0741.5	0745	-	100	Ned
																		178	ED	0742	1130	0935	530	Kis
24	0958	1325	1015	N29	W77	3	19						1003				38	9400	CI	0952	1250	1012	1063	HHI
																		2980	SD	1003	1028	-	-1729	Ned
																		1500	CD	1005	1035	1013	812	HHI
																		536	CD	1001	1010.5	1010	135	Pra
28	2113	2315	2126	N24	W33	3	20											9500	SD	2122	2125	2123.3	507	Tok
																		2800	SD	2121	2126	2124	(100)	Ott
29	0746	0930	0754	N17	E36	2							0746				38	9500	SD	0748	0756	0751	2140	Tok
																		3750	SD	0746	0756	0750	(1050)	Nag
																		2980	SD	0747	0806	-	-588	Ned
																		2000	CD	0747	0756	0751	(500)	Nag
Apr. 04	0640	0956	0800	N15	W44	3	21											231	CD	0640	0720	0650	105	Pra
05	2316	2519	2327	N16	W67	3+	22											9500	ECD	2321	2328	2323	2960	Tok
																		3750	CD	2323	2331	2323	(2300)	Nag
																		2000	CD	2320	2329	2323	(580)	Nag
08	0903	1010	0921	N27	E85	3	23											19000	ECD	0914	-	-	1350	Gor
																		9400	CD	0914	0942.5	0915	925	HHI
																		3000	CD	0914	0932.5	0916	1484	HHI
																		2980	SD	0915	0937	-	-2150	Ned
																		1500	SD	0915	0930.2	0916	-925	HHI
																		800	CD	0915	0957	0918	320	Cra
																		545	CD-EC[illegible]	0915	0947	0920	308	Mos
																		208	ECD	0916	0935	0918	4720	Mos
																		200	CD	0915	0919.5	-	-500000	Ned
09	1645	1710	1650	N24	E70	2		1653	1703	3	290 - 40	Har						9400	CD	1646	1658	1648	385	HHI
																		2980	CD	1646	1651	-	340	Ned
																		1500	CD	1647	1651.4	1650	248	HHI
																		545	SD	1648.5	1650	-	230	Ned
																		545	CD	1653.5	1658	-	220	Ned
																		200	CD	1648	1650		-600	Ned
																		200	CD	1653.5	1659	-	-600	Ned
																		167	CD	1648.1	1652	1649	-1000	NBS
																		167	CA	1653	1701	1656	-1000	NBS

TABLE IV 1959 (CONTINUED)

FLARE								SPECTRUM OBSERVATIONS TYPE II					SPECTRUM OBSERVATIONS TYPE IV					SINGLE-FREQUENCY RADIO EMISSIONS						
Date	Beg. UT	End UT	Max. UT	Position		Imp.	Flare Serial No.	Beg. UT	End UT	Max. Int.	Frequency Range	Ref. Obs.	Beg. UT	End UT	Max. Int.	Frequency Range	Ref. Obs.	Frequency	Type	Beg. UT	End UT	Max. UT	Flux	Obs.
Apr. 11	0807	0933	0838	N28	E46	3	24											19000	SD	0834	0838	0836	540	Gor
																		9375	CD	0834	0838	0835	410	Gor
																		2980	SD	0835	0840.5	-	429	Ned
																		600	ECD	0833.5	0834	-	190	Ucc
																		600	CD	0836	0844	-	113	Ucc
																		545	FD	0833.5	0837.5	-	180	Ned
																		208	ECD	0836	0838	0837	515	Mos
																		23	S	0824.7	0825	0824.8	700	AOP
11	2145	2205	2150	S16	E35	1+		2149	2154	3	340 - 100	Har						2800	SD	2146.5	2150.5	2147.4	(35)	Ott
																		545	CD	2146.5	2147.5	-	≥350	Hol
																		200	CD	2150.0	2154.6	2151.7	790	Hir
																		167	CD	2150	2157.3	2154	≥100	NBS
12	1104	1225	1117	N26	E30	3	25											9400	SD	1108	1213.5	1112	450	HHI
																		3000	SD	1108	1116.5	1112	329	HHI
																		2980	SD	1109	1117	-	370	Ned
																		600	CD	1111	1114.5	-	230	Ucc
																		545	F	1103	1111	1107	325	Mos
																		234	F	1106.9	1109	1108.7	400	AOP
																		200	FD	1105	1108	-	500	Ned
13	0823	0935	0840	N27	E19	3	26											9400	F/SD	0829	0918.9	0834	418	HHI
																		3000	SD	0830	0846.7	0840	314	HHI
																		2980	CD	0832	0845.5	-	282	Ned
																		545	F	0832	0836	0833	306	Mos
14	1824	1948	1832	N09	W13	1+							1824	1831	3	580 - 240	Har	2800	SD	1824	1854	1841	(15)	Ott
																		600	ECD	1824.5	1828	-	270	Ucc
May 03	0008	0020	0016	N18	W48	1		0012	0022	3	300 - 50	Har						9400	SD	0013.5	0015	0014.3	437	Tok
																		200	CD	0012.2	0013.7	0013.5	3000	Tok
																		167	CD	0010.5	0012.5	0011.6	≥100	NBS
																		167	CA	0013	0021.3	0013	≥1000	NBS
08	2252	2322	2257	N23	E86	3	27	2259	2319	3	300 - 50	Har	2254		A		38	9400	SD	2255	2300	2256.5	(2700)	Nag
																		2800	CD	2254	2352	2257	(2200)	Ott
																		2000	SD	2255	2307	2257	(1600)	Nag
																		545	SD	2255	2320	-	≥250	Hol
																		200	ECD	2255	2304	-	1500	Hir
																		167	CD	2255	2308	2303	≥1000	NBS
09	0123	0212	0150	N20	E78	3	28											200	ESD	0155.5	0155.8	-	3200	Tok
10	2055	2610	2140	N19	E47	3+	29	2123	2141	3+	140 - 25	Har	2116	2400	3	580 - 25	Har	9500	CD	2117	2217	2149	2900	Tok
													2100				38	9400	CD	2200	2340	2203	(1650)	Nag
													2200		B		38	2800	CD	2100	2340	2149	(2500)	Ott
																		2000	CD	2200	2340	2213	(1300)	Nag
																		1000	CD	2200	2340	2232	(1550)	Nag
																		545	CD	2104.5	2109	-	≥330	Hol
																		545	CD	2116	2346	-	450	Hol
																		200	CD	2114.2	2115.5	2115.1	910	Hir
																		200	CA	2120	2335	2118	390	Hir
																		200	CD	2122.7	2123.7	2123	1050	Hir
																		167	ECD	2115	2500	-	≥1000	NBS
																		167	CD	2115	2121.9	2122	≥1000	NBS
																		167	CA	2122	2140	2141	≥1000	NBS
11	No Flare Reported												0000	0130			Har							

TABLE IV 1959 (CONTINUED)

FLARE								SPECTRUM OBSERVATIONS TYPE II					SPECTRUM OBSERVATIONS TYPE IV					SINGLE-FREQUENCY RADIO EMISSIONS						
Date	Beg. UT	End UT	Max. UT	Position		Imp.	Flare Serial No.	Beg. UT	End UT	Max. UT	Frequency Range	Ref. Obs.	Beg. UT	End UT	Max. Int.	Frequency Range	Ref. Obs.	Frequency	Type	Beg. UT	End UT	Max. UT	Flux	Obs.
May 11	2006	2150	2028	N10	E41	3+	31	2020	2039	3+	280 - 25	Har	2028	2046	3	400 - 25	32	2800	CA	2010	2330	2022	(900)	Ott
													2010		A		38	545	CD	2013	2043	-	100	Par
																		200	CD	2022	2043.7	2022	1600	Hir
																		167	CD	2019	2023.6	2023	≈1000	NBS
																		167	CA	2024	2047.4	2040	≈100	NBS
12	0655	0801	0708	N10	W22	2+	32											9500	SD	0705	0715	0710	575	Tok
																		3750	SD	0702	0722	0705	(39)	Nag
																		200	SD	0637	0637.4	-	350	Ned
13	0457	0553	0514	N22	E26	2+	33	0516	0525			Syd	0510				38	9400	SD	0510	0515	0513.1	1150)	Nag
													0525	0610			Syd	3750	SD	0510	0515	0513.1	(570)	Nag
																		2000	CD	0510	0516	0513.2	(230)	Nag
																		1000	CD	0511	0517	0513.2	240	Nag
																		545	CD	0512	0525	-	210	Hol
																		200	CD	0512	0532	-	≈800	Hol
																		200	CD	0550	0635	-	300	Hol
																		200	CD	0512	0642	0608	220	Osl
																		200	CD	0512.3	0513.6	0512.5	1500	Hir
																		200	CD	0515.8	0516.6	0516.3	1100	Hir
																		200	CD	0520	0533.2	0521	1800	Hir
13	0820	1256	0925	S10	E90	3	34											600	ECDF	0854	0856.5	-	100	Ucc
																		545	CD	0854	0856.5	0854	75	Pra
13	1422	436	-	S13	W52	1		1425	1430	3	160 - 50	Har						127	ECD	1427	1431	1430	≈30	Tok
13	1554	1650	1610	N14	E18	3	35											9400	SD,M	1552	1620.4	1554	320	HHI
																		1500	F	1553.3	1554.5	1553.7	232	HHI
																		167	SD	1625	1625.2	1625	≈100	NBS
																		167	SD	1631	1632	1631.6	≈100	NBS
																		167	SD	1637	1637.2	1637	≈100	NBS
17	0523	0600	0527	N21	W30	3	36						0523				38	9400	CD	0523	0523	0525	(4700)	Nag
																		3750	CD	0523	0536	0525	(3300)	Nag
																		2000	CD	0524	0539	0525	(2700	Nag
																		1000	CD	0524	0539	0525	(1030)	Nag
																		600	ECD	0524	0554	-	333	Ucc
																		200	ECD	0526	0533	0529	17000	Tok
18	No Flare		Reported					0407	0412			Syd						9400	SD	0403	0405	0404.1	(2550)	Nag
																		3750	SD	0403	0406	0404.2	(1750)	Nag
																		2000	SD	0403	0408	0404.3	(930)	Nag
																		1000	SD	0403.5	0409.5	0404.8	(430)	Nag
																		545	CD	0404	0418	-	150	Hol
																		200	CD	0409	0411	0409.5	300	Tok
19	1332	1402	1340	N21	W54	2		1344	1353	3	280 - 50	Har						2800	CA	1338	1353	1339	(250)	Ott
																		1500	F	1338.5	1344	1339.5	258	HHI
																		234	M	1339	1346.6	1339	350	AOP
																		200	CD	1338.5	1339.5	-	140	Ned
																		200	CD	1349	1352	-	≈23000	Ned
																		169	CD	1338	1340.2	-	≈98	IRS
																		169	CD	1344	1349	-	≈97	IRS
23	No Flare Reported							0103	0114	3	150 - 50	Har												
June 05	No Flare Reported							0546	0550			Syd						208	M	0600	1200	1017	139	Mos

TABLE IV 1959 (CONTINUED)

FLARE								SPECTRUM OBSERVATIONS TYPE II					SPECTRUM OBSERVATIONS TYPE IV					SINGLE-FREQUENCY RADIO EMISSIONS						
Date	Beg. UT	End UT	Max UT	Position		Imp.	Flare Serial No.	Beg. UT	End UT	Max. Int.	Frequency Range	Ref. Obs.	Beg. UT	End UT	Max. Int.	Frequency Range	Ref. Obs.	Frequency	Type	Beg. UT	End UT	Max. UT	Flux	Obs.
June																								
09	No Flare Reported												1635		A		38	9400	CD	1635	1850.7	1652	783	HHI
																		2980	CD	1640	1707	-	759	Ned
																		2800	SD	1,35	2317	1652	(2000)	Ott
																		1500	CD	1644	1827.5	1656	1170	HHI
																		545	CD	1647	1705	-	550	Ned
																		200	CD	1651	1722	1702	60	Osl
																		167	CD	1651.1	1657.1	1655.7	100	NBS
																		167	CA	1657	1801	1706	100	NBS
10	No Flare Reported							0247	0308			Syd						9400	SD	0245	0248	0246.4	(1650)	Nag
																		2000	SD	0244.5	0250	0246.6	(1450)	Nag
																		1000	SD	0245	0252	0247	(475)	Nag
																		545	CD	0245	0249	-	≈1800	Hol
																		200	CD	0247.5	0249.5	0248	11000	Tok
09	No Flare Reported												1714	1800	2	50 - 25	32	2980	CD	1735	1820	-	≈759	Ned
													1728		A		38	2800	SA	1728	1838	1740	(1800)	Ott
																		600	ECD	1734	1809	-	400	Uco
																		200	SD	1735	1747	-	30	Ned
11	1802	2130	1807	N17	E78	3	37											9400	F	1802	1813.3	1805	368	HHI
																		2800	SA	1804	1817	1806	(110)	Ott
																		1500	F	1804	1818.1	1805	265	HHI
																		545	FD	1806.5	1807.2	-	160	Ned
																		200	CD	1803	1804	-	200	Ned
																		200	CD	1807	1807.5	-	500	Ned
																		167	F	1808	1810.3	1809.8	≈100	NBS
12	0734	1159	0851	N21	E65	3	38											19000	ECD	0905	0908	0905	770	Gor
																		9400	CA	0904	0914	0906	436	HHI
																		2980	CD	0905	0909	-	396	Ned
																		1500	M	0904	0932	0906	346	HHI
																		810	FD	0905	0913	0907	302	Cra
																		234	F	0759	0805.9	0759	300	AOP
																		200	CD	0739.8	0740.6	0740	460	Tok
																		200	CD	0757.5	0759.5	0758	1200	Tok
																		23	S	0758	0758.4	0758.1	500	AOP
15	0232	0420	0302	N20	E28	3	39											9400	CD	0230	0330	0242	(45)	Nag
																		3750	CD	0230	0330	0245	(32)	Nag
																		2000	SD	0230	0330	0250	(16)	Nag
16	0618	0810	0643	N15	E15	3	40						0624				38	9400	CD	0622	0628	0625.9	(2300)	Nag
																		3750	CD	0623	0629	0625.6	(1100)	Nag
																		2000	SD	0623	0628	0625.9	(1150)	Nag
17	1421	1604	1441	N16	W12	3	41											9400	CA·SD	1427	1600	1440	650	HHI
																		1500	F	1439	1443	1440	255	HHI
																		808	SD	1439.5	1445	1440	125	Pra
																		231	S	1432.5	1433	-	60	Pra
18	1134	1300	1148	N16	W12	3+	42						1136				38	19000	ECD	1139	1145	1139	2400	Gor
																		9375	ECD	1139	1153	1139	2300	Gor
																		2800	CD	1139	1429	1140	(1225)	Ott
																		1500	SD	1138	-	1142	1025	HHI
																		810	FD	1139	1155	1140	219	Cra
22	1010	1140	1035	N18	W67	3	43											19000	SD	1029	1031	1030	2550	Gor
																		9400	CD	1023	1124.1	1030	673	HHI
																		9375	SD	1028	1032	1029	970	Gor
																		2980	CD	1029	1033	-	383	Ned
																		2800	SD	1029	1133	1030.5	(150)	Ott
																		1500	SD	1030	1038	1031	368	HHI

TABLE IV 1959 (CONTINUED)

FLARE								SPECTRUM OBSERVATIONS TYPE II					SPECTRUM OBSERVATIONS TYPE IV					SINGLE-FREQUENCY RADIO EMISSIONS						
Date	Beg. UT	End UT	Max. UT	Position		Imp.	Flare Serial No.	Beg. UT	End UT	Max. Int.	Frequency Range	Ref. Obs.	Beg. UT	End UT	Max. Int.	Frequency Range	Ref. Obs.	Frequency	Type	Beg. UT	End UT	Max. UT	Flux	Obs.
June 22	No Flare Reported							0503	0512			Syd												
July 05	2330	2350	2345	N08	W24	1		2338	2349	1	210 - 80	Syd, 18						208	CD,ECD	2333	2343	2337	94	Vor
																		167	CD	2337.5	2343	2338.1	≥100	NBS
07	No Flare Reported							0343.5	0345	1	130 - 80	Syd, 18						200	FCD	0342.5	0346.3	0345	≥180	Osl
09	1930	2320	2013	N18	E67	2+							2042				38	2800	SA	2042	2102	2046	(475)	Ott
													2044	2400	3	580-25	Har, 18	545	-	2023	2100	-	120	Par
																		545	CD	2103	2233	-	1400	Hol
																		200	-	2023	2213	-	2400	Par
																		200	CA	2110	2220	2200	500	Hir
																		167	CA	2018	2524	-	≥1000	NBS
10	0206	0538	0230	N20	E63	3+	44	0222	0306			Syd	0223		B		38	9400	CD	0209	0245	0224	(26500)	Nag
																		3750	CD	0209	0247	0224	(6300)	Nag
																		2000	CD	0211	0341	0224	(3000)	Nag
																		1000	CD	0209	0359	0223	6000	Nag
																		600	CD	0244	0344	-	≥252	Syd
																		545	CD	0208	0240	-	1000	Hol
																		209	ECD	0209	0305	0221	≥1400	Uk
																		167	CD	0210	0215	0210	≥1000	NBS
12	2134	2420	2230	N19	E24	3	46											3750	SD	2225	2240	2228	(105)	Nag
																		2800	SA	2224	2240	[illegible]28	(80)	Ott
13	0255	0655	0410	N15	E18	3	47											3000	SD	0249	0252	0250	346	Tok
																		3000	SD	0254	0256	0255.5	324	Tok
13	No Flare Reported												1937	2005	2-3	65 - ≥25	Har, 18	2800	SD	1935	2200	2007	(25,	Ott
																		200	CD	1948.5	1951.5	1951	55	Osl
																		167	CD	1938	2013	1951	≥100	NBS
14	0325	1121	0349	N17	E04	3+	48	0338	0412	3	130 - 25	Syd, 18	0330		B		38	9400	CD	0330	0435	0349	(6300)	Nag
			0527										0401	0610	1-3	≥210 - 25	Syd, 18	3750	CD	0330	0510	0356	(6000)	Nag
																		2000	CD	0331	0536	0420	(8450)	Nag
																		1000	CD	0331	0536	0422	20600	Nag
																		545	CD	0337	0542	-	40000	Hol
																		200	CD	0337	1337	-	10000	Hol
14	1400	1730	1452	S25	E37	3+	49											2800	SD	1443	1513	1446	(85)	Ott
																		1500	M	1443	1515	1447	340	HHI
																		808	CD	1405	1413.5	1409	≥100	Pra
																		600	ECD	1408	1413	-	180	Uco
																		600	SD	1443	1509	-	90	Uco
16	1525	1715	1616	N14	W27	3+	50	1616	1623	3	260 - 25	Har, 18						9400	CA,M	1605	1703.3	1615	600	HHI
																		2800	SA	1613	1622	1615	(350)	Ott
																		600	SD	1614	1622	-	100	Uco
																		200	CD	1614.5	1618.5	1617	≥200	Osl
																		200	CA	1628.3	1629.6	1629.3	140	Osl
																		167	CD	1616	1620.9	1619	≥1000	NBS
16	2114	2430	2128	N16	W30	3+	51						2121	2543	3	≥580 - ≥25	Har, 18	9400	SD	220[illegible]	2252	2207	(640)	Nag
													2118		B		38	3750	CD	2201	2301	2201	(1500)	Nag
																		2800	CD	21[illegible]8	2418	2154	(6500)	Ott
																		2000	M	2[illegible]01	2306	2210	(2350)	Nag
																		1000	M	2204	2309	2226	(6500)	Nag
																		545	CD	2114	2359	-	5500	Hol
																		200	CD	2120	2530	-	1100	Hol
																		167	CD	2121	2123	2121.6	≥1000	NBS
																		167	CA	2123	2610	2124	≥1000	NBS

TABLE IV 1959 (CONTINUED)

FLARE								SPECTRUM OBSERVATIONS TYPE II					SPECTRUM OBSERVATIONS TYPE IV					SINGLE-FREQUENCY RADIO EMISSIONS						
Date	Beg. UT	End UT	Max. UT	Position		Imp.	Flare Serial No.	Beg. UT	End UT	Max. Int.	Frequency Range	Ref. Obs.	Beg. UT	End UT	Max. Int.	Frequency Range	Ref. Obs.	Frequency	Type	Beg. UT	End UT	Max. UT	Flux	Obs.
July 17	0043	0121	-	N18	W36	1							0000	0143			Har	9400	SD	0041	0042	0041.2	(35)	Nag
																		2000	CD	0024	0049	0043	(108)	Nag
																		1000	CD	0032	0057	0043	(80)	Nag
17	0607	0638	-	N20	W44	1		0602	0606			Syd						600	SD	0605	0617	-	77	Uec
																		127	CA	0600	0800	0630	30	Tor
27	1222	1340	1230	N14	E50	2+							1235				38	9400	F	1232	1251.6	1235	400	HHI
																		2800	SD	1225	1341	1229	(1025)	Ott
																		1500	CA	1225	1300	1229	570	HHI
																		545	CD	1230	1237	-	400	Ned
																		234	CD	1226	1250.5	1228	4000	AOP
																		200	CD	1225	1230	-	-700	Ned
																		167	CD	1225	1228.8	1227.8	-1000	NBS
																		167	CA	1229	1237.2	1230	-1000	NBS
																		127	ECD	1225	1232	1229	150	Tor
																		23	F	1225	1229.8	1227.7	-2000	AOP
27	2050	2250	2115	N27	E26	3	53	2118	2126	2	90 - 25	Har						2800	SD	2100	2250	2128	(20)	Ott
																		2800	SA	2107	2117	2111	(75)	Ott
																		208	CDM	2100	2141	2108	-94	Vor
																		200	CD	2107	2110	-	-450	Hol
																		167	CD	2107	2115	2110	-1000	NBS
																		167	CA	2115	2147	2118	-1000	NBS
29	1202	1408	1244	N11	E27	2							1158				38	9400	F,M	1201	1234.3	1209	338	HHI
																		2980	CD	1202	1215	-	497	Ned
																		2800	SD	1158	1748	1209	(325)	Ott
																		808	CD	1158	1215.5	1207	180	Pra
																		808	CA	1230	1245	1236	105	Pra
																		600	-	1214	1353	-	115	Uec
																		234	C	1206	1238	1212	105	AOP
																		231	S	1207.5	1258	-	90	Pra
																		200	CD	1205	1230	-	75	Ned
29	2020	2234	2047	N10	E21	3	54											2800	SD	2028	2039	2031	(15)	Ott
29	2117	2243	2120	N15	E22	2+	55						2117				38	2800	SD	2118	2223	2119	(790)	Ott
																		545	SD	2121	2125	-	(25)	Hol
																		200	M	2119	2125.5	2119	405	Hir
																		167	CD	2117	2120	2119	-1000	NBS
																		167	CA	2120	2120.6	2120	-100	NBS
Aug. 01	No Flare Reported							1754	1810	2	140 - 45	Har												
04	1028	1113	1048	N04	W12	3	56											9400	F	1031.9	1035	1032.9	380	HHI
																		2800	CD	1030	1034	-	286	Ned
																		1500	CA	1030	1037.5	1031	220	HHI
																		810	FD	1031	1031.5	1031	77	Cra
																		808	CD	1030	1035	1032.5	105	Pra
																		600	ESD	1030	1030.6	-	70	Uec
11	1203	1234	1209	N20	W24	3	57											9400	F	1202	1209.7	1206	313	HHI
																		3000	F	1204.5	1209	1205.8	304	HHI
																		2980	SD	1205.5	1207	-	320	Ned
																		2800	SD	1205	1222.5	1206	(120)	Ott
																		1500	F	1205	1211.5	1206	340	HHI
																		536	CD	1205	1212.5	1212	85	Pra
																		234	CD	1205.1	1207.3	1206.1	3000	AOP
																		200	CD	1205	1206.5	-	-630	Ned
																		167	SD	1212	1213.5	1212.5	-100	NBS

TABLE IV 1959 (CONTINUED)

FLARE								SPECTRUM OBSERVATIONS TYPE II					SPECTRUM OBSERVATIONS TYPE IV					SINGLE-FREQUENCY RADIO EMISSIONS						
Date	Beg. UT	End UT	Max. UT	Position		Imp.	Flare Serial No.	Beg. UT	End UT	Max. Int.	Frequency Range	Ref. Obs.	Beg. UT	End UT	Max. Int.	Frequency Range	Ref. Obs.	Frequency	Type	Beg. UT	End UT	Max. UT	Flux	Obs.
Aug. 17	0328	0346	0335	N15	W16	1+		0334	0341			Syd						9500	CD	0329	0334	0331	490	Tok
																		3750	CD	0328.5	0332.5	0331.1	(170)	Nag
																		545	CD	0327	0330	-	500	Hol
																		200	F	0328.6	[illegible]	0328.6	660	Hir
																		200	CD	0330	0331.8	0331.2	1400	Tok
																		200	CD	0334.3	0336.3	0335.5	2600	Tok
18	1014	1411	1030	N12	W33	3+	58						1025		B		38	19000	ECD	1025	1045	-	≥2000	Gor
																		9400	CD	1022	1214.3	1030	933	HHI
																		3000	ECD	1026	1212.2	1030	621	HHI
																		3000	CD	1035	1058	1039	720	Sim
																		2980	CD	1025	1048	-	985	Ned
																		1500	CA	1025	1128.5	1030	745	HHI
																		810	FD	1024	1158	1030	290	Cra
																		600	ECD	1025	1150	-	610	Ucc
																		545	CD	1029	1229	-	550	Ned
																		234	C	1025	1225	1031	4400	AOP
																		208	ECD	1029	1035	1030	6250	Mos
																		200	CD	1025	1036	1033	4800	Osl
																		200	CD	1029	1229	-	≥600	Ned
																		178	CD	1040	1130	1129	254	Kis
																		23	C	1030	1032.5	1030.5	2000	AOP
18	1300	1440	+	N08	E29	1+							1353	2243	3	580 - 210	Har	2800	SD	1403.5	1405	1404	(6)	Ott
																		808	CD	1350	1400	1355	165	Pra
																		536	CD	1350	1407.5	1353	125	Pra
																		234	CA	1418	1435	1426	1300	AOP
																		215	D	1402	1405	1403	96	Rig
																		200	CD	1404	1404.8	-	240	Ned
24	2233	2332	2239	N17	E28	2+	60											2800	SD	2234	2321	-	≥(150)	Ott
																		1420	SD	2236	2241	2239	122	Syd
																		600	SD	2232	2238	2235	67	Syd
25	0457	0522	0502	N00	W64	3	61											9400	CD	0501.5	0503.5	0501.8	(40)	Nag
																		3750	CD	0501.5	0503.5	0502	(100)	Nag
																		2000	CD	0501.5	0503.5	0502.1	(58)	Nag
																		1000	CD	0501.5	0503.5	0503	(45)	Nag
25	0623	0740	0634	N20	E01	3+	62											9400	SD	0631	0651	0634	(30)	Nag
																		3750	CD	0624	0639	0633	(100)	Nag
																		2000	CD	0624	0639	0634	(30)	Nag
27	0057	0101	-	S11	E22	1+							0000	0113			Har	9400	SD	0057	0059	0058.2	(58)	Nag
																		3750	SD	0058	0100	0058.3	(17)	Nag
28	0027	0128	[illegible]	N11	E71	2		0038	0048	2	140 - 50	Har	0024				38	9400	CD	0030	0055	0041	(280)	Nag
								0039	0127			Syd	0055	0330			Syd	3750	CD	0024	0054	0041	(540)	Nag
																		2000	CD	0029	0054	0043	(250)	Nag
																		600	CD	0027	0052	0041	79	Syd
																		209	CD	0031	0047	0032	245	Irk
28	No Flare Reported												0114				38	9500	SD	0120	0140	0122	1040	Tok
																		9400	SD	0114	0135	0118	(470)	Nar
																		3000	ESD	0115	0135	0120	1520	Tok
																		2000	CD	0111	0141	0123	(2250)	Nag
																		545	CD	[illegible]	0129	-	≥410	Hol
																		209	CD	[illegible]	0129	0122	300	Irk
																		200	CA	0117	0129	0123	330	Tok

TABLE IV 1959 (CONTINUED)

FLARE								SPECTRUM OBSERVATIONS TYPE II					SPECTRUM OBSERVATIONS TYPE IV					SINGLE-FREQUENCY RADIO EMISSIONS						
Date	Beg. UT	End UT	Max. UT	Position		Imp.	Flare Serial No.	Beg. UT	End UT	Max. Int.	Frequency Range	Ref. Obs.	Beg. UT	End UT	Max. Int.	Frequency Range	Ref. Obs.	Frequency	Type	Beg. UT	End UT	Max. UT	Flux	Obs.
Aug. 31	1850	2054	1908	N10	E11	2							1858				38	2800	SA	1859	1918	1906	(270)	Ott
													1859	1916	3	580 - 330	Har	545	CD	1900	1917	-	-250	Par
																		200	CD	1855	1925	-	450	Par
																		167	CD	1853	1932	1918	-100	NBS
31	2222	2332	2252	S08	W46	2+	63											9400	CD	2236	2336	2249	(77)	Nag
																		3750	CD	2236	2326	2249	(38)	Nag
Sept. 01	1648	1832	1705	S12	W52	3	64											2800	SD	1645	1911.4	-	(20)	Ott
																		2800	CA	1658	1714	1706	(70)	Ott
01	1923	2216	1948	N12	E60	2+	65	1939	1945	3	60 - 30	Har	1914	1950	3	580 - 320	Har	2800	SD	1928	2300	2023	(50)	Ott
																		2800	CA	1932	2013.5	2009	(45)	Ott
																		545	CD	1927.5	1959.5	-	300	Par
02	0720	0954	0745	N10	W10	3	66											9400	CD	0737	0757	0742	(75)	Nag
																		3750	CD	0740	0747	0741	(180)	Nag
																		2980	CD	0740	0747.5	-	430	Ned
																		2000	CD	0734	0745	0741	(245)	Nag
																		1000	F	0725	0751	0740	(1170)	Nag
																		810	CD	0724	0751	0740	-305	Cra
																		600	ECD	0726	0750	-	248	Ucc
																		200	CD	0736	0746	0743	320	Hir
																		200	CD	0742.5	0746.5	[illegible]	-300	Ned
02	1602	1645	1606	N25	W77	2+	67	1606	1615	3	350 - 40	Har						9400	CA	1603	1626.2	1605	750	HHI
																		2980	CD	1604	1609	-	417	Ned
																		2800	CD	1603	1641	1607	(120)	Ott
																		545	CD	1605	1609	-	(13)	Ned
																		200	CD	1605	1614	1610	-1500	Osl
																		200	CD	1609.5	1614	-	-540	Ned
																		167	CD	1609	1611.1	1610	-1000	NBS
03	0421	0439	0423	N25	W86	2+		0424.5	0429			Syd						9500	ECD	0421.1	0424.1	0421.1	981	Tok
																		3000	ESD	0420.5	0422.5	0420.5	6850	Tok
																		2000	SD	0421	0424.5	0422.2	(385)	Nag
																		545	CD	0421.5	0424.5	-	-550	Hol
																		200	ECD	0422	0430	0425	3400	Tok
05	1556	1614	1558	N12	W52	1+		1603	1610	2	250 - 100	Har						2980	SD	1557	1600	-	238	Ned
																		200	FD	1556	1605	-	260	Ned
																		167	CD	1555.6	1559.6	1557	-100	NBS
11	2158	2211	2159	N14	E00	1		2204	[illegible]	[illegible]	180 - 75	32						167	SD	2203.6	2204.5	2204	-100	NBS
15	No Flare Reported							2124	[illegible]	[illegible]	85 - 25	Har												
								2135	[illegible]	[illegible]	[illegible] 35	Har												
Oct. 10	0437	0624	0501	S18	W53	3	68											9400	SD	0459	0506	0502	(25)	Nag
																		3750	CD	0458	0505	0500	(30)	Nag
																		2000	CD	0457	0502	0500.1	(75)	Nag
																		1000	CD	0456	0504	0500	(83)	Nag
																		600	SD	0457	0506	0501	57	Syd
																		200	CD	0458	0506	0502	270	Tok
Nov. 11	No Flare Reported							0657	0714			Syd												
18	No Flare Reported							0043	0044			Syd						1000	SD	0101.5	0103	0102.4	(27)	Nag
																		208	DF	0000	0120	0133	-500	Vor

TABLE IV 1959 (CONTINUED)

FLARE								SPECTRUM OBSERVATIONS TYPE II					SPECTRUM OBSERVATIONS TYPE IV					SINGLE-FREQUENCY RADIO EMISSIONS						
Date	Beg. UT	End UT	Max. UT	Position		Imp.	Flare Serial No.	Beg. UT	End UT	Max. Int.	Frequency Range	Ref Obs.	Beg. UT	End UT	Max. Int.	Frequency Range	Ref. Obs.	Frequency	Type	Beg. UT	End UT	Max. UT	Flux	Obs.
Nov.																								
21	1734	1928	1746	N21	W29	1+		1741	1752	3	125 - 25	Har												
28	0923	1156	0937	S15	W17	2+	69											2980	CD	0928	0943	-	530	Ned
																		910	CD	0925	0943	0928	425	Cra
																		536	CD	0925	0937.5	-	~295	Pra
																		234	CD	0932.6	0932.8	0932.8	400	AOP
																		208	ECD,CD	0930	1000	0940	200	Sim
28	2006	2130	2018	N12	E31	3	70	2017	2045	3	240 - 25	Har	2027				38	2800	SD	2010	2025	-	~(225)	Ott
																		167	SD	2013.8	2015.4	2014.1	~1000	NBS
																		167	CD	2015	2016.9	-	~1000	NBS
29	1816	2012	1848	N09	E18	2+	71	1854	1904	3	150 - 35	Har	1843				38	2800	CA	1843	1905	-	~(175)	Ott
																		545	CD	1843	1853	-	200	Par
30	0247	0256	0250	N08	E16	2+		0251	0358			Syd	0312	0350			Syd	9400	CD	0247	0259	0250.3	(4050)	Nag
																		3750	CD	0247	0259	0252.3	(1750)	Nag
																		3000	CD	0248	0257	0252.5	1229	Tok
																		2000	CD	0247	0305	0253.3	(2750)	Nag
																		1000	CD	0247.5	0302.5	0250.5	(3450)	Nag
																		545	CD	0246	0257	-	~750	Hol
																		200	CD	0247	0259	-	~9000	Hol
																		200	ECD	0248.3	0249	0348.6	850	Tok
																		200	ECD	0251	0303	0254	6300	Tok
30	1720	1906	1741	N07	E06	3	72	1741	1810	3+	580 - 25	Har	1739	2330	3	580 - 25	Har	2800	SD	1738	1756	-	~(175)	Ott
													1738				38	545	CD	1738	1758	-	~300	Par
																		167	CD	1740	1815	1740	~1000	NBS
																		167	CA	1815	1923	1833	~1000	NBS
Dec. 01	1638	2035	1700	N20	W05	2+	73	1733	1734	1	140 - 60	Har	1400	2240	3	580 - 350	Har	167	ECD	1750	2322	-	~100	NBS
02	1219	1412	1229	N07	W16	2+	74						1250		B		38	2980	CD	1246	1255	-	543	Ned
																		2800	SD	1245	1347	1248	(875)	Ott
																		808	CD	1245	1335	1251	120	Pra
																		600	ECD	1247	1334	-	428	Ucc
																		545	SD	1251	1255	-	250	Ned
																		536	SD	1231.5	1233	-	245	Pra
																		234	CD	1231.4	1232	1231.6	700	AOP
																		234	CD	1249.8	1254.2	1251.4	4000	AOP
																		234	CA	1257	1400	1400	450	AOP
																		200	CD	1250	1252.5	-	~1300	Ned
03	0116	0204	0120	N13	W39	2		0121	0126			Syd						9500	CD	0116.5	0120.5	0119.5	456	Tok
																		9500	CD	0120	0146	0120	543	Tok
																		3000	CD	0116.5	0122.5	0119.2	265	Tok
																		3000	CD	0130	0144	0140	279	Tok
																		208	ECD,F	0115	0143	0121	~600	Uss
																		200	ECD	0115.8	0119.3	0117	430	Tok
																		200	ECD	0120.8	0123.8	0121.7	1600	Tok
																		200	ECD	0129	0130	0129.5	220	Tok
																		200	CA	0131	0142	0139	440	Tok
10	0512	0527	0516	N15	W70	2+		0521	0529			Syd						9500	SD	0517	0519	0518	507	Tok
																		3000	SD	0516.5	0519.5	0518	363	Tok
																		200	ECD	0515.5	0519	0516.7	1500	Tok
																		200	ESD	0520.3	0521	-	1100	Tok
11	No Flare Reported							0412	0418			Syd						3000	SD	0406.5	0409.5	0407.3	269	Tok
																		200	CD	0412.1	0413.8	-	~1400	Hir
18	0636	0700	0638	S07	W53	1+		0640	0647			Syd	0653	0723			Syd	9500	ECD	0634	0638	0634	1233	Tok
																		545	CD	0634	0636.5	-	140	Hol
																		200	CD	0634	0636	-	~400	Hol
21	0043	0350	0052	S04	W34	2		0055	0120			Syd	0050				38	9500	CD	0049	0055	0050.1	737	Tok
													0120	0350			Syd	3000	CD	0045	0057	0050	611	Tok
																		208	ECD,DF	0043	0138	0049	130	Uss

V. CATALOGUE OF GEOMAGNETIC STORMS DURING 1959

V

TABLE V. CATALOGUE OF GEOMAGNETIC STORMS DURING 1959

This catalogue has been prepared from geomagnetic storm data from many sources. Data derived from papers published in the scientific literature are referenced in the last column of the table. The lists of sudden commencement storms published in the Journal of Geophysical Research (reference 25, 26). The Annals of the IGY (reference 46) and Bulletins 12n, published by the IAGA (reference 4) have been used to obtain the basic list.

The table has been set up in several sections that will be described in some detail under the column headings; these sections are as follows:

1. General storm classification.
2. Number of observatories reporting the storm and type of storm reported (from reference 4).
3. Sudden commencement reports in references 4, 25, 26, and 46.
4. Planetary three hour Greenwich interval indices during the storm.
5. Values for D, H, and Z and other storm data from six selected magnetic observatories.

		Geographic		Geomagnetic	
		Lat.	Long.	Lat.	Long.
Co	College Alaska	N64°52'	212°10'	N64.5	255.4
Fr	Fredericksburg	N38°12'	282°38'	N49.6	349.9
Gr*	Greenwich	N51°00'	355°31'	N54.6	79.0
Ho	Honolulu	N21°18'	201°54'	N21.1	266.5
Si	Sitka	N57°04'	224°40'	N60.0	275.4
Tu	Tucson	N32°15'	249°10'	N40.4	312.2

*Data published by the Royal Greenwich Observatory in reference 23.

The column heading, together with any necessary descriptions or definitions, follows:

Column 1 Greenwich Day

GENERAL STORM CLASSIFICATION (Columns 2 through 7)

Column 2 Onset time UT

Column 3 End, Greenwich day/UT

Column 4 Type, g - gradual, sc - sudden commencement

Column 5 Maximum intensity, m - moderate (K - index as great as 5) ms = moderately severe (K = 6 or 7), s = severe (K = 8 or 9).

Column 6 Maximum three hour K_p

Column 7 Average storm K_p. This has been calculated as the average K_p for the period shown in Columns 2 and 3.

NUMBER OF OBSERVATORIES REPORTING THE GEOMAGNETIC STORM (Columns 8 through 20)

These data have been taken from the IAGA Bulletin 12n (reference 4). The names of the observatories reporting in each category are given in that reference. The meanings of the column symbols follow:

A - The phenomenon is a very distinct ssc

B - It is a fair, ordinary, but unmistakable ssc

C - It is a doubtful ssc

D - The ssc was decidedly not recorded on the magnetogram although the records were satisfactory.

E - The phenomenon cannot be discovered because of heavy disturbance.

X - The recording is missing

Other observatories have classified the phenomena in question with the following symbols:

si - Sudden geomagnetic change or impulse

b - Clear and isolated bays appearing during calm periods without pulsations or sharp beginnings.

bs - Bay with sharp beginnings without pulsations

bp - Bay with pulsation without sharp beginnings

bps - Bay with pulsation and sharp beginning

pt - Train of pulsations consisting of several series of oscillations.

pg - Giant pulsations

The number of observatories reporting in each of the categories is given.

NUMBER OF ssc IN THE PUBLISHED LISTS (Columns 21 through 24)

Column 21 From reference 4. This is the sum of the A's and B's, Columns 8 and 9.

Column 22 From reference 25

Column 23 From reference 26

Column 24 From reference 46

PLANETARY THREE-HOUR INDICES AND OTHER DATA DURING THE STORM PERIOD

Column 25 Planetary three-hour indices

Column 26 Sum of the K_p for the Greenwich day

Column 27 Ap for the Greenwich day

Column 28 The Greenwich day and three hour interval with the first $K_p \geq 4-$

Column 29 The Greenwich day and the first three-hour interval in which the K_p for three consecutive intervals was less than 4-

Geomagnetic data for the six selected observatories listed on page 4.V-i. With the exception of the Greenwich (Gr) data, the values given in Columns 30 through 36 were taken from reference 25. The Greenwich data were published in the The Observatory, Vol. 80 (1960), 78-80 (reference 23).

Column 30 D-Magnetic Declination - This is the azimuth of the horizontal component or the magnetic intensity measured from the geographic north toward the east from 0 to 360. Unit in minutes of Arc.

Column 31 H-Horizontal Intensity. The magnitude of the horizontal component, always considered as positive. In units of gammas (10^{-5} gauss)

Column 32 Z-Vertical Intensity. The magnitude of the vertical component. Positives if downward, negatives if upward, in units of gammas (10^{-5} gauss)

Column 33 Onset Time. This is the time reported by the observatory.

Column 34 End Time. Reported by the observatory (Greenwich Day/UT)

Column 35 Maximum K_p. This is the maximum three-hour K_p reported by the observatory.

Column 36 Name of the Observatory. The code is given on page 4.V-i.

Column 37 Range of Starting Time.

Column 38 Sources. These are the published sources for the data given in this table. In many cases these references give relations of the storms to other phenomena, such as a solar flare, polar cap absorption, etc.

TABLE V-A. MAJOR GEOMAGNETIC STORMS DURING 1959

A list of all storms during 1959 with at least one K_p equal to or greater than 7+ is given on Table V-A, page 4.V-4. These data are taken from page 99, reference 4.

TABLE V

Serial No.	Date	Onset	End	Type	Max. Int.	Max. Kp	Average Storm Kp	TYPE REPORTED REF 4 A	B	C	D	E	X	[illegible]	[illegible]	bs	bp	bps	pt	pg	N 4
	Jan.																				
1	01	1122	-	sc	-	2-	-	-	-	-	-										-
2	02	1122	-	sc	-	2-	-	7	25	15	13		1	13							32
[illegible]	05	0136	07 04xx	sc	ms	6-	3+	25	29	6	2		2	10							54
		1029	06.20xx	sc	ms	6-	4o	-	-	-	-										
	06																				
	07																				
4	09	1459	11 02xx	sc	ms	6+	5o	23	24	10	4	[illegible]	2	3		1	2	1			47
	10																				
	11																				
																					19
5	12	1124	12/24xx	sc	-	3o	2+	3	16	20	34										
6	16	0624	-	-	-	-	-	-	-	-	-										
		0927	17 06xx	sc,g		4o	4-	15	33	16	9		1	1							48
	17																				
	18																				
7	25	0859	25/21xx	sc		4+	4+	18	44	5	4		2	1							62
		1124	-	sc		4+	-	3	12	19	29	3		8							15
8	26	0322	26/18xx	sc.g	ms	6o	4o	10	20	15	11	1	1	13	1						30
		1130	26/18xx	sc.g	ms	6o	5-	-	-	-	-										-
9	27	0914	-	-	-	3o	-	-	-	-	-										-
10	29	0513	30/16xx	sc	-	4+	3+	-	-	-	-										-
		0704	-	-	-	4+	-	-	-	-	-										-
	30																				
	Feb.																				
	02																				
11	03	1000	06/24xx	g	m	5+	4+	-	-	-	-										-
	04	0550	-	-	m	5+	-	-	-	-	-										-
	05																				
	06																				
	07																				
12	11	0318	12/24xx	sc	ms	6+	4+	28	34	3	3		1	7							62
		0756	13/00xx	sc	ms	6+	4+	39	25	6	-		1	4							64
		0900	12/00xx	g	ms	6+	4+	-	-	-	-										-
	12																				
13	14	1145	14/22xx	sc,g	ms	6-	5+	14	37	10	10	1	1	1			1				51
14	15	0152	15/23xx	sc	ms	6-	5o	-	-	-	-										-
		2350	17/13xx	sc,g	ms	6+	5o	-	-	-	-										-
	16	0649	17/03xx	sc	ms	6+	5o	7	11	12	21	8	4	10					1		18
	17																				
15	22	0046	23/13xx	sc		4+	3+	23	49	4	2			2							72
	23																				
16	24	2319	27/06xx	sc	ms	7+	5-	9	28	20	4		1	12							37
	25	0125	27/02xx	g	ms	7+	5o	-	-	-	-										
	25	0215	27/06xx	sc	ms	7+	5o	3	21	26	15	3	2	3		1					24
		1157	27/06xx	sc	ms	7+	5o	-	-	-	-										
	26																				
17	27	1045	02/24xx	g	ms	6-	-	-	-	-	-										
	28	12xx	04/00xx	g	ms	6-	4+	-	-	-	-										
	Mar.																				
	01																				
	02																				
	03																				
	04																				
18	22	2228	26/08xx	sc		3+	-	11	29	17	6	1		8					1		40
19	25	0139	25/23xx	sc,g	m	5+	4o	1	15	30	23	1	1	3							16
		1204	25/21xx	sc	m	5+	4o	1	18	20	25		2	8							19
20	26	0842	04/12xx	sc	s	8+	6o	54	16	1	2		1	1							70
	27																				
	28																				
	29																				
	30																				
	Apr.																				
	08																				
	09	1823	12/02xx	sc	s	8-	6-	60	11	1	2		2								71

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CATALOGUE OF GEOMAGNETIC STORMS DURING 1959

Obs. Ref. Reference 25	26	46	Kp Three-Hour Gr. Interval 1	2	3	4	5	6	7	8	ΣKp	Ap	Kp Interval 1st Kp ≥ 4 - Date/Interval	Time 3 Consecutive Kp < 4 - Date, Interval	D	H	Z
–	21	38	0o	0o	0+	1-	1-	0+	0o	0o	2o	1	-	-	-	-	-
–	–	–	0o	0o	0+	2-	2-	1+	1o	1o	7o	3	-	-	-	-	-
10	43	65	2o	1+	1o	4-	4o	4o	5-	6-	26+	25	05/4	07/3	170	1100	630
	2	2													22	129	6
			5-	4o	3o	3+	4o	4-	4o	3+	30o	24			15	118	4
			4+	4-	3+	3o	2-	2o	4-	4o	26-	19			45	400	280
9	40	48	5-	2+	2o	3-	4-	6o	5-	6+	32+	38	09/5	11/2	310	1590	1010
			6-	5o	5-	5o	5-	4+	5+	4+	39o	45			24	115	12
			5-	2+	2o	1+	2+	2o	3o	4-	21+	14			41	105	13
															2	60	1
															160	1100	78
															16	126	4
1	7	8	4o	2+	1o	2o	3-	3o	3o	3o	21o	13	-	-	6	43	5
			2-	2o	3-	3-	2-	2+	3o	1o	17o	9					
	2	2													-	-	-
5	39	42	1+	0+	2o	4+	4o	4-	4-	4-	23o	17	16/4	18/3	55	480	40
			3-	4o	3+	3+	4o	4-	3-	2o	26-	18					
			4-	4o	3o	3-	3o	4o	3o	3+	27-	19					
11	59	60															
0	5	5	1o	1o	1-	4-	4+	4+	4+	3-	22o	18	25/4	26/7	2	70	3
															18	121	2
3	16	25	1+	4-	2-	4+	6o	4+	1+	0+	22+	22			22	80	1
2	–	–													135	1000	50
-	1	4	0o	2o	3-	3o	3-	2+	2o	2o	17-	9	-	-	-	-	-
1	–	–															
–	2	3	1+	2-	3-	3+	3o	3+	4+	4o	24-	17	-	-	35	100	9
			3+	3+	2+	3o	2+	2o	2+	0+	19o	11					
			2-	4+	4+	4o	4o	3+	3+	4o	29o	23	02/2	06/8			
2	–	–	4o	3-	2+	4o	4-	4-	3+	5-	28+	22			35	125	6
–	2	2	5o	4+	3+	4o	5-	4o	5-	5+	35+	36			9	337	4
			4-	5-	4-	4-	4-	4o	3+	4-	30+	24					
			4o	3-	2o	4-	3+	3+	4o	3o	26o	18					
			3o	3-	2-	2+	3+	2+	3-	1o	19o	11					
5	51	66															
8	47	55	1o	4-	4-	6+	5+	5-	4-	4+	33-	36	11/2	12/5	26	175	10
1	–	–													5	120	1
			4-	5o	3+	4o	3+	3+	3o	4-	29+	24			95	720	48
															19	125	2
10	39	51	3+	4o	4-	4o	6-	5o	3+	2+	31+	30			310	2220	119
															24	138	12
															36	165	1
1	–	–													19	140	4
3	2	2	3+	6-	6-	5o	4+	4+	4o	2-	34o	37			140	1560	20
1	9	15	5o	6o	5o	3o	5+	6-	6+	6o	42+	61			290	1830	10
			6-	5-	5o	3-	2o	2o	2o	1-	25-	24					
3	51	62	3o	4+	3+	4o	2+	3o	2o	3o	25o	17			10	133	
			4-	4-	4+	4-	3o	1-	1-	0o	20-	15			23	96	
															-	-	-
2	20	40	0o	0+	1o	2-	2-	1o	1-	2-	8o	4			300	2070	12
7	3	3													58	190	2
5	11	13	3+	5-	6+	6-	6+	7+	5+	4+	43+	69	25/2	03/3	4	150	
1	2	3													29	242	1
															140	1560	9
			5+	5+	6+	5-	5-	5-	4+	4+	40-	48	25/2	04/1	28	166	
1	2	2	3+	4o	3-	3o	4+	6-	5o	4-	32-	30			-	-	-
1			5-	5o	3o	4o	5o	5o	6-	5+	38-	44			27	147	
			5-	5o	5o	4+	5-	6-	4o	4+	38-	42					
			4o	4+	5-	4o	4+	4-	5-	4o	34-	31					
			4-	4+	4-	4-	3+	4-	3+	4o	30-	23					
			3+	2+	3o	3+	3-	3-	3+	2o	23-	14					
1	22	41	1-	1-	1o	2-	3o	1+	1o	2o	10+	5	-	-	7	136	
3	5	9															
	12	15	2+	5+	3+	2+	4+	5+	5o	3+	31+	31	25/2	25/8	28	137	
17	70	71	2+	1+	4o	6+	8o	5+	6+	7+	41o	81			530	1940	17
			7+	8-	8+	7-	8+	8+	8-	6+	61-	178			62	357	4
			3+	5+	4+	5+	6+	7o	7+	7+	46+	87			93	340	6
			7-	6+	6+	5-	6-	6o	5+	3-	45-	73			6	300	
			3+	4-	4+	5o	3o	2o	2o	2o	25+	20			320	1700	12
															32	267	
			3-	3+	3+	3o	4-	3+	3o	5+	28-	22	08/5	12/2			
15	62	67	6o	6+	5-	4o	2-	2+	5+	5-	35o	44			256	1720	8
															46	208	1
															3	110	
															220	1550	10
															29	223	

Onset	End	Max. Kp	Obs.	Range of Starting Time	Sources
-	-	-	-	-	28
-				-	
) 05/0127	07/12xx	6	Co	05/09xx - 05/1029	28
05/0136	07/04xx	4	Fr		
) 05/0136	07/11xx	5	Tu		
) 05/03xx	06/20xx	6	Si		
) 09/1146	10/22xx	6	Co	09/1146 - 09/1459	17, 27, 28, 39, 37
) 09/1459	11/02xx	5	Fr		
) 09/1459	10/xxxx		Gr		
) 09/1459	[illegible]/24xx	5	Ho		
) 09/12xx	10/20xx	8	Si		
) 09/1459	11/02xx	6	Tu		
) 12/1127	12/24xx	-	Bi	1124 - 1127	28
-					
) 16/08xx	17/16xx	7	Si	16/08xx - 16/0927	28
					28, 39, 37
5 0859	26/16xx	5	Ho		28
4 0900	26/18xx	5	Tu		
6 1155	26/18xx	5	Fr	0322 - 1155	28
0 1130	26/15xx	9	Si		
-					
4 0513	30/16xx	5	He	0513 - 0704	
5 1000	06/24xx	5	Wi	03/1000 - 04/0550	
8 1055	04/23xx	6	Hu		
					28, 37
0 11/0318	13/01xx	6	Fr	11/0318 - 11/0900	28, 37
5 11/0318	12/06xx	6	Ho		
0 11/0900	12/00xx	8	Si		
9 11/0756	13/01xx	5	Tu		
0 14/02xx	14/22xx	8	Co		
9 14/1143	17/12xx	6	Fr		
0 14/12xx	16/xxxx	-	Gr	14/02xx - 14/12xx	12, 16, 28, 47
2 14/1142	17/09xx	6	Tu		
0 15/0152	15/23xx	6	Co		
0 15/2321	17/19xx	7	Co	15/0152 - 16/0649	28
32 0046	23/13xx	5	Ap		16, 37
81 0046	23/13xx	5	He		
0046	-	-	PM		
80 24/2323	03/00xx	7	Co		28, 37
85 24/2319	02/xxxx	-	Gr	24/2318 - 28/12xx	
15 24/2318	26/12xx	6	Ho		
04 25/0215	27/06xx	6	Fr		28
30 25/0600	04/01xx	9	Si		
55 25/0125	-	6	Tu		
-	-	-	-		
71 28/12xx	04/00xx	5	Fr		
34 2228	26/08xx	7	Ap		28
					28
45 25/0130	26/00xx	6	Fr.		28
00 26/0843	30/15xx	8	co		15, 17, 28, 37
26 26/0842	30/14xx	8	Fr		
00 26/0842	29/xxxx	-	Gr		
45 26/0842	29/12xx	7	Ho		
30 26/0842	30/12xx	9	Si		
93 26/0843	30/12xx	7	Tu		
70 09/1828	10/23xx	7	Co		12, 17, 28, 37
18 09/1828	11/02xx	6	Fr		
15 09/1826	10/21xx	6	Ho		
10 09/1829	10/20xx	9	Si		
18 09/1829	12/02xx	7	Tu		

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Serial No.	Date	Onset	End	Type	Max. Int.	Max. Kp	Average Storm Kp	A	B	C	D	E
	Apr											
22	10	0801	10/19xx	sc	s	8-	4+	18	13	12	10	7
	11	1007	12/02xx	-	-	5o	3o	-	-	-	-	
	12											
23	23	1036	26/06xx	sc	ms	7-	4o	55	18	1	1	
	24											
	25											
	26											
24	30	1250	30/21xx	-	-	5o	5-	-	-	-	-	
	May											
25	04	2021	05/15xx	sc,g	ms	6+	5o	17	40	13	2	
	05											
26	07	2151	08/24xx	sc	m	5+	4o	-	15	26	27	
	08	0353	-	-	-	5+	4o	-	-	-	-	
	09											
27	11	2328	12/24xx	sc,g	s	8+	6+	41	14	2	2	9
	12											
	13											
28	15	0703	16/12xx	sc,g	ms	6o	5o	3	17	30	20	
	16											
29	24	0540	25/10xx	sc	ms	7+	5o	46	23	2	1	
		2026	25/10xx	sc	ms	7+	4+	4	28	17	12	2
	25											
	June											
30	09	0016	10/13xx	sc	m	4+	4o	13	24	18	2	
	10											
31	11	0909	11/18xx	sc	m	4+	4o	48	21	4	-	
	17	1444	-	sc	m	3+	-	-	-	-	-	
	18											
32	22	1651	-	sc	ms	6o	-	-	-	-	-	
	23	1316	-	sc	ms	6o	-	1	11	17	33	
		15xx	24/09xx	g	ms	6o	4+	-	-	-	-	
	2a											
33	27	0651	28/23xx	g	ms	8o	4+	-	-	-	-	
		1119	-	-	-	6o	-	-	-	-	-	
		1348	28/07xx	sc	ms	6o	5o	-	-	-	-	
	28											
34	29	0728	30/02xx	sc,g	ms	6+	5+	44	25	-	2	1
35	30	0801	30/24xx	sc,g	ms	6o	5-	5	39	12	3	
	July											
36	11	1625	12/03xx	sc	ms	7-	6o	70	6	-	-	
	12											
37	15	0803	16/09xx	sc	s	9o	8-	55	16	4	-	2
	16											
	17	1624	-	-	-	-	-	-	-	-	-	
		1638	19/18xx	sc	s	9-	7-	58	12	2	-	1
	18											
	19											
	20											

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YPE REPORTED REF 4								No. Obs. Rep.				Kp									
								Reference				Three Hour Gr. Interval									
X	si	b	bs	bp	bps	pt	pg	4	25	26	46	1	2	3	4	5	6	7	8	ΣKp	Ap
2	9		1					31	1	16	25	5-	5o	8-	7+	7+	7o	5+	3+	48-	98
										2	3	4-	3+	4-	4o	3o	2+	4-	5o	29-	23
												4-	3o	2o	3-	2-	1+	1-	3-	18-	10
1								73	15	69	69	0o	0+	0+	4o	5-	5o	7-	6+	27+	40
												4-	4o	4+	4o	5-	4+	2+	4o	31+	27
												3o	4-	4o	3-	3o	4o	4+	4-	28+	22
												4-	4o	3-	3o	2o	3o	3o	4+	26-	18
										3		2o	2o	3o	2o	5-	5o	5-	2o	25+	21
								57	7	54	54	3o	2-	2+	3o	3-	2+	3o	5o	23o	16
												6+	5+	3o	4o	4o	2o	1o	0+	26o	29
1	5							15	3	12	13	1+	1-	1o	1+	1o	1o	1o	3o	10+	6
										3	3	3+	5+	5+	5o	4-	4o	3-	4o	33+	33
												3+	3-	3-	4-	4-	4-	3-	3-	25o	16
3	2							55	10	43	48	3o	2+	4o	3o	4-	4-	4-	6o	29+	26
												7o	7-	7-	6-	7-	8+	5+	5-	51o	108
												2-	2+	4-	3-	3-	3o	3o	3+	22+	14
4								20	3	19	22	2+	2o	3-	5-	5o	5+	5-	5+	32o	33
												6o	6-	6-	4-	2+	2-	2o	4+	31+	36
3	1							69	13	66	67										
2	7			1				32	1	14	20	3+	4o	6-	5o	5-	4o	5-	7-	39-	52
												6+	4-	4-	5+	2+	3o	3-	2+	27+	25
3	16							27	1	22	40	3o	3+	4o	4+	4o	3-	3o	2+	27-	19
												4-	4+	2+	2+	2o	2o	1+	2o	20o	12
3								69	8	53	55	1+	1+	2-	5o		5-	2o	2-	24-	24
										2	3	0+	0+	0-	0+	1o	1+	3-	3+	10-	6
												2-	2+	2o	1+	3+	2+	2o	2-	17-	8
								-	-	2	3	2-	2-	2o	3+	3o	3+	3-	3o	20o	11
2	7					1		12		8	9										
								-	2	-	-	3-	2o	2o	2-	2-	4-	4-	5-	22o	15
												6-	6o	3-	1+	1o	2-	4-	3-	25-	26
									6	2	3										
										4	4										
									1			0+	1-	2+	3o	6o	6-	4o	5o	27o	31
												5o	4+	4+	3+	6-	4o	4o	3+	34o	34
2	2							69	9	48	49	3o	3+	6o	6o	5o	4+	5-	6+	39-	51
2	10							44	2	26	29	5-	3o	4+	5+	6o	5-	4o	3o	35o	38
								76	12	64	67	4-	4o	3o	2-	3+	7-	5+	6+	34o	44
												6+	3-	3-	3-	4+	3o	1+	2+	25+	24
2								71	17	64	65	4+	5o	8o	9-	9-	9o	9-	9-	61o	23
												7+	+	4+	3o	4-	3+	4+	5o	30+	47
										2	3										
2	1							70	15	62	62	3+	4+	3+	4-	3+	8+	9-	3+	43+	110
												8o	8-	8o	6-	5-	7o	5-	6o	52-	119
												5o	4+	3+	4o	4o	5o	4o	3+	33o	31
												3o	3-	3+	3+	3-	4-	3o	4+	26o	18

'INUED)

Kp Interval 1st Kp > 4 - Date/Interval	Time 3 Consecutive Kp < 4 - Date, Interval	D	H	Z	Onset	Er.	Max. Kp	Obs.	Range of Starting Time	Sources
08. 5	12/2	10	369	33	081u	10/19xx	7	Hu		28 28
23/4	25/3	196	940	580	23/1034	25/23xx	7	Co	23 1034 - 23/1036	28
		41	191	170	23/1036	26 06xx	6	Fr		
		44	150	195	23/1036	23/xxxx	-	Gr		
		3	85	25	23/1036	24/15xx	5	Ho		
		80	420	350	23/1036	26/10xx	6	Si		
		24	216	59	23/1036	24/17xx	6	Tu		
30. 5	30 8	-	-	-	-	-	-	-	-	
04/8	05/6	22	146	54	04/2020	05/16xx	5	Fr	-	28, 37
		1	115	10	04/2021	05/15xx	6	Ho		
		16	171	42	04/2021	05/16xx	6	Tu		
		34	396	163	07/21xx	13/01xx	7	Fr	07/21xx - 08/0500	28,37
		15	89	27	07/2152	08/17xx	5	Tu		
08/2	09/1	75	1140	750	08. 0500	08/15xx	8	Si		
11/3	13/1	197	770	1170	11/1451	12/22xx	7	Co	1451 - 23xx	12. 16, 17, 27, 28, 29, 47, 37
		35	355	220	11/2328	12/xxxx	-	Gr		
		10	160	45	11/23xx	12/24xx	6	Ho		
		150	1460	710	11/2300	12/22xx	8	Si		
		31	285	47	11/2150	12/23xx	7	Tu		
15/4	16/5	34	154	130	15/07xx	10/12xx	6	Fr		16, 28
		12	102	36	15/0703	16/10xx	5	Tu		
24/2	25/4	158	910	650	24/0540	24/18xx	6	Co	0540 - 2028	28, 37
		20	158	154	24/0540	25/12xx	6	Fr		
		1	75	30	24/0540	25/12xx	5	Ho		
		155	600	600	24/0539	25/10xx	7	Si		
		21	171	42	24/0540	25/17xx	6	Tu		
09/3	09/6	20	87	54	0016	10/13xx	5	Fr		28
		18	121	43	0910	11/23xx	5	Fr		12, 28, 47. 37
		13	78	-	0909	11/17xx	5	Tu		
-	-	-	-	-	-					
										28
		45	650	300	1700	24/09xx	7	Si	15xx - 21xx	28
23/6	24/3	37	107	112	15xx	24/09xx	7	Fr		
27/5	28/8	280	1510	780	07xx	28/23xx	6	Co	0630 - 1348	
		170	1100	780	0730	01/00xx	8	Si		
		24	145	82	07xx	29/03xx	5	Fr		
		30	220	95	1348	28/07xx	7	Wi		
		190	1380	890	29/03xx	30/20xx	7	Co	03xx - 0728	
		26	142	190	29/0728	30/24xx	6	Fr		
		3	85	25	29/0728	30/06xx	6	Ho		
		17	98	38	29/0728	30/17xx	6	Tu		
		25	190	100	30/0802	30/24xx	6	Wi		28
		15	110	58	30/0802	30/24xx	5	He		
11. 6	12/2	19	256	128	1625	12/18xx	7	Fr		12, 16, 17, 27, 28, 29, 47, 37
		4	80	40	1626	12/06xx	6	Ho		
		18	158	37	1625	12/03xx	6	Tu		
15/1	19 8	840	3780	3060	0802	16/04xx	9	Co	0800 - 0803	12, 16, 17, 27, 28, 29, 32, 39 47
		143	1453	1005	0803	16/12xx	9	Fr		
		127	1685	790	0803	16/xxxx	-	Gr		
		11	400	85	0803	16/09xx	8	Ho		
		560	3760	2150	0800	16/04xx	9	Si		
		47	810	200	0802	16/08xx	9	Tu		
		730	4400	2320	1638	18/21xx	9	Co	1303 - 1639	12, 16, 17, 27, 28, 29, 47, 37
		61	794	502	1638	21/11xx	9	Fr		
		48	505	300	1639	18/xxxx	-	Gr		
		10	210	30	1639	19/09xx	7	Ho		
		300	1660	900	1638	19/09xx	9	Si		
		40	337	72	1638	18/18xx	8	Tu		

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Serial No.	Date	Onset	End	Type	Max. Int.	Max. Kp	Average Storm Kp	TYPE REPORTED REF 4 A	B	C	D	E	X	si	b	bs	bp	bps	pt	pk	No. Obs Refe: 4	25
	24																					
	25																					
39	26	0243	-	g	-	5+	-	-	-	-	-											
	27																					
	28																					
	Aug.																					
	15																					
40	16	0404	19/09xx	sc,g	s	8+	6-	26	34	8	5		1	1							60	14
	17																					
	18																					
	19																					
41	20	0412	24/10xx	sc	ms	6-	4+	59	16	-	-		1								75	10
	21																					
	22																					
	23																					
	24																					
	Sept.																					
42	01																					
	02																					
	03	1417	06/13xx	sc,g	ms	7+	5-	10	30	12	3	1	1	17							40	1
		2159	05/11xx	sc	ms	7+	5o	49	17	1	-	3	4	1				1			66	13
	04																					
	05																					
	06																					
	18																					
43	19	1052	22/24xx	sc	ms	7o	5+	-	-	-	-											1
		1128	-	sc	ms	7o	-	16	17	8	12		1	17			2	2			33	
44	20	1157	22/21xx	sc	ms	7o	6c	24	25	10	8	2	3	3							49	5
	21																					
	22	0304	-	-	-	7o	-	-	-	-	-											
	23																					
	Oct.																					
45	03	1711	07/15xx	g	ms	7o	5-	-	-	-	-											1
	04	1856	-	-	-	6o	-	-	-	-	-											
46	05	1203	07/02xx	sc,g	ms	6o	4+	-	-	-	-											4
		1604	-	sc	ms	6o	4+	1	13	21	28	1	1	8							14	
	06																					
	07																					
47	17	0309	19/06xx	sc.g	m	5+	4o	-	-	-	-											2
		0624	19/04xx	g	m	5+	4o	-	-	-	-											2
	18																					
	19																					
48	29	2347	05/16xx	sc	ms	6+	5+	54	17	1	1		1		1						71	12
	30																					
	31																					
	Nov.																					
	01																					
	02																					
	03																					
	04																					
	05																					
49	09	0318	-	sc	m	4-	-	1	20	19	19			13		1					21	
50	13	1119	15/02xx	g	m	5-	4+	-	-	-	-											1
	14																					
	15																					
51	21	1136	23/22xx	sc	ms	6-	4o	1	27	13	42	1	2	8							28	1
52	27	2351	29/02xx	sc	s	8o	5+	62	12	-	1		1								74	16
	28																					
	29																					
53	30	0247	05/00xx	sc	ms	6o	4o	-	-	-	-											2
		0552	01/16xx	sc,g	ms	6o	5-	-	14	19	33	1	3	3							14	4
		0653	01/21xx	sc,g	ms	6o	5o	4	13	18	28	1	3	7		1					17	3
	Dec.																					
	01																					

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TABLE V 1959 (CONTINUED)

Rep.		Kp														
		Three Hour Gr. Interval										Kp Interval	Time			
6	46	1	2	3	4	5	6	7	8	ΣKp	Ap	1st Kp ≥ 4 - Date/Interval	3 Consecutive Kp < 4 - Date/Interval	D	H	Z
		3o	2-	3-	5o	3+	4-	5+	5o	30-	28					
		4+	4+	4+	5o	4-	5-	5+	5-	36+	38					
2	2	4o	4+	4o	4o	5o	5-	5o	5-	35-	33	24/4	28/2	-	-	-
		5-	3+	4+	4-	3-	3o	4+	4o	30o	25					
		4-	2-	2+	3-	3o	3-	2+	3o	22o	13					
		3-	2-	1+	3+	4o	5o	4+	6-	28o	27					
48	4o	4+	4+	7-	7+	8+	8o	7-	7+	53o	130	15/5	19/4	370	2180	1700
		8-	8+	7-	6+	5+	7o	5o	5+	52-	114			73	307	365
		3o	4+	5+	3o	4+	4o	5-	3-	31+	28			50	300	400
		3+	5-	4+	3o	2o	3o	4o	3o	27+	21			4	275	33
														413	1980	1380
														25	255	100
56	58	3-	6-	6-	5o	4o	2+	5o	4o	34-	28	20/2	24/4	32	234	80
		5-	4-	4o	5o	3+	4o	5+	5-	35-	34			2	70	40
		4+	4-	4+	3o	3o	4-	5o	4o	31o	27			22	147	57
		4-	3+	4-	4-	5-	5-	4+	4+	32+	28					
		4-	4-	5o	3+	2-	3o	2o	3o	26o	20					
		3+	3o	3+	4-	3o	4o	4+	3-	27+	20	01/4	03, 1			
		4+	5+	5o	5-	3-	3+	4o	5-	34o	34					
17	35															
52	52	3o	3-	3+	4-	3o	4-	4o	7o	30+	33	03/4	06/4	280	2200	1020
		7-	7+	7o	6+	6o	7o	5+	6-	51+	103			22	107	79
		5o	4-	4o	4o	4o	4-	4+	6-	34+	34			36	255	260
		6-	4-	4-	3-	2+	2+	1o	1-	22o	16			4	230	38
														190	1330	590
														22	160	60
		3+	3-	3o	5-	4o	4-	4+	5o	31-	27					
2	3															
20	38	6o	6o	3+	5o	4+	2+	3-	3-	32+	36	18/4	19/6	11	222	26
37	43	4o	5o	5+	5o	6o	6-	6+	6-	43o	61	20/1	22/8	44	195	195
		6-	7-	7o	5-	6o	7-	6+	5+	48+	86			6	105	30
4	6	6+	7-	7o	6-	6-	5o	5+	2+	44o	73			19	199	66
		3-	3-	4-	4-	2+	5-	4+	5o	29o	24					
3	3	1o	3-	4o	3o	3+	6-	7-	7-	33o	46	03/3	05/3	42	151	170
1		5o	7o	5+	5-	6-	3o	4+	3+	38+	51					
7	8	5-	4+	3o	3-	3+	4+	6o	6-	34o	37	05/6	07/3	-	-	-
		6-	6-	5+	5+	5-	5o	5+	4+	41+	53			24	101	96
		3+	4-	3-	3+	3-	1+	2+	4o	23+	15			10	332	[illegible]
														24	156	.
2	2	1o	2-	3-	4+	4-	3o	4-	4-	24-	17	17/7	19/3	22	91	142
		5-	4+	5-	5+	4+	5-	4-	4+	36o	36			28	132	90
		4-	4o	2+	3+	2-	1+	2o	3+	23-	15			11	404	65
														19	115	42
56	57	0+	1+	1+	1o	2-	1-	0+	3+	10o	6			31	182	116
		5+	4o	3-	2+	3+	3-	4o	6-	30o	28			43	165	165
		4+	3o	3+	5o	4+	5o	5o	6-	36-	38			-	-	-
														17	161	37
		4-	5o	6+	5+	5+	4-	4-	4-	37-	43					
		5o	6-	6+	5o	6-	6-	6+	6-	45+	62					
		6-	5-	5-	5o	5-	6-	5o	5-	40o	48					
		2o	3-	5-	4+	5o	5-	6o	4+	34-	36					
		5-	5o	5o	4o	4o	3-	3o	2-	31-	28					
		1-	2o	0o	1+	2o	3-	4-	3o	15+	9			-	-	-
5	8	2+	2-	2o	3-	3+	3-	3-	4-	21o	12	13/8	14/8	17	76	100
		4+	4-	4o	5-	5-	4o	4-	3o	32o	28					
		3-	2-	2-	1o	1-	1-	0o	1o	9+	5					
12	17	1o	2+	2o	3+	4+	4o	3o	3o	23o	16			30	125	94
		3+	4o	3+	4-	3+	2+	3+	2+	26-	17					
		5+	6-	5+	5o	4+	3+	4+	2o	35+	40					
59	59	4-	2+	3o	2o	2o	2o	3-	5-	22+	15	27/	29/2	157	1640	860
		6o	8o	7+	7-	4+	4-	4o	4o	44o	82			45	235	274
		4-	3-	2-	4o	3+	3o	3-	2-	23-	15			39	170	120
														3	290	27
														125	1830	800
														27	263	45
5	6															
5	9	3-	2	5+	6-	5+	6o	4o	5-	36o	43	30/3	01/6	331	1350	1200
														30	165	82
														135	1100	720
		5o	4+	4+	5-	4+	3+	3o	2-	31-	28			17	114	44

(2)

Onset	End	Max. Kp	Obs.	Range of Starting Time	Sources
16/04xx	17/24xx	8	Co	15/12xx - 16/1344	12, 16, 38, 37
16/0403	19/09xx	8	Fr		
15/12xx	17/xxxx	-	Gr		
16/0404	17/15xx	?	Ho		
16/0405	18/09xx	9	Si		
16/0404	18/09xx	7	Tu		
0413	24/13xx	6	Fr	-	12, 16, 27, 28, 47
0413	21/11xx	6	Ho		
0412	24/10xx	6	Tu		
					28
2158	04/21xx	8	Co	-	16, 28, 29, 47, 37
2159	06/19xx	5	Fr		
2159	04/xxxx	-	Gr		
2159	05/08xx	7	Ho		
2159	05/15xx	9	Si		
2159	06/11xx	7	Tu		
19/1053	22/24xx	-	Bi	19/0400 - 19/1128	28
20/1157	22/xxxx	-	Gr	20/02xx - 20/1158	28, 37
20/1158	22/21xx	6	Ho		
20/1158	22/21xx	7	Tu		28
05/17xx	07/15xx	7	Fr	03/04xx - 03/17xx	
05/1203	07/02xx	-	Gn	05/01xx - 05/1604	
05/12xx	06/22xx	6	He		
05/1200	06/20xx	6	Hu		
05/1202	07/15xx	6	To		
0309	19/06xx	5	Gn	05xx - 0900	
03xx	19/14xx	5	He		
0625	19/04xx	6	Hu		
0622	18/20xx	5	To		
29/2347	03/23xx	6	Fr	-	16, 28, 37
29/2347	05/xxxx	-	Gr		
29/2348	30/09xx	5	Ho		
29/2347	01/17xx	6	Tu		
11xx	15/02xx	5	Gn	1119 - 11xx	
1137	23/22xx	5	He	-	28
2350	29/01xx	7	Co	-	16, 28, 37
2351	29/00xx	7	Fr		
2351	28/xxxx	-	Gr		
2351	28/24xx	8	Ho		
2351	28/19xx	8	Si		
2351	28/19xx	7	Tu		
					28
06xx	01/23xx	7	Co	0247 - 0700	
06xx	04/12xx	6	Fr		
0700	01/21xx	8	Si		
0548	01/16xx	6	Tu		

Serial No.	Date	Onset	End	Type	Max. Int.	Max. Kp	Average Storm Kp	A	B	C	D	E
54	Dec. 05 06	0649	06/06xx	sc	s	8-	5+	49	25	2	-	
55	13 14 15 16	1822	16/17xx	sc,g	m	5+	4o	-	10	23	34	
56	23 24	1525	24/14xx	sc	ms	6o	4o	25	39	5	1	
57	26 27 28 29	1022	29/13xx	g	ms	6-	4+	-	-	-	-	

Mo.	Day	Onset sc	1st 3 kp >
Feb.	25	24/2319	2
Mar.	26	26/0842	4
	28		4
Apr.	09	09/1828	7
May	11	11/2328	8
	24	24/2027	7
July	15	15/0803	2
	17	17/1638	6
Aug.	16	16/0404	3
Sept.	03	03/2159	8
Nov.	27	27/2351	8
Dec.	05	05/0659	4

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TABLE V 1959 (CONTINUE

(PE REPORTED REF 4								No. Obs. Rep.				Kp									
								Reference				Three Hour Gr. Interval									
X	si	b	bs	bp	bps	pt	pg	4	25	26	46	1	2	3	4	5	6	7	8	∑Kp	Ap
								74	15	57	57	3o	0o	4o	5-	6+	7-	8-	6+	36-	68
												3o	4+	3+	3+	3o	2o	3o	2+	24-	16
	5							10	4	3		4o	3+	2+	2-	1o	2+	3o	5+	23o	18
												5-	4+	5+	5o	5-	5+	5-	3o	37o	40
												3+	4+	4+	4o	3+	3+	4o	4+	31o	26
												3+	2+	3o	3+	4-	4o	2+	3o	25o	17
1	3							64	5	38	49	3-	3-	4-	3-	3-	6o	4+	5-	29+	28
												4o	1+	4o	4o	3+	1+	2-	2o	22-	15
									1	2	2	3-	4-	3+	4+	4+	4-	4o	5-	31-	26
												5-	5-	4o	6-	4+	5-	4o	4+	36+	38
												5o	5-	4+	5-	5+	5+	5-	3o	37o	40
												4o	4o	4o	4-	4-	3-	1o	2o	25o	18

TABLE V-A MAJOR GEOMAGNETIC STORMS D

hr 5-	No. 3 hrs Intervals	Number 3hr. Intervals Kp = 7-	7o	7+	8-	8o	8+	9-	9o	Consecutive 3 hr-Kp's, No. Kp<5- At Le: 1	2	3	4	5	6	7	8
	6	-	-	1	-	-	-	-			5-	6+	6-	6+	7+	5+	
	13	1	-	2	2	1	3	-					5+	8o	5+	6+	7+
	12	1	1	2	-	-	-	-					5+	6+	7o	7+	7+
	9	-	1	2	1	-	-	-								5+	5-
	9	3	1	-	-	-	1	-									6o
	3	-	-	1	-	-	-	-								5-	7+
	9	-	-	1	.	1	-	4	1		5o	8o	9-	9-	9o	9-	9-
	12	-	1	-	1	2	2	1							8+	9-	8+
	14	3	1	2	1	1	2	-				7-	7+	8+	8o	7-	7+
	10	1	2	1	1	-	-	-									8-
	5	1	-	1	-	1	-	-									5-
	5	1	-	-	1	-	-	-					5-	6+	7-	5-	6+

D)

Kp Interval 1st Kp ≥ 4 - Date Interval	Time 3 Consecutive Kp ≥ 4 - Date Interval	D	H	Z	Onset	End	Max. Kp	Obs.	Range of Starting Time	Sources
05/3	06/3	357	1980	1290	0701	06/06xx	8	Co	0649 - 0701	16, 26, 37
		27	224	96	0659	06/12xx	6	Fr		
		50	215	275	0659	05/xxxx	-	Gr		
		4	85	30	0659	06/24xx	5	Ho		
		160	1160	870	0700	06/03xx	9	Si		
		16	204	48	0659	06/11xx	6	Tu		
13/8	16/1	248	1530	830	17xx	15/02xx	7	Co	1130 - 2000	
		19	132	72	17xx	16/17xx	5	Fr		
		14	107	38	16xx	16/17xx	5	Tu		
23/6	21/5	19	112	44	1525	24/14xx	5	Fr		28, 37
		16	78	34	1525	24/02xx	5	Tu		
26/2	29/6	30	175	80	1000	29/13xx	6	Wi	01xx - 17xx	

DURING 1959

ast One Kp ≥ 7+ 1	2	3	4	5	6	7	8	+	Ap			Storm Number Table V
									69			16
7+	8-	8+	7-	8+	8+	8-	6+		81	178		20
7-	6+	6+	6-	6-	6o	5+			87	73		20
5-	5o	8-	7+	7+	7o	5+			44	98		21
7o	7-	7-	6-	7-	8+	5+	5-		26	108		28
6+									52	25		30
7+	5+								236	47		37
8o	8-	8o	6-	5-	7o	5-	6o	5o	110	119	31	38
8-	8o	7-	6+	5+	7o	5o	5+		130	114		40
7-	7+	7o	6+	6o	7o	5+	6-	5o	39	103	34	42
6o	8o	7+	7-						15	82		52
									68			54

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VI. CATALOGUE OF SOLAR-TERRESTRIAL EFFECTS DURING 1959

VI

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TABLE VI. CATALOGUE OF SOLAR-TERRESTRIAL EFFECTS DURING 1959

This table will include short wave radio fadeouts of importance 3 or greater that lasted for 30 minutes or more, as well as S.W.F.'s that occur at the times of the major flares catalogued in Table I, Solar Flare Effects from reference 4. All polar cap absorptions reported in the literature; Geomagnetic storms with a maximum $K_p \geq 5$; and Forbush decreases.

The column headings together with any necessary description or definitions follow:

Column 1 Date

Column 2. Major Flare Serial Number from Table 4.I

FLARE DATA (Columns 3 through 7)

A few minor or sub flares are given when a clear association with an SWF or other terrestrial effect has been made in the literature.

Column 3 Flare Beginning Time

Column 4 Flare End

Column 5 Time of Maximum

Column 6 Heliographic Position of the Flare

Column 7 Flare Importance

SHORT WAVE FADE (Columns 8 through 12)

Column 8 Onset

Column 9 Importance. SWF's are given an importance rating on a scale from 1- to 3+, based on the amplitude of the fade, duration of the event, and confidence in the reality of the event.

Column 10 Type (S, SL, or G) the following classifications are used:
S - SWF (S) - sudden drop out and gradual recovery
Slow S - SWF (SL) - drop out takes 5 to 15 minutes and gradual recovery
G - SWF (G) - Gradual disturbance fade irregular in either the drop out or recovery stage

Column 11 Duration in Minutes

Column 12 Widespread Index. The degree of confidence in identifying the event by individual stations is combined into an index of certainty that the event is geographically widespread, ranging from 1 (possible - single station reporting) to 5 (definite - many stations reporting).

SOLAR FLARE EFFECT (Columns 13 through 15)

Preliminary reports of solar flare effects, sometimes referred to as a magnetic crochet, have been published in the Journal of Geophysical Research, reference 26. The SFE's recorded in this catalogue are limited to those listed in reference 4. As a "distinctly" SFE or an "unmistakable" SFE (Classes A and B). The list of the reporting observatories is given in reference 4.

Column 13 Beginning Time

Column 14 Number of Observatories Reporting the Effect

Column 15 Intensity. Strong effects, indicated by the letter "S", are marked by an asterisk in reference 4. Insofar as possible the SFE has been associated in time with a solar flare.

POLAR-CAP ABSORPTION (Columns 16 through 21)

Column 16 Onset Time. If reference 1 is listed in Column 21, the starting time has been taken from that source.

Column 17 Rise time in Hours from Reference 1

Column 18 Duration in Hours

Column 19 Absorption in db on the 30 Mc/s Riometer.

Column 20 Probable Flare - day/beg. If a polar-cap absorption-flare, association is given in the literature the reference is given in Column 21.

Column 21 The Sources Checked during the preparation of this catalogue have been listed.

GEOMAGNETIC STORMS (Columns 22 through 31)

The geomagnetic storms listed in this portion of the catalogue are limited to those with a maximum $K_p \geq 5$. A few minor storms have been included if one or more investigators associated them with a major flare, or it was preceded by a PCA and/or followed by a Forbush decrease.

Column 22 Onset Time

Column 23 End Time

Column 24 Type, the symbols g (gradual) and sc (sudden commencement) have been used. In a few cases both a g and an sc are indicated. In these cases, three or more magnetic observatories listed the storm with a sudden commencement.

Column 25 Maximum Intensity - The symbols m (moderate K_p as great as 5) ms (moderately severe K_p = 6 or 7) and s (severe K_p = 8 or 9) have been used.

Column 26 Maximum K_p

Column 27 Number of Magnetic Observatories Reporting the Storm as an sc in references 4 and 46.

Column 28 ΣK_p. This is the sum of the 8 three-hour Greenwich day K_p's, from reference 5.

Column 29 Ap from reference 5.

Column 30 Probable Flare day/beginning. An entry in this column is based on one or more flare-storm correlations in one or more of the references listed in Column 31.

Column 31 Sources of Flare Associations

FORBUSH DECREASE (Columns 32 through 35)

Column 32 Onset Time. The day and hour given in reference 27. In reference 41 the onset is given to the nearest tenth of a day. The data from reference 41 were kindly supplied by Dr. Carmichael in advance of publication.

Column 33 Magnitude of the Decrease in Percent.

Column 34 Duration. The value given in this column with an asterisk (*) is the duration of the decrease phase in hours (from reference 27). When the duration is preceded by a greater than sign (>), the value is taken from references 41. This is the time in days from the start of the event to the time of "half intensity" recovery.

Column 35 Probable Flare (day/hour). An entry is given if a flare - Forbush decrease association was given in reference 27.

		FLARE						SHORTWAVE FADE					SOLAR FLARE EFFECTS			
Date	Maj. Flare Serial No.	Beg. UT	End UT	Max. UT	Position		Imp.	Onset	Imp	Type	Dur. (Min.)	W.S. Index	Beg. UT	No. Obs. Reported	Int.	Onset
1958																
Dec.																
31	100	1656	1803	1703	S18	W54	3	1700	2+	S	36	5				
1959																
Jan.																Jan
01																
02		0911	1002	0917	S10	W68	2	0913	2	S	25	1				
03		No Flare Reported						0141	3	G	94	1				
		No Flare Reported											1146	28	S	
		1617	1702	1638	S12	W90	1+	1600	3	SL	105	5				
05	1	1040	1220	1105	N26	E27	2+									
07		0215	0404	0240	S15	W10	2+									
		1750	2045	1855	N25	W03	2									
09																
21	2	1709	1750	1709	N10	E48	3	1702	2+	S	41	5	1702	8	-	
22	3	1108	1147	1127	N08	W03	3									
		2050	2145	2059	N08	W08	2									
25																
26	4	0842	1030	0900	N16	W61	3	0855	2	S	20	4				26/xxxx
27	6	1340	1520	1430	N08	W60	2+	1428	2	S	27	5				
Feb.																
01	7	0352	0458	0423	N12	E83	3	0422	3-	S	28	5	0420	11	S	
02	9	1816	2019	1824	N09	E60	3	1817	3	S	85	5				
09		0058	0246	0137	N10	E90	2	0200	3	S	45	5				
	10	0735	1545	0955	N09	E88	3	0952	3	S	52	4				
		1230	1441	-	N08	E88	2+	1300	2-	G	94	5				
10	11	0800	1530	-	N09	E73	3									Feb.
11																
12	12	2301	2515	2325	N13	E48	3+	2308	2	SL	40	5				
13		2342	2402	2347	N22	E54	2									13/0800
																13/1400
14																
16													Feb.			
18		No Flare Reported						0500	2+	S	25	5	0503	12	-	
19	15	2032	2244	2037	N11	W10	3	2030	1+	SL	40	5				
22																
24																
Mar.																
05		No Flare Reported						0520	3	S	100	4				
07		1723	1750	1730	N01	E90	2	1725	3	SL	115	5				
10		No Flare Reported						0513	3	SL	115	5				
		0704	0755	0730	N26	W70	2	0708	3-	SL	80	1				
12		No Flare Reported						0854	3	G	59	1	Mar.			
16		0050	0216	0052	N28	E35	1+	0050	1+	S	50	5	0050	8	-	
		0353	0424	0404	N29	E27	2	0357	2	SL	33	5	0357	4	-	
19	16	1035	1205	1053	N28	W18	3	1058	2	S	27	4				
20		2229	2250	2227	N28	W39	1+	2238	1	S	17	4				
21		0158	0259	0205	N12	W36	2+	0200	3	S	40	4				
	17	0900	1127	0916	N15	W42	3	0912	3	S	27	5				
22		0104	0154	0116	N23	W17	1									
		No Flare Reported						0430	3	G	100	1				
		1338	1615	1345	N29	W49	2	1341	3	S	84	5				
24	18	0700	0908	0737	N19	W04	3	0738	3	SL	41	1				
	19	0958	1325	1015	N29	W77	3	1002	3	S	107	5	1003	26	S	
25																
26																
28	20	2113	2315	2126	N24	W33	3	2121	1+	S	24	5				
29		0746	0930	0754	N17	E37	2	0750	3	S	40	5				
Apr.																
04	21	0640	0956	0800	N15	W44	3	0748	2	SL	42	5				
05	22	2316	2519	2327	N16	W67	3+	2317	3+	S	93	5	2321	17	S	
08	23	0903	1010	0921	N27	E85	3	0913	2+	S	32	5	0915	39	S	
		2040	2106	2046	N28	E78	1	2045	1	SL	15	5				
09																
10																
11	24	0807	0933	0838	N28	E46	3	0839	2	S	26	5				
12	25	1104	1225	1117	N26	E30	3	1110	1+	SL	17	5	1110	13	-	
13	26	0823	0935	0840	N27	E19	3	0835	2	S	25	5				
20		No Flare Reported						1053	3	SL	35	1				
22		No Flare Reported						1116	3	S	54	5				
23																
May																
02		2355	2442	2414	N15	W48	2+									
04																
05		2106	2124	2110	N23	E90	2	2107	2-	S	23	5				
07																
08	27	2252	2322	2257	N23	E86	3	2258	2	S	22	5				
10	29	2055	2610	2140	N19	E47	3+	2110	3+	SL	560	5				May
	30	2315	2520	-	N19	E51	3									10/2300
11		No Flare Reported											0606	9	-	11/0030
	31	2006	2150	2028	N10	E41	3+	2015	3-	S	67	5				11/0130
12	32	0655	0801	0708	N10	W22	2+	0705	2	S	39	3				
13	33	0487	0553	0514	N22	E26	2+	0511	2	S	36	5				
	35	1584	1650	1610	N14	E18	3	1600	1+	G	30	5				
15																
17		0103	0118	0104	N20	E82	1-	0107	3	S	100	5				
	36	0523	0600	0527	N21	W30	3	0525	2+	S	35	3				
23		0029	0113	0035	N14	E43	1+									
		1436	1506	1453	N15	E38	1									

ALOGUE OF SOLAR-TERRESTRIAL EFFECTS DURING 1959

POLARCAP ABSORPTION					GEOMAGNETIC STO						
Rise Time (hr)	Dur. (hr)	abs. Db 30 mc sec Riometer	Prob. Flare	Ref.	Onset	End	Type	Max. Int.	Max. Kp	No Fin: Rept. 4	R 4
					Jan.						
					05 0136	07/04xx	sc	ms	6-	54	6
					09/1459	11, 02xx	sc	ms	6+	47	4
					25, 0859	25/21xx	sc	m	4+	62	6
				26	26 0322	26/18xx	sc,g	ms	6o	30	2
					Feb.						
					11/0318	12/24xx	sc	ms	6+	62	6
					11/0956	13/00xx	sc	ms	6+	64	5
2	74	2.6		1 20							
					14/1142	14/22xx	sc,g	ms	6-	51	5
					16/0649	17/03xx	sc	ms	6+	18	1
					22/0046	23/13xx	sc	m	4+	72	6
					24/2319	27/06xx	sc	ms	7+	37	4
					Mar.						
					25/0130	25/23xx	sc,g	m	5+	16	
					25/1204	25/21xx	sc	m	5+	19	1
					26/0842	04/12xx	sc	s	8+	.0	2
					Apr.						
					09/1823	12/02xx	sc	s	8-	71	6
					10/0801	10/19xx	sc	s	8-	31	2
					23/1036	26/06xx	sc	ms	7-	73	4
					May						
					04/2021	05/15xx	sc,g	ms	6+	57	5
					07/2151	08/24xx	sc	m	5+	15	
			10/2055								
	168	15	10/2315	29							
6	170	22		1, 9							
	200	>15	10/2055	22, 27, 28 47, 54	11/2328	12/24xx	sc,g	s	8+	55	
					15/0703	16/12xx	sc,g	ms	6o	20	

(2)

RMS					FORBUSH DECREASE				
ıl ef. ;	ΣKp	Ap	Prob. Flare	Ref.	Onset	Mag. Dec. %	Dur-ation	Prob. Flare	Ref.
5	26+	25	02/0911	28	Jan. 05	1.6			28
8	32+	38	07/0215 07/1750	17, 25 36, 39	09/2000 09.8	5 3	2.5* >2		27, 28 41
0 5	22o 22+	18 22	22/1108 22/2050 22/2050	28 36, 39 28	25.9	6	>5.4		28, 41
6 5	33- 33-	36	09/0058 09/0735 09/1230	28 36 28, 36	Feb. 11.3	10	>6.4		22, 28, 41
1 .5	31+ 42+	30 61	12/2301 13/2342	12, 16, 28, 36 28					
2 0	25o 8o	17 4	19/2032	16, 28, 36 28, 36					
9 5 1	31+ 31+ 41o	31 31 81	22/0104 22/1338 24/0958	28 28 16, 17, 28, 36	Mar. 26/0730 26.4	3.5 5.2	 >1.6	24/0958	27a, 28, 41
7 5	35o 48-	44 98	08/0903 08/2040	12, 17, 28, 36 28	Apr. 09.9	3.5	>3.0	08/0903	28, 41
9	27+	40			23.9	40	>1.7		41
4	23o	16	02/2355	28, 36					
3	10+	6	05/2106	28, 36					
48	29+	26	10/2055	12, 16, 17, 28 29, 36, 47	May 10/xxxx	4.0			22
22	32o	33	11/2006 13/0457	16, 28, 36	12/0000 12.0	14.8 14.5	7* >2.5	10/2055	27 41, 46

* Duration of the decrease phase in hours from Ref. 27.

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(5)

		FLARE						SHORTWAVE FADE			
Date	Maj. Flare Serial No.	Beg. UT	End UT	Max. UT	Position		Imp.	Onset	Imp.	Type	Dur. (Min.)
24											
June											
09		No Flare Reported						1635	3+	S	180
11	37	1802	2130	1807	N17	E78	3	1803	2+	SL	122
12	38	0734	1159	0851	N21	E65	3	0755	1-	G	83
13		0357	0408	0401	N17	E58	1+	0358	1	S	20
15	39	0232	0420	0302	N20	E28	3	0235	2	SL	35
16	40	0618	0810	0643	N15	E15	3	0623	2	S	34
17	41	1421	1604	1441	N16	W02	3	1430	2+	SL	45
18	42	1134	1300	1148	N16	W12	3+	1138	2+	S	22
22	43	1010	1140	1035	N18	W67	3	1028	2	S	30
23											
28		1904	1936	1906	S12	E43	1				
29											
30											
July											
10	44	0206	0538	0230	N20	E63	3+	0200	3+	SL	190
	45	0539	1000	-	N19	E58	3	0505	3+	G	155
11											
12	46	2134	2420	2230	N19	E24	3	2220	2-	G	100
14	48	0325	1121	0349	N17	E04	3+	0328	3+	S	180
	49	1400	1730	1452	S25	E37	3+	1355	2+	SL	105
15											
16	50	1525	1715	1616	N14	W27	3+	1610	2-	S	28
	51	2114	2430	2128	N16	W30	3+	2118	3+	S	177
17											
27	53	2050	2250	2115	N2[illegible]	E26	3	2105	1+	SL	23
29	54	2020	2234	2047	N10	E21	3	2023	2-	SL	42
	55	2117	2243	2120	N15	E22	2+	2120	2	S	45
Aug.											
03		1515	1525	-	N07	W08	1	1525	3-	SL	99
04	56	1028	1113	1048	N04	W12	3	1031	2	SL	11
14		0040	0234	0121	N12	E30	2+	0105	3	SL	125
16											
18	58	1014	1411	1030	N12	W33	3+	1025	3	S	120
	59	1654	1822	1325	N05	E16	2+	1700	1+	SL	49
20											
24	60	2233	2332	2239	N17	E28	2+	2240	2+	S	60
25	62	0623	0740	0634	N20	E01	3+	0630	1+	S	33
31		1650	2054	1910	N10	E11	2	1856	2+	SL	64
	63	2222	2332	2252	S08	W46	2+	2242	2+	S	32
Sept.											
01	64	1648	1832	1705	S12	W52	3	1655	3-	S	87
	65	1923	2216	1948	N12	E60	2+	1945	2	SL	73
02	66	0720	0954	0745	N10	W10	3	0725	2	SL	73
	67	1602	1645	1606	N25	W77	2+	1605	2	S	26
03		0421	0439	0423	N25	W86	2+	0422	3	S	20
19											
20											
Oct.											
05											
06		1405	1448	1425	N30	E64	2				
10	68	0437	0624	0501	S18	W53	3	0500	1+	S	62
26		1958	2036	2006	N07	W05	1+				
28		0315	0340	-	S11	E07	2	0322	2+	S	45
29											
Nov.											
18		2322	2435	2334	N23	W66	2	2330	2	SL	28
21											
26	69	0923	1156	0939	S15	W17	2+	0930	1+	S	46
27											
28	70	2006	2130	2018	N12	E31	3	2010	2	SL	35
29	71	1816	2012	1848	N09	E18	2+	1843	2+	S	59
30		0247	0356	0250	N08	E16	2+	0249	3-	S	31
	72	1720	1906	1744	N07	E06	3	1735	3-	SL	47
Dec.											
01		1147	1251	1157	N11	W01	1+	1247	3	S	40
	73	1638	2035	1701	N09	W05	2+	1705	3	S	115
02		No Flare Reported						0330	3-	S	80
	74	1219	1412	1229	N07	W16	2+	1246	2+	S	76
05											
13											
21		0043	0350	0055	S04	W54	2				
23											

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	SOLAR FLARE EFFECTS			POLARCAP ABSORPTION					
W.S. Index	Beg. UT	SFE No. Obs. Reported	Int.	Onset	Rise Time (hr)	Dur. (hr)	abs. db 30 mc sec Riometer	Prob. Flare	Pt.
				June					
5				09 xxxx					20
5									
5									
5				13 1330			1.5	13 0357	20, 22, 29
1									
5	0623	39	S						
5									
5	1139	25	S						
5									
				July					
5				10/0400		96	15	10 0206	29
1				10/0700	29	360	20	10 0206	1, 9, 28, 54
				10/1100		96	-	10 0206	27
5									
5				14/0730	20	72	23.7	14 0325	1, 9, 27, 29
4									
5				16/2250		120	15	16 2114	1, 9 47, 54
5									
				17/0000	10	67	21.2	16/2114	27, 29
				17/0300	-	120	-		
4									
5									
5	2118	9	-						
5									
3									
5				Aug.					
5	1075	11	S	18/1130	-	-	15	18. 1014	1,20,22
5									
5									
5									
5									
5									
5									
5				Sept.					
5				02/0400		48	Small	01/1648	29
5								01 1923	29
5	0421	14	-						
									—
				Oct					
				06/xxxx	-	-	-	06/1405	29
1									
5									
5									
3									
5									
5									
5	0248	11	S						
5									
1									
5									
1									
5									

GEOMAGNETIC STORMS												FORBUSH DECREASE				
Onset	End	Type	Max. Int.	Max. Kp	Sudden Impulse	Final Ref.	K_p	Ap	Flare	Ref.		Onset	Mag. Dec. %	Duration	Prob. Flare	Ref.
												May				
4 0940	25 10xx	sc	ms	7+	69	57	[illegible]	32	23 002ø	28		24 xxxx	2.1		23/0029	28
24 2520	25 10xx	sc	ms	7+	32	26	39-		23 1436	36		24 8	2.7	>1.1		41
												June				
												11.4	4.4	0.9		41, 46
											28					
3 1310	-	sc	ms	6o	12	9	22o	15								
9 0728	30 02xx	sc,g	ms	6+	69	49	39-	51		28						
0 0801	30 24xx	sc,g	ms	6o	44	29	35o	38	28 1904							
July												July				
11 1625	12 03xx	sc	ms	7-	76	67	34o	44	10/0206	12, 16, 17, 28 29, 36, 47		11/1715	9.9	12*	10/0206	27, 28
												1/17	9.2	>3.5		41
15 0803	16 09xx	sc	s	9o	71	65	61o	236	14/0325	12, 16, 17, 28 29, 36, 39, 47		15	14.5	18*	14/0325	27, 46
												15	13.0	>2.0		22, 28, 41
17 1638	19 18xx	sc	s	9-	70	62	43+	113	16/1525 16/2114	17 12, 16, 28, 29 36, 37		17/1655	15.5	7*	16/2114	27, 46
												17.9	12.2	[illegible]		22, 28, 41
Aug.																
16 0405	19 03xx	sc,g	s	8+	60	48	53o	130	14/0040	12, 16, 28, 36						
20 0412	24 10xx	sc	ms	6-	75	58	34+	28	18/1014	12, 16, 20, 47		Aug. 20/0415	6.8	3*		27
												[illegible]	6.5	>1.4**		28, 41
Sept.																
												Sept. 04.0	4.1	>3.1		28, 41
03 1417	06 13xx	sc,g	ms	7+	40	35	30+	33	31/1650	28		09/xxxx				46
03 2159	06 11xx	sc	ms	7-	66	52	30+	33	01/1923	28, 29, 36, 47		19.0	8.0	>1.1**		22, 28, 41
19 1128	-	sc	ms	7o	33	38	32+	36		28						
20 1157	22 21xx	sc	ms	7o	49	43	43o	61		28, 36						
Oct.																
05 1604	-	sc	ms	6o	14	8	34o	37								
29 2347	05 16xx	sc	ms	6+	71	57	10o	6	26/1958 28/0312	28, 36 36						
Nov.																
21 1136	23 22xx	sc	ms	6-	28	17	23o	16	18/2322	28						
27 2351	29 02xx	sc	s	8o	74	59	22+	15	26/0923	16, 28, 36						
30 0552	01 16xx	sc,g	ms	6o	14	6	36o	43								
30 0653	01 21xx	sc,g	ms	6o	17	9	36o	43								
												Dec. 03.0	7.2	>3.2**		41
Dec.																
05 0649	06 06xx	sc	s	8-	74	57	36-	68	02/1219	28						
13 1822	16 17xx	sc,g	m	5+	10		23o	18								
23 1525	24 14xx	sc	ms	6o	64	49	29+	28	21 004[illegible]	28, 36						

*Duration of the decrease phase in hours (Ref. 27)
**Indicated as a "considerably doubtful event" in Ref. 41.

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(a)

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VII. CATALOGUE OF BALLOON FLIGHTS ASSOCIATED WITH MAJOR SOLAR FLARES DURING 1959

VII

TABLE VII. CATALOGUE OF BALLOON FLIGHTS DURING 1959 ASSOCIATED WITH MAJOR SOLAR FLARES

Two hundred sixty-three balloon flights were reported by the World Data Center A for cosmic rays and published in reference 3; 104 of these flights were made within four days of a major solar, a solar spectral emission of Type II, or Type IV, or a polar cap absorption event. A search of the literature revealed eight flights not included in reference 3.

A bibliography of paper published in the scientific literature from which the list of balloon flights was compiled, is given on page 4.VII-iii. These flights are referenced in the last column of the table.

A description of the column headings follow:

Column 1 Greenwich Date

Column 2 Flare Serial Number. This refers to the major flare serial number in Table I. Minor flares are those associated with Type II, or Type IV spectral emissions, or polar-cap absorption, listed in Columns 6, 7, or 8.

Column 3 Event Number from Table VIII

Column 4 Beginning Time of the Flare

Column 5 Flare Importance

Column 6 Spectral Observations Type II, Beginning Time

Column 7 Spectral Observations Type IV, Beginning Time

Column 8 Polar-cap Absorption, Greenwich day/beginning UT

BALLOON DATA (Columns 9 through 17)

Column 9 Launch Date

Column 10 Time the Flight Reached Recording Altitude

Column 11 Time at Altitude, Hours, Minutes

Column 12 Maximum Altitude. This is given in either kilometers or millibars as reported in the literature.

Column 13 Name of the Place Where Balloon was Launched.

Column 14 Geographical Latitude and Longitude of the Launch Site.

Column 15 Instrument Carried. Where:

C - Single Geiger Counter
4CA - Four channel pulse height analyzer with NaI Crystal
Sc - Scintillations Counter
T - Double Coincidence Counter Telescope
EM - Emulsion Pack
I - Ionization Chamber

Column 16 Group. These have been designated as follows:

Minn. - School of Physics, University of Minnesota Dr. J. R. Winckler
New York - Department of Physics, New York University Dr. S. A. Korff
CIT - Norman Bridge Laboratory of Physics California Institute of Technology Dr. H. V. Neher
Chicago - Enrico Fermi Institute, University of Chicago, Dr. Peter Meyer, Dr. Gordon Lentz.
SUI - Department of Physics, State University of Iowa, Dr. J. A. van Allen, Dr. Carl McIlwain
SIU - Southern Illinois University, O. B. Young

Column 17 Published Balloon Flight Data. References that discuss the data obtained during some of the flights refer to the balloon flight bibliography, page 4.VII-iii. In many cases several of the flights are discussed in the reference. In general, only large or outstanding changes in the radiation count are discussed.

REFERENCES FOR TABLE 4.VII BALLOON FLIGHTS DURING 1959

1. Anderson, K.A., Balloon Observations of X-Rays in the Auroral Zone I, J. Geophys. Res., 65, (1960), 551-564.

2. Anderson, K.A., Balloon Observations of X-Rays in the Auroral Zone II, J. Geophys. Res., 65, (1960), 3521 -

3. Anderson, K.A., Secondary Cosmic-Ray Photons Below Cascade Energy, Phys. Rev., 123, (1961), 1435-1439.

4. Anderson K.A., and D.C. Enermark, Observations of Solar Cosmic-Rays Near the North Magnetic Pole, J. Geophys. Res., 65, (1960), 2657-2671.

5. Bhavsar, P. D., Scintillation-Counter Observations of Auroral X-Rays During the Geomagnetic Storm of May 12, 1959 J. Geophys. Res., 66, (1961), 679-692.

6. Biswas, S., Forbush Decrease of the Flux of Heavy Primary Nuclei of Cosmic Rays on May 12 and July 12, 1959, J. Geophys. Res., 66, (1961), 2653-2657.

7. Brown, R.R., and R. G. D'Arcy, Observations of Solar Flare Radiation at High Latitude During the Period July 10 - 17, 1959, Phys. Rev. Ltrs. 3, (1959), 390-392.

8. Brown, R.R., and R. G. D'Arcy, Solar Protons from the Flare of July 10, 1959, Arkiv for Geofysik, Bd 3 nr 21, (1961) 443-447.

9. Brown, R.R., and R.A. Weir, Ionospheric Effects of Solar Protons, Arkiv for Geofysik, Bd 3 nr 21, (1961), 523-529.

10. Earl, J.A., Balloon Measurement of Solar Cosmic-Rays at Fort Churchill, Canada, During July, 1959, J. Geophys. Res., 66, (1961), 3095-3107.

11. Ehmert, A.H.E., G. Pfotzer, C.D. Enger, and R.R. Brown, Observations of Solar Flare Radiation and Modulation Effects at Balloon Altitudes, J. Geophys. Res., 65, (1960), 2685-2694.

12. May, T.C., A Study of Auroral X-Rays at Minneapolis Between 23 August 1959 and 1 August 1960, Tech. Rpt. CR-36, Univ. of Minnesota, April, 1961.

13. McDonald, F.B., Primary Cosmic-Ray Intensity Near Solar Maximum, Phys. Rev., 116, (1959), 462-463.

14. McDonald, F.B., and W.R. Webber, Charge in the Low Rigidity Primary Cosmic Radiation During the Large Forbush Decrease of May 12, 1959, J. Geophys. Res., 65, (1960), 767-770.

15. McDonald, F.B., and W.R. Webber, Proceedings of the First International Space Science Symposium, P. 968. (Ed. by Kallmann-Byl, North-Holland Publ. Co. 1960).

16. Meyer, P., Cosmic-Ray Alpha Particle Flux During Sharp Forbush Intensity Decreases, J. Geophys. Res., 65, (1960), 3881-3887.

17. Neher, H.V., and H.R. Anderson, Cosmic-Rays at Balloon Altitudes and the Solar Cycle, J. Geophys. Res., 67, (1962), 1309-1315.

18. Stevenson, G.R., and C.J. Waddington, The Alpha-Particle Component at the Primary Cosmic Radiation over North England, Phil. Mag. 6, (1961), 517-530.

19. Waddington, C.J., Note on Ending Particles in Nuclear Emulsions Exposed to the Primary Cosmic Radiation, Nuovo Cimento 18, (1960), 820-822.

20. Winckler, J.R., Balloon Flight Record Status Report as of 31 December 1959, School of Physics, Univ. of Minnesota.

21. Winckler, J.R., and P.D. Bhavsar, Low Energy Solar Cosmic Rays and the Geomagnetic Storm of May 12, 1959, J. Geophys. Res., 65, (1960), 2637-2655.

22. Winckler, J.R., P.D. Bhavsar, and L.E. Peterson, Time Variations of Solar Cosmic Ray During July 1959 at Minneapolis, J. Geophys. Res., 66, (1961), 995-1022.

23. Winckler, J.R., E.P. Ney, and P.S. Freier. Protons From the Sun on May 12, 1959, Phys. Rev. Ltrs., 3. (1959). 183.

24. Yagoda, H., Cosmic-Ray Monitoring of the Manned Stratolab Balloon Flights, GRD Res. Notes No 43. AFCRL-TN-60-640, Sept. 1960.

TABLE VI: BALLOON FLIGHTS ASSOCIATED

	FLARE				SPECTRAL		PCA	BALLOON FLIGH			
								Launch		Time At Altitude	
Gr Day	Serial No.	Event No.	Beg. UT	Imp.	Type II Beg.	Type IV Beg.	Gr Day Beg UT	Gr. Day	UT	Hr.	Min.
Jan.								Jan.			
05	1	3	1040	2+	0245		05, xxxx	05	1335	1	34
								06	0800	2	11
									0803	0	57
									0818	0	36
									0850	4	09
								08	0800	1	27
									0800	1	47
									0812	1	03
									1146	1	18
								09	0800	5	58
									0835	1	14
21	2	8	1700	3	1716			22	0801	2	19
22	3		1108	3					0801	2	53
									0805	0	40
									0906	1	20
								23	0200	7	30
									0601	2	04
									0810	1	30
								24	0800	2	16
26	4	12	0842	3			26/xxxx	26	0802	3	26
									1255	1	28
	5	13	1027	3				27	0800	2	41
27	6		1340	2+		1032			0802	1	07
									1300	1	33
								28	0800	2	12
								29	0800	2	14
									0806	1	41
									0810	1	22
								30	0800	2	20
									0800	1	29
									0810	1	25
								31	0803	2	56
Feb.								Feb.			
01	7	15	0252	3				02	0062	16	1
02	8	16	1015	3					0804	0	57
	9	7	1816	3	1853				0837	1	17
								03	0800	2	10
									0800	2	23
									0814	1	15
								04	-	-	
									0800	1	30
									1300	1	43
								05	0801	1	53
									0803	2	21
									0823	1	21
									1302	1	78
								06	0800	1	56
									0800	1	12
									0810	1	15
									1300	1	52
09	10		0735	3				09	0800	2	35
									0803	2	58
									0817	1	21
10	11		0800	3				10	0800	2	28
									0800	1	30
									0810	1	16
								11	-	-	
									0802	1	50
								12	0801	2	15
									0805	2	19
									0810	1	17
12	12	28	2301	3+		2250	13/0800	13	0800	2	04
									0807	1	27
									1000	1	45
									1315	2	00
								14	0800	2	26
									0800	2	13
								16	0802	1	54
									1315	2	27
18	13		1005	3				18	-	-	
-	14		1142	3					0801	2	48
									1300	1	37
									1311	1	08
								19	0750	2	18
									0811	1	15
									1300	1	46
19	15	36	2032	3		2030		20	0620	16	17
								20	0800	2	22
									0800	2	34
									0814	1	08
								21	0800	1	44
								23	0800	3	41
									0804	1	52
									0814	1	22

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WITH MAJOR SOLAR FLARES DURING 1959

Altitude km	MB	LOCATION Name	Geographic Lat.	Long.	Inst. Carried	Group	Ref.
9		Dolgoprudnaya, USSR	N55.9	E37.5	C	MSU	
5		Dolgoprudnaya, USSR	N55.9	E37.5	C	MSU	
4		Crimea, USSR	N44.9	E34.0	C	MSU	
4		Murmansk, USSR	N69.0	E33.1	C	MSU	
1		Murmansk, USSR	N69.0	E33.1	C	MSU	
1		Dolgoprudnaya, USSR	N55.9	E37.5	C	MSU	
6		Crimea, USSR	N44.9	E34.0	C	MSU	
5		Murmansk, USSR	N69.0	E33.1	C	MSU	
0		Murmansk, USSR	N69.0	E33.1	C	MSU	
5		Crimea, USSR	N44.9	E34.0	C	MSU	
0		Murmansk, USSR	N69.0	E33.1	C	MSU	
4		Crimea, USSR	N44.9	E34.0	C	MSU	
6		Dolgoprudnaya, USSR	N55.9	E37.5	C	MSU	
2		Murmansk, USSR	N69.0	E33.1	C	MSU	
3		Murmansk, USSR	N69.0	E33.1	C	MSU	
9		Crimea, USSR	N44.9	E34.0	C	MSU	
3		Dolgoprudnaya, USSR	N55.9	E37.5	C	MSU	
9		Murmansk, USSR	N69.0	E33.1	C	MSU	
5		Dolgoprudnaya, USSR	N55.9	E37.5	C	MSU	
3		Dolgoprudnaya, USSR	N55.9	E37.5	C	MSU	
0		Murmansk, USSR	N69.0	E33.1	C	MSU	
5		Dolgoprudnaya, USSR	N55.9	E37.5	C	MSU	
5		Crimea, USSR	N44.9	E34.0	C	MSU	
3		Crimea, USSR	N44.9	E34.0	C	MSU	
5		Dolgoprudnaya, USSR	N55.9	E37.5	C	MSU	
3		Dolgoprudnaya, USSR	N55.9	E37.5	C	MSU	
1		Crimea, USSR	N44.9	E34.0	C	MSU	
5		Murmansk, USSR	N69.0	E33.1	C	MSU	
4		Crimea, USSR	N44.9	E34.0	C	MSU	
5		Dolgoprudnaya, USSR	N55.9	E37.5	C	MSU	
3		Murmanks, USSR	N69.0	E33.1	C	MSU	
0		Dolgoprudnaya, USSR	N55.9	E37.5	C	MSU	
	10	Minneapolis, Minn.	N44.9	W93.3	C,I,Sc,EM	Minnesota	
9		Dolgoprudnaya, USSR	N55.9	E37.5	C	MSU	
3		Murmansk, USSR	N69.0	E33.1	C	MSU	
4		Dolgoprudnaya, USSR	N55.9	E37.5	C	MSU	
3		Crimea, USSR	N44.9	E34.0	C	MSU	
1		Murmansk, USSR	N69.0	E33.1	C	MSU	
		Brownwood, Texas	N32.0	W99.0	Sc	Minnesota	13, 14
0		Dolgoprudnaya, USSR	N55.9	E37.5	C	MSU	
0		Dolgoprudnaya, USSR	N55.9	E37.5	C	MSU	
7		Dolgoprudnaya, USSR	N55.9	E37.5	C	MSU	
9		Crimea, USSR	N44.9	E34.0	C	MSU	
4		Murmansk, USSR	N69.0	E33.1	C	MSU	
9		Dolgoprudnaya, USSR	N55.9	E37.5	C	MSU	
1		Crimea, USSR	N44.9	E34.0	C	MSU	
6		Dolgoprudnaya, USSR	N55.9	E37.5	C	MSU	
1		Murmansk, USSR	N69.0	E33.1	C	MSU	
8		Dolgoprudnaya, USSR	N55.9	E37.5	C	MSU	
4		Crimea, USSR	N44.9	E34.0	C	MSU	
9		Dolgoprudnaya, USSR	N55.9	E37.5	C	MSU	
2		Murmansk, USSR	N69.0	E33.1	C	MSU	
9		Crimea, USSR	N44.9	E34.0	C	MSU	
8		Dolgoprudnaya, USSR	N55.9	E37.5	C	MSU	
2		Murmansk, USSR	N69.0	E33.1	C	MSU	
		Brownwood, Texas	N32.0	W99.0	Sc	Minnesota	13
0		Dolgoprudnaya, USSR	N55.9	E37.5	C	MSU	
4		Dolgoprudnaya, USSR	N55.9	E37.5	C	MSU	
4		Crimea, USSR	N44.9	E34.0	C	MSU	
2		Murmansk, USSR	N69.0	E33.1	C	MSU	
7		Dolgoprudnaya, USSR	N55.9	E37.5	C	MSU	
3		Murmansk, USSR	N69.0	E33.1	C	MSU	
6		Crimea, USSR	N44.9	E34.0	C	MSU	
9		Dolgoprudnaya, USSR	N55.9	E37.5	C	MSU	
5		Crimea, USSR	N44.9	E34.0	C	MSU	
4		Dolgoprudnaya, USSR	N55.9	E37.5	C	MSU	
5		Crimea, USSR	N44.9	E34.0	C	MSU	
4		Dolgoprudnaya, USSR	N55.9	E37.5	C	MSU	
		Minneapolis, Minn.	N44.9	W93.3	-	Minn.	20
9		Crimea, USSR	N44.9	E34.0	C	MSU	
1		Crimea, USSR	N44.9	E34.0	C	MSU	
7		Murmansk, USSR	N69.0	E33.1	C	MSU	
7		Dolgoprudnaya, USSR	N55.9	E37.5	C	MSU	
1		Murmansk, USSR	N69.0	E33.1	C	MSU	
7		Crimea, USSR	N44.9	E34.0	C	MSU	
	7-15	Minneapolis, Minn.	N44.9	W93.3	C,I,Sc,EM	Minnesota	20
5		Crimea, USSR	N44.9	E34.0	C	MSU	
3		Dolgoprudnaya, USSR	N55.9	E37.5	C	MSU	
3		Murmansk, USSR	N69.0	E33.1	C	MSU	
3		Dolgoprudnaya, USSR	N55.9	E37.5	C	MSU	
3		Dolgoprudnaya, USSR	N55.9	E37.5	C	MSU	
3		Crimea, USSR	N44.9	E34.0	C	MSU	
3		Murmansk, USSR	N69.0	E33.1	C	MSU	

TABLE VII 1

	FLARE				SPECTRAL		PCA	BALLOON		
Gr Day	Serial No.	Event No.	Beg UT	Imp.	Type II Beg.	Type IV Beg.	Gr Day Beg UT	Launch Gr. Day	UT	T A H
Mar.								Mar.		
21	17		0900	3				25	0211	[illegible]
24	18		0800	3		0734		27	1215	[illegible]
	19	53	0958	3		1003		28	0506	[illegible]
Apr.								Apr.		
05	22	59	2316	3+				09	1230	[illegible]
08	23	60	0903	3						
11	24		0807	3				13	-	-
12	25		1104	3				15	1625	[illegible]
13	26	65	0823	3					1700	[illegible]
								16	1310	[illegible]
May								May		
08	27	73	2252	3	2259	2234		12	0333	[illegible]
09	28	74	0123	3					-	[illegible]
10	29	76	2055	3+	2123	2116	10 2300		0334	[illegible]
									-	[illegible]
	30		2315	3					1920	[illegible]
11	31	78	2006	3+	2020	2028				
12	32		0655	2+				13	0623	[illegible]
13	33	81	0457	2+	0516	0510		16	-	-
	34		0820	3					0008	[illegible]
	35		1554	3					1120	[illegible]
June								June		
11	37		1802	3				12	0210	[illegible]
22	43		1010	3				24	0647	[illegible]
									2030	-
July								July		
10	44	109	0206	3+	0222	0223	10/0700	10	0659	[illegible]
	45		0539	3					1240	-
									1623	[illegible]
								11	0252	[illegible]
									0543	[illegible]
								11	1050	[illegible]
									1723	[illegible]
								12	0503	-
									1049	[illegible]
									1123	[illegible]
12	46		2143	3				13	1345	[illegible]
13	47	112	0255	3					1612	[illegible]
14	48	113	0325	3+	0338	0330	14/0730	14	2130	[illegible]
	49	115	1400	3+					2300	[illegible]
								15	0325	[illegible]
									0804	[illegible]
									0918	[illegible]
									1608	[illegible]
									1807	[illegible]
								16	0148	[illegible]
									0618	[illegible]
									2[illegible]	-
16	50	117	1525	3+	1616				2320	[illegible]
	51	118	2114	3+		2121				
		119					17/[illegible]00	17	1022	[illegible]
									1605	[illegible]
									2310	[illegible]
								18	0230	[illegible]
									0531	[illegible]
									0055	
									1152	
									2125	-
								19	0243	
									2229	

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FLIGHTS			LOCATION					
ime at ltitude r. Min.	Altitude Km	MB	Name	Geographic Lat.	Long.	Inst. Carried	Group	Ref.
5 45		10	Minneapolis, Minnesota	N44.9	W93.3	C,I,Sc,EM	Minnesota	20
1 00		10	Minneapolis, Minnesota	N44.9	W93.3	I,C,EM	Minnesota	20
5 00		10	Minneapolis, Minnesota	N44.9	W93.3	C,I,Sc,EM	Minnesota	20
9 14		10	Minneapolis, Minnesota	N44.9	W93.3	I,C,Sc,EM	Minnesota	20
		-	Minneapolis, Minnesota	N44.9	W93.3	Sc	Minnesota	15
9 00		3	Fairbanks, Alaska	N64.8	W147.9	I,T,4CA	SU1	1
7 00		9	Fairbanks, Alaska	N64.8	W147.9	I,T,4CA	SU1	1
1 05		75	Fairbanks, Alaska	N64.8	W147.9	I,4CA,AP	SU1	1
3 53		9	Chicago, Ill.	N42.0	W88.0	T	Chicago	
1 17		13.5	Minneapolis, Minn.	N44.9	W93.3	EM	Minnesota	6
2 00		10	Minneapolis, Minn.	N44.9	W93.3	C,I,Sc,EM	Minnesota	5, 20, 21, 23
1 12		12	Minneapolis, Minn.	N44.9	W93.3	EM	Minnesota	6
2 50	37		Swarthmore, Pa.	N39.9	W75.4	T	Bartol	
3 40		10	Minneapolis, Minn.	N44.9	W93.3	C,I,Sc,EM	Minnesota	16, 20
		6.5	Minneapolis, Minn.	N44.9	W93.3	Sc	Minnesota	14, 15
1 00		8	Parker, S.D.	N43.5	W97.0	Sc	Chicago	16
2 33		10	Minneapolis, Minn.	N44.9	W93.3	C,I,Sc,EM	Minnesota	20
0 00		10	Minneapolis, Minn.	N44.9	W93.3	C,I,Sc,EM	Minnesota	15, 20
1 00		10	Minneapolis, Minn.	N44.9	W93.3	I,C,EM	Minnesota	20
		7-15	Minneapolis, Minn.	N44.5	W93.3	-	Minnesota	20
3 45		10	Minneapolis, Minn.	N44.9	W93.3	I,C,EM	Minnesota	6, 20, 22
		17	College, Alaska			C	UC	7, 8, 9
1 27	30		Lindau, Germany	N51.5	E10.1	C	Max Plank Institute	11
3 45		10	Minneapolis, Minn	N44.9	W93.3	C,I,Sc,EM	Minnesota	6, 20, 22
3 10		4	Ft. Churchill, Canada	N58.7	W93.8	C,I,EM	Minnesota	10
3 00	32		Swarthmore, Pa.	N39.9	W75.4	T	Bartol	
3 00		10	Minneapolis, Minn.	N44.9	W93.3	C,EM	Minnesota	20, 22
		-	Minneapolis, Minn.	N44.9	W93.3	C, I,EM,T	Minnesota	6, 12, 22
4 34		2.5	Ft. Churchill, Canada	N58.7	W93.8	C,EM	Minnesota	6, 10
2 21		10	Chicago, Ill.	N42.0	W88.0	NM	Chicago	
1 45		5	Parker, S.D.	N43.5	W97.0	Sc	Chicago	
2 12	31		Lindau, Germany	N51.6	E10.1	C	Max Plank Institute	11
5 00		10	Minneapolis, Minn.	N44.9	W93.3	I,EM	Minnesota	20, 22
0 30			College, Alaska			C	UC	7
5 10		10	Minneapolis, Minn.	N44.9	W93.3	C,I,Sc,EM	Minnesota	20, 22
2 20		10	Minneapolis, Minn.	N44.9	W93.3	SU,EM	Minnesota	20, 22
3 42		10	Chicago, Ill.	N42.0	W88.0	T	Chicago	
2 12	30		Lindau, Germany	N51.6	E10.1	C	Max Plank Institute	11
5 00		10	Minneapolis, Minn.	N44.9	W93.3	C,EM	Minnesota	20, 22
5 37		10	Minneapolis, Minn.	N44.9	W93.3	C,I,Sc,EM	Minnesota	20, 22
3 45		10	Parker, S.D.	N43.5	W97.0	Sc	Chicago	16
		30	College, Alaska			C	UC	7
6 00		10	Minneapolis, Minn.	N44.9	W93.3	C,EM	Minnesota	20, 22
3 45		10	Minneapolis, Minn.	N44.9	W93.3	C,I,EM	Minnesota	20, 22
2 27	32		Lindau, Germany	N51.6	E10.1	C	Max Plank Institute	11
5 00		10	Minneapolis, Minn.	N44.9	W93.3	C,EM	Minnesota	20, 22
2 32		5	Parker, S.D.	N43.5	W97.0	Sc	Chicago	16
4 26		10	Minneapolis, Minn.	N44.9	W93.3	C,I,EM	Minnesota	20, 22
9 05		8	Resolute Bay NWT, Canada	N74.0	W94.9	C,I,T	UC	4
2 40		9.7	Ft. Churchill, Canada	N58.7	W93.8	I,EM	Minnesota	10
		7-15	Minneapolis, Minn.	N44.9	W93.3	I,EM	Minnesota	20
5 45		10	Minneapolis, Minn.	N44.9	W93.3	I,EM	Minnesota	20
7 00		8	Resolute Bay NWT, Canada	N74.0	W94.9	C,I,T	UC	4

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TABLE VII

	FLARE				SPECTRAL		PCA		BALLOON FLIGHTS			
Gr. Day	Serial No	Event No.	Beg. UT	Imp	Type II Beg.	Type IV Beg.	Gr Day	Beg. UT	Launch Gr. Day	Launch UT	Time at Altitude Hr.	Min.
20	52		0559	3					20	1750	5	15
									21	0140	9	00
										1605	2	37
									22	2059	0	05
									23	1557	2	19
27	53	124	2050	3	2118				24	0301	3	00
29	54		2020	3								
	55	126	2117	2-		2117			29	0730	5	20
										1436	2	36
									31	1440	2	50
										1600	2	19
Aug. 04	56		1028	3					Aug. 04	1144	0	00
									06	1303	2	44
									08	1102	4	00
11	57	130	1203	3					11	0538	14	45
									12	1325	1	36
									13	0905	2	05
18	58	137	1014	3+		1025	18/1130		19	1200	2	45
	59		1654	2+					20	0610	13	30
									22	0623	1	50
										1403	6	00
Sept. 01	64	149	1648	3			02/0400		Sept. 04	0130	5	00
	65	148	1923	2+	1939	1914						
	66	150	0720	3					05	0410	19	20
	67	151	1602	2+	1608							
Oct. None												
Nov. 26	69	184	0923	2+					Nov. 28	1716	28	36
28	70	186	2006	3	2017	2027			30	0344	15	30
29	71	187	1816	2+	1854	1843						
30	72	190	1720	3	1741	1739						
Dec. 01	73	192	1638	2+	1733	1400			Dec. 01	0312	5	20
02	74	194	1219	2+		1250			02	0441	7	17
									03	0445	8	30
									04	0618	7	40

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Altitude Km	Altitude MB	LOCATION Name	Geographic Lat.	Geographic Long.	Inst. Carried	Group	Ref.
	4	Ft. Churchill, Canada	N58.7	W93.8	I	Minnesota	10
	8	Resolute Bay NWT, Canada	N74.0	W94.9	I,T,4CA	UC	4
30		Lindau, Germany	N51.6	E10.1	C	Max Plank Institute	11
	8	Resolute Bay NWT. Canada	N74.0	W94.9	C,I,T	UC	4
33		Lindau, Germany	N51.6	E10.1	C	Max Plank Institute	11
	8	Resolute Bay NWT, Canada	N74.0	W94.9	I,T,4CA	UC	4
31		Bristol, England	N51.5	W02.5	EM	Bristol	18, 19
-	15.5	Thule, Greenland	N76.5	W68.9	I	CIT	17
-	23-8	Thule, Greenland	N76.5	W68.9	I	CIT	17
35		Lindau, Germany	N51.6	E10.1	C	Max Plank Institute	11
	8	Churchill, Canada	N58.7	W93.8	C,I,T	UC	2
-	16.2	Thule, Greenland	N76.5	W68.9	I	CIT	17
	8	Churchill, Canada	N58.7	W93.8	I,T,4CA	UC	2, 3
	7-15	Minneapolis, Minn.	N44.9	W93.3	C,I,Sc,EM	Minn.	20
-	18.0	Thule, Greenland	N76.5	W68.9	I	CIT	17
	8	Churchill, Canada	N58.7	W93.8	C,I,T	UC	2
	9	Int. Falls, Minn.	N48.5	W93.2	Sc	Chicago	
	10	Minneapolis, Minn.	N44.9	W93.3	C.I.T.EM	Minnesota	12, 20
	10	Minneapolis, Minn.	N44.9	W93.3	C,EM	Minnesota	20
	8	Churchill, Canada	N58.7	W93.8	I,T,4CA	UC	2
40		Sioux Falls, S.D.	N43.5	W96.7	NM	New York	6
	10	Minneapolis, Minn.	N44.9	W93.3	C,I,T,EM	Minnesota	12, 20
25		Stratobowl, S.D.			EM	USAF	24
	10	Minneapolis, Minn.	N44.9	W93.3	C,I,T,EM	Minn.	12, 20
	10	Minneapolis, Minn.	N44.9	W93.3	C,I,T,EM	Minnesota	12, 20
	10	Minneapolis, Minn.	N44.9	W93.3	C,I,T,EM	Minnesota	12, 20
	10	Minneapolis, Minn	N44.9	W93.3	C,I,T,EM	Minnesota	12, 20
	10	Minneapolis, Minn.	N44.9	W93.3	C,I,T,EM	Minnesota	12, 20

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VIII. CHRONOLOGICAL CATALOGUE OF MAJOR SOLAR EVENTS DURING 1959

VIII

TABLE VIII. CHRONOLOGICAL CATALOGUE OF MAJOR SOLAR EVENTS DURING 1959

This table was prepared for publication by Dr. Prince and Miss Hedeman at the McMath-Hulbert Solar Observatory. The entries include the following (except as noted on page 1.9, paragraph 8).

1. All major flares that are listed in the McMath-Hulbert working list of solar flares with importance 3 and 3+.

2. All great short wave fades of importance 3 or 3+ that last for 30 minutes or more.

3. All great 10 cm bursts with a peak flux equal to or greater than 500 units (10^{-22} Wm^{-2} $(c/s)^{-1}$).

4. The most active plages. (Produced 30 or more flares during disk passage.)

5. The greatest sunspots (area $\geq$ 1000 millionths in the Greenwich data).

6. All spectral radio emissions of Type II and Type IV. In addition, outstanding bursts of Type I and Type III have been included.

7. Radio emissions at 200 Mc/s at the time of major events.

8. Radio emissions at other frequencies.

9. Polar-cap absorptions.

10. Geomagnetic storms.

The entries in this section of the catalogue will bring together in chronological order many of the entries already given in Tables I through VI. The exceptions are defined below:

(a) The major solar flare requirement for Table I is based on the list of flares reported in the IAU Quarterly Bulletin and includes some of importance 2+ and all flares of importance 3 and 3+. In Table VIII only flares of importance 3 and 3+ listed in the McMath-Hulbert Observatory working list of flares are included.

(b) The Table VIII requirement for "the greatest" sunspots is based on Greenwich data and only those with an area greater than a 1000 millionth and those with a Mt. Wilson magnetic classification of γ or $\beta\gamma$ qualify. On the other hand, Table II includes all sunspot groups

from the Royal Greenwich Observatory list with a maximum area, during disk passage, equal to or greater than 500 millionth, and all groups with γ , and $\beta\gamma$, Mt. Wilson magnetic classification.

As in the previous tables, minor flares, small sunspot groups, plages, and the other solar and solar-terrestrial effects associated with any of the major entries are included if an observation is available.

Descriptions or critical comments about many of the events listed in this catalogue are given on page 4.VIII-viii.

A major entry, i.e., one qualifying under 1 through 6 above is indicated by an asterisk in the appropriate column. The column headings and explanations, where necessary, are given below:

Column 1 Event Number, starting with one at the beginning of each year.

Column 2 Greenwich date of the event.

FLARE DATA (Columns 3 through 8)

These will include all 3 and 3+ flares as well as minor flares, and in some cases - sub-flares that may be associated with a solar or terrestrial event given in subsequent columns of the table:

Column 3 Beginning of the flare UT. If the start of the flare was observed, the beginning time is underlined.

Column 4 End time UT. If the end of the flare was observed, the time is underlined.

Column 5 Time of maximum, UT.

Column 6 Importance. This is the value assigned to the flare in the McMath-Hulbert working list of flares.

Column 7 The heliographic position.

Column 8 Number of observations.

SHORT WAVE RADIO FADEOUTS (Columns 9 through 14)

Sudden ionosphere disturbances may be detected in a number of ways: short wave fadeouts (SWF), enhancement of low frequency atmospherics (SEA), increase in cosmic absorption (SCNA), sudden phase anomalies at VLF (SPA), and sudden signal enhancements at VLF (SES).

The data included in this catalogue are limited to SWF's and includes all outstanding short wave radio fadeouts of importance 3 or 3+ that lasted for 30 minutes or more. In addition minor SWF's that occurred at the time of the flares catalogued in Columns 3 through 8 are included. The following data are given.

Column 9 Type (S, SL, or G). The following classifications are used:
S-SWF (S): sudden dropout and gradual recovery
Slow S - SWF (SL): dropout takes 5 to 15 minutes and gradual recovery
G-SWF (G): Gradual disturbance: fade irregular in either the dropout or recovery stage.

Column 10 Importance. SWF's are given an importance rating on a scale from 1- to 3+ based on amplitude of the fade, duration of the event, and confidence in the reality of the event.

Column 11 Beginning time UT.

Column 12 Duration in Minutes.

Column 13 Widespread Index. The degree of confidence in identying the event by the individual stations is combined into an index of certainty that the event is geographically widespread, ranging from 1 (possible - single station) to 5 (definite - many stations).

Column 14 Number of Observations. The column gives the number of observatories reporting the event.

SOLAR RADIO EMISSIONS AT 10 cm (Columns 15 through 19)

Column 15 Type. Two different classifications are used: (1) numerical, on a scale from 1 to 9, defined in "Description of tables and graphs for CRPL-F, Part B. Solar-Geophysical Data," alphabetical symbols used in reference 19.

Column 16 Beginning Time UT.

Column 17 Duration in Minutes.

Column 18 Time of Maximum Flux, UT.

Column 19 Peak Flux.

Column 20 Observatory.

PLAGE DATA (Columns 21 through 29)

The data in this section of Table VIII are taken from the McMath-Hulbert Plage Catalogues. The entries in this table are limited to: plage regions that were the source of 30 or more flares during disk passage, indicated in Column 20 with an asterisk, and/or plage regions associated with flares tabulated in Columns 3 through 8. The column headings, in general, self-explanatory, follow:

Column 21 McMath-Hulbert Plage Number.

Column 22 Greenwich Day of Central Meridian Passage.

Column 23 Mean Longitude.

Column 24 Mean Latitude.

Column 25 Average Intensity. The intensity of calcium plages are estimated on a scale from 1 (faint) to 5 (very bright). The values given in this column are the average intensity during disk passage.

Column 26 Average Maximum Area. In units of millionth of the area of the solar hemisphere.

Column 27 Number of Flares. This is the total of all flares associated with the plage during disk passage.

Column 28 Age in Rotations. The number 1 indicates that the plage is new.

Column 29 Identification. This is the number of the plage region during the previous rotation. If two or more numbers are given in this column, those plages or parts of them combined to form the tabulated plage.

SUNSPOT DATA (Columns 30 through 35)

This portion of the catalogue is limited to the sunspots in the plage region given in Column 20.

Column 30 Mt. Wilson Magnetic Classification.

Column 31 Greenwich Date of Central Meridian Passage.

Column 32 Mean Latitude During Disk Passage.

Column 33 Mean Magnetic Field Strength H, in units of 100 gauss.

Column 34 When seen. The first number gives the date the sunspot was first seen; the second number is the last date on which the spot was seen.

Column 35 Area from unpublished Greenwich data.

Column 36 Mt. Wilson Sunspot Numbers, of all spots located in the plage of Column 21.

DYNAMIC SPECTRUM DATA (Columns 37 through 42)

Column 37 Type I Bursts. The following information is given: amount of activity indicated by the Symbols I_s, b, G, g, or s; duration of the burst - beginning time, end time, and the intensity on a scale from 1 (weak) to 3 (strong). The activity symbols are defined as follows:

At 100 Mc/s intensity 1 corresponds to 5 to 40 x 10^{-22} Wm^{-2} $(c/s)^{-1}$, 2 = 40 to 200 x 10^{-22} Wm^{-2} $(c/s)^{-1}$ and 3, 200 x 10^{-22} Wm^{-2} $(c/s)^{-1}$

I_s - A noise storm
C - A noise storm with a slowly varying enhancement over a broad spectrum
b - Single bursts
g - Small group (<10) of bursts
G - Large group (≥ 10) of bursts
s - Storm intermittent but apparently connected activity.

Column 38 Type III bursts, activity, duration and intensity.

Column 39 Type II (slow drift) bursts, duration, and intensity.

Column 40 Type IV (broad band continuum) duration and intensity.

Column 41 Observatory

Column 42 Frequency Range

200 Mc/s DATA (Columns 43 through 48)

Column 43 Type

Column 44 Beginning Time UT.

Column 45 Duration in Minutes.

Column 46 Time of Maximum Flux.

Column 47 Peak Flux.

Column 48 Observatory.

OTHER RADIO DATA (Columns 49 through 55)

Column 49 Frequency Mc/s.

Column 50 Type.

Column 51 Beginning Time UT.

Column 52 Duration in Minutes.

Column 53 Time of Peak Flux.

Column 54 Peak Flux.

Column 55 Observatory.

POLAR-CAP ABSORPTION DATA (Columns 56 through 61)

Column 56 Greenwich Day.

Column 57 Onset Time.

Column 58 Time to Rise to Peak.

Column 59 Duration in Hours.

Column 60 Intensity.

Column 61 Observer.

B - Bailey

H - Hakura and Goh

K - Kiruna

L - Leinbach

GEOMAGNETIC STORMS (Columns 62 through 67)

Column 62 Greenwich Day.

Column 63 Beginning of the Storm.

Column 64 Duration of the Storm (h) indicates hours, (d) indicates days.

Column 65 Type.

Column 66 Intensity*

m - moderate.
ms - moderately severe
s - severe

Column 67 Number of Stations Reporting the Storm.

Column 68 Maximum K_p During the Storm.

* The magnetic storms listed in this section of the table comprise a summary of the magnetic storm data reported by individual magnetic observatories in the Jounal of Geophysical Research. The data given in Columns 63, 64, 65, and 66 are based on an evaluation of the individual reports, and represent a description of the storm which best fits the observations of a majority of the stations. It should be noted that the "consensus" for the intensity of the storm is not always reflected by the maximum 3 hour K_p value reached during the storm, as listed in Column 68.

The above method of evaluating the storm intensity also was used in the magnetic storm data of Table VIII for 1958. However, the storm intensities as published in Table VIII for the years 1954-1957 are based on the accepted ranges in the maximum K_p values reached during the storms, and do not indicate the majority of the observing stations.

Event No.	Gr. Day	FLARE DATA Beg. (UT)	End (UT)	Max. (UT)	Imp.	Position		Number of Observations	SHORT-WAVE RADIO FADEOUTS Type	Imp.	Beg. (UT)	Dur. (Min)	Index	No. of Obs.
	1959 Jan.													
1	03	1600	1702	1605 1638	1+	S12	W90	1 1	*SL	3	1600	105	5	8
2	05													
3	07	0215	0404	0240	2	S10	W10	2, 1	G	2	0120	100		1
4	09													
5	10													
6	14	2140	2152	2142	1-	N21	E11	1, 1						
7	16													
8	21	*1700	1750	1709	3	N10	E48	2, 1	S	2-	1702	41	5	10
9	22	2050	2145	2058	1-	N08	W08	4, 3	G	2-	1942	221		1
10	25													
11	26													
12	29	*0842	1000	0900	3	N16	W61	9, 1	S	2	0855	20	4	3
13	30	*1027	1315	1056	3	N16	W61	8 3						
14	31													
15	Feb. 01	*0352	0458	0423	3	N12	E83	1(1c)	S	3-	0422	28	5	4
16	02	*1017	1225	1039	3	N22	W30	7(3c)	SL	1	1032	18		1
17	02	*1816	2055	1824	3	N09	E60	3(3c)	*S	3	1817	85	5	10
18	03	0040	0107	0044	2	N12	E08	1(1c)	SL	1+	0038	22	5	3
19	03													
20	07	1557	1620	1604	1-	N14	W60	1(1c)						
21	07	2318	2324		1+	N17	W58	1(1c)						
22	08													

4.VIII.- 11.

10 CM EVENTS						PLAGE DATA									
Type	Beg. (UT)	Dur. (Min)	Max. (UT)	Peak Flux	Obs.	McM Plage No.	CMP Gr.Day	Lo	Lat.	Aver. Int.	Aver. Max. Area	No. of Flares	Age in Rotation	Identi-fication	
	1550	90	1651.5	225	OT	*4934	1958 Dec. 28	73	S17	3.5	10000	48	4	4897	
						4947	1959 Jan. 06	314°	S18	3	3000	6	1	New	
						4953	10.5	255°	N14	3.5	11000	23	2	4919	
•	2130	>15	Indet.	>2000	OT	4962	15.5	189°	N22	3	4500	15	2	4924	
*2 4	1701.5 1713	11.5 15	1707.5 –	600 25	O O	*4976	25	64	N17	3.5	7500	34	5 and 1	4936 2nd new	
2	2056.5	3	2057.5	145	OT	*4973	23	90°	N08	3.5	7000	46	1	New	
CD	0855	12.5	0859	386	Ner	*4969	21	116°	N17	3	13000	39	3	4932	
*Great Burst	1032 1106	34 30	1036	1099 25	NGR	4969									
						4997	Feb. 07	253	N12	3	13000	2	3	4953	
						4983	Jan. 31	345°	N21	3	4500	19	2	4943	
3 6 6 6	1817 1819 1847 1904	65 9 7 13	Indet. 1821.2 1851.3 1910.3	30 115 27 120	OT	4997									
						4992	Feb. 04	292°	N18	2.5	3500	22	2	4951	
						4992									
						4992									

TABLE VIII CHRONOLOGICAL CATALOGUE

SPOT DATA						
Mt. Wilson Type	CMP Gr.Day	Lat.	H	When Seen	Area (Greenwich Data)	Mt. Wilson No.
	1958 Dec.					
lαpl	27.0	S19	25	20 - 1		13800
lγl	27.6	S17	24	21 - 2		803
lβfl	28.4	S14	19	21 - 3		804
	1959 Jan.					
dβl	06.7	S16	(25)	1 - 13		13834
lβpl	11.0	N13	37	4 - 16	2400	13842
dβpd	15.8	N23	(15)	10 - 20		13859
dβpd	16.0	N18	15	11 - 19		860
lαpl	25.4	N11	(30)	19 - 31	1500	13883
lβpl	25.4	N14	(15)	19 - 31		884
dβpl	26.0	N09	(10)	24 - 31		895
lβl	23	N08	(25)	16 - 29	1900	13877
lβl	20.9	N12	(15)	14 - 27		13870
dβpd	21.3	N09	(15)	18 - 26		880
dβγl	21.8	N18	(25)	17 - 27		878
See Spot Data for Event 12						
	Feb.					
lαpd	08.2	N11	(15)	2 - 9		13916
	Jan.					
lβpl	30.9	N10	(10)	24 - 31		13897
See Spot Data for Event 15						
	Feb.					
lαpl	03.4	N15	(20)	28 - 6		13908
	04.3	N23	(15)	28 - 8		909
See Spot Data for Event 18						
See Spot Data for Event 18						

OF MAJOR SOLAR EVENTS FOR 1959

	DYNAMIC SPECTRUM DATA					
Event No.	I and Cont. Time/Int.	III Time/Int.	II Time/Int.	IV Time/Int.	Obs.	Freq. Ra (mc)
1		b1615/3 g1617/1	*1610- 1613/2		H,M	150- 100
2						
3	I_S weak - all day S0246- 0443/2	g0202/2 g0230- 0234/2	*0245- 0247/2	*0246- 0443/2	S	210- 25
4						
5						
6						
7						
8		b1708/1 g1720- 1721/3	*1718- 1743/3		H,M	140- 25
9	C2057- 2059/3 I_S 2100- 2110/1	g2057- 205[illegible]/3	*2102- 2112/2		H	180- 25
10						
11						
12						
13						
14						
15						
16						
17	C1858- 1918/2	g1853/m g1857/m g1906- 1907/2 g1910/3	*1853- 1903/3		H,M	180- 40
18			*0054- 0106/2		S	
19						
20		g1614.5- 1619/1	*1616- 1623/3		M	(ABC)
21		g2312/2 g2314- 2316/1 g2334- 2335/3	*2334- 2341/2		H	240- 100
22						

nge	200 MC DATA							OTHER RADIO DATA						
	Type	P g. (UT)	Dur.	Max. (UT)	Peak Flux	Obs.	Δt Max.	Freq. (mc)	Type	Beg. (UT)	Dur. (Min)	Max. (UT)	Peak Flux	Obs.
	-	0220	>57	-	-	HAW		545	CA	0215	70	-	170	N(H)
	-	0245	45	-	1000	N(H)								
	CA	0250	25	0305	2400	T								
	CD	1706	2	-	230	N(P)		545	SD	1702.5	12.5	-	55	N(P)
	CD	2056.5	3	-	600	N(P)		9530	CA	2056.4	>35	2057.2	>443	NRL
								3200	CD	2056.4	>35	2057.2	170	NRL
								167	CD	2056	14	2058	>1000	NRL
								9400	CD	0836	202	0856	663	HHI
								1500	CD	0855	5	0858.5	344	HHI
								600	CA	0852	19.5		95	Uc
								536	CD	0856	10.5	0856	85	Pr
								231	CD	0903.8	0.9	0903.9	800	Aop
	CD	1040	5	1042	47	AB		9400	CD	0836	202	1036		HHI
								1500	CD	1025	13.5	1037	765	HHI
								810	CD	1036	15	1038	189	Cra
								600	CA	1054	19		138	Uc
								536	CD	1030	35	1041	245	Pr
	CD	0420.5	6	0423.8	3500	TK		9500	ESD	0408	1	0408.3	496	Tk
										0420	4	0422	>1391	
								3750	CD	0408	17	0422	(550)	Nag
								2000	CD	0408	16	0422	(270)	Nag
								1000	SD	0420.5	4.5	0422.1	(140)	Nag
								545	SD	0420	5		110	N(H)
	M	<1820	>415			HAW		9530	3	1814.6	70	1902.2	75	
	CD	1854	1		540	N(P)			6	1819.7	9.5	1821.6	471	NRL
	F	1904	9		130				2	1847.2	9	1851.7	116	
									6	1904.2	13	1911.8	223	
								545	CD	1904	10		20	N(P)
								167	SD	1858	0.2		>100	NBS
									SD	1902	0.2		>100	
									SD	1903	0.2		<100	
									F	1906	3	1907	>100	
									F	1909.5	2	1910	>100	
								9500	CD	0042.2	4	0044	706	Tk
								3750	CD	0040	6	0044	(125)	Nag
								2000	CD	0042	6	0044	(40)	Nag
								1000	CD	0042	4	0043.8	(28)	Nag
	CD	1618	5		>550	NER		600	ECD	1612.5	2.5		90	Ucl
								167	CD	1615	7.5	1620	>1000	NBS
									M	1623	37.5		100	
	FD	2334	2.5		220	N(H)		1000	CD	2329	4	2331.2	(75)	Nag
	CD	2337	20		55			545	SD	2329	4.5		20	N(H)
								167	CD	2334	8.5	2339	>100	NBS

POLARCAP ABSORPTION							GEOMAGNETIC STORMS							
Onset Day	Time UT	Rise to Peak	Dur.	Int. (DB)	Obs.	Δt	Start Day	UT	Dur.	Type	Int.	No. of Sta. Reporting	Max. 3-Hr Kp	Event No.
							Jan. 05	0136	2.5d	Sc	m	13	6	2
							09	1459	1.5d	Sc	ms	15	6	4
							16	0527	1.4d	Sc	m	[illegible]	4	7
							25	0859	0.7d	Sc	m	11	4	10
							26	0305	0.7d	Sc	ms	5	6	11
							29	05--	1.2d	g	m	2	4	14
							Feb. 03	10--	2.4d	g	m	3	5	19
							08	12--	1.0d	g	m	1	[illegible]	22

		FLARE DATA						SHORT-WAVE RADIO FADEOUTS					
Event No.	Gr. Day	Beg. (UT)	End (UT)	Max. (UT)	Imp.	Position	Number of Observations	Type	Imp.	Beg. (UT)	Dur. (Min)	Index	No. of Obs.
23	08	1343	1350		1	N10 E90	1(1c)		2	1342	29	5	7
24	09	0058	0246	0157	2	N10 E90	1(1c)	*S	3	0200	45	5	5
25	09	09[illegible]	1019	0955	2+	N09 E88	10(4c)	*S	3	0952	[illegible]	4	3
26	09	1641	1720		1	N06 E80	1(1c)	S	2+	1632	48	5	10
27	11												
28	12	*2301	2519	2325	3	N13 E43	2(2c)	SL	2	2308	40	5	6
29	13												
30	13												
31	14												
32	15												
33	16												
34	18							S	2+	0500	25	5	3
35	18							G	2	2230	25		1
36	19	*2032	2244	2037	3	N11 W10	3(3c)	SL	1+	2030	40	5	7
37	20	1735	1905	1752 1814	1	N23 E06	3(3c)	G	1	1753	44		1
38	22												
39	25												
40	26												
41	27												
42	28												
43	Mar.							*S	3	0520	100	4	2

10 CM EVENTS						PLAGE DATA								
Type	Beg. (UT)	Dur. (Min)	Max. (UT)	Peak Flux	Obs.	McM Plage No.	CMP Gr.Day	Lo	Lat.	Aver. Int.	Aver. Max. Area	No. of Flares	Age in Rotation	Identification
6	1342.5	8	1343.2	180	OT	*5009	16	134°	N12	3	40	43	1 and 4	Mostly new and part of 4969
CD	0157	12	0204.7	303	Tk	5009								
SD	0956.5	3	0959.8	193	HHI	5009								
6	1639	11	1642.5	80	OT	5009								
						5009								
CD	0502.6	14	0503.3	308	Tk									
2 4	2030 2040	10 70	Indet.	>200 30	OT	5016	19.5	88°	N09	2.5	4000	11	2	4973
6 4	1812.5 1827.5	15 30	1815.7	105 12	OT	*5018	21.5	66°	N18	3	10000	55	2	4976
						*5026	26.5	356°	N24	3	6000	34	3	4983

This may not be a real SWF of Imp. 3, since Nera calls it Imp. 1, and continues it for only 15 min. The other reporting station is Okinawa.

TABLE VIII

SPOT DATA						
Mt. Wilson Type	CMP Gr.Day	Lat.	H	When Seen	Area (Greenwich Data)	Mt. Wilson No.
lfpl	15.9	N09	22	9 - 20		13929
See Spot Data for Event 23						
See Spot Data for Event 23						
See Spot Data for Event 23						
See Spot Data for Event 23						
lβfl	19.2	N11	22	13 - 25		13931
* βrl	21.2	N18	29	19 - 26	1200	13936
dβl	21.7	N29	18	23 - 28		942
fαpl	21.9	N11	30	19 - 27		938
dβl	26.7	N23	13	23 - 4		13946

1959 (CONTINUED)

	DYNAMIC SPECTRUM DATA				
Event No.	I and Cont. Time. Int.	III Time Int.	II Time Int.	IV Time Int.	Obs
23		g1344.5-1349.8/3	*1344.5-1349.8/3		M
24	I 0319-^{s}0521/1	g0204-0207/1	*0208-0245/3	*0215-0317	S
25					
26	I 1400-^{s}>2400/3,2,1 C<1400-1744/3,2,1	g1643-1644 m g1644.4-1704/mw	*1643, m	*1654-1708/w	M,H
27					
28	I 2303-^{s}2404/2,1	g2302/1 g2304-2305, 2 g2306/2 g2310-2311/2 G2312-2314/2		*2303-2409/3	H,S
29					
30					
31					
32					
33					
34		g0448.5-0450/1 G0501-0506/1	*0508-0523 2		S
35		g2232-2233/1- g2237/2 g2248/2	*2241-2251/3		H
36	I 2031-^{s}2200/2	b2044/1-b2059/1 g2107-2108/1			H,M
37	I 1757-^{s}1900/1	g1748-1749/1 G1806-1808/1	*1753-1804, 3	*1813-1824/3	H
38					
39					
40					
41					
42					
43					

Freq. Range (mc)	200 MC DATA							OTHER RADIO DATA						
	Type	Beg. (UT)	Dur. (Min)	Max. (UT)	Peak Flux	Obs.	t Max.	Freq. (mc)	Type	Beg. (UT)	Dur. (Min)	Max. (UT)	Peak Flux	Obs.
	CD	1343	10		> 550	Ner		9400	SD	1343	6.4	1346	283	HHI
								3000	CD	1340.5	11.1	1343.1	455	HHI
								1500	CD	1342	7	1348	645	HHI
								600	ECD	1343	7.5		350	Uc
								169	ECD	1344	11		> 83	Irs
	CA	0203	45		90	N(H)		9500	CD	0158.8	3	0159.7	510	Tk
	CA	0208	5		> 5500	N(H)			ECD	0204	5	0204.5	541	
								3750	F	0157	12	0207	(65)	Nag
								2000	CD	0157	10	0205	(280)	Nag
								1000	CD	0159	9	0205	(660)	Nag
								545	CD	0209	8		120	N(H)
	CA	1005	70		110	Ner		9400	SD	0958.8	3	1000	288	HHI
								1500	F	0954	16.5	1004	293	HHI
								810	CD	1003	20	1004	220	Cra
								600	ECD	1002	3.5		210	Uc
									CA	1005.5	15.5		135	
								169	ECA	1005	300			Uc
	CD	1642	10		> 550	N(P)		9530	CD	1640	10		65	NRL
		1700	15					3200	CD	1639	10		56	NRL
								545	CD	1642	18		55	N(P)
								167	CD	1640	42	1648	>1000	NBS
580-50	ECD	2257	50	2319		HAW		9400	CD	2257	60	2313	(345)	Nag
	CD	2303	45		750	N(H)		3750	CD	2250	70	2313	(440)	Nag
								2000	CD	2250	55	2314	(335)	Nag
								1000	F	2304	40	2333	(325)	Nag
								545	CD	2303	40		350	N(H)
								167	CD	2310	40	2320	>1000	NBS
	SD	0447	0.5		600	Tk		9400	F	0502	11	0503	(230)	Nag
	F	0503	9	0505	700			3750	F	0502	11	0503	(67)	Nag
								1000	F	0503	10	0503.5	(45)	Nag
								545	SD	0503	1.5		55	N(H)
150-50														
	SD	2058.8	0.1	2059		HAW		9530	6	2030	12	2035	53	NRL
									4	2042	40		32	
								3200	6	2030	12	2034.5	417	NRL
									4	2042	40		30	
								167	E	2030	125		< 100	NBS
									F	2059	1		> 100	
	M	< 1800	> 393			HAW		9530	3	1812.6	45	1815.2	36	NRL
								3200	6	1812.6	45	1815.2	93	NRL
								167	CD	1750.5	3	1752.5	> 100	NBS
									M	1753.5	144	1817	< 100	
								9500	SD	0525.7	1	0526.2	496	Tk

POLAR CAP ABSORPTION							GEOMAGNETIC STORMS							
Onset Time Day	UT	Rise to Peak	Dur.	Int. (DB)	obs.	Δ t	Start Day	UT	Dur.	Type	Int	No. of Sta. Reporting	Max. 3-Hr. K	Event
							Feb. 11	0756	2.0d	Sc	ms	15	[illegible]	27
Feb. 13	0800	12h	74	21	B									
							13	10--	0.6d	g	ms	5	4	30
							14	1142	2.5d	Sc	ms	11	6	31
							15	00--	0.9d	g	m	3	6	32
							16	00--	1.5d	Sc ?	ms	13	6	33
							22	0046	1.5d	Sc	m	3	4	38
							25	0125	2.1d	g ?	ms	18	7	39
							27	12--	0.7d	g	m	2	6	41
							28	12--	2.5d	g	m	5	6	42

		FLARE DATA						SHORT - WAVE RADIO FADEOUTS					
Event No.	Gr Day	Beg. (UT)	End (UT)	Max. (UT)	Imp.	Position	Number of Observations	Type	Imp.	Beg. (UT)	Dur. (Min)	Index	No. of Obs.
44	Mar. 07	1723	1750	1730	2	N01 E90	1(1c)	*SL	3	1725	115	5	9
45	09	1715	1757	1727	2	N14 W67	2(2c)	SL	2	1722	38	4	5
46	10	0614	0644		1-	N12 E66	1(1c)	*SL	3	0513	115	5	4
47	12												
48	13												
49	21	0158	0259	0205	2	N12 W37	4(2c)	*S	3	0200	40	4	3
50	21	0903	1043	0916	2	N15 W42	16(3c)	*S	3	0912	37	5	4
51	21	1309	1344	1331	1+	N28 W46	8(2c)	SL	1	1325	33	3	2
52	22	1338	1545	1348	1+	N29 W50	7(3c)	*S	3	1341	86	5	10
53	24	*0958	1325	1015	3	N29 W77	16(4c)	*S	3	1002	107	5	5
54	25												
55	26												
56	28	*2113	2315	2126	3	N24 W33	5(5c)	S	1+	2121	24	5	6
57	29	0747	0930	0754	2	N17 E37	6(3c)	*S	3	0750	40	5	6
58	31												
59	April 05	*2316	2519	2327	3+	N16 W67	4(3c)	*S	3+	2317	93	5	10
60	08	*0905	1010	0920	3	N27 E85	10(3c)	S	2+	0913	32	5	6
61	09												
62	09	1645	1710	1650	2	N25 E70	2(2c)	S	1+	1645	35	5	11

10 CM EVENT						PLAGE DATA									
Type	Beg. (UT)	Dur. (Min)	Max. (UT)	Peak Flux	Obs.	McM Plage No.	CMP Gr.Day	Lo	Lat.	Aver. Int.	Aver. Max. Area	No. of Flares	Age in Rotation	Identi-fication	Mt.Wil. Type
9 2	1722 1741	19 15	1746	15 45	OT	5048	Mar. 15	138°	N08	2.5	1500	4	2	5009	lαp
6 4	1719 1725	6 10	1721.3	60 5	OT	5035	05.5	264°	N18	3	5000	27	4	4997	lβf
						5048									See Spo
CD	0159	17	0203	403	Tk	*5052	18	99°	N10	2.5	9000	47	3	5013 and 5016	*lrl αβl
SD	0907	7	0910	350	HHI	50.									See Sp
*SD	1329	1		502	Ner	*5054	18.5	92°	N28	3.5	10000	80	5	5011	*lβr
*2 4	1340 1355	15 180	1345.5	525 30	OT	5054									See Sp
*Great Burst	1002.5	57	1012	>1729	HHI	5054									See Sp
It should be noted that when Ottawa began observations at 1200 UT, a period of increased flux was in progress, and the flux remained high for >3h20m. The peak flux was 55 during this interval.															
2 4	2120.5	7 35	2123.5	100 22	OT	5061	26	354°	N22	3	6000	21	4	5026	lβl
*SD	0747	19		> 588	Ner	*507[illegible]	Apr. 01	274°	N17	3.5	6000	46	5	5035	lαp lβf *lβr
						*5068	Mar. 31	288°	N23	3	4500	42	1	New	*lβp
						5071									See Sp
*SD	0914.5	22		> 2150	Ner	*5093	Apr. 15	90°	N24	3	9000	41	6 and 4	5054 and part of 5052	*lrl
6 4	1646 1653	7 10	1649	130 6	OT	5093									See Sp

TABLE VIII

SPOT DATA						
	CMP Gr.Day	Lat.	H	When Seen	Area (Greenwich Data)	Mt.Wilson No.
	Mar. 15.0	N10	25	8 - 20		13979
	05.2	N14	(15)	27 - 11		13957
Data for Event 44						
	17.7	N13	17	11 - 23	1300	13983
	18.4	N12	(15)	15 - 23		995
t Data for Event 49						
	18.6	N27	(25)	11 - 24	1700	13984
t Data for Event 51						
t Data for Event 52						
	26.3	N24	18	19 - 1		14004
	31.7	N12	15	25 - 5		14016
	Apr. 01.1	N17	(15)	25 - 5		017
	01.1	N15	15	26 - 5		020
	Mar. 31.2	N25	30	24 - 5	1500	14014
ot Data for Event 57						
	Apr. 15.0	N26	15	8 - 20		14050
ot Data for Event 60						

1959 (CONTINUED)

	DYNAMIC SPECTRUM DATA				
Event No.	I and Cont. Time/Int.	III Time/Int.	II Time/Int.	IV Time/Int.	Obs.
44		g1724/2 g1725/1 g1726/3 g1727/3 g1728- 1729/1 G1731- 1742/3			H
45	I_s 1658- 1741/1 1720- 1727/2	g1721- 1722/1 g1723/1 g1724/1 b1730/1 b1743/1	*1724- 1727/3		H
46		g0512- 0514/1 b0522.5/1 G0558- 0604.5/1			S
47					
48			*0441- 0457/2		S
49					
50					
51	I_s 1330- 1351/1	G1333- 1335/1			H
52	I_s 1338- >2400/1				H
53					
54					
55					
56	I_s in progress all day	b2118/1			H
57					
58					
59	I_s 2307- >2400/1	g2315/2 b2328/2 g2339- 2340/2			H
60					
61					
62	C1649- 1650/3	G1646- 1650/2 g1705- 1706/2	1653- 1703/3		H,M

Freq. Range (mc)	200 MC DATA							OTHER RADIO DATA						
	Type	Beg. (UT)	Dur.	Max. (UT)	Peak Flux	Obs.	t Max.	Freq. (mc)	Type	Beg. (UT)	Dur. (Min)	Max. (UT)	Peak Flux	Obs.
								9530	6	1730	25	1745	43	NRL
								3200	6	1730	25	1745	58	NRL
200-50								9530	2	1720.3	2.7	1721	27	NRL
								3200	C	1719	7	1721	62	NRL
									1	1739	15.5	1744	6	
								3750	CD	0521	8	0527	(12)	Nag
	ECD	0440	15	0440	39	Irk								
								9500	SD	0156	2	0156.2	559	Tk
								3750	CD	0200	30	0202	(70)	Nag
								2000	CD	0200	15	0204	(70)	Nag
								1000	CD	0200	15	0203	(320)	Nag
	SD	0900	3	0901	57	Sim		9400	SD	0905	143	0907	375	HHI
								9400	SD	1327	12.9	1330	408	hHI
								1500	SD	1329.7	1.3	1330	141	HHI
								600	CD	1329	6		145	Uc
								545	FD	1329.5	5		85	Ner
								167	SD	1325.8	0.2		<100	NBS
								600	ECD	1345	1.5		70	Uc
								9400	CD	0952	178	1012	1083	HHI
								1500	CD	1005	30	1013	812	HHI
								600	ECD	1025	1		93	Uc
								536	CD	1001	9.5	1010	105	Pra
								9500	SD	2122	3	2123.3	507	Tk
								9500	SD	0748	8	0751	2140	Tk
								3750	SD	0746	10	0750	(1050)	Nag
								2000	CD	0747	9	0751	(500)	Nag
	SD	2339	0.4		> 280	Ner		9500	ECD	2321	7	2323	2960	Tk
								3750	CD	2323	> 8	2323	(3300)	Nag
								2000	CD	2320	9	2323	(380)	Nag
								1000	CD	2322	7	2323	(38)	Nag
	CD	0915	4.5		> 500000	Ner		9400	CD	0914	28.5	0915	925	HHI
								3000	CD	0914	18.5	0916	1484	HHI
								1500	SD	0915	15.2	0916	> 925	HHI
								810	CD	0915	42	0918	> 320	Cra
								545	CD	0915	17	0920	> 500	Ner
								169	CD	0916	10		> 92	Irs
290-40	CD	1648	2		> 600	Ner		9400	CD	1646	12	1648	383	HHI
	CD	1653.5	5.5		> 600			1500	CD	1647	8.4	1650	248	HHI
								600	CD	1644.8	4.8		83	Uc
								545	SD	1648.5	1.5		230	Ner
									CD	1653.5	4.5		220	
								167	CD	1648.1	3.9	1649	>1000	NBS
									CD	1653	8	1656	>1000	
								18		1649	3			Bo

POLARCAP ABSORPTION							GEOMAGNETIC STORMS							
Onset Day	Time UT	Rise toPEAK	Dur.	Int. (DB)	Obs.	Δ t	Start Day	UT	Dur.	Type	Int.	No. of Sta. Reporting	Max. 3-Hr Kp	Event No.
							Mar. 12	11--	0.5d	g	m	2	4	47
							25	0130	0.9d	g	m	5	5	54
							26	0842	4.3d	Sc	ms	8	18	55
							Apr. 09	00--	0.5d	g	m	3	6	61

		FLARE DATA						SHORT-WAVE RADIO FADEOUTS					
Event No.	Gr. Day	Beg. (UT)	End (UT)	Max. (UT)	Imp.	Position	Number of Observations	Type	Imp.	Beg. (UT)	Dur. (Min)	Index	No. of Obs.
63	April 09												
64	11	2145	2205	2150	1+	S16 E35	1(1c)						
65	13	*0830	0935	0840	2	N27 E19	16(3c)	S	2	0835	25	5	5
66	14	1824	2002	1830	2	N08 W14	2(2c)	SL	2-	1823	62	5	7
67	22	1130	1300		1-	N17 W18	3(1c)	*S	3	1116	54	5	10
68	23												
69	28												
70	May 02 03	2355	0114	0015	1	N15 W48	4(2c)	S[illegible]	1+	0000	42	5	3
71	04												
72	07												
73	08	2252	2346	2257	2+	N21 E83	3(3c)	S	2	2258	22	5	12
74	09	*0123	0212	0150	3	N20 E78	[illegible]c)						
75	09												
76	10	*2102	2610	2140	3+	N18 E47	6,5c)	*SL	3+	2110	[illegible]	5	11
77	11												
78	11	*2006	2150	2[illegible]30	3	N10 E41	4(4c)	S	3-	2015	67	5	9
79	11												
80	12												

10 CM EVENTS						PLAGE DATA									
Type	Beg. (UT)	Dur. (Min)	M (UT)	Peak Flux	Obs.	McM Plage No.	CMP Gr.Day	Lo	Lat.	Aver. Int.	Aver. Max. Area	No. of Flares	Age in Rotation	Identi-fication	Mt. Wil Type
2	2146.5	4	2147.4	35	OT	5089	13.5	109°	S16	3.5	3000	21	2	5053	lβp
SD	0830	16.7	0835	314	HH1	5093									lxl
3	1823.5	30	1841	15	OT	5090	13.5	109°	N10	3	2500	11	4	5052	lβd
CD	1115	10		239	Ner	5098	20.5	17°	N19	2.5	1000	10	5	5060 (part of)	dβf
						*5120	30	251°	N14	3	2000	39	1	New	dβf
2 *2 4	2248 2254 2312	1 18 >30	2248.5 2257	14 2200 20	OT	*5148	May 15	53°	N14	3.5	14000	97	5	5090	*lβs *lxd *dβx lαp
						5148									See Sp
						*5133	09.5	126°	S14	3.5	2500	49	3	Part of 5089	dβp
*GB	2100	>160	2148.5	2500	OT	5148									See Sp.
*6 4	2010 2050	40 >160	2021.5	900 50		5148									See Sp
						*5147	12	93°	N26	3	6000	47	7	5093	*lβ

TABLE VIII

SPOT DATA						
	CMP Gr.Day	Lat.	H	When Seen	Area (Greenwich Data)	Mt. Wilson No.
	14.1	S16	(20)	7 - 20		14045
	13.7	N10	(15)	7 - 18		14046
	21.1	N18	(15)	22 - 27		14079
	29.8	N14	24 -	5		14090
	May					
	14.8	N16	(15)	8 - 21	1300	14121
	14.9	N08	(15)	8 - 20		122
	16.0	N18	(15)	16 - 21		141
	16.1	N17	(25)	9 - 21		125
Data for Event 73						
	09.8	S15	15	4 - 15		14106
Data for Event 73						
ot Data for Event 73						
	12.0	N25	14	5 - 17		14114

1959 (CONTINUED)

	DYNAMIC SPECTRUM DATA				
Event No.	I and Cont. Time/Int.	III Time/Int.	II Time/Int.	IV Time/Int.	Obs.
63					
64		g2146- 2147/2	2149- 2154/3		H
65					
66		G1823- 1826/1 g1845- 1846/1		1824- 1824/3	H
67					
68					
69					
70		b2357/1 g0011/2	*0012- 0022/3		H
71					
72					
73	C2248- 2249/3 C2256- 2300/3 I_s 2321- >0125/1	G2248- 2249/3 G2255/3 G2346- 2347/3 g2350/2 g2351/1 g2358/1	*2259- 2319/3		H,M
74					H
75					
76	I_s 2248- >0130/2	g2104- 2105/2 b2107/1 g2108/2 g2111/2 b2114/1 g2116- 2117/3 g2121- 2122/2 g2124- 2125/2 g2143/2 b2150/1	*2123- 2141/3+	*2116- >0130/3	H H
77					
78	I_s 2200- 2310/1 C2056- 2058/3	b2016/1 b2020/1 b2053/1 g2054/1 g2106/3 g2108/2 g2109/3 g2112/2 g2114/2 G2115- 2116/2 g2117- 2118/1 b2128/1 b2131/1	*2020- 2039/3+	*2028- 2043/3	H H
79					
80					

11·VIII-HR A

	200 MC DATA							OTHER RADIO DATA						
Freq. Range (mc)	Type	Beg (UT)	Dur. (min.)	Max (UT)	Peak Flux		Δ t Max.	Freq. (mc)	Type	Beg. (UT)	Dur. (Min)	Max. (UT)	Peak Flux	Obs.
340-100	CD	2150.6	4	2151.7	790	Hir		545	CD	2146.5	1		>350	N(H)
								167	CD	2149.7	7.3	2153.5	>100	NBS
								9400	SD	0829	50	0834	418	HHI
								1500	SD	0832	12	0840	232	HHI
								600	CD	0831	4.5		170	Uc
								545	F	0832	4	0833	306	Mos
580-240								600	CD	1824.3	3.5		270	Uc
								545	CD	1824.5	6		>300	N(P)
	CD	1115	1.5		580	Ner		9400	SD	1105	21.8	1120	265	HHI
	M	1006	81	1116	605	Mos		1500	CD	1115	12	1120	243	HHI
								600	SD	1103.5	0.3		65	Uc
									SD	1115	10		75	
								234	F	1110	10	1116	1400	Aop
300-50	CD	0012.2	1.5	0013.5	3000	Tk		9500	SD	0013.5	1.5	0014.3	437	Tk
								1000	SD	0057	0.2		(43)	Nag
								167	CD	0010.5	2	0011.6	>100	NBS
									CA	0012.5	8.3	0013	>1000	
300-50	CD	2248	1		320	N(H)		9500	SD	2255.5	3	2256.4	>1600	Tk
	CD	2255.5	10		1500			2000	SD	2255	12	2257	(1600)	Nag
	CD	2346.5	0.8		320			1000	SD	2255	25	2257	(1100)	Nag
								545	SD	2255	25		>200	N(H)
								167	SD	2247.5	1	2247.7	>1000	NBS
									CD	2255	13	2303	>1000	
	SD	0155.5	0.3		3200	Tk								
140-25	CD	2114.2	1.3	2115.1	910	Hir		9500	CD	< 2117	>60	2149	2900	Tk
	CA	2120	135	2148	390			2000	CD	< 2200	>100	2213	(1300)	Nag
580-25	CD	2122.7	1	2123	1050			1000	CD	< 2200	>100	2222	(1550)	Nag
								545	CD	2104.5	4.5		>330	N(H)
									CD	2116	150		450	
								167	SD	2107.6	0.2		>100	NBS
									SD	2111.8	0.2	2112	>100	
									CD	2115	>275		>1000	
									ECD	2115	6.9	2122	>1000	
									CA	2122	>18	2141	>1000	
								18		2115	2			
										2130	12			Bo
										2230	65	2310		
280-25	CD	2022	21.7	2025	1600	Hir		545	CD	2013	30		100	N(P)
400-25								167	CD	2019	4.6	2023	>1000	NBS
									CA	2024	23.4	2040	>100	
								18		2036	4	2039		McM
										2055	4	2058		

POLARCAP ABSORPTION							GEOMAGNETIC STORMS							
Onset Time Day	UT	Rise to Peak	Dur.	Int. (DB)	Obs.	Δ t	Start Day	Hr. (UT)	Dur.	Type	Int.	No. of Sta. Reporting	Max. 3-Hr Kp	Event No.
							09	1828	[illegible].4d	Sc	ms	18	8	63
							23	1036	1.4d	Sc	ms	15	7	68
							28	23--	1.0d	g	m	2	5	69
							May 04	2020	0.8d	Sc	m	7	6	71
							07	21--	0.8d	g	m	6	5	72
May 11	0030	26h	170	1 6	B,L,K									
							11	2330	1.5d	Sc	ms	19	8	79

4. [illegible]-40 (2)

1959 (CONTINUED)

	DYNAMIC SPECTRUM DATA						200 MC DATA					
Event No.	I and Cont. Time Int.	III Time Int.	II Time Int.	IV Time Int.	Obs.	Freq. Range (mc)	Type	Beg. (UT)	Dur. (Min)	Max. (UT)	Peak Flux	Obs.
.	I_s 0525-0630 1	g0512 0515 3 z0520-0521.5 2	0516 525, 3	0525-0630. 1	S		CD CD CD CD	0512.3 0515.8 0520 0550	1.3 0.8 11.2 45	0512.5 0516.3 0521	1500 1100 1800 300	Hir Hir Hir N(H)
82	I_s in progress 1245-1453 1	g1417/1	1425-1430, 3		H	160-50						
83		z2340.4-2341 *	2342-2344, m		M							
84												
85		b0100 1 b0116/1			H							
86							CD	0706.9	0.2		470	Hir
87			*0407-0412/1		S		CD	0409	2		120	N(H)
88												
89	1338-1340 1	g1338-1339, 2	*1344-1353 3		H,M	280-50	CD CD	1338.5 1349	1 3		130 23000	N N
90												
91		G0056-0059/2	*0102-0114 3		H	150-50	SL M	0059.6 0143	2 >120	0059.6	- -	HAW
92												
93												
94	I_s in progress 0304-0615, 1		*0546-0550/1		S		M	<0500	>360		139	Mos
95	I_s in progress 1302-1900, 1	b1622/1 b1647/3 G1651-1652 1 g1653/2 b1706/2		*1714-1800/2	H	50-25	CD CD	1650 1735	25 12		50 12	Ner Ner
96		g0249/1	*0247-0308/2		S		CD	0247.5	2	0248	11000	Tk
97												

4.VIII-SL (1)

Δt Max.	OTHER RADIO DATA							POLAR CAP ABSORPTION						
	Freq. (mc)	Type	Beg. (UT)	Dur. (Min.)	Max. (UT)	Peak Flux	Obs.	Onset Time Day	UT	Rise to Peak	Dur.	Int. (DB)	Obs.	Δt
	9500	ESD	0512	3	0513.1	1700	Tk							
	3750	SD	0510	5	0513.1	(570)	Nag							
	2000	CD	0510	5	0513.2	(230)	Nag							
	1000	CD	0511	6	0513.2	(240)	Nag							
	600	CD	0511.5	7.5		90	Uc							
		CA	0519	15		20								
	545	CD	0512	13		210	N(H)							
	167	SD	1416.7	0.8		>100	NBS							
	127	ECD	1427	4	1430	> 30	Tok							
	9500	ESD	2340.1	1	2340.2	888	Tk							
	3750	SD	2340	1.5	2340.6	(1000)	Nag							
	2000	SD	2340	2	2340.8	(640)	Nag							
	1000	SD	2340	4	2341.2	(120)	Nag							
	3750	CD	0105.5	6	0106	(34)	Nag							
	2000	CD	0105.5	2.5	0106.1	(38)	Nag							
	9500	ESD	0704.4	3	0706.2	1200	Tk							
	3750	SD	0705	3	0706.7	(1280)	Nag							
	2000	SD	0705.5	5	0706.8	(815)	Nag							
	1000	CD	0706	9	0707	(170)	Nag							
	808	ECD	0706	15	0706	>140	Pra							
	600	CD	0706	1		115	Uc							
		CA	0707	6		79								
	536	SD	0705.5	4	0705.5	>145	Pra							
	231	CD	0705	8	0712	> 50	Pra							
	9500	SD	0403.8	1.5	0404.1	1750	Tk							
	3750	SD	0403	3	0404.2	(1750)	Nag							
	2000	SD	0403	5	0404.3	(930)	Nag							
	1000	SD	0403.5	6	0404.8	(430)	Nag							
	545	CD	0404	14		150	N(H)							
	9400	CD	1338.2	12.8	1339.2	350	HHI							
	1500	F	1338.5	5.5	1339.5	258	HHI							
	808	CA	1338	12	1340	80	Pra							
	600	ESD	1338	7		67	Uc							
	231	CD	1338	8	1345	55	Pra							
	168	CD	1338	2.2		>98	Irs							
		CD	1344	5		>97								
	167	F	0053	7	0059	> 100	NBS							
	9400	CD	1635	118.7	1652	783	HHI							
					1657	708								
					1739.4	610								
	1500	CD	1644	103.5	1647.5	630	HHI							
					1648.5	861								
					1656	>1130								
					1722	254								
					1740	886								
	600	CD	1646	20		360	Uc							
		CD	1734	35		400								
		CA	1822	38		-								
	545	CD	1647	18		>500	Ner							
		CD	1735	20		230								
		SD	1841	0.5		>350								
	167	CD	1651.1	6	1655.7	>100	NBS							
		CA	1657	64	1705	<100								
	9500	ESD	0245.5	3	0246	1020	Tk							
	2000	SD	0244.5	5.5		(1450)	Nag							
	1000	SD	0245	7		(475)	Nag							
	545	CD	0245	4		>1800	N(H)							

GEOMAGNETIC STORMS							
Start Day	Hr.(UT)	Dur. (Min)	Type	Int.	No. of Sta. Reporting	Max. 3-Hr. Kp	Event No.
May 15	07--	1.2d	g	ms	5	6	84
18	0400	0.3d	g	m	1	5	88
24	0540	1.4d	Sc	m	14	7	92
June 03	23--	1.2d	g	m	2	5	93
11	0909	0.4d	Sc	m	8	6	97

		FLARE DATA						
Event No.	Gr. Day	Beg. (UT)	End (UT)	Max. (UT)	Imp.	Position		Num Obse
81	May 13	0509	0553	0515	2+	N22	E26	7(2c)
82	13	a1416	1438	1424	1-	N11	E14	3(1c)
		b1416	1435	1418	1	S08	E84	4(1c)
		c1422	1436	1426	1	S13	E52	3(1c)
83	13	2339	2418	2341	1+	S07	E87	3(2c)
84	15							
85	17	0104	0204	0110	1-	N20	W26	2(2c)
86	17	0700	0722	0708	1	N21	W30	4(2c)
87	18							
88	18							
89	19	1332	1401	1340	2	N21	W57	4(1c)
90	21							
91	23	0029	0113	0035	1	N14	E43	2(2c)
92	24							
93	June 03							
94	05	0545	0554		1-	S14	E12	1(1c)
95	09	1707	1900		2	N17	E90	2(2c)
96	10							
97	11							

ber of rvations	SHORT-WAVE RADIO FADEOUTS						10 CM EVENTS								
	Type	Imp.	Beg. (UT)	Dur. (Min)	Index	No. of Obs.	Type	Beg. (UT)	Dur. (Min)	Max. (UT)	Peak Flux	Obs.	McM Plage No.	CMP Gr. Day	Lo
	*	2	0511	36	5	5							5148		
													a5148		
													b5156	20	347°
													c5133		
	S	1+	2340	10	5	4	*2	2340.3	>2.7	2341	880	OT	5156		
	*S	3	0107	100	5	4	CD	0105.7	1	0106.1	264	Tk	5148		
	S	2+	0705	23	5	5	*CD	0705	23.1	0707	1277	HHI	5148		
	S	2	0404	50	5	4	SD	0403.2	11	0404	440	Tk			
	S	1+	1335	25	5	7	2 4	1338 1343	5 10	1339.3	250 7	OT	5148		
													*5157	21.5	327°
													5165	27	254
													*5179	June 05	135°
	*S	3+	1635	180	5	14	*2 4 2 6 *2 6	1635 1707 1707.5 1716 1728 1841	32 380 5 12 70 25	1652 1709.5 1718.5 1739.5 1841.5	2000 25 15 135 1800 35	OT	*5204	17.5	330°
							*SD	0245.8	8	0248	520	Tk			

TABLE VIII

PLAGE DATA						SPOT DATA						
Lat.	Aver. Int.	Aver. Max. area	No. of Flares	Age in Rotation	Identi-fication	Mt. Wilson Type	CMP Gr. Day	Lat.	H	When Seen	Area (Greenwich Data)	Mt. Wilson No.
						See Spot Data for Event 73						
						See Spot Data for Event 73						
S08	2.5	4000	10	3	5103	bℓαd	20.3	S06	(15)	14 - 24		14138
						See Spot Data for Event 75						
						See Spot Data for Event 82b						
						See Spot Data for Event 73						
						See Spot Data for Event 73						
						See Spot Data for Event 73						
N20	3	4500	30	3	5105	dβpℓ	20.6	N23	(15)	19 - 26		4150
						dβpℓ	21.0	N16	(15)	15 26		139
N16	2.5	2500	7	2	5120	ℓβd	26.2	N14	(7)	20 - 23		14156
						dβpd	26.7	N11	(15)	25 - 30		163
S12	3.5	10000	56	1 and 4	Partly new and partly 5133	*ℓβrℓ	June 04.5	S11	23	29 - 10		14173
						dβfd	05.5	S10	16	30 - 5		174
N19	3.5	9000	69	4	5157	ℓαpd	16.7	N21	15	10 - 21		14207
						*ℓrℓ	17.5	N17	23	11 - 23		211

4.VIII-5R

Event No.	Gr. Day	FLARE DATA						SHORT-WAVE RADIO FADEOUTS					
		Beg. (UT)	End (UT)	Max (UT)	IMP	Position	Number of Observations	Type	Imp.	Beg. (UT)	Dur. (Min)	Index	No. of Obs.
98	June 13												
99	16	*0618	0810	0629	3	N16 E15	11(4c)	S	2	0623	34	5	9
100	18	*1130	1310	1145	3	N16 W12	9(2c)	S	2+	1138	52	5	8
101	22												
102	23												
103	23												
104	27												
105	29												
106	July 05	2330	2353	2343	1-	N09 W23	3(2c)	S	1	2339	1		1
107	07	0337	[illegible]	0339	1-	N19 E93	1(1c)	G	1-	0312	55		1
108	09	1930 2115 2155	 2320	1957 2130 2229	2	N18 E67 N19 E48 N21 E55	5(4c)	S	1+	1943 2040	81	5	7
109	10	*0206	1000	0230	3+	N20 E60	10(6c)	*SL	3+	0200	190	5	9
110	10												
111	11												
112	13	*0255	0605	0410	3	N15 E18	1(1c)	G	2-	0405	77		1
113	14	*0325	0901	0349	3+	N17 E04	18(6c)	*S	3+	0328	180	5	8
114	14												
115	14	*1400	1730	1445	3	S25 E37	14(7c)	SL	2+	1355	105	4	4
116	15												
117	16	*1552	1645	1616	3	N14 W27	8(6c)	S	2-	1610	28	5	8

10 CM EVENTS						PLAGE DATA									
Type	Beg. (UT)	Dur.	Max. (UT)	Peak Flux	Obs.	McM Plage No.	CMP Gr.Day	Lo	Lat.	Aver. Int.	Aver. Max. Area	No. of Flares	Age in Rotation	Identi-fication	Mt. Wilson Type
															See Spot Dat
						5204									
9 *6 4	1053.5 1138.5 1153.5	45 15 165	1140	15 1225 60	OT	5204									See Spot Dat
						*5219	23	257°	N13	3	10000	33	2 and 3	5165 and 5166	*lβpl
						*5244	July 04.5	105°	N11	3	4500	45	2	5185	dβpl dβl
						*5265	14	339°	N16	3.5	12000	96	[illegible] and 2	5204 and 5218	dβpl *lxl
3 2 2 2	1810 2042 2112 2218	>360 20 56 18	2110 2045.5 2128.5 2227	50 475 490 30	OT	5265									See Spot Dat
*SD	0206	35	0224	>1300	Tk	5265									See Spot Da
SD	0254	2	0255.5	324	Tk	5265									See Spot D.
*CD	0331	40	0359	1300	Tk	5265									See Spot D.
2	1443	30	1445.5	85	OT	5273	17.5	263°	S24	3	4000	12	2	5242	lαd dαd
3 2	1610 1612.5	35 9	1614.8	14 350	OT	5265									See Spot D

TABLE VIII

SPOT DATA					
CMP Gr.Day	Lat.	H	When Seen	Area (Greenwich Data)	Mt. Wilson No.
a for Event 95					
a for Event 95					
June 22.9	N09	36	16 - 28	1700	14224
July 04.2	N07	(15)	29 - 10		14236
04.9	N13	(20)	01 - 11		269
13.8	N20	13	9 - 20		14285
14.7	N17	27	8 - 20	1400	284
a for Event 107					
ta for Event 107					
ta for Event 107					
ta for Event 107					
17.4	S25	7	11 - 13		14290
17.7	S25	2	15 - 20		299
ta for Event 107					

1959 (CONTINUED)

	DYNAMIC SPECTRUM DATA				
Event No.	I and Cont. Time/Int.	III Time/Int.	II Time/Int.	IV Time/Int.	Obs.
98					
99					
100					
101	I 0359- s0608/1	g0507- 0508/2	*0503- 0512/1		S
102					
103					
104					
105					
106			*2338- 2349/1		S
107			*0343.5- 0345/1		S
108	Intermittent I 1940- s2118/2 I 2240- s2609/3	III 1934- s2020/2 b2042/1 g2045- 2046/3		*2044- >2400/3	H,S,M
109	I in progress s<0000- 0209/2 C0210- 0212/3	G0210- 0212/3 III in progress s<0000- 0343/1	*0222- 0306/1		S
110					
111					
112		b0238.5/1 g0249- 0250/1 b0251.5/1 g0254/1			S
113	I 0401- s>0610/3		*0338- 0412/3	*0401- ≥0610/3	S
114					
115	C1409- 1412/1 I 1308- s1511/1	G1334- 1335/2 g1444/1 g1446/1			H
116					
117	I s in progress all day 1622-1631/2	g1610/1 g1615/3 b1637/1	*1616- 1623/3		H,M

4 WTT-6R (1)

Freq Range (mc)	200 MC DATA							OTHER RADIO DATA						
	Type	Beg. (UT)	Dur. (Min)	Max. (UT)	Peak Flux	Obs.	Δt Max.	Freq. (mc)	Type	Beg. (UT)	Dur. (Min)	Max. (UT)	Peak Flux	Obs.
								9500	ESD	0624	10	0625	1140	Tk
								3750	CD	0623	6	0625.6	(1100)	Nag
								2000	SD	0623	5	0625.9	(1150)	Nag
								1000	CD	0625	7	0627	(56)	Nag
								19000	ECD	1139	6	1139	2400	Gor
								9375	ECD	1139	14	1139	2300	Gor
								3000	CD	1139	48	1140		HHI
								1500	SD	1138	-	1142	1025	HHI
								810	FD	1139	16	1140	219	Cra
								600	ESD	1139	11		145	Uc
								545	CD	1133.5	1.5		60	Ner
									CD	1139	15		65	
	CD	2337	6		>350	N(H)		208	CD	2333	10	2337	94	Vor
								167	CD	2337.5	5.5	2338.5	>100	NBS
								18	CD	2331	6	2335		Bo
	CD	0342.5	3.8	0345	>180	Osl								
580-25	F?U	1946	4	1949	100	Osl		9400	CD	2219	13	2224	(27)	Nag
	M	2023	110		2500	N(P)		3750	SD	<2159	>6	2159	(80)	Nag
	F	2319	31	2342		HAW		2000	CD	<2150	>15	2159	(265)	Nag
								1000	CD	<2157	>9	2201	(95)	Nag
									M	2219	75	2244	(290)	
								545	M	2023	37		120	N(P,H)
									CD	2103	90		1400	
								167	CD	1946	21	1958	>100	NBS
									CA	2018	306	2138	>1000	
								18		2004	2			Bo
										2007	1			
										2012	2			
										2035	>1			
										2045	10	20		
										2110	>305			HAW
	CD	0209	35		>500	N(H)		9500	ECD	0207	30	0224	14000	Tk
								3750	CD	<0209	>38	0224	(6300)	Nag
								2000	CD	<0211	>90	0224	(3000)	Nag
								1000	CD	0209	100	0223	6000	Nag
								600	CD	<0244	>60		>252	Syd
								545	CD	0208	32		1000	N(H)
								167	CD	0210	>5		>1000	NBS
	CD	0337	600		10000	N(H)		9500	ECD	0330	30	0349	3600	Tk
								3750	CD	0330	100	0356	(6000)	Nag
								2000	D	0331	125	0420	(8450)	Nag
								1420	CD	0330	131		>114	Syd
								1000	CD	0331	125	0422	20600	Nag
								545	CD	0337	125		40000	N(H)
								1500	M	1443	32	1447	340	HHI
								808	CD	1405	8.5	1409	>100	Pra
								600	ECD	1408	5		180	Uc
									SD	1443	23		90	
								545	SD	1409	1		70	Ner
								18		1442	8	1449		McM
260-25	CD	1616	3		800	Ner		9400	CA	1605	58	1615	600	HHI
								1500	CA	1613	9.5	1615.5	670	HHI
								600	SD	1614	8		100	Uc
								167	CD	1616	4.9	1619	>1000	NBS

POLAR CAP ABSORPTION							GEOMAGNETIC STORMS							
Onset Day	Time UT	Rise to Peak	Dur.	Int (DB)	obs.	Δt	Start Day	UT	Dur.	Type	Int.	No. of Sta. Reporting	Max. 3-Hr Kp	Event No.
June 13	1330		>40	1.5	L									
							June 23	15--	0.7d	g	ms	3	8	103
							27	07--	1.7d	g	ms	7	6	104
							29	0728	1.7d	Sc	ms	11	6	105
July 10	0700	29h	360	160	B,L,K		July 11	1625	1.2d	Sc	ms	13	7	111
14	0730	20h	72	190	B,L,K									
							15	0803	1.4d	Sc	S	19	9	116

2

4 VIII - bR

3

		FLARE DATA						SHORT-WAVE RADIO FADEOUTS					
Event No.	Date	Beg. (UT)	End (UT)	Max. (UT)	Imp.	Position	Number of Observations	Type	Imp.	Beg. (UT)	Dur. (Min)	Index	No. of Obs.
118	16	*2114	2230	2132	3+	N16 W31	4(4c)	*S	3+	2118	177	5	11
119	17												
120	17	0520	0656	0626	1+	N16 W40	1(1c)						
121	17												
122	24												
123	27	1224	1258	1229	2	N14 E50	9(2c)	S	2+	1228	26	5	6
124	27	*2050	2250	2115	3	N27 E26	6(5c)	SL	1+	2105	95	4	6
125	29	1202	1408	1213	2	N11 E26	8(4c)	SL	2+	1153	102	5	11
126	29	2117	2243	2120	2+	N15 E22	3(3c)	S	2	2120	45	5	11
127	31												
128	Aug. 01	1746	1754	1750	1-	N15 W37	2(2c)						
129	08												
130	11	1203	1232	1206	2	N20 W24	7(3c)						
131	14	0040	0326	0120	2	N11 E27	5(3c)	*SL	3	0105	125	5	3

4.VIII-72 TA

10 CM EVENTS						PLAGE DATA									
Type	Beg. (UT)	Dur. (Min)	Max. (UT)	Peak Flux	Obs.	McM Plage Data	CMP Gr.Day	Lo	Lat.	Aver. Int.	Aver. Max. Area	No. of Flares	Age in Rotation	Identi-fication	Mt. Wilso Type
*GB	2118	>180	2154	6500	OT	5265									See Spot D.
						5265									See Spot D
*2 4	1225 1241	16 60	1228.5	1025 18	OT	*5294	July 31.5	107°	N13	3.5	12500	79	3 and 8	5244, 5246 and 5249	lαpd *lβil
3 2	2100 2107	110 10	2128 2111	20 75	OT	5291	29.5	134°	N25	2.5	4000	13	1	New	lαpl
2 4	1158	20 270	1209	325 55	OT	5294									See Spot D
*2 4	2117.5 2127.5	10 55	2119.3	790 25	OT	5294									See Spot D
						5292	31.5	107°	N36	3	1500	7	2	5241	*lrd
3	1743	30	1755	12	OT	5298	30	127°	N14	1.5	300	2	1	New	iβd lβfd
2 4	1205 1207.5	2.5 15	1206	120 6	OT	*5315	Aug. 10	342°	N18	3	12000	52	8	5265	lβpl lβd lxd
						*5323	16	263°	N14	3	6000	48	4	5280	lβl lβpl

TABLE VIII

SPOT DATA					
CMP Gr.Day	Lat.	H	When Seen	Area (Greenwich Data)	Mt. Wilson No.
ıta for Event 107					
ıta for Event 107					
July					
31.0	N05	9	24 - 1		14319
31.5	N11	22	24 - 6	1600	320
29.4	N24	20	22 - 5		14314
ıata for Event 123					
)ata for Event 123					
31.8	N36	13	24 - 5		14321
29.2	N16	(3)	1 - 4		14336
30.0	N14	(5)	30 - 31		333
Aug.					
09.8	N20	26	3 - 16		14343
09.9	N26	10	3 - 14		344
11.3	N14	15	4 - 15		348
16	N12	(15)	9 - 22		14356
16.7	N15	(15)	9 - 22		357

1959 (CONTINUED)

	DYNAMIC SPECTRUM DATA				
Event No.	I and Cont. Time/Int.	III Time/Int.	II Time/Int.	IV Time/Int.	Obs
118	I_s in progress 2241-0440/1	g2120-2121/3 g2122/3 b2244/1 b2349/2 b2352/2	*(2121)	*2121-> 2543/3	H,S,M
119					
120			*0602-0606/1		S
121					
122					
123	C1231-1237/m	g1225-1230/m g1231-1237/m			M,H
124	C2107-2112/2 I_s 2106-2139/1	g2107-2108/3 g2110-2111/3 g2116/2 b2118/1 g2122/2	*2118-2126/2		H,M
25					M
126	C2118-2120/1 I_s 2117-2130/3	G2118-2120/3 b2120/1 g2123-2124/1 g2125/2 b2127/1 g2129/2			H,M
127					
128	C1745-1747/3 I_s 1746-1755/2 I_s 1759->2400/1	b1746/1 b1747/3 b1748/2	*1754-1810/2		H
129					
130		g1206-1207/m	*1212-1215/m		M
131	I_s 0141->0413/1				S,H

Freq. Range (mc)	200 MC DATA							OTHER RADIO DATA						
	Type	Beg. (UT)	Dur. (Min)	Max. (UT)	Peak Flux	Obs.	Δ t Max.	Freq. (mc)	Type	Beg. (UT)	Dur. (Min)	Max. (UT)	Peak Flux	Obs.
580-25	CD	2120	250		1100	N(H)		9400	SD	< 2207	>45		(640)	Nag
								2000	M	< 2201	>65		(2350)	Nag
								1000	M	< 2204	>65		(6500)	Nag
								545	CD	2114	165		5500	N(H)
								167	CD	2121	2	2121.6	>1000	NBS
									CA	2123	>287	2124	>1000	
								18		2128	4	2131		McM
										2135	5	2139		
										2144	11	2151		
								600	SD	0605	12		77	Uc
								231	S	0536	1.5		60	Pra
								127	CA	< 0600	> 120	0630	30	Tor
	CD	1225	5		> 700	Ner		9400	F	1232	19.6	1235	403	HHI
								3000	CA	1218	30.9	1228.6		HHI
								1500	CA	1225	45	1228.5	570	HHI
												1234	500	
								808	CD	1225	38	1235	85	Pra
								600	ECD	1226	13		>325	Uc
									SD	1250	12		70	
								545	CD	1225	12		400	Ner
								234	CD	1226	24.5	1228	4000	Aop
								167	CD	1225	3.8	1227.8	>1000	NBS
									CD	1228.8	8.2	1229.5	>1000	
								127	ECD	1225	7	1229	150	Tor
								23	F	1225	4.8	1227.7	>2000	Aop
								18		1225	5	1228		McM
90-25	CD	2107	3		> 450	N(H)		208	CDM	< 2100	> 41	2108	> 94	Vor
								167	CD	2107	8	2110	>1000	NBS
									CA	2115	32	2118	>1000	
								18		2106	4			Bo
	CD	1205	25		75	Ner		9400	FM	1201	33.3	1209	338	HHI
								3000		1159.6	40.4	1209		HHI
								808	CD	1158	17.5	1207	180	Pra
									CA	1230	15	1236	105	
								600	ECD	1156	18		160	Uc
									CA	1214	99		115	
								545	SD	1159.5	4		25	Ner
									SD	1205	9		90	
								167	CD	1208	27	1221.3	>100	NBS
	CD	2120.5	6		> 450	N(H)		545	SD	2121	4		40	N(H)
								167	CD	2117	3	2119	> 1000	NBS
									CA	2120	6	2120	> 100	
								18		2116	4			Bo
140-45								18		1745	5			Bo
	CD	1205	1.5		> 630	Ner		9400	F	1202	7.7	1206	313	HHI
								3000	F	1204.8	4.5	1205.8	304	HHI
								1500	F	1205	6.5	1206	340	HHI
								600	ECD	1205.3	7.5		90	Uc
								545	CD	1205	4.5		20	Ner
									CD	1210	2.5		33	
								234	CD	1205.1	2.2	1206.1	3000	Aop
								167	SD	1212	1.5	1212.5	>100	NBS
	CD	0140	65		190	N(H)		9400	CD	0130	100	0224	(50)	Nag
								3750	CD	0130	85	0224	(80)	Nag
								2000	CD	0130	80	0225	(105)	Nag
								1000	F,CD	0130	90	0220	(435)	Nag
								545	CD	0130	55		150	N(H)

POLAR CAP ABSORPTION							GEOMAGNETIC STORMS							
Onset Day	Time UT	Rise to Peak	Dur.	Int. (DB)	Obs.	Δt	Start Day	UT	Dur.	Type	Int	No. of Sta. Reporting	Max. 3-Hr Kp	Event No.
July 17	0000	10h	67	170	B,L,K									
							July 17	1638	2.2d	Sc	s	18	9	121
							24	09--	3.1d	g	m	3	5	122
							Aug. 06	09--	0.5d	g	m	1	5	129

		FLARE DATA						SHORT-WAVE RADIO FADE OUTS					
Event No.	Gr. Day	Beg. (UT)	End (UT)	Max. (UT)	Imp.	Position	Number of Observations	Type	Imp.	Beg. (UT)	Dur. (Min)	Index	No. of Obs.
132	Aug. 15												
133	16												
134	17	0328	0348	0335	1	N14 W15	3	S	2	0330	30	5	4
135	17	1218	1248	1230	1+	N15 W20	6(1c)	S	2+	1220	22	5	6
136	17	2046	2113	2049	2	N14 W27	4(4c)	S	2	2048	24	5	7
137	18	*1014	1350	1030	3	N12 W33	18(7c)	*S	3	1025	120	5	5
138	18												
139	20												
140	20												
141	23												
	27												
142	25												
143	28	0027	0128	0039 0113	1	N11 E71	6(4c)	SL	2+	0028	168	5	4
144	28												
145	28												
146	31	1850	2054	1910	1+	N10 E11	4(4c)	SL	2+	1856	64	5	6
147	Sept. 01												
148	01	1923	2216	1938	2+	N12 E60	3(3c)	SL	2	1945	73	5	4

10 CM EVENTS						PLAGE DATA									
Type	Beg. (UT)	Dur. (Min)	Max. (UT)	Peak Flux	Obs.	McM Plage No.	CMP Gr. Day	Lo	Lat.	Aver Int	Aver. Max. Area	No. of Flares	Age in Rotation	Identification	Mt. Wil. Type
CD	0329	3	0331.2	362	Tk	5323									See Sp
*SD	1218.7	5.8	1221	681	HHI	5323									See Sp
2 4	2046.5 2053.5	7 10	2048	90 4	OT	5323									See Sp
*GB	1025 1048	23 75	1030	985	Ner	5323									See Sp
						*5329	Aug. 20	210°	N08	3	6500	36	1	New	lβl
						*5336	25	144°	N18	3	9500	34	1	New	*lβp
						*5344	Sept. 01.5	45°	N10	3	8000	55	4 and 1	5310 and new	*lβ lβp
*ESD	0115	20	0120	1520	Tk	5344									See Sp
						*5340	Aug. 28.5	97°	S12	3	4500	42	1	New	*lβ
6 2	1853 1858.5	4.5 19	1855.8 1906	28 207	OT	5344									See s
3 -	1928 1931.5	>212 41.5	2023 2009.3	50 45	OT	5354	Sept. 05.5	352°	N15	1.5	1200	2	1	Part of 5315	dβ

TABLE VIII

SPOT DATA							
...on	CM: Gr. Day	Lat.	H	When Seen	Area (Greenwich Data)	Mt. Wilson No.	
...t Data for Event 131							
...t Data for Event 131							
...ot Data for Event 131							
...ot Data Event for 131							
	Aug. 20.1	N06	(20)	13 - 26		14366	
...l	25.2	N16	(25)	18 - 31	1200	14378	
	Sept.						
l	01.0	N09	15	25 - 7		14399	
l	02.0	N11	11	26 - 7		400	
...ot Data Event for 143							
...l	Aug. 28.8	S12	14	22 - 4	1500	14389	*
...ot Data Event for 142							
...l	Sept. 05.2	N13	(5)	31 - 7		14414	

#.VIII-82(3)

1959 (CONTINUED)

	DYNAMIC SPECTRUM DATA				
Event No.	I and Cont. Time Int.	III Time Int.	II Time Int.	IV Time Int.	Obs.
132					
133					
134		g0329/2 G0330-0332/2	*0334-0341/2		S
135					
135	C2048-2050/3 I_s in progress all day	g2047.6/m g2047.8-2051/S	*2052-2054/m		M,H
137		g1124.2-1125/S b1135/w	*1125.9-1129.3/S	* 1353-2243/3	H,M
138					
139					
140					
141	Continuum Radiation Aug. 23-Aug. 27				
142					
143	I_s in progress all day	g0030/1 g0031/2 b0038/1	*0039-0127/2	*0055-0330/1	H,S
144	I_s in progress	III_s in progress	II in progress	IV in progress	S
145					
146	*1347-1924/2	III_s in progress all day g1844/3 b1852/3 g1853-1855/3 g1857-1859/1 G1859-1917/2 G1917-1918/3		*1859-1916/3	H,M
117					
148	C1958-2001/3 I_s in progress all day	III_s in progress all day b1923/1 g1935/1 g1946/2 G1952-1955/3 G1955-2006/2	*1939-1945/3	*1914-1950/3	H

4. VIII - 8R (1)

Freq. Range (mc)	200 MC DATA							OTHER RADIO DATA						
	Type	Beg. (UT)	Dur. (Min)	Max. (UT)	Peak Flux	Obs.	Δ t Max.	Freq. (mc)	Type	Beg. (UT)	Dur. (Min)	Max. (UT)	Peak Flux	Obs.
	CD	0325.5	3		>350	N(H)		9500	CD	0329	5	0331	490	Tk
	CD	0330	1.8	0331.2	1400	Tk		3750	CD	0328.5	4	0331.1	(170)	Nag
	CD	0334.3	2	0335.5	2600			2000	F	0317	18	0331	(67)	Nag
								1000	F	0328.5	6	0333.8	(80)	Nag
								600	CD	0329	5	0331	120	Syd
								545	CD	0327	3		500	N(H)
	CD	1219.5	4.5		>650	Ner		9400	CA,M	1211	38.7	1221	485	HHI
	CD	1225	2		>650			2800	SD	1219	67	1221	335	Ot
								808	CD	1219	6	122[illegible]	150	Pra
								600	CD	1219	5		235	Uc
								545	CD	1219.5	5		120	Ner
								234	CD	1220	7	1225	3500	Aop
								167	CD	1219	5.4	1220.8	>1000	NBS
									CA	1224.4	4.6	1226.3	>1000	
								18		1220	4			Re
	CD	2045.7	1.3	2046.5	460	Hir		600	F	2042	2		52	Syd
	SD	2047.6	1.2	2048.8		HAW		545	CD	2048	2		110	N(P)
	CD	2049	1		>600	N(P)		167	CD	2047.6	4.2	2048.2	>1000	NBS
	M	2052	85.5	2202		HAW			CA	2052	53.2	2055	>100	
								18		2047	3			Re
560-210	CD	1025	11	1033	4800	Osl		19000	ECD	1025	20		>2000	Gor
	CD	1029	120		>600	Ner		9400	CD	1022	112.3	1030	933	HHI
								1500	CA	1025	63.5	1030	745	HHI
								808	CD	1025	45	1032	175	Pra
									CD	1245	25	1303	150	
								600	CD	1025	85		610	Uc
								545	CD	1029	120		550	Ner
								178	CD	1040	50	1129	254	Kis
								23	CD	1030	2.5	1030.5	2000	Aop
140-50	CD	0031	16	0032	245	Irk		9400	CD	0030	25	0041	(280)	Nag
								3750	CD	0024	30	0041	(540)	Nag
								2000	CD	0029	25	0043	(250)	Nag
								600	CD	0027	25	0041	79	Syd
	CD	0116	15	0123	200	N(H)		9500	SD	0120	20	0122	1040	Tk
								2000	CD	0111	30	01[illegible]	(2250)	Nag
								545	CD	0114	15		410	N(H)
								18		0113	17			HA
580-330	CD	1855	30		450	N(P)		545	CD	1900	17		>250	N(P)
								167	CD	1853	39	1917.5	>100	NBS
580-320								545	CD	1927.5	32		>300	N(P)
60-30														

POLAR CAP ABSORPTION							GEOMAGNETIC STORMS							
Onset Time Day	UT	Rise to Peak	Dur.	Int. (DB)	Obs.	Δ t	Start Day	UT	Dur.	Type	Int.	No. of Sta. Reporting	Max. 3-Hr. Kp	Event No.
							Aug. 15	12--	0.6d	g	m	3	6	132
							16	0404	3.2d	Sc	ms	17	8	133
Aug. 18	1130		15		B									
							20	0412	4.4d	Sc	ms	10	6	140
							Sept. 01	04--	1.4d	g	m	1	5	147

4. VII -8R (3)

		FLARE DATA						SHORT-WAVE RADIO FADE OUTS					
[illegible]	[illegible] Dec	Beg. (UT)	End (UT)	Max. (UT)	Imp.	Position	Number of Observations	Type	Imp.	Beg. (UT)	Dur. (Min)	Index	No. of Obs.
[illegible]	Nov. 2												
[illegible]	02	0720	0954	0745	2-	N10 W10	13(6c)	SL	2	0725	73	5	2
151	02	1602	[illegible]	1606	2	N25 W77	8(5c)	S	2	1605	26	5	9
152	03	0421	[illegible]	0423	1	N25 W86	3(3c)	*S	3	0422	20	5	5
153	[illegible]												
[illegible]	05	1550	1614	1558	1	N13 W52	4(3c)	S	1	1558	27	3	2
155	11	2157	2211	2200	1-	N14 E01	3(3c)	S	1-	2115	45		1
[illegible]	15												
157	15	2110	[illegible]	2120	1-	S13 W63	3(3c)						
[illegible]	15												
[illegible]	16												
[illegible]	20												
[illegible]	23												
162	25												
[illegible]	Oct. [illegible]												
[illegible]	03												
165	05												
[illegible]	06	1405	1448	1421	2	N30 E64	8(4c)	S	1	1420	23	5	8
167	06												
168	06												
169	17												
170	17												
171	20												
172	25							G	1-	0005	29		1
173	2[illegible]												
174	31												
175	Nov. 02												
176	04												
177	11												

#. VIII-92 (1)

10 CM EVENTS						PLAGE DATA									
Type	Beg. (UT)	Dur. (Min)	Max. (UT)	Peak Flux	Obs.	McM Plage No.	CMP Gr. Day	Lc	Lat.	Aver. Int	Aver. Max. Area	No. of Flares	Age in Rotation	Identification	Mt. Wil Type
CD	0734.4	25.8	0741	430	HHI	5344									See Sp
6 5	1603 1611	8 30	1607.3	120 -8	OT	*5339	Aug. 27	167°	N19	3	8000	44	2,3, and 4	5292, 293, 294, 298	lβd dβf dβp
*ESD	0420.5	2	0420.5	6850	Tk	5339									See Sp
SD	1557	3		238	Ner	5344									See Sp
2	2157.5	3	2159	15	OT	5360	Sept. 11.5	272°	N08	3	7000	18	1	New	lαp *lβr lαp
						5367	10	144	S16	3	1200	10	1	New	dβp
						5408	Oct. 11.5	250°	N31	3	1000	21	1	New	dβp
						5405	08.5	276°	N05	3	3000	23	2	5360	lα *lβ
*ESD ESD	0150.8 0222	2 1	0150.9 0222.2	543 600	Tk										
*ESD	0012.5	3	0012.8	717	Tk										
						*5452	Nov. 11	194°	S19	3.5	4500	44	1	New	*lβ

4.VIII - 9L

(2)

TABLE VIII

SPOT DATA						
on	CMP Gr. Day	Lat.	H	When Seen	Area (Greenwich Data)	Mt. Wilson No.
t Data Event for 143						
	Aug.					
	26.8	N16	(12)	20 - 26		14382
	27.3	N18	11	21 - 2		386
	27.4	N24	(25)	25 - 3		396
t Data Event for 151						
t Data Event for 143						
	Sept.					
	10.9	N04	15	4 - 15		14423
	11.4	N05	35	5 - 16		425
	11.8	N13	11	5 - 15		426
	09.9	S18	(20)	10 - 15		14436
	Oct.					
l	11.6	N29	(20)	6 - 17		14490
pd	08.3	N06	(10)	2 - 8		14483
	08.7	N05	(15)	4 - 14		487
	Nov.					
pl	11.2	S17	(25)	5 - 17	1100	14543

H. VIII-9L

1959 (CONTINUED)

	DYNAMIC SPECTRUM DATA				
Event No.	I and Cont. Time/Int.	III Time/Int.	II Time/Int.	IV Time/Int.	Obs.
149					
150					
151		G1605-1608/2 G1611-1614/3	*1608-1615/3		H,M
152	I_s in progress all day	III_s in progress all day G0422-0423/3	*0424.5-0438/3		S
153					
154	C1557-1559/2	g1553-1554/2 g1555-1556/1 G1556-1600/3 g1601/2 g1602/2 G1603-1604/2	*1603-1610/2		H,M
155	I_s in progress all day	G2157-2159/3	*2204-2205/2		H
156					
157			*2124-2127/2 *2135-2144/3		H
158					
159					
160					
161					
162					
163					
164					
165					
166					
167					
168					
169					
170					
171					
172					
173					
174					
175					
176					
177					

4.VIII-9R

Freq. Range (mc)	200 MC DATA							OTHER RADIO DATA						
	Type	Beg. (UT)	Dur.	Max. (UT)	Peak Flux	Obs.	Δ t	Freq. (mc)	Type	Beg. (UT)	Dur. (Min)	Max. (UT)	Peak Flux	Obs.
	CA	0726	8	0728	32	AB		9400	CD	0737.2	33.4	0742.4	355	HHI
	CD	0736	10	0743	320	Hir		3750	CD	0737	10	0741	(180)	Nag
	CD	0742.5	4		>300	Ner		2000	CD	0734	11	0741	(245)	Nag
								1500	CD	0739.5	5.5	0742.4	388	HHI
								1000	F	0725	26	0740	(1170)	Nag
								810	CD	0724	27	0740	>305	Cra
								600	CD	0726	24		248	Uc
								545	CD	0739	5		200	Ner
350-40	CD	1605	9	1610	1500	Osl		9400	CA	1603	13.2	1605	750	HHI
								1500	CA	1603.4	8	1606	284	HHI
								600	SD	1605.3	6.5		108	Uc
								545	CD	1605	4		25	Ner
								167	CD	1609	2.1	1610	>1000	NBS
								18		1605	2			Bo
	ECD	0422	8	0425	3500	Tk		9500	ECD	0421.1	3	0421.1	981	Tk
								2000	SD	0421	3.5	0422.2	(385)	Nag
								1420	ESD	0420	5.5	0421	175	Syd
								545	CD	0421.5	3		>550	N(H)
250-100	FD	1556	9		260	Ner		167	CD	1555.6	4	1557	>100	NBS
									F	1601	7	1606	>100	
								18		1554	6			McM
180-75								157	SD	2203.6	0.9	2204	>100	NBS
85-25 60-35								18		2107	2			Bo
								536	S	1418	1		50	Pra
	FD	0009.5	3		400	N(H)								

POLAR CAP ABSORPTION							GEOMAGNETIC STORMS							
Onset Day	Time UT	Rise to Peak	Dur.	Int. (DB)	Obs.	Δ t	Start Day	UT	Dur.	Type	Int.	No. of Sta. Reporting	Max. 3-Hr Kp	Event No.
Sept. 02	0400		~ 48		B									
							Sept. 03	2159	2.6d	Sc	ms	16	7	153
							15	11--	0.8d	g	m	1	5	156
							17	17--	0.4d	g	m	3	5	158
							18	10--	1.3d	g	m	4	6	159
							20	02--	2.9d	g	ms	13	7	160
							23	05--	1.4d	g	m	2	[illegible]	161
							25	00--	1.0d	g	m	1	6	162
							Oct. 01	04--	1.5d	g	m	7	6	163
							03	07--	1.6d	g	ms	10	7	164
							05	1200	1.5d	g	ms	7	6	165
Oct. 06	1530													167
							17	06--	2.0d	g	m	6	5	170
							25	03--	1.7d	g	ms	2	5	172
							29	2347	1.2d	Sc	ms	[illegible]	6	173
							31	0900	1.3d	g	ms	4	6	174
							Nov. 02	0646	2.0d	g	ms	5	6	175
							04	0448	1.4d	g	m	6	5	176

4. VIII - 92 (P)

		FLARE DATA							SHORT-WAVE RADIO FADE OUTS					
Event No.	Gr Day	Beg. (UT)	End (UT)	Max. (UT)	Imp.	Position		Number of Observations	Type	Imp.	Beg. (UT)	Dur. (Min)	Index	No. of Obs.
178	Nov 11													
179	14													
180	18								SL	2-	0035	65		1
181	21	1734	1940	1746	1+	N20	W30	3(3c)	G	1	1750	42		1
182	23													
183	26													
184	26	0923	1110	0937	2-	S15	W17	7(2c)	S	1+	0930	46	3	2
185	27													
186	28	*2006	2130	2018	3	N12	E31	[illegible](3c)	S	2	2010	35	5	9
187	29	1816	2012	1848	2+	N09	E18	4(4c)	S	2+	1843	59	5	9
188	30	0247	0356	0250	2+	N08	E16	1	S	3-	0249	31	5	5
189	30													
190	30	*1720	1906	1744	3	N07	E06	5(5c)	S	3-	1735	47	5	9
191	Dec. 01	1456	1622	1533	2	N09	W06	3(3c)	SL	2+	1512	61	5	9
192	01	1638	2035	1709	2+	N09	W05	4(4c)	*S	3	1705	115	5	10
193	02													
194	02	1219	1412		2+	N07	W16	2	S	2+	1246	76	5	9
195	05													

4.VIII-10L

10 CM EVENTS						PLAGE DATA									
Type	Beg. (UT)	Dur. (Min)	Max. (UT)	Peak Flux	Obs.	McM Plage No.	CMP Gr. Day	Lo	Lat	Aver. Int.	Aver. Max. Area	No. of Flares	Age in Rotation	Identification	Mt. Wilson Type
						5461	Nov 19	89°	N10	3	3600	2	1 and 2	New and parts of 5429 and 5427	*lαpd*
						5468	26	357°	N16	3	7500	11	2 and 3	5439 and part of 5437	*lαpl* *dpl* *dβfi*
*CD	0928	14		530	Ner	5467	24.5	16°	S13	2.5	3500	6	2	5438	*dβl*
2 4 2	2010 2025 2029	15 >20 7	- - 0931.5	>225 20 17	OT	*5476	Dec. 01.5	284°	N07	3	8500	64	4	5443	*Jβp*
3 6	1820 1843	110 22	- -	18 >175	OT	5476									See Spot
*CD	0247	9	0252.5	1229	Tk	5476									See Spot
2 4	1737.8 1745.8	18 60	-	>175 20	OT	5476									See Spot
3	<1522	>330	-	50	OT	5476									See Spo
						5476									See Spo
*2 4	1245 1257	12 170	1247.5	875 35	OT	5476									See Sp

TABLE VIII

SPOT DATA					
C. P. Gr. D.	Lat.	H	When Seen	Area Greenwich Data	Mt. Wilson No.
N.					
19.1	N14	12)	12 - 23		14557
25.6	N15	[illegible]	19 - 1	1000	14557
26.1	N23	15)	20 - 1		569
26.2	N06	10)	24 - 1		576
25.2	S18	(15)	22 - 30		14571
Dec. 01.5	N07	(25)	24 - 6	1400	14[illegible]3

Data Event for 18[illegible]

Data for Event 18[illegible]

Data for Event 186

Data for Event 186

Data for Event 186

Data for Event 186

1959 (CONTINUED)

	DYNAMIC SPECTRUM DATA				
Event No.	I and Cont. Time Int.	III Time Int.	II Time Int.	IV Time Int.	Obs.
171	C0633-0639/1	g0633-0639/1 g0640/2 g0643/1	*0657-0714/2		S
179					
180	I_s in progress all day	g0030.5/1 b0036/1	*0043-0044/1		S
181	I_s in progress all day		*1741-1752/3		H,M
182					
183					
184					
185					
186	C2014-2019/3 I_s 2013-2024/1	G2012-2015/3 g2016-2017/2 g2018-2019/2 g2020/2 g2025-2026/3 b2031/2	*2017-2045/3	*(2013-2050/w)	H,M
187	I_s 1851-1957/1	g1843-1844/2 g1845-1846/2	*1854-1904/3		H,M
188	I_s 0344-0442/2	g0241/2 g0248/3 b0252.5/2	*0251-0328/3	*0312-0350/1	S
189					
190		G1738-1740/2 g1741-1742/3 G1743-1746/3	*1741-1810/3+	*1739->2330/3	H,M
191	G1513-1517/3 I_s 1522-2233/1	G1258-1400/2 G1512-1515/3 G1516-1519/3 G1520-1523/2		*<1400-2240/3	H,M
192	I_s in progress G1730-1740/2	g1720-1721/1 g1722/1 G1725-1727/1 b1758/2	*1733-1734/1		H
193					
194	I_s 1253-1310/w I_s 1430-2214/m		*1250-1253/3	*1305-2214/m	M
195					

4.VIII.-10R-

Freq. Range (mc)	200 MC DATA							OTHER RADIO DATA						
	Type	Beg. (UT)	Dur. (Min)	Max. (UT)	Peak Flux	Obs.	Δt Max.	Freq. (mc)	Type	Beg. (UT)	Dur. (Min)	Max. (UT)	Peak Flux	Obs.
125-25														
	CD	0930	30	0940	200	Sim		3000	CD	0926.2	20	0933.6		HHI
								1500	CD	0926.5	20	0938.5	294	HHI
								810	CD	0925	18	0928	425	Cra
								545	CD	0927.5	3.5		300	Ner
								234	CD	0932.6	0.2	0932.8	400	Aop
240-25								545	CD	2027	7		250	N(P)
								167	SD	2013.9	1.5	2014.1	>1000	NBS
									CD	2015	1.9		>1000	
150-35								545	CD	1843	10		200	N(P)
								167	CD	1850	4	1851.5	>100	NBS
									CA	1857	9	1902	>100	
	CD	0247	12		>9000	N(H)		9400	CD	0247	12	0250.3	(4050)	Nag
	ECD	0248.3	0.7	0248.6	850	Tk				0300	130	0315		
	ECD	0251	12	0254	6300			3750	CD	0247	12	0252.3	(1750)	Nag
										0300	130	0313		
								2000	CD	0247	18	0250.3	(2750)	Nag
										0305	115	0340		
								1000	CD	0247.5	20	0250.5	(3450)	Nag
										0308	110	0345		
								545	CD	0246	11		>750	N(H)
580-25								545	CD	1738	20		>300	N(P)
								167	CD	1740	35	1740	>1000	NBS
									CA	1815	68	1833	>1000	
580-150								600	ECD	1336	>90		270	Uc
								167	CD	1513.5	5	1516.5	>100	NBS
140-60														
	CD	1250	2.5		>1300	N		608	CD	1245	60	1251	120	Pra
	CA	1257	-		650			600	ECD	1247	47		428	Uc
								545	SD	1251	2		250	Ner
								234	CD	1249.8	3.4	1251.4	4000	Aop
									CA	1257	>63	1400	450	

POLAR CAP ABSORPTION							GEOMAGNETIC STORMS							
Onset Time Day	UT	Rise to Peak	Dur.	Int. (DB)	Obs.	Δ t	Start Day	UT	Dur.	Type	Int.	No. of Sta. Reporting	Max. 3 Hr Kp	Event No.
							Nov. 14	00--	0.8d	g	ms	3	5	179
							23	00--	0.9d	g	ms	7	6	182
							27	2351	1.2d	Sc	ms	18	8	185
							30	0545	1.4d	g	ms	12	6	189
							Dec. 02	04--	1.9d	g	ms	6	6	192
							05	0659	1.4d	Sc	ms	16	8	195

11. VIII → 10R

		FLARE DATA							SHORT-WAVE RADIO FADEOUTS					
Event No.	Gr Day	Beg. (UT)	End (UT)	Max. (UT)	Imp.	Position		Number of Observations	Type	Imp.	Beg. (UT)	Dur. (Min)	Index	No. of Obs.
196	Dec. 05	1215	1250	1221	2	N11	W07	2(2c)	S	2	1220	12	5	4
197	08	0116	0204	0120	1+	N15	W39	2(1c)	S	1+	0118	42	5	3
198	08	0747	0839	0756	2	N12	W44	2(1c)	S	1+	0755	25	5	4
199	10	0512	0537	0518	2+	N15	W70	1(1c)	S	1+	0518	27	5	3
200	11								S	1+	0407	23	1	1
201	13													
202	15													
203	18	0636	0700	0636	1	S07	W53	1(1c)	S	1+	0637	20	4	2
204	21	0043	[illegible]	0052	2	S04	W53	4(3c)	*SL	3+	0045	315		1
205	23													
206	26													

4.VIII-11C

10 CM EVENTS						PLAGE DATA									
Type	Beg. (UT)	Dur. (Min)	Max. (UT)	Peak Flux	Obs.	McM Plage No.	CMP Gr.Day	Lo	Lat.	Aver. Int	Aver. Max. Area	No. of Flares	Age in Rotation	Identification	Mt. Wilson Type
SD *CD SD	1216 1219 1224	1 2 1		220 551 367	Ner	*5478	Dec. 05.5	231°	N12	3.5	5000	44	1	New	*ℓβxℓ ℓβfℓ
CD CD	0116.5 0130	6 14	0119.2 0140	265 279	Tk	5478									See Spot
*CD	0757	4		560	Ner	5478									See Spot
SD	0516.5	3	0518	363	Tk	5478									See Spot
SD	0406.5	3	0407.3	269	Tk										
						5491	15	106°	N15	3.5	5200	6	1	New	*ℓβpℓ
						5490	14	119°	S05	2.5	1500	6	1 and 3	Part of 5459 and new	dβℓ
*CD CD	0045 0107	12 10	0050 0113	611 328	Tk	5494	12.5	73°	S05	3	2500	6	1	New	ℓαpℓ

2

4.VIII - 11L

TABLE VIII

SPOT DATA					
CMP Gr. Day	Lat.	H	When Seen	Area (Greenwich Data)	Mt. Wilson No.
Dec. 05.5	N10	(25)	29 - 11		14585
05.9	S18	(12)	2 - 11		591
ata for Event 196					
ata for Event 196					
ata for Event 196					
15.2	N19	31	9 - 21	1000	14600
14.3	S06	(12)	11 - 19		14606
17.5	S03	21	10 - 22		14603

4.VIII-11C
(3)

1959 (CONTINUED)

	DYNAMIC SPECTRUM DATA				
Event No.	I and Cont. Time Int.	III Time Int.	II Time Int.	IV Time Int.	Obs.
196					
197		b0114.5 1 G0116-0120 3 III S 0122-0139. 1	*0121-0126 3		S
198					
199		G0515-0518.5, 2	*0521-0529/3		S
200		g0400.5-0401/1 g0406.5-0409/1	*0412-0418/3		S
201					
202					
203		G0634.5-0638/3	*0640-0647/2	*0653->0723/1	S
204	I 0207- S 0350/2	G0043.5-0051/3 b0125.5/1 b0127/1 g0156-0157/3	*0055-0102/2	*0120-0350/2	S
205					
206					

4.VIII-11R

0

Freq Range (mc)	200 MC DATA							OTHER RADIO DATA						
	Type	Beg. (UT)	Dur. (Min)	Max. (UT)	Peak Flux	Obs.	Δt Max.	Freq. (mc)	Type	Beg. (UT)	Dur. (Min)	Max. (UT)	Peak Flux	Obs.
	CD	1213	13		>1000	Ner		9400	CD	1217.4	14.4	1220.2	780	HHI
												1224.2	553	
								808	ECD	1229	9	1229	120	Pra
								600	ECD	1219	8		370	Uc
	ECD	0115.8	3.5	0117	430	Tk		9500	CD	0116.5	4	0119.5	450	Tk
	ECD	0120.8	3	0121.7	1600				CD	0129	17	0140	543	
	ECD	0129	1	0129.5	220			1420	CD	0117	25		131	Syd
	CA	0131	11	0139	440			208	CD	0115	28	0121	>600	Uss
	CD	0754	7		>500	Ner		9100	CD	0757	4			Ner
								1500	CD	0753.5	10.4	0759	412	HHI
								600	ECD	0753	11		138	Uc
								545	CD	0754	8		220	Ner
								178	SD	0752	14	0805	267	Kis
	ECD	0515.5	3.5	0516.7	1500	Tk		9500	SD	0517	2	0518	507	Tk
	CD	0412	3		>500	N(H)		209	ECD	0405	12	0412		Irk
								9500	ECD	0634	4	0634	1233	Tk
	CD	0634	2		>400	N(H)		545	CD	0634	2.5		140	N(H)
	ECD	0043	55	0049	130	Uss		9500	CD	0049	6	0050.1	737	Tk

(2)

POLAR CAP ABSORPTION							GEOMAGNETIC STORMS							
Onset Time Day	UT	Rise to Peak	Dur.	Int. (DB)	obs.	Δt	Start Day	UT	Dur.	Type	Int.	No. of Sta. Reporting	Max. 3 Hr. Kp	Event No.
							Dec. 13	17--	1.2d	g	ms	10	5	201
							23	1525	1.0d	Sc	m	6	6	205
							26	02--	3.5d	g	ms	11	6	206

4.VIII-11R

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NOTES AND COMMENTS ABOUT SOME 1959 SOLAR-TERRESTRIAL EVENTS

1 The major SWF on January 3 at 1600 UT, accompanies an average flare that occurred in Region No. 4934 as it was going over the west limb of the sun. This very large, bright and active plage was also responsible for events No. 215 and 217 in the 1958 catalogue of major solar events. The spot No. 13803 is a return of the βp spot No. 13733 in Region 4897. The Type II burst at 1610 UT, was observed by Ft. Davis over a frequency range of 150 - 100 Mc, and by Michigan on their A band. Except for the period of irregular activity reported by Ottawa at 2800 Mc, no radio events are reported at any other single radio frequencies at the time of the SWF and the Type II burst.

2 No 10 cm. event is reported at the time of the Type II and Type IV bursts on January 7 at 0245 UT. The SWF appears in the CRPL "check-list," but is not listed as a bona fide SWF in the F-series Bulletin, since it was reported by only one station, and was not confirmed by any other observers. At meter wavelengths, the single radio events are of long duration and are characterized as a rise and fall in flux.

4 This sudden commencement magnetic storm of January 9 at 1459 UT, follows Event No. 3 after a time interval of about 2-1/2 days. The storm was world-wide, and perhaps it should be noted that 5 of the 15 stations reporting the storm started it about 3 hours earlier than the time of the Sc, and classified the storm as gradual.

5 The βp spot No. 13842, in Region No. 4953, is one of the largest spots of the year - with area equal to 2400 millionths of the solar hemisphere. (All area values given for spots in this catalogue for 1959 are based on measures made at the Greenwich Observatory. In the previous catalogues for the years 1953 - 1958, the area measures are based on Mt. Wilson data.) This very large spot is associated with a very large and very bright plage which is only moderately active and which does not produce any solar optical or radio events of sufficient magnitude to warrant their inclusion in this catalogue.

6 No dynamic spectrum events, and no events at any other single radio frequencies, were reported at the time of the large 10 cm. burst recorded at Ottawa on January 14 at 2130 UT, in the sunset oscillations. The only known solar flare is a minor event of short duration, for which there is no known related short-wave fadeout. If this is truly a great 10 cm. burst (Mme. Pick-Gutmann classifies it as a "probable Type IV.") then it is highly unusual to find such a paucity of related concomitant solar events among the optical and radio data.

7 This very weak disturbance, which began with a sudden commencement on January 16 at 0927 UT., was preceded by a day of extremely quiet geomagnetic conditions on the 15th.

8 The major flare on January 21 at 1709 UT, occurred in a large, bright and active region which contains a mixture of old and new plage. The flare appears to be associated with the newer portions of the plage. The αp spot No. 13883 is one of the largest spots of the year, with an area equal to 1500 millionths of the solar hemisphere (Greenwich data). In addition to the 3 major spots listed in the table of spot data, there were numerous other small, short-lived spots present within the plage. The Type II burst at 1718 UT, was reported by Fort Davis over the frequency range of 140 - 25 Mc.

9 The Type II burst on January 22 at 2102 UT, was reported by Fort Davis over the frequency range of 180 - 25 Mc, and is associated with moderate flare activity in a large, bright and active plage which is situated near the center of the solar disk. The only known related SWF is a rather dubious event which appeared in the CRPL "check-list" but was unconfirmed by other observers. Region 4973 is a new plage, and β spot No. 13877 is one of the largest spots of the year, with an area equal to 1900 millionths of the solar hemisphere (Greenwich data).

10 & 11 These two geomagnetic storms on January 25 and 26 seem to be part of an almost continual disturbance. Six of the eleven stations that report the first storm on January 25 continue the storminess through the period of the next storm, but five stations start a new storm on January 26 at 0325 UT. Two of these five stations classify this as a gradual storm, the other three indicate that the storm began with a sudden commencement.

12 The major flare on January 26 at 0842 UT, occurred in a very large, bright and active plage (Region 4969) which contains a complex $\beta\gamma$ spot (No. 13878). No dynamic spectrum observations exist at the time of the flare. For the single radio frequencies, no major solar radio event is reported at meter wavelengths, at decimeter and centimeter wavelengths a burst of relatively short duration begins almost simultaneously at all frequencies, and is markedly more intense at the higher frequencies.

13 This major flare on January 26 at 1027 UT occurs very soon after the fading of Event No. 12, in the same plage and very nearly in the same position, and perhaps the two should actually be regarded as a single great solar event. The 9400 Mc radio event actually is reported as a single event, which has two maxima and covers the time interval of the two flares. The two flares were observed and reported by many observers, the majority of whom were patrolling the sun visually. We have accepted the importance classification assigned to the two flares by the cinematographic patrol station, which possesses a complete photographic record of the two events. It is strange that no known SWF is reported with this second major flare. The 10 cm. radio event consists of a very large burst, followed by a modest post-burst increase in flux, and Mme. Pick-Gutmann classifies this as a "probable Type IV." The single radio frequency reports seem to indicate that the radio burst related to this flare swept rather slowly through the radio spectrum from high to low frequencies, reaching maximum intensity at successively later moments.

14 This very minor geomagnetic disturbance of January 29 at 05h UT. was classified as a storm by only two stations (Witteveen and Hermanus). It represents the only change which has occurred in the geomagnetic indices since the major solar events of January 26.

15 No. 10 cm. observations, and no dynamic spectrum observations exist at the time of the major flare on February 1 at 0352 UT. Very strong bursts of short duration appear to occur simultaneously at all wavelengths, just prior to flare maximum.

16 No 10 cm. event is reported in association with the major flare on February 2 at 1017 UT. Dynamic spectrum observations were not being made at the time of the flare, and no radio events are reported at any of the single radio frequencies. The SWF is taken from the CRPL "check-list."

17 The plage and spot data for this event are similar to that given for Event No. 15. The major flare and SWF on February 2 at 1816 UT, was accompanied by a large 18 Mc cosmic noise absorption event starting at 1818 UT. The dynamic spectrum events are all related in time, to the post-maximum phase of the flare. The Type II burst at 1853 UT. was observed by Ft. Davis over a frequency range of 150 - 40 Mc. At centimeter wavelengths, the radio event consists of a group of three complex bursts which are superposed on a lengthy but modest rise and fall in flux.

18 The Type II burst on February 3 at 0054 UT. is associated with a flare of imp. 2 that occurred in Region 4992 when it was near the center of the solar disk. Flares in this region on February 7 also seem to be responsible for the two Type II events on February 7 that are described in Events No. 20 and 21. The αp spot No. 13906 in region 4992 is a return of the $\gamma\beta$p spot No. 13829 in Region 4951. In addition to the two major spots described in the spot table, Region 4992 also contained five other small short-lived spots. No 10 cm. observations exist at the time of the Type II burst, but the radio events which are reported at other high frequencies indicate that a strong microwave burst of short duration probably occurred near the start of the flare. At meter wavelengths, no event is reported in association with the Type II burst.

19 This minor disturbance on February 3 at 10h UT. was classified as a storm by only three stations. One of these three stations starts the storm with a sudden commencement on the next day, on February 4 at 0946 UT.

20 & 21 The plage and spot data for these events are similar to that given for Event No. 18. No SWF's, and no 10 cm. events are reported in association with the two Type II bursts on February 7 at 1616 UT. and 2334 UT. Both events occurred over a wide range of frequencies, from 240 - 100 Mc. Fort Davis was not observing when the first event occurred.

22 Although this minor geomagnetic disturbance on February 8 at 12h UT. was classified as a storm by only one station, it represents a real change in the 3-hour K_p values from quiet conditions to storm level.

23 The Type II burst on February 8 at 1344 UT, reported by Michigan only, since Fort Davis was not observing at this time) is associated with an average flare which took place in Region 5009 at the east limb of the sun. Activity in this same region is also accountable for Events No. 24, 25, 26 and 28, and is undoubtedly also related to the terrestrial effects described in Events No. 27, 29, 30, 31 and 32. The single radio frequency reports indicate that a major radio burst occurred at all frequencies practically simultaneously with the start of the Type II burst.

24 The plage and spot data for this event are similar to that given for Event No. 23. The Type II burst reported by Sydney on February 9 at 0208 UT was accompanied by weak Type IV emission that began at 0210 UT, degenerated into a weak noise storm after 0317 UT. At centimeter and decimeter wavelengths, the single frequency radio event consists of a major burst that starts at about the time of flare maximum. At meter wavelengths the radio event consists of a rise and fall in flux, on which is superposed a very great burst. The latter is coincident with the start of the Type II burst.

25 The plage and spot data for this event are similar to that given for Event No. 23. No dynamic spectrum observations exist at the time of the SWF on February 9 at 0052 UT. At meter wavelengths, the radio event consists of a long-enduring rise and fall in flux that begins about 10 minutes after flare maximum.

26 The plage and spot data for this event are similar to that given for Event No. 23. The flares associated with Events No. 24, 25 and 26 all occurred on February 9 near the east limb of the sun, in the active plage region No. 5009. Like Event No. 23, these limb flares were not great optical flare events, but they appear to have as a common characteristic an association with Type II and Type IV radio bursts in the radio spectrum. The bursts on February 9 at 1643 UT. and 1654 UT. are events which are classified as Type II and Type IV bursts by Michigan, but not by Fort Davis. The latter observers report unclassified bursts at 1645 and 1650 UT., with strong continuum emission from 1643 - 1708 UT. Although the start of the optical flare is not known, strong cosmic noise absorption began at 1638 UT. on 18 Mc receivers and indicates that the flare event started at about this time. At centimeter wavelengths, the single radio frequency events indicate that a microwave burst of modest intensity accompanied the start of the flare. At meter wavelengths, the radio event consists of a very strong major burst of long duration. The 200 Mc record is characterized by periodic rises and falls in flux throughout the day, with noise in progress. After 1700 UT. there is a gradual decline in the base level and an end to the noise storm.

27 This major geomagnetic Sc storm of February 11 at 0756 UT. was world-wide. Five of the 15 stations which reported the storm start the storm earlier, with a sudden commencement at 0518 UT. Two stations continue the storm through the interval of storminess covered by the next two storms, which are described in Events No. 30 and 31

28 No 10 cm. observations exist at the time of the major flare on February 12 at 2301 UT. The plage and spot data for this event are similar to that given for Event No. 23. The Type IV burst at 2303 UT, was observed by Fort Davis over a frequency range of 500 - 50 Mc. The Sydney observers do not classify this event as Type IV, but instead report continuum emission in progress at 2315 - 2358 UT., intensity 2. They also continue the noise storm to $\geq$ 0532 UT. The single radio frequency reports indicate that a great burst of long duration occurred at all wavelengths. This major event is followed 9 hours later by the proton event described next in Event No. 29.

29 This PCA event on February 13 at 0800 UT. was detected by means of the oblique-incidence VHF ionospheric scatter signal intensity observation technique used by Bailey in his study of solar proton events.

30 This weak interval of geomagnetic disturbance on February 13 at 10h UT. was classified as a separate storm by only three stations (SITK, Witteveen, and McQuarrie). There is a small but real increase in the 3-hour K_p values, but only to a maximum value of 4. Perhaps this interval of weak geomagnetic disturbance is related to the PCA event of No. 29, with which it seems to be coincident in time.

31 This major Sc storm on February 14 at 1142 UT. has two maxima. A peak intensity of 5 is reached in the 3-hour K_p values on the 14th, after which the values decline and then increase again to a second maximum of 6 on the 15th. Five stations indicate that the storm

60 This major flare on April 8 at 0905 UT., with its very great 10 cm. burst, occurred in a very large, bright and active region, McMath Plage 5092, as it was moving around the east limb of the sun. This plage is a return of parts of the two active plages 5052 and 5054 of the previous solar rotation which together were responsible for Events 49, 50, 51, 52 and 53. The complex γ spot No. 14056 is a return of the large δγ spot No. 13984 in region 5054 (see Event No. 51). Dynamic spectrum observations do not exist at the time of the flare. The radio events which are reported at the single radio frequencies indicate that a major radio burst occurred at all wavelengths and that perhaps some form of Type IV or continuum emission may exist in the microwave region of the radio spectrum.

61 Although this brief storm on April 9 at 0000 UT. is classified as a storm in only 3 stations, it represents a short interval of time during which geomagnetic activity increases, as the 3-Hr. K_p values reach storm level.

62 The plage and spot data for this event are similar to that given for Event No. 60. The Type II burst on April 9 at 1653 UT was observed by Fort Davis over a frequency range of 290 - 40 Mc. The 10 cm. event consists of a complex burst - not very strong - followed by a brief post-burst increase in flux. It may be a coincidence, but the latter part of the 2800 Mc event occurs exactly at the time of the Type II burst. At decimeter and meter wavelengths, the radio event consists of two major bursts which follow each other closely in time at 1648 and 1653 UT. The second of these two bursts coincides in time with the start of the Type II burst, while the first is coincident with the short period of continuum emission reported in the dynamic spectrum. The flare which was associated with the Type II burst occurred near the east limb of the sun, and was accompanied by rather strong cosmic noise absorption, and a radio burst, at 18 Mc.

63 This strong geomagnetic storm on April 9 at 1800 UT. reaches maximum severity on the 10th, decreases in intensity on the 11th, and then has a slight resurgence late on the 11th before diminishing again on the 12th.

64 No known SWF is reported in association with the Type II burst on April 11 at 2149 UT., which was observed by Fort Davis over a frequency range of 340-100 Mc. At the single radio frequencies, the minor radio bursts which are reported at centimeter and decimeter wavelengths occur simultaneously with the group of Type III bursts in the dynamic spectrum, and near the start of the flare. At meter wavelengths, the radio event consists of a major burst which is coincident with the Type II burst.

65 The plage and spot data for this event are similar to that given for Event No. 60. No dynamic spectrum observations exist at the time of the major flare on April 13 at 0830 UT. At meter wavelengths, no radio event is reported, but this may be due to a lack of observations at these low frequencies at the time of the flare.

66 This strong Type IV burst on April 14 at 1824 UT. is unusual because of its short duration. It is coincident in time with the start of the optical flare and with the major radio bursts which occurred at decimeter wavelengths. The 10 cm. event consists of a small rise and fall in flux. No known 200 Mc event is reported at the time of the Type IV burst, which was observed by Fort Davis over a frequency range of 580-240 Mc. The Fort Davis observers also report unclassified bursts at 1849 UT Int. 3, and 1850 - 1852, Int. 1. The flare which is associated with the Type IV event occurred near the center of the solar disk, in Plage No. 5090. This region, in its fourth rotation, is a return of active region 5052 which is described in Note No. 49. The δ spot No. 14046 is a return of the complex γ spot No. 13983 in region 5052.

67 The major SWF on April 22 at 1116 UT. is associated with minor flare activity which may be related to the development of the βγ f spot in plage region 5098 on the 22nd. No dynamic spectrum observations exist at the time of the major SWF. Although, the start of the flare is not know, the occurrence of a major sudden enhancement of atmospherics at 1115 UT., and the start of the sudden SWF at 1116 UT., would indicate that the flare itself began at about this same time. Rather large bursts also occur at 1115 UT. at all of the single radio frequencies.

70 No known 10 cm. event is reported at the time of the Type II burst on May 3 at 0012 UT. However, the single radio frequency reports at other centimeter wavelengths indicate that a strong microwave burst of short duration occurred at about the same time. The Type II event was observed by Fort Davis over a broad frequency range of >300 - <50 Mc.

73 The very great 10 cm. burst on May 8 at 2254 UT. and the strong Type II burst at 2259 UT. are associated with major flare activity in plage region 5148 which is partly on the disk and coming around the east limb of the sun on the 8th. This remarkable plage region - of great area, unusually bright, and so fruitful in the production of flares - is in its fifth rotation as a return of region 5095, although some portions of region 5149 is also a return of region 5100 and is in its second rotation. Earlier predecessors of region 5095 were the active regions 5016 and 4976, described in events and Notes No. 8 and 37. Plage 5148 certainly represents a great resurgence of activity at a location on the sun where active plages have existed for at least five solar rotations. The region contains an unusual number of complex spots - δγ spot No. 14141, γ spot No. 14122, and βγ spot No. 14121. The latter is one of the largest spots of the year, with an area equal to 1300 millionths of the solar hemisphere (Greenwich data). The αp spot No. 14125 is a return of βp spot No. 14070 in region 5100. During its transit across the solar disk, from May 8 to 22, Region 5148 was responsible for 12 events in this catalogue - the major solar events described in Nos. 73, 74, 76, 78, 81, 82a, 85, 86, and 89, and the related terrestrial events described in Nos. 77, 79 and 84. The great 10 cm. burst at 2254 UT. reaches its maximum intensity quickly, at the same time as flare maximum, and is followed by a long-enduring but not very strong post-burst increase in flux, which is lost in the sunset oscillations at Ottawa. In the dynamic spectrum, the strong Type II burst at 2259 UT. was observed by Fort Davis over the broad frequency range of >300 - <50 Mc. The Type II was preceded by several groups of strong Type III bursts with enhanced continuum emission. The latter were coincident with the starts of the 10 cm. bursts, as well as the starts of the major bursts reported at all other single radio frequencies. It seems quite evident that a major burst swept through the entire range of the radio spectrum, almost instantaneously, at 2259 UT. Major cosmic noise absorption at 18 Mc also began at this time. Because of the intensity of the bursts at centimeter wavelengths, it is undoubtedly true that some form of microwave Type IV emission occurred, but was probably not very long-lasting. In the lower frequency range of the dynamic spectrum, the observers at both Fort Davis and Michigan seem to agree that Type IV emission was not present. Instead, the Type II burst is followed by the onset of a weak but long-enduring noise storm. In retrospect, Region 5148 made a sweeping entrance upon the solar scene, majestically announcing its arrival on May 8 with Event No. 73, and climaxing its passage across the solar disk with the great solar proton-flare of May 10 - 11 (described in Events No. 76 and 77).

74 The plage and spot data for this event are similar to that given for Event No. 73. No SWF and no 10 cm. bursts are reported at the time of the major flare on May 9 at 0123 UT. Also, no special events are reported in the dynamic spectrum, but observations end at 0130 UT. A noise storm, that began with Event No. 73, is in progress at the time. At the single radio frequencies, the only known radio event which occurred at the time of the flare is a strong burst of very short duration at meter wavelengths. It is highly unusual for a flare of importance 3 to show none of the effects mentioned above. However, it should be pointed out that, following the decline of the major flare described in the preceding Event No. 73, flare activity of a lesser degree has continued to take place near the limb in active region 5148. Between 2346 UT. and the start of Event No. 74, two flares, plus the major flare event of No. 74, should be regarded as a part of - or a consequence of - the major solar event of May 8 at 2252 UT. described in Note No. 73.

75 This event refers to a bright and flare-rich plage, Region 5133. However, none of the optical and radio events associated with flare activity in this region were of sufficient magnitude to warrant their inclusion in this catalogue of major solar events.

76 The plage and spot data for this event are similar to that given for Event No. 73. This very great flare on May 10 at 2102 UT. also produced great effects in all of the other categories which make up this catalogue, and was accompanied by a solar proton event (described next in Event No. 77). Strong cosmic noise absorption at 18 Mc began at 2103 UT., with the start of the flare and the great 10 cm. burst. In the dynamic spectrum, the Type II burst was observed by Ft. Davis over the frequency range 140 - 25 Mc., and the Type IV event over all frequencies, from 580 - 25 Mc. The numerous Type III bursts which was reported, seem to indicate that a Type III noise storm occurred between 2104 - 2150 UT. In addition, the Ft. Davis observers report an unclassified burst at 2253 - 2258 UT., Int. 3, which has "some features of a Type II." All of the single radio frequency events are great bursts. At decimeter and meter wavelengths, it is clear that the great bursts are major events - the second part, which represents the start of a major solar storm with a strong radio emission. It first began at 2115 UT. with the start of the Type IV event, the major SWF, and a strong SEA cosmic enhancement [illegible] atmospherics.

77 This great storm [illegible] on May 11 at 0630 UT. arrived at the earth three and one-half hours after the start of the great flare of May 10, and continued for an interval [illegible] days. Perhaps this unusually long duration has been augmented by the occurrence of other major solar events in Region 5149 as it continued its transit across the solar disk.

78 The plage and spot data for this event are similar to that given for No. 73. This event on May 11 at 2004 UT. is the third very great event which has taken place in Region 5148 since its appearance at the east limb of the sun on May 8th. Like Event No. 76, it produced great effects in all of the categories which make up this catalogue. Strong cosmic noise absorption at 18 Mc. began at 2015 UT., coincident with the start of the SWF. The flare and the 10 cm. event began earlier than this, at 1956 and 2000 UT. respectively. At centimeter wavelengths, the radio event consists of a very great burst, which is followed by a very short post-burst increase in flux. In the dynamic spectrum, the Type II burst was observed by Ft. Davis over the frequency range 280 - 25 Mc., and the Type IV event over a broad range of frequencies from 400 - 25 Mc., and the Type I event over a broad range of frequencies from 400 - 25 Mc. Unlike Event No. 76 on May 10th in which the Type IV burst on May 21th is of short duration (only 18 minutes). A noise storm of intermittent Type III bursts occurred between 2016 - 2131 UT., and a weak noise storm of Type I bursts began later, at 2200 UT. At decimeter and meter wavelengths, the radio events at the single radio frequencies consist of major - bursts. The 18 Mc bursts occur while the cosmic noise absorption event is still in progress.

79 Although this [illegible] geomagnetic disturbance on May 11 is worldwide, and is quite evidently a sudden commencement storm, all observers do not agree exactly concerning its starting time. Some stations report the start of the storm at various minutes between 2326 and 2332 UT. Three stations start the Sc earlier, at about 1452 UT. Five stations classify the storm as gradual. An examination of the 3-Hr. Kp values reveals that the Kp's show an initial increase which begins at about the time of the earlier Sc at 1452 UT. Since this is about 18 hours after the occurrence of the great proton flare of May 10th, it is tempting to believe that these two events are related to each other. One can then also perhaps assume that the later Sc at about 2330 UT. is due to the arrival at the earth of an increase in solar protons from the flare at 2006 UT., and a consequent strengthening of the intensity of the already existing storm.

80 This large, bright and active plage region 5147, with a complex δγ spot, did not produce any solar activity of sufficient magnitude to warrant its inclusion in this catalogue of major solar events. The δγ spot No. 14114 is a return of γ spot No. 14050 in Region 5092 (see Event No. 60), which was a return of the large δγ spot No. 13984 in region 5054 (Event No. 51).

81 The plage and spot data for this event are similar to that given for Event No. 73. No 10 cm. event is reported at the time of the Type II burst on May 13 at 0516 UT. and the Type IV which follows. However, the radio events which are reported at other high frequencies indicate that the event at centimeter wavelengths consists of a strong burst of short duration - prior to flare maximum. At decimeter and meter wavelengths, the radio event is a major - burst. In the dynamic spectrum, the weak Type IV, beginning at 0525 UT., is accompanied by the onset of a weak noise storm, also at 0525 UT.

82 No SWF and no 10 cm. events are reported at the time of the Type II burst on May 13 at 1429 UT. It is difficult to find a unique solar event to associate with the Type II burst, since three flares were in progress simultaneously, in three different regions on the solar disk, when the Type II burst occurred. One of these is a sub-flare of importance 1- in region 5148 (see Event No. 73 for plage and spot data). The second is a flare of importance 1 in region 5156, near the east limb of the sun. The third is a flare of importance 1 in Region 5133, in the southwest quadrant near the west limb (see Event No. 75 for plage and spot data). The αp spot No. 14138 in region 5156 is a return of βp spot No. 14086 in Region 5103. At meter wavelengths, no radio event is reported at the time of the Type II burst, which was observed by Ft. Davis over a frequency range of 160 - 50 Mc.

83 The large 10 cm. burst on May 13 at 2340 UT. and the Type II burst at 2342 UT are associated with flare

[illegible] is [illegible] and will [illegible] maximum at [illegible] UT, [illegible] the 3-hour K [illegible] first [illegible] [illegible] case.

32 [illegible] of the [illegible] stations include this interval of [illegible] on February 15 as a part of the preceding [illegible] of Event No. 31.

33 Parts of the 13 [illegible] consist of a separate [illegible] the status of Event No. 31; [illegible] the period of observations. Five [illegible] the edge [illegible] that this event of February 16 with a [illegible] commencement, but cannot agree as to its [illegible], which ranges from February 15 at 2321 UT. to February 16 at 1919 UT.

34 Since flare phase [illegible] do not exist at the time of the Type II burst on February 18 at 0568 UT., plage and spot data for this event are not available.

35 Since there was no solar [illegible] in progress at the time of the Type II burst on January 18 at 2241 UT., plage and spot data for this event are not available. The SWF is taken from the CRPL check-list of unconfirmed ionospheric disturbances, and seems to bear a good time relation with the dynamic spectrum events. The Type II burst was observed by Fort Davis over a frequency range of 150-50 Mc. No radio events are reported at any of the single radio frequencies in association with the Type II burst.

36 The major flare on February 19 at 2037 UT. seems to have a greater effect at the high radio frequencies than at the low frequencies. The 10 cm. event consists of a large burst (complicated by interference), followed by a long-lasting moderate increase in flux. Other bursts are evident (varying in shape and similarity to the 10 cm. burst) at meter wavelengths; the only response is a minor burst of very short duration at 1[illegible] Mc. Pick-Gotmann reports a probable Type II at the time of the 10 cm. event. Both Fort Davis [illegible] agree that the major flare was not accompanied by any [illegible] radio emission. In the dynamic spectrum, the response to the flare consisted primarily of the onset of a noise storm.

37 The Type II burst on February 20 at 1753 UT. and its related Type IV burst at 1813 UT. are associated with flare activity in plage region 5018, which is near the central meridian of the sun on the 26th. This very large, bright and very active plage is primarily a return of the plage part of region 4946, which was responsible for Event No. 8 in this catalogue. Region 5018 will continue to be a bright and active plage for several more rotations, and will eventually return in May as region 5148, in which the great solar proton event of May 10-11 occurred (Events No. 76 and 77). The $\beta\gamma$ spot No. 13930 in plage region 5018 is one of the largest [illegible] of the year, with an area equal to 1700 millionths of the solar hemisphere (Greenwich data). The $\alpha\beta$ spot No. 13933 in region 4946. Although [illegible] average flare, the quiet event is very long-[illegible] and has two [illegible] of [illegible] that the first [illegible] only at the [illegible] long waves, while the second place for [illegible] strong Type II burst at 1753 UT., followed by the onset of a noise storm, and the strong major radio burst at meter wavelengths, are undoubtedly related to the first phase of the flare with its maximum at 1752 UT. The 10 cm. event, at 1817 UT., consists of a complex burst and a small post-burst increase in flux. This event is late in the lifetime of the flare, but is coincident with the second flare maximum and with the "strong fine-structure" Type IV burst in the dynamic spectrum. The Type II burst was observed by Fort Davis over a frequency range of 100-40 Mc. and the Type IV burst over a range of 280-60 Mc. Unclassified bursts were also reported at 1752 UT. (int. 1-), 1817-1813/int. 3, and 1820-1813/int. 2.

38 This weak geomagnetic disturbance [illegible] at 0016 UT. was classified as a storm by only two stations. It follows an interval of extremely quiet geomagnetic conditions which [illegible] (Feb. 18, 19, 20, 21).

39 This major geomagnetic [illegible] 0[illegible] UT. apparently did not exist [illegible] solar activity such as the events included in this catalogue. It is difficult to classify the storm, which was worldwide. Half of the reporting stations classify it as a gradual storm, beginning at about 0125 UT. The other half begin the storm with a sudden commencement at about 0215 UT., and five of these stations indicate that the time of SC start was preceded by an earlier initial impulse. It should also be noted that this storm occurs 27 days after the weak disturbance of January 20, described in Event No. 14.

40 This event appears here in the catalog as a flare that represents the central meridian passage of a very bright and active plage region that had once [illegible] three during its dark passage. No major optical or radio events of sufficient magnitude to warrant inclusion in this catalogue, accompanied the passage of that plage region, occurred during its [illegible] across the solar disk.

41 No known flare is reported at the time of the major SWF on March 5 at 0520 UT., therefore plage and spot data for this event are not available. There [illegible] be some doubt as to whether or not this is really an SWF of importance 3, since one of the two observers classified the event as lasting approximately 15 minutes. No 10 cm. event, and no [illegible] in the dynamic spectrum and no radio event at meter wavelengths are reported at the time of the SWF. Indeed, the only known related event is a minor burst which occurred at a frequency of 9500 Mc.

42 The major SWF on March 7 at 1725 UT. is due to a limb-flare that occurred in plage region 5018 as it was cresting around the east limb of the sun. Region 5018 is a return of the active plage 5009, described in Event No. 23 above, and in which the solar proton flare of February 12 occurred (Events No. 22 and 29). The $\alpha\beta$ spot No. 13979 is a return of the $\beta\gamma$ spot No. 13929 in region 5009. The 10 cm. event is described by Ottawa as a "precursor," followed by a single simple burst. This is an interesting example of two events which are closely-spaced on the radio record but undoubtedly are the result of two different flares. The precursor is related, in time, to the limb-flare of importance 2+ in progress at 1723 UT. in region 5018, while the burst at 1[illegible] UT. is related to a flare of imp. 1+ in progress at that time in region 5016, also located in the east limb. Perhaps the flares in the regions, which are near each other, are physically related. In the dynamic spectrum, some rather intermittent Type III bursts are reported after the start of the flare, and the event is listed as primarily Type III noise storm from [illegible] the "[illegible]" [illegible] single radio frequencies, no radio event is reported at any meter or decimeter wavelengths.

43 The Type II burst on March 9 at 1724 UT. was observed by Fort Davis over a frequency range of 200-50 Mc. The Fort Davis observers also report unclassified bursts at 1732 - 1738/int. 1, 1743/int. 2 and 1752 - 1755/int. 3. The Type II burst is related to a flare that occurred near the west limb of the sun. No single frequency radio event is reported at meter wavelengths at the time of the Type II burst, and at centimeter wavelengths the bursts are minor.

46 The plage and spot data for this event are similar to that given for Event No. 44: No 10 cm. event is reported at the time of the major SWF on March 10 at 0513 UT., but this may be due to a lack of observations. A minor burst is reported at other centimeter wavelengths, but no other radio events are reported at any other single radio frequencies. In addition to the groups of weak Type III bursts, Sydney also reports unclassified burst activity at 0531 and 0603 UT.

47 This very weak geomagnetic disturbance was classified as a storm by only two stations - Hermanus and Huancayo - and follows three days of extremely quiet geomagnetic conditions.

48 No known flare is reported at the time of the Type II burst on March 13 at 0151 UT., therefore plage and spot data for this event are not available. No SWF is reported at this time, and among the single radio frequency events, the only known radio event is a minor burst at meter wavelengths, coincident in time with the Type II burst.

[illegible] SWF [illegible] UT. [illegible] meter wavelengths event is reported at meter wavelengths.

50 The plage and spot data for this event are similar to that given for Event No. 49. No dynamic spectrum observations exist at the time of the large SWF on March 21 at 0903 UT. The only radio event reported at meter wavelengths is a minor burst of short duration that occurred just prior to the start of the flare which is associated with the SWF.

51 This strong 10 cm. event on March 21 at 1129 UT. is a sudden wave burst of very short duration, occurred just [illegible] the maximum of a flare associated with plage region 5051. This [illegible] large [illegible] and extent [illegible] contains a complex $\beta\gamma$ spot, No. 13985, which is one of the largest spots of the year, with an area of 1300 millionths of the solar hemisphere (Greenwich data). This large plage and large $\beta\gamma$ spot are located just north of the large circular plage region 5052 with its large $\alpha\beta$ spot, described as Event No. 19. In the dynamic spectrum, the related event is primarily the onset of a weak noise storm. At meter wavelengths, no single frequency radio event is reported in association with the 10 cm. burst.

52 The plage and spot data for this event are similar to that given for Event No. 51. The large 10 cm. event on March 22 at 1340 UT., coincident with the large SWF, consists of a strong burst which is followed by a very long interval of increased flux. In the dynamic spectrum, the only response is the large SWF and 10 cm. burst is the onset of a weak but long-enduring noise storm.

53 This great solar flare on March 24 at 0958 UT. occurred in plage region 5051 when it was near the west limb of the sun. The plage and spot data are similar to that given for Event No. 51. The flare was accompanied by a major SWF, and by very great radio bursts at the high radio frequencies. It is possible that the great 10 cm. burst has a very longer duration than the tabulated time assigned to it by Hill. When Ottawa began observations at 1200 UT., a period of increased 10 cm. flux was in progress and lasted for more than 30 min. Misc. Pick-Gotmann classified this event as a "probable Type IV" because of the great bursts at centimeter wavelengths. No dynamic spectrum observations exist at 0958 UT. at the time of the flare. At decimeter wavelengths, the single radio frequency reports indicate that only relatively minor bursts occurred, and at meter wavelengths no radio event is reported.

54 This minor geomagnetic disturbance on March 25 at 0130 UT. follows a period of extremely quiet geomagnetic conditions from March 16 - 22.

55 This major geomagnetic storm is worldwide and of long duration. The storm has 3 maxima: the first maximum value of 8+ reached on the 26th, after which the 3-hr. K values decline briefly and then increase to a second maximum of 8 on the 27th. After another decrease, the third maximum of 7+ is reached on the 28th.

56 The major flare on March 28 at 21-3 UT. has only a relatively minor ionospheric effect. In the radio spectrum, minor bursts are reported at centimeter wavelengths, and no events are reported at meter wavelengths. [illegible] of [illegible] day [illegible] β spot No. 14094 in plage region 5051 is a return of the $\beta\gamma$ spot No. 13946 in region 5026, described in Event No. 10.

57 The large 10 cm. burst on March 29 at 0747 UT., with its [illegible] SWF, is associated with flare activity in plage region 5071. This very large, very bright and very active plage contains a complex $\beta\gamma$ spot, No. 14020. No dynamic spectrum observations exist at the time of the SWF and large 10 cm. burst, and no known major radio events are reported at meter wavelengths among the single frequency radio reports. Because of [illegible]

March 28 [illegible] storm denot[illegible]

58 Plage region 5068 is mostly a new plage, although it still contains a few remnants of old plage 5042. The $\beta\gamma$ spot, [illegible] year, with solar hem[illegible] its large spot and numerous flares, did not produce any solar optical or radio events of sufficient magnitude to warrant their inclusion in this catalogue.

59 The plage and spot data for this event are similar to that given for Event No. 57. No 10 cm. observations exist at the time of the major flare and SWF on April 5 at 2316 UT., but single radio frequency observations at other high frequencies indicate that a strong microwave burst occurred at centimeter wavelengths. In the dynamic spectrum, the radio event is characterized by several Type III bursts and the onset of a weak noise storm. The 14. Davis observers also report an unclassified burst at 2324-2326 UT/int. 3.

60 This major flare on April 8 at 0905 UT., with its very great 10 cm. burst, occurred in a very large, bright and active region, McMath Plage 5097. As it was coming around the east limb of the sun. This plage is a return of parts of the two active plages 5052 and 5054 of the previous solar rotation which together they were responsible for Events 49, 50, 51, 52 and 53. The complex γ spot No. 14056 is a return of the large $\beta\gamma$ spot No. 13984 in region 5054 (see Event No. 51). Dynamic spectrum observations do not exist at the time of the flare. The radio events which are reported at the single radio frequencies indicate that a major radio burst occurred at all wavelengths and that perhaps some form of Type IV or continuum emission may exist in the microwave region of the radio spectrum.

61 Although this brief storm on April 9 at 0000 UT. is classified as a storm by only 3 stations, it represents a short interval of time during which geomagnetic activity increases, as the 3-Hr. K_p values reach storm level.

62 The plage and spot data for this event are similar to that given for Event No. 60. The Type II burst on April 9 at 1653 UT was observed by Fort Davis over a frequency range of 290-40 Mc. The 10 cm. event consists of a complex burst - not very strong - followed by a brief post-burst increase in flux. It may be a coincidence, but the latter part of the 2300 Mc event occurs exactly at the time of the Type II burst. At decimeter and meter wavelengths, the radio event consists of two major bursts which follow each other closely in time at 1645 and 1653 UT. The second of these two bursts coincides in time with the start of the Type II burst, while the first is coincident with the short period of continuum emission reported in the dynamic spectrum. The flare which was associated with the Type II burst occurred near the east limb of the sun, and was accompanied by rather strong cosmic noise absorption, and a radio burst, at 18 Mc.

63 This strong geomagnetic storm on April 9 at 1828 UT. reaches maximum severity on the 10th, decreases in intensity on the 11th, and then has a slight resurgence late on the 11th before diminishing again on the 12th.

64 No known SWF is reported in association with the Type II burst on April 11 at 2149 UT., which was observed by Fort Davis over a frequency range of 340-100 Mc. At the single radio frequencies, the minor radio bursts which are reported at centimeter and decimeter wavelengths occur simultaneously with the group of Type III bursts in the dynamic spectrum, and near the start of the flare. At meter wavelengths, the radio event consists of a major burst which is coincident with the Type II burst.

65 The plage and spot data for this event are similar to that given for Event No. 60. No dynamic spectrum observations exist at the time of the major flare on April 13 at 0830 UT. At meter wavelengths, no radio event is reported, but this may be due to a lack of observations at these low frequencies at the time of the flare.

66 This strong Type IV burst on April 14 at 1824 UT. is unusual because of its short duration. It is coincident in time with the start of the optical flare and with the major radio bursts which occurred at decimeter wavelengths. The 10 cm. event consists of a small rise and fall in flux. No known 200 Mc event is reported at the time of the Type IV burst, which was observed by Fort Davis over a frequency range of 580-240 Mc. The Fort Davis observers also report unclassified bursts at 1849 UT/Int. 3, and 1850 - 1852/Int. 1. The flare which is associated with the Type IV event occurred near the center of the solar disk. In Plage No. 5090. This region, in its fourth rotation, is a return of active region 5052 which is described in Note No. 49. The β spot No. 14046 is a return of the complex γ spot No. 13983 in region 5052.

67 The major SWF on April 22 at 1116 UT. is associated with minor flare activity which may be related to the development of the β f spot in plage region 5098 on the 22nd. No dynamic spectrum observations exist at the time of the major SWF. Although the start of the flare is not know, the occurrence of a major sudden enhancement of atmospherics at 1115 UT., and the start of the sudden SWF at 1116 UT., would indicate that the flare itself began at about this same time. Rather large bursts also occur at 1115 UT. at all of the single radio frequencies.

70 No [illegible] 10 cm. event is reported at the time of the [illegible] single [illegible] wavelengths indicate that a strong microwave burst of short duration occurred at about the same time. The Type II event was observed by Fort Davis over a broad frequency range of ~300 - ~50 Mc.

73 The very great 10 cm. burst on May 8 at 2254 UT. and the strong Type II burst at 2259 UT. are associated with major flare activity in plage region 5148 which is partly on the disk and coming around the east limb of the sun on the 8th. This remarkable plage region - of great area, unusually bright, and so frontal in the production of flares - is in its fifth rotation as a return of region 5095, although some portions of region 5148 is also a return of region 5100 and is in its second rotation. Earlier predecessors of region 5095 were the active regions 5016 and 4976, described in events and Notes No. 8 and 37. Plage 5148 certainly represents a great resurgence of activity at a location on the sun where active plages have existed for at least five solar rotations. The region contains an unusual number of complex spots, $\beta\gamma$ spot No. 14141, γ spot No. 14122, and $\beta\gamma$ spot No. 14121. The latter is one of the largest spots of the year, with an area equal to 1300 millionths of the solar hemisphere (Greenwich data). The αp spot No. 14125 is a return of βp spot No. 14070 in region 5100. During its transit across the solar disk, from May 8 to 22, Region 5148 was responsible for 12 events in this catalogue - the major solar events described in Nos. 73, 74, 76, 78, 81, 82, 85, 86, and 89, and the related terrestrial events described in Nos. 77, 79 and 84. The great 10 cm. burst at 2254 UT. reaches its maximum intensity quickly, at the same time as flare maximum, and is followed by a long-enduring but not very strong post-burst increase in flux, which is lost in the sunset oscillations at Ottawa. In the dynamic spectrum, the strong Type II burst at 2259 UT. was observed by Fort Davis over the broad frequency range of >300 - <50 Mc. The Type II was preceded by several groups of strong Type III bursts with enhanced continuum emission. The latter were coincident with the starts of the 10 cm. bursts, as well as the starts of the major bursts reported at all other single radio frequencies. It seems quite evident that a major burst swept through the entire range of the radio spectrum, almost instantaneously, at 2255 UT. Major cosmic noise absorption at 18 Mc also began at this time. Because of the intensity of the bursts at centimeter wavelengths, it is undoubtedly true that some form of microwave Type IV emission occurred, but was probably not very long-lasting. In the lower frequency range of the dynamic spectrum, the observers at both Fort Davis and Michigan seem to agree that Type IV emission was not present. Instead, the Type II burst is followed by the onset of a weak but long-enduring noise storm. In retrospect, Region 5148 made a sweeping entrance upon the solar scene, majestically announcing its arrival on May 8 with Event No. 73, and climaxing its passage across the solar disk with the great solar proton-flare of May 10 - 11 (described in Events No. 76 and 77).

74 The plage and spot data for this event are similar to that given for Event No. 73. No SWF and no 10 cm. bursts are reported at the time of the major flare on May 9 at 0123 UT. Also, no special events are reported in the dynamic spectrum, but observations end at 0130 UT. A noise storm, that began with Event No. 73, is in progress at the time. At the single radio frequencies, the only known radio event which occurred at the time of the flare is a strong burst of very short duration at meter wavelengths. It is highly unusual for a flare of importance 3 to show none of the effects mentioned above. However, it should be pointed out that, following the decline of the major flare described in the preceding Event No. 73, flare activity of a lesser degree has continued to take place near the limb in active region 5148. Between 2346 UT. and the start of Event No. 74, two flares, plus the major flare event of No. 74, should be regarded as a part of - or a consequence of - the major solar event of May 8 at 2252 UT. described in Note No. 73.

75 This event refers to a bright and flare-rich plage, Region 5133. However, none of the optical and radio events associated with flare activity in this region were of sufficient magnitude to warrant their inclusion in this catalogue of major solar events.

76 The plage and spot data for this event are similar to that given for Event No. 73. This very great flare on May 10 at 2102 UT. also produced great effects in all of the other categories which make up this catalogue, and was accompanied by a solar proton event (described next in Event No. 77). Strong cosmic noise absorption at 18 Mc began at 2103 UT., with the start of the flare and the great 10 cm. burst. In the dynamic spectrum, the Type II burst was observed by Ft. Davis over the frequency range 140 - 25 Mc., and the Type IV event over all frequencies, from 580 - 25 Mc. The numerous Type III bursts which was reported, seem to indicate that a Type III noise storm occurred between 2104 - 2150 UT. In addition, the Ft. Davis observers report an unclassified burst at 2253 - 2258 UT./Int. 3, which has "some features of a Type II." All of the single radio frequency events are great bursts. At decimeter and meter wavelengths, it is clear that the great bursts are major - events in the second part, which represents the start of a major flare at 2102 with a strong enhancement of flare begun at 2315 UT. with the start of the Type IV event, the major SWF, and a strong SEA sudden enhancement of atmospherics.

77 This great shower of solar protons on May 11 at 0020 UT., arrived at the earth three and one-half hours after the start of the great flare of May 10, and continued for an interval of seven days. Perhaps this unusually long duration has been responsible for the occurrence of other major effects in H (plage 5148) as it continued its transit across the solar disk.

78 The plage and spot data for this event are similar to that given for No. 73. This event on May 11 at 2004 UT. is the third very great event which has taken place in Region 5148 since its appearance at the east limb of the sun on May 8th. Like Event No. 76, it produced great effects in all of the categories which make up this catalogue. Strong cosmic noise absorption at 18 Mc. began at 2015 UT., coincident with the start of the SWF. The flare and the 10 cm. event began earlier than this, at 2000 and 2010 UT. respectively. At centimeter wavelengths, the radio event consists of a very great burst, which is followed by a very large post-burst increase in flux. In the dynamic spectrum the Type II burst was observed by Ft. Davis over the frequency range 280 - 25 Mc., and the Type IV event over a broad range of frequencies from 400 - 25 Mc., and the Type I over over a broad range of frequencies from 400 - 25 Mc. Unlike Event No. 76 on May 10th in which the Type IV burst on May 11th is of short duration (only 18 minutes). A noise storm of intermittent Type III bursts occurred between 2016 - 2131 UT., and a weak noise storm of Type I bursts began later, at 2200 UT. At decimeter and meter wavelengths, the radio events at the single radio frequencies consist of major - bursts. The 18 Mc bursts occur while the cosmic noise absorption event is still in progress.

79 Although this strong geomagnetic disturbance on May 11 is worldwide, and is quite evidently a sudden commencement storm, all observers do not agree exactly concerning its starting time. Nine stations report the start of the storm at various minutes between 2326 and 2332 UT. Three stations start the Sc earlier, at about 1452 UT. Five stations classify the storm as gradual. An examination of the 3-Hr. Kp values reveals that the Kp's show an initial increase which begins at about the time of the earlier Sc at 1452 UT. Since this is about 18 hours after the occurrence of the great proton flare of May 10th it is tempting to believe that these two events are related to each other. One can then also perhaps assume that the later Sc at about 2330 UT. is due to the arrival at the earth of an increase in solar protons from the flare at 2006 UT., and a consequent strengthening of the intensity of the already existing storm.

80 This large, bright and active plage region 5147, with a complex $\beta\gamma$ spot, did not produce any solar activity of sufficient magnitude to warrant its inclusion in this catalogue of major solar events. The $\beta\gamma$ spot No. 14144 is a return of γ spot No. 14050 in Region 5093 (see Event No. 60), which was a return of the large $\beta\gamma$ spot No. 13984 in region 5054 (Event No. 51).

81 The plage and spot data for this event are similar to that given for Event No. 73. No 10 cm. event is reported at the time of the Type II burst on May 13 at 0516 UT. and the Type IV which follows. However, the radio events which are reported at other high frequencies indicate that the event at centimeter wavelengths consists of a strong burst of short duration prior to flare maximum. At decimeter and meter wavelengths, the radio event is a major - burst. In the dynamic spectrum, the weak Type IV, beginning at 0525 UT., is accompanied by the onset of a weak noise storm, also at 0525 UT.

82 No SWF and no 10 cm. events are reported at the time of the Type II burst on May 13 at 1425 UT. It is difficult to find a unique solar event to associate with the Type II burst, since three flares were in progress simultaneously, in three different regions on the solar disk, when the Type II burst occurred. One of these is a sub-flare of importance 1- in region 5148 (see Event No. 73 for plage and spot data). The second is a flare of importance 1 in region 5156, near the east limb of the sun. The third is a flare of importance 1 in Region 5133, in the southwest quadrant near the west limb (see Event No. 75 for plage and spot data). The αp spot No. 14138 in region 5156 is a return of βp spot No. 14086 in Region 5103. At meter wavelengths, no radio event is reported at the time of the Type II burst, which was observed by Ft. Davis over a frequency range of 160 - 50 Mc.

83 The large 10 cm. burst on May 13 at 2340 UT. and the Type II burst at 2342 UT. are associated with flare

activity in Region 5144. The plage and spot data for this region are given in Event No. 82. In the dynamic spectrum, the burst at 2342 UT. is classified as Type II on the Michigan observers. But Ft. Davis observers find the burst as unclassified, with the notation, "Similar to Type II." Among the single radio frequencies no events are reported at decimeter and meter wavelengths at the time of the Type II burst. However, a long wave burst sweeps rapidly through the higher frequencies at about 2340 UT. and this strong but very brief burst at centimeter wavelengths is associated with the weak sweep of Type III bursts which are reported in the dynamic spectrum, and which precede the Type II.

85 The major SWF on May 17 at 0107 UT. is associated with minor flare activity in region 5146. The plage and spot data for this region are given in Event No. 73. There are no other major events related to the SWF. Among the single radio frequencies, no events are reported at decimeter or meter wavelengths at the time of the SWF, and only weak Type III bursts occur in the dynamic spectrum. At centimeter wavelengths, a very brief single burst occurs simultaneously at all of the higher radio frequencies shortly after the start of the flare but prior to the start of the SWF.

86 The large 10 cm. burst on May 17 at 0705 UT. is associated with minor flare activity in region 5146. The plage and spot data for this region are given in Event No. 73. Dynamic spectrum observations do not exist at the time of the 10 cm. burst. The single radio frequency reports indicate that a burst of short duration sweeps through the radio spectrum, from high to lower frequencies, between 0704 and 0707 UT. and is strongest as a microwave burst at the centimeter wavelengths.

87 Since the solar flare patrol was not in progress at the time of the Type II burst on May 18 at 0407 UT., plage and spot data for this event are not available. The single radio frequency reports indicate that a strong microwave burst swept rapidly through the radio spectrum at centimeter wavelengths, prior to the start of the Type II burst. At decimeter and meter wavelengths, the bursts are minor.

88 This strange geomagnetic disturbance - of very short duration - represents a very real but brief increase in the 3-hr. Kp values to storm level, although it was classified as a storm by only one station (SITKA). It may be a coincidence, but it should be noted that this minor disturbance occurs simultaneously with the Type II solar event No. 87, above.

89 The Type II burst on May 19 at 1344 UT. is associated with flare activity in Region 5148 which is nearing the west limb of the sun. The plage and spot data for this event are given in Event No. 73. The strong Type II event was observed by Michigan and Ft. Davis, over a frequency range of 280 - 50 Mc. The single radio frequency reports indicate that a radio burst occurred simultaneously at all wavelengths at 1338 UT., obviously related to the Type III burst which occurred in the dynamic spectrum at this same time. This burst was strongest at the higher frequencies. At decimeter wavelengths the radio burst is described as a small rise and fall in flux. At meter wavelengths, the radio event consists of a minor burst which is coincident with the Type II burst, and a major burst coincident with the Type II event.

90 This active plage region 5157 does not produce any major solar optical and radio events. See remarks for Event No. 40.

91 No SWF and no radio events at centimeter wavelengths are reported at the time of the Type II burst on May 23 at 0102 UT. The Type II was observed by Ft. Davis over a frequency range of 280 - 50 Mc., and is related to flare activity in plage region 5165. This plage is a return of active region 5120, described in Event No. 70. The β spot No. 14156 is a return of $\beta\gamma$ spot No. 14090, which formed on the disk in Region 5120 on April 24th. The dynamic spectrum observations at Ft. Davis end on the 24th at 0115 UT. The 200 Mc report from Hawaii indicates that a noise storm began at meter wavelengths at 0143 UT.

93 This minor geomagnetic disturbance on June 3 at 23h UT. occurs 27 days after the minor storm on May 7, described in Event No. 72, which in turn is 27-28 days after the Sc storm beginning on April 9 (Event No. 63). These three geomagnetic storms may perhaps be members of a small sequence.

94 No SWF and no 10 cm. bursts are reported at the time of the Type II burst on June 5 at 0546 UT., which is associated with minor flare activity near the center of the solar disk, in plage region 5179. This very large, very bright and very active plage, which includes a complex $\beta\gamma$ spot, is partly in and partly the return of plage 5123 (described in Event No. 75). The new part of the plage is adjacent to the $\beta\gamma$ spot and is the dominant part of the region. With the exception of a weak sweep in progress at meter wavelengths, no radio events are reported at any of the single radio frequencies at the time of the Type II.

95 This very great solar event on June 9, which includes a great SWF, two great cm. bursts, and a Type IV burst in the dynamic spectrum, is associated with an unusual bright flare that was in plage region 5204 as it was coming around the east limb of the sun. This interesting region - very large, very bright and extremely active - is in its fourth rotation, and is the return of plage 5157 (described in Event No. 90). In its transit across the solar disk, Region 5204 is responsible for four major events in this catalogue - Nos. 95, 97, 99 and 100 - and when the region returns during the next solar rotation in July, it will come back as the great region of July 1959, which is famous for its production of an unusual number of cosmic ray events and strong geomagnetic effects. In region 5204, the $\beta\gamma$ spot No. 14207 is a return of $\beta\gamma$ spot No. 14150 in region 5157, and the complex γ spot No. 14211 is a return of $\beta\gamma$ spot No. 14139. The great 10 cm. burst, beginning at 1635 UT., is unusually complex. It consists of a great burst which is followed by a very long period of increased flux, on which is superposed four other bursts. One of these, at 1728 UT., is also a very great burst. The large 10 cm. burst at 1635 UT. is coincident with the start of the great SWF, and of major cosmic noise absorption at 18 Mc. Strangely enough, no brightening is observed in the region at the limb at this time. Continuous solar observations were made at the McMath-Hulbert Observatory on June 9, from 1200 - 2200 UT. The optical flare begins at 1707 UT., coincident with the start of the long interval of increased 10 cm. flux, and is a part of a complex system of bright loops, which remain active for many hours. In the dynamic spectrum, the Type IV burst at 1714 UT. was observed by Ft. Davis over the very low frequency range of 50 - 25 Mc. At all of the single radio frequencies, the radio event appears to consist of a group of several major bursts. The first of these begins at the high frequencies at 1635 UT., with the start of the SWF. As we go to longer wavelengths, the bursts start at successively later times - at meter wavelengths the radio burst starts at 1650 UT. and is described as a rise and fall in flux. The second of the two great 10 cm. bursts seems to start off a similar chain of events, perhaps even more important and far-reaching. This burst begins most intensely at centimeter wavelengths at 1728 UT., starts at decimeter wavelengths as a major burst at about 1734 UT., and reaches meter wavelengths at about 1735 UT. as a small rise and fall in flux. A strong 18 Mc. burst superposed on the SCNA that began at 1638 UT., occurred at 1738 UT. and was followed by an interval of even more intense bursts (or enhancement) between 1745 - 1830 UT. This latter event may indicate that the duration of the Type IV burst observed in the dynamic spectrum at very short wavelengths, could be extended to 1830 UT.

96 Although a flare patrol was in progress, no known flare (and no SWF) is reported in association with the Type II burst on June 10 at 0247 UT., therefore plage and spot data for this event are not available. At all of the single radio frequencies, the radio event consists of a major burst, whose intensity increases as we go from the high to lower frequencies. Strong bursts occur almost simultaneously at centimeter and decimeter wavelengths, several minutes prior to the start of the Type II burst; the very strong burst of short duration at meter wavelengths is coincident with the start of the Type II.

97 The geomagnetic storm on June 11 at 0909 UT, began with a sudden commencement, some 40 hours after the occurrence of the unusual limb event described in Event No. 95. This very brief disturbance is followed by an unusually long interval of 11 days of very quiet geomagnetic conditions.

98 This small PCA event on June 13 at 1330 UT. does not appear in any of Bailey's published lists, but is taken from the table of solar proton events which was compiled by Mrs. H. H. Malitson for the NASA proton manual. The observation was received as a private communication from H. Leinbach, who observed the weak event on the riometer record made at College, Alaska. It is difficult to find any really satisfactory solar flare event to associate with the solar protons. A flare of Imp. 1+ occurred in Region 5201 (described in Event No. 95) at 0357 UT., about 10 hours prior to the start of the PCA. However, this flare is [illegible] 33 minutes and is observed at a number of small height ranges. There was no SWF (Imp. flare [illegible] a major [illegible] of duration [illegible] coincident with the start of the flare. Flares [illegible] up to this time [illegible] associated with similar [illegible] events. As an alternative, or second possibility, we offer the suggestion that this weak proton event which incidentally, is also clearly evident in the Fairbanks riometer data, perhaps may be associated with the return of the active May region which produced the great PCA event of May 15 - 16. (Events Nos. 73 and 77). This great plage, region 5148, returns during the next solar rotation as [illegible] three plages - Regions 5165, 5[illegible], and 5156 - which cross the central meridian of the sun between June 10 - 12. The most active of these is plage region 5156, which crosses the central meridian of the sun on June 13th. It should also be pointed out that perhaps the unusually quiet geomagnetic conditions which prevail at this time (see Note No. 97) have been conducive to the detection of this weak proton event on the riometers located at high geomagnetic latitudes.

99 The plage and spot data for this event are similar to that given for Event No. 95. No 10 cm. observations and no dynamic spectrum observations exist at the time of the major flare on June 16 at 0918 UT. The single radio frequency reports indicate that a very strong radio burst occurred at centimeter wavelengths, coincident with the start of the SWF. No radio event is reported at meter wavelengths.

100 The plage and spot data for this major flare on June 18 at 1130 UT. are similar to that given for Event No. 95. The large 10 cm. burst at 1138 UT. is preceded by a "precursor" which started 45 minutes earlier. (It is quite probable that this earlier event is related to a flare in another region on the sun.) The large burst is followed by a long-enduring but modest post-burst increase in flux. Dynamic spectrum observations do not begin until 1220 UT., when a weak noise storm is in progress. The single radio frequency reports indicate that a burst sweeps rapidly through the radio spectrum, and occurs almost simultaneously at all centimeter and decimeter wavelengths at about 1139 UT. This burst is strongest at the higher frequencies and diminishes in intensity at the longer wavelengths. No radio event is reported at meter wavelengths at the time of the flare.

101 No known flare is reported at the time of the Type II burst on June 22 at 0503 UT., therefore plage and spot data for this event are not available. Also, no SWF, no 10 cm. events, and no radio events at any of the other single radio frequencies are reported at the time of the Type II

102 The $\beta\gamma$ spot No. 14224 is one of the largest spots of the year, with an area equal to 1700 millionths of the solar hemisphere (Greenwich data). This very large spot is associated with a very large, bright and active plage which does not produce any solar optical or radio events of sufficient magnitude to warrant their inclusion in this catalogue.

106 The Type II burst on July 5 at 2338 UT. is associated with minor flare activity. The SWF is taken from the XRPL check-list and is an unconfirmed event reported by only one station. No 10 cm. event is reported at the time of the Type II burst, but this may be due to a lack of observations. However, at the single radio frequencies, no event is reported at any of the centimeter wavelengths.

107 This very minor flare - a brightening beyond the limb of the sun - is the only flare event which is reported at any time near the time of the Type II burst on July 7 at 0343 UT. It indicates activity in region 5265 as it is coming around the east limb. The SWF is from the CRPL check-list and is an uncomfirmed event reported by only one station. With the exception of the minor burst at meter wavelengths, no radio events are reported at any of the single radio frequencies in association with the Type II. Plage Region 5265 is THE GREAT REGION OF 1959 - extremely large in area, very bright, and most prolific in the production of flares, many of which were major events. During its transit across the disk of the sun, this remarkable region was responsible for 14 events in this catalogue - the major solar optical and radio events described in Nos. 107, 108, 109, 112, 113, 117, 118, 120, the proton events Nos. 110, 114 and 119 (the latter with cosmic rays recorded at ground level), and the geomagnetic effects described in events Nos. 111, 116 and 121. Region 5265 is the return of region 5204, which is the unusual plage described in Note No. 95. The

complex spot No. 14284 is a return of spot No. 14211 in region 5204, which was a return of βp spot No. 14139 in region 5157. This spot is also one of the largest spots of the year, with an area equal to 1400 millionths of the solar hemisphere (Greenwich data). In addition to the two major spots listed in the spot table, the plage region also contained four other smaller spots of a more ephemeral nature.

108 The strong Type IV event on July 9 at 2044 UT. is associated with an important flare in region 5265, near the east limb of the sun. The plage and spot data for this region are given in Event No. 107. This unusual flare event seems to be the "forerunner" for the great solar proton flare that follows on the 10th. The flare of July 9th was observed continuously at the McMath-Hulbert Observatory, and in the course of its development it spreads to different parts of the plage. We have chosen to classify the activity "in toto" as a single flare event, rather than as three separate flares. The great burst of Type IV radio emission in the dynamic spectrum, recorded by all three observers, was reported by Ft. Davis over their entire frequency range, >580 - ≤25 Mc. Ft. Davis also reports an unclassified burst at 2045 - 2046 UT/Int. 3, and structure in the continuum between 2114 - 2257 UT. Observations began at Sydney at 2259 UT, at which time there is reported "a possible Type II in progress," and continuum emission <2259 - 0139 UT. This latter observation may be an indication that the duration of the Type IV burst could be extended to 0139 UT. The starts of the flare and the SWF appear to be related to the onsets of noise storms of Type III bursts and Type I bursts. The complex 10 cm. event consists of several large bursts which are superposed on a very long-enduring rise and fall in flux. Observations at other centimeter wavelengths did not begin early enough to give a complete picture of the radio event at these other high frequencies. At meter wavelengths the radio bursts are described as "rise and fall in flux." At meter wavelengths, the radio event consists of a major burst which occurs near the start of the flare and prior to the first flare maximum. This is followed by a strong second part which is described as a "great rise and fall" in flux. An unusual series of 18 Mc. bursts are reported, superposed on a cosmic noise absorption event that began at 1947 UT., near the time of start of the flare and SWF. From a direct examination of the composite 18 Mc record, it is evident that this absorption event is followed by a strong 18 Mc burst at 2045 UT., and then by a most unusual period of greatly enhanced flux and strong bursts, beginning at 2115 UT. and continuing until 0215 UT. The ending time is not known, because a great absorption event begins at this time - and may possibly begin even earlier, at about 0209 UT.

109 The major event on July 10 at 0206 UT. is a great event in all of the categories into which this catalogue is divided. The plage and spot data are similar to that given for Event No. 107. The great proton-flare began only a few hours after the flare of Event No. 108, and remained bright for an unusually long interval of time after flare maximum. Strong 18 Mc. cosmic noise absorption began at ~0215 UT. The Type II event begins at 0222 UT., while a weak Type III noise storm is in progress. Although the Sydney observers do not report any Type IV continuum emission with this event, it seems likely that some form of Type IV emission occurred, because of the strong radio frequencies. The great 10 cm. burst which begins with the start of the flare at 0206 UT. is duplicated at other centimeter wavelengths. Major + bursts are also reported at decimeter and meter wavelengths, coincident with the group of strong Type III bursts with continuum at 0210 UT. It may be purely coincidental, but it should be noted that this great flare is associated with the cessation of radio noise at the low frequencies - which is an unusual and atypical effect. In the dynamic spectrum, a strong Type I noise storm which began subsequent to the flare of event No. 108, ceases at 0209 UT. on July 10. An 18 Mc noise storm with greatly enhanced flux also ceases at about this same time, which of course is coincidental with the start of activity associated with Event No. 109.

110 This strong polar cap absorption event on July 10 began, according to Bailey, at 0700 UT. (using ionospheric scatter technique). The other two observers, at College, Alaska and Kiruna, Sweden start the event earlier, (from the 30 Mc riometer records) at 0400 UT. The duration is based on the assumption that the event continues through the period of the next two events (Nos. 114 and 119). It is clear, from the 30 Mc riometer records also, that this event has not ceased when the next events begin. We wish to suggest that the magnitude of this PCA event - indeed the event itself - may be due to the combined effect of the two flares of events No. 108 and 109 - rather than to a single flare.

112 It is difficult to decide about the authenticity of this Imp. 3 flare on July 13 at 0255 UT. Other observers were observing the sun during part of the period during which the flare is reported as being in progress, and do not report any flare activity at a similar position. The only related SWF which we can find is a gradual fade that begins 70 minutes after the first observation of the flare, but 5 minutes before flare maximum. The SWF is taken from the CRPL check-list, and is an unconfirmed event. The position of the flare places it in region 5265, for which the plage and spot data are given in Event No. 107. In the dynamic spectrum several weak Type III bursts occur between 0250 UT. and 0254 UT., and the only radio event reported at any of the single radio frequencies is a single burst of short duration at centimeter wavelengths at 0254 UT.

113 Like Event No. 109, this major event on July 14 at 0325 UT. is a great event in every category. The plage and spot data are similar to that given for Event No. 107. The great flare and SWF were accompanied by strong cosmic noise absorption at 18 Mc. beginning at 0331 UT and lasting for several hours. Great Major + radio bursts occur at all of the single radio frequencies. At centimeter wavelengths the large bursts begin at ~0330 UT., near the start of the flare and SWF. However, at decimeter and meter wavelengths the great bursts begin later, at 0337 UT. - more nearly coincident with the start of the strong Type II burst in the dynamic spectrum. The Type IV emission continues strong until 0535 UT., and then begins to decrease in intensity but is still in progress when observations cease at 0610 UT. The onset of a strong Type I noise storm accompanies the beginning of the Type IV continuum emission, and the great duration of the 200 Mc single frequency radio event may be an indication of the duration of the noise storm (and perhaps of the Type IV also?).

114 The proton event on July 14 at 0730 UT. is superposed on the declining aspect of the event that began on July 10 (Event No. 110).

115 The major flare on July 14 at 1400 UT. is unusual in several respects. The flare and the SWF begin together at 21400 UT., and the flare brightens very slowly, reaching maximum intensity 45 minutes later, at 1445 UT. The flare occurs in a moderately large and bright plage which is not very active, and at a time when there apparently were no spots in the region. A small α spot which came around the east limb with the plage on the 11th had expired on the disk on the 13th, and a second small α spot did not appear in the region until the 15th - the day following the flare. Radio bursts at centimeter wavelengths did not occur until 1443 UT., just prior to flare maximum. At decimeter wavelengths, a minor burst occurred earlier, moving from higher to lower frequencies in this range, between 1405 - 1409 UT. At meter wavelengths, no radio events are reported. In the dynamic spectrum there are some weak Type III bursts at the time of flare maximum, and Ft. Davis also reports an unclassified burst at 1418 - 1419/Int. 1. At 18 Mc the event is most unusual (as recorded at the McMath-Hulbert Observatory). A cosmic noise absorption event begins very gradually at 1400 UT., and superposed on this slowly decreasing signal there is a major burst at 1442 - 1450 UT., after which the absorption increases more rapidly. The absorption event is interrupted at about 1515 UT. by the onset of what should perhaps be described as an 18 Mc noise storm, with an enhancement of flux and variable burstiness that lasts for about four hours.

116 The severe geomagnetic disturbance on July 15 at 0803 UT. is one of the comparatively rare storms for which the 3-hour Kp's reach a maximum value of 9. This high maximum is maintained for 5 three-hourly intervals.

117 This event on July 16 at 1552 UT. is another flare of Imp. 3 in region 5265. Plage and spot data are described in Event No. 107. The 10 cm. event consists of a rather strong burst, superposed on a rather modest rise and fall in flux which began several minutes earlier, at the start of the SWF. The single radio frequency reports seem to indicate that an event moved slowly through the solar radio spectrum starting at about 1605 UT. at centimeter wavelengths, and reaching the meter wavelengths at 1616 UT. in the form of a strong major burst. This is coincident with the start of the strong Type II burst in the dynamic spectrum, which was observed at Ft. Davis over a frequency range of 260 - 25 Mc. There is no evidence for any Type IV emission with this flare.

118 This event on July 16 at 2114 UT. is perhaps the greatest of all of the great events that have occurred in the remarkable plage region 5265 as it has transited the solar disk since July 7. In all of the categories into which this catalogue is divided, this major event leaves its mark in a truly outstanding fashion. Much has already been written about this "cosmic ray flare," and details will be omitted here except for a reminder to the reader of the great system of loop-type prominences which developed near the flare area during the later stages of the flare. The very great 10 cm. burst was one of the most intense bursts that have ever been recorded at Ottawa. All of the single radio frequency reports indicate that great major + bursts occurred at all radio wavelengths, from very high to very low frequencies. The large 18 Mc bursts are superposed on a strong cosmic noise absorption event that began at 2117 UT., and which is interrupted at about 2200 UT. by the onset of a great enhancement of flux lasting for three or more hours. The great Type IV burst of continuum emission at 2121 UT. is reported by all three dynamic spectrum observers, and was recorded at Ft. Davis over the entire range of their frequency sweep from < 580 - >25 Mc. A Type II burst at 2121 UT. was reported by the Michigan observers, but not by Ft. Davis. However, the latter reports "structure in the continuum" between 2120 - 2250 UT. over a range of 200 - 560 Mc. consisting of "fast drift bursts with positive and negative slopes." This major proton-flare is one of those very rare events for which an increase in cosmic rays was detected at the surface of the earth. A ground level effect was recorded at 2250 UT. by neutron monitors.

119 The proton event on July 17 at 0000 UT. is superposed on the declining aspects of the two previous events of July 10 and 14 (Events No. 110 and 114).

120 No SWF and no 10 cm. events are reported at the time of the weak Type II burst on July 17 at 0600 UT., which is associated with moderate flare activity in region 5265. Plage and spot data for this region are given in Event No. 107. No really major radio events are reported at any of the single radio frequencies. At very low frequencies, a weak noise storm is in progress.

121 This great sudden commencement storm or July 17 at 1638 UT. is one of those rare events for which the 3-hr. Kp's reach a maximum value of 9.

122 There is no obvious "major" solar event to associate with the onset of this gradual geomagnetic storm of July 24 at 09h UT. It occurs about 2 - 3 days after the west limb passage of our active plage region 5265. It should also be pointed out that this storm occurs 27 days after the gradual storm of June 27 (Event No. 104).

123 The large 10 cm. burst on July 27 at 1225 UT. is associated with flare activity in a very large, very bright and very active plage. This region, plage 5294, is a return of three plages - 5244, 5246, and 5249, but the dominant part of 5294 is related to Region 5244 (described in Event No. 106). The αp spot No. 14319 is a return of βp spot No. 14263 in region 5244. The βp spot No. 14320 is one of the largest spots of the year, with an area equal to 1600 millionths of the solar hemisphere (Greenwich data). Major bursts occur at 1225 UT. at all of the single radio frequencies, and it seems evident that a strong burst sweeps simultaneously throughout the entire range of the radio spectrum at this time, near the start of the flare. The duration of these bursts diminishes as we go to lower frequencies. Because of the strong emission at centimeter wavelengths, Mme. Pick-Gutmann lists this event as a "probable Type IV."

124 This major flare on July 27 at 2050 UT. brightens slowly, and is accompanied by very little emission at the longer radio wavelengths. The 10 cm. event consists of a burst which is superposed on a long rise and fall in flux - neither of which is very strong. In the dynamic spectrum, the Type II burst that begins at 2118 UT., shortly after flare maximum, was observed by Ft. Davis over the frequency range of 90 - 25 Mc. Several strong groups of Type III bursts at 2106 UT. preceded the Type II, and are accompanied by continuum emission and the onset of a weak noise storm of short duration. The Ft. Davis observers also report an unclassified burst at 2044 UT/Int. 3. The major bursts which are reported at meter and dekameter wavelengths at the single radio frequencies, appear to be related to the strong Type III bursts (with continuum) in the dynamic spectrum.

125 The plage and spot data for this event are similar to that given for Event No. 123. The event is included here in this catalogue because it appears in Mme. Pick-Gutmann's list of "probable Type IV's," and it seems to be a good candidate. The 10 cm. burst consists of a large burst, followed by a very long period of increased flux. Although the peak flux as measured at Ottawa was 325, NERA evaluates the peak as equal to 497. In the dynamic spectrum, no

event is reported at the time of the 10 cm. burst and observations began at Michigan at 1600 UT. Among the events reported at the single radio frequencies major bursts occur at all wavelengths.

126 The plage and spot data for this event are similar to that given for Event No. 123. The 10 cm. event on July 29 at 2117 UT. consists of a large burst, followed by a post-burst increase in flux somewhat similar to Event No. 125. Major bursts of short duration occur at meter wavelengths almost simultaneously after the large 10 cm. burst. In the dynamic spectrum, the events can best be described as the onset of temporary noise storms of Type III bursts and Type I bursts simultaneously with the start of the flare and the 10 cm. burst. The Ft. Davis observers also report unclassified bursts "similar to Type II," at 2121-2122 UT Int. 2 and 2124 Int. 3. Because of the strong burst at centimeter wavelengths, Mme. Pick-Gotmann classifies this event as "probable Type IV."

127 This event is included here only because of the presence of a complex spot. The region in which it is located does not produce any solar optical or radio events of sufficient magnitude to warrant their inclusion in this catalogue.

128 No SWF is reported in association with the Type II burst on August 1 at 1754 UT., which was observed by Ft. Davis over a frequency range of 140 - 45 Mc. The Type II is related to minor flare activity. Several groups of Type III bursts, with continuum emission, occur at the start of the flare. The Type II burst begins as the flare is ending, and is followed by the onset of a weak but long-enduring noise storm of Type I bursts. At the single radio frequencies, no events are reported at decimeter and meter wavelengths. The 10 cm. event is a minor rise and fall in flux.

129 The major geomagnetic disturbance on August 6 at 09h UT. was classified as a storm by only one station (Hermanus), although the 3-hr. Kp's reach a value of 5, which is regarded as storm level.

130 The Type II burst on August 11 at 1212 UT. is associated with flare activity in plage region 5315 = a large, bright and active region which is the return of the great July region 5265 (Event No. 107, etc.). In addition to the three spots listed in the table of spot data, the region also contains 5 other lesser spots of a more ephemeral nature. No SWF is reported in association with the Type II burst, which occurs late, with respect to the start of the flare, and of flare maximum. The single radio frequency events seem to indicate that a burst of short duration occurs at about 1205 UT. at all wavelengths and increases in intensity at meter wavelengths, although is described here as a minor burst.

131 No 10 cm. observations exist at the time of the major SWF on August 14 at 0105 UT. The SWF is associated with a major flare in the large, bright and active plage, region 5323, that is responsible for 6 major events in the catalogue - Nos. 131, 134, 135, 136, 137 and 158. In general these events have a common characteristic - the production of a Type II burst in the dynamic spectrum. Observations at other single radio frequencies indicate that a radio burst of long duration began simultaneously at 0130 UT. at centimeter and decimeter wavelengths (and characterized as a noise storm at 545 Mc.). At meter wavelengths the radio event begins later, at 0140 UT., and is described as a rise and fall in flux. In the dynamic spectrum there is the onset of a long-enduring but weak noise storm at 0141 UT. All of these radio events begin after flare maximum, and well after the start of the SWF.

133 The major geomagnetic storm with sudden commencement on August 16 at 0404 UT. begins before the preceding minor disturbance of August 15 (Event No 132) has completely subsided.

134 The Type II burst on August 17 at 0334 UT. is related to flare activity in Region 5323. Plage and spot data for this region are given in Event No. 131. Strong radio bursts of short duration occur at all wavelengths near the start of the flare, and in association with groups of Type III bursts in the dynamic spectrum.

135 The plage and spot data for this event are similar to that given for Event No. 131. No dynamic spectrum observations exist at the time of the large 10 cm. burst on August 17 at 1218.7 UT. (observations do not begin at Ft. Davis until 1240 UT., near the end of the flare). Strong radio bursts of short duration occur at all wavelengths almost simultaneously, at ~1219 UT., near the start of the flare. There is some indication of a post-burst enhancement of flux following the bursts at centimeter wavelengths.

136 The Type II burst on August 17 at 2052 UT. is related to flare activity in Region 5323. Plage and spot data for this region are given in Event No. 131. Michigan reports the Type II burst on their A and B bands, and Ft. Davis reports an unclassified burst at 2052-2059 UT. "similar to Type II." The Type II burst begins after the start of the flare and after flare maximum. It is preceded by a group of strong Type III bursts with continuum emission, which occur near the start of the flare. Radio bursts of short duration occur at all wavelengths near the start of the flare. There is some indication that the radio burst at meter wavelengths is followed by the onset of a noise storm which begins with the start of the Type II burst.

137 This is a major event in all of the categories into which this catalogue is divided. The major flare on August 18 at 1014 UT. occurred in Region 5323. Plage and spot data are given in Event No. 131. The starting time for the flare varies from 1014 to 1022 UT., even among cinematorraphic patrol stations. The 10 cm. event, which is a great burst followed by a long-enduring postburst increase in flux, begins after the start of the flare, but with the start of the major SWF. The dynamic spectrum events which appear in the table are a combination of the events reported by the two observers. At Ft. Davis, observations began at 1240 UT. and Type IV radiation is reported < 1353 UT. and "intermittent throughout the day," over a frequency range of 560 - 210 Mc. At Michigan, observations began earlier and Type IV emission is reported as early as 1103 UT. (From the reports of radio events at the single radio frequencies, it is evident that a major burst occurred at all wavelengths throughout the radio spectrum.

138 The small solar proton event on August 18 at 1130 UT. is reported by Bailey in his supplementary list of small events. Its duration is not known.

139 This large bright plage, Region 5329, appears as an "event" in this catalogue only because 36 flares of importance 2+ occurred in the plage during its transit across the solar disk. The region was not associated with any solar optical or radio events of sufficient magnitude to warrant their inclusion in this catalogue.

141 This event is most unusual, and therefore appears in the catalogue, although strictly speaking it is not an isolated solar optical or radio event. In the dynamic spectrum, some form of continuum emission is reported by all observers for several days between August 23 - August 27 - a period during which continuum radiation apparently was emitted rather steadily from the sun. Interferometer observations from Nancay (159 Mc.) and Nera (255 Mc.) indicate that the origin of the radiation most likely was the solar plage region 5336 (described next in Event No. 142). During this interval, unusual noise storm activity was recorded at meter wavelengths by several observers. Designated as "peculiar" it was difficult for the radio observers to decide whether the remarkable intensity fluctuations were of a solar nature, or of interplanetary origin. Indeed, some of the peculiar records were at first set aside as being affected by man-made interference. Since details within the unusual noise storm were recorded independently, at different radio observing stations, it is believed that the radio noise is of solar origin. It is also believed that, near the earth, a modulation of this radiation occurred and produced scintillation-like intensity fluctuations which varied with the observing site. This most interesting period is discussed in several papers of the Information Bulletin published by Nera (CF. Bulletins Nos. 1, 2, 3). And finally to emphasize in yet another way that the interval August 23 - 27 is most unusual, we should like to quote from a letter from Dr. Winckler to Dr. Fokker: "A great increase in the outer radiation zone was observed during the end of August. We have considered that this increase was associated with the great noise storm which prevailed during that period. ***It could be, that the basic source of the increase in the radiation belt (which began about August 20) was connected with the solar radio center before it was observed in electromagnetic waves as it came around the limb. ***Perhaps the radio fluctuations are actually due to the emission of electrons in the vicinity of the earth or in interplanetary space between the sun and the earth. One reason for suspecting that the emission occurs a long distance from the sun is from observations of Warwick at Boulder with the 15 to 30 Mc sweep frequency interferometer which shows day to day firings shifts consistent with a source moving with the sun's rotation but possibly 20 or 25 solar radii away from the disk. ***It appears that either rather strong hydromagnetic waves or electrons themselves came across from the sun and produced effects in the outer reaches of the earth's magnetic field."

142 This very large, bright and active plage, Region 5336, does not produce any individual solar optical or radio events of sufficient magnitude to warrant their inclusion as a major event in this catalogue. However, the region - with its large spot - is the source of the unusual radio emission described above in detail in Event No. 141. The βp spot No. 14378 is one of the largest spots of the year, with an area equal to 1200 millionths of the solar hemisphere (Greenwich data).

143 The Type II burst on August 28 at 0039 UT. and the Type IV at 0055 UT. are associated with flare activity in plage region 5344, near the east limb of the sun. This very large, bright and very active plage contains a complex βp spot and is responsible for at least 5 major events in this catalogue - Nos. 143, 144, 146, 150 and 154. No 10 cm. observations exist at the time of the Type II burst, but reports at other high frequencies indicate that a very large radio burst occurred at centimeter wavelengths in association with the Type II. In the dynamic spectrum the Type II burst was recorded at Ft. Davis over a frequency range of 140 - 150 Mc. The weak but long-enduring Type IV emission was reported by Sawyer that notes the Ft. Davis observers who report continuum emission in progress throughout their entire observing period, which ceases at 0115 UT.). A Type I noise storm is in progress all day, and the Sydney observers also report a Type III noise storm in progress throughout the period of their observing hours (0000 - 0632 UT.).

144 The large 10 cm. burst on August 28 at 0115 UT. is related to activity in the same flare described above in Event No. 143, near the time of its second maximum brightening at 0113 UT. Major radio bursts occur at all wavelengths at about this time. Because of the strong bursts at centimeter wavelengths at both 0059 UT. and 0115 UT., Mme. Pick-Gotmann classifies Events No. 143 and 144 as "probably Type IV."

145 This large, bright and active plage, Region 5340, contains a complex βp spot, No. 14389, which is one of the largest spots of the year, with an area equal to 1500 millionths of the solar hemisphere (Greenwich data). This region did not produce any solar optical or radio events of sufficient magnitude to warrant their inclusion as a major event in this catalogue.

146 The Type IV emission on August 31 at 1859 UT. is associated with flare activity near the center of the disk, in Region 5344. Plage and spot data for this region are given in Event No. 143. The Type IV burst was observed by Ft. Davis over a frequency range of 580 - 330 Mc. In the dynamic spectrum the event was also marked by the onset of a noise storm of strong Type III bursts (on an already noisy record), and the onset of a noise storm of Type I bursts. An unclassified burst is reported at 1844 - 1845 UT. Int. 2. At centimeter and decimeter wavelengths, the single radio frequency reports indicate that a large radio burst occurred in coincidence with the Type IV burst. At meter wavelengths, a major - burst started about 4 minutes earlier. Because of the strong radio emission at centimeter wavelengths, Mme. Pick-Gotmann classifies this event as a "probable Type IV."

147 Although this minor geomagnetic disturbance on September 1 at 04h UT. was classified as a storm by only one station, it represents a real increase in the 3-hr. Kp's to storm level (Kp = 5).

148 The Type IV emission on September 1 at 1914 UT. and the Type II burst at 1939 UT. are associated with an important flare that occurred near the east limb of the sun, in plage Region 5354. This plage is another return of the great July region, plage 5265, which returned in August as plage 5315 (described in Event No. 130). The 10 cm. event consists of a period of irregular burst activity, superposed on a rise and fall in flux, neither of which is very strong. No distinct radio event occurred at meter wavelengths, where the only report is noise in progress throughout the day. The Type IV radio burst was observed by Ft. Davis over a frequency range of 580 - 320 Mc, and the Type II at very low frequencies from 60 - < 30 Mc. In the dynamic spectrum, Type III and Type I noise storms are in progress throughout the day. The intensity of the Type III bursts increases with the start of the flare. It is somewhat unusual for a Type IV burst to begin prior to the start of the Type II burst, and especially before the start of the flare.

149 This very small proton event appears in the NASA proton manual, but was not of sufficient intensity to be included in Bailey's list of primary PCA events.

150 The flare on September 2 at 0720 UT. was well-covered by 13 different observers. Four stations

classified the flare as Importance 3, on the basis of visual observations. Six cinematographic stations classified the flare either as Importance 1+ or 2, but no greater than this. For this reason, we have classified the flare as Importance 2+, in the McMath-Hulbert Observatory Working List. There is no doubt that a large and major flare occurred. The plage and spot data for this event are given in Event No. 143. No dynamic spectrum observations exist at the time of the flare. Relatively strong radio bursts occurred at all radio frequencies, prior to flare maximum.

151 The Type II burst on September 2 at 1608 UT. is associated with flare activity in Region 5336, which is a large, bright and active plage near the west limb of the sun on the 2nd. The 10 cm. event consists of a burst which is followed by a decrease in flux, instead of the more usual post-burst increase. (A burst followed by absorption is a relatively rare event on the 2800 Mc recorder and in at least one previous case it was shown to be due to the effect of the interposition of an active dark flocculus over a portion of a flare.) The Type II burst was observed at Ft. Davis over a frequency range of 350 - 40 Mc. Among the single radio frequencies, large radio bursts occur at centimeter wavelengths at 1603 UT., near the start of the flare. At meter wavelengths the large radio burst starts two minutes later, at 1605 UT., concurrently with a group of Type III bursts which precedes the Type II burst in the dynamic spectrum.

152 The Type II event on September 3 at 0424 UT., with its related major SWF and large 10 cm. burst is associated with rather minor flare activity in plage region 5329 which is now at the west limb of the sun. Plage and spot data for this region are given in Event No. 151. The very strong 10 cm. burst at 0420.5 UT, is of very short duration, and it seems evident, from other single frequencies records, that a strong but brief microwave burst occurred almost instantaneously at all centimeter wavelengths at the time of the start of the flare.

153 Nine of the sixteen stations that report the sudden commencement geomagnetic storm on September 3 at 2159 UT. indicate that the Sc was preceded by an earlier initial impulse. An examination of the 3-Hr. Kp values discloses that this change occurred about 6 hours prior to the Sc.

154 The Type II burst on September 5 at 1603 UT. is associated with flare activity in Region 5344. Plage and spot data for this region are given in Event No. 143. The Type II was observed at Ft. Davis over a frequency range of 250 - 100 Mc., and was preceded by several groups of Type III bursts which swept through the dynamic spectrum in an intermittent fashion for 10 minutes prior to the start of the Type II burst. Unclassified bursts were also reported, at 1558 UT., Int. 3 and 1559/Int. 3. The single radio frequency reports seem to indicate that a radio burst of rather short duration occurred at all radio wavelengths, starting first at the low frequencies and then several minutes later at the higher frequencies.

155 The Type II burst on September 11 at 2204 UT. is associated with minor flare activity near the center of the solar disk, in plage region 5360. The Type II burst was observed by Ft. Davis over the low frequency range of 180 - 75 Mc., and was preceded by a group of strong Type III bursts which are coincident with the start of the flare and the start of a weak 10 cm. burst. No 200 Mc. event is reported at the time of the Type II burst. The SWF is from the CRPL check-list and is an unconfirmed event, reported by only one station.

157 The two Type II bursts on September 15 at 2124 UT. and 2135 UT. are associated with minor flare activity near the west limb of the sun, in plage region 5367. No SWF is reported at the time of the Type II bursts, and no radio events are reported at any of the single radio frequencies with the exception of a minor 18 Mc. burst at 2107 UT., a few minutes before the start of the flare. The Type II burst at 2124 UT. was observed by Ft. Davis over the frequency range 85 - 35 Mc., and the second burst at 2135 UT. covered the range of 60 - 35 Mc. The Ft. Davis observers also report an unclassified burst at 2116.5 - 2139 UT./Int. 3, with the comment, "Possibly part of following Type II." A weak noise storm, which is in progress, ends at 2113 UT.

158 - 165 It is difficult to find any "major" solar optical or radio events to connect with these various geomagnetic storms, with the possible exception of the first two. Between September 17 - 25 and Oct. 1 - 5 geomagnetic storms, primarily "gradual" in nature, occurred intermittently. For Event No. 160, six stations indicate that a sudden commencement occurred on the 20th at 1158 UT - about 10 hours after the gradual start of the storm.

166 Strictly speaking, this is not a "major" solar event. It is included here because it is the only flare event which has any time-association with the proton event of No. 167, and there may be no relationship whatsoever between the two events. The Importance 2 flare on October 6 at 1405 UT. occurred near the east limb of the sun, at an unusually high latitude. No dynamic spectrum events are reported at the time of the flare, and no radio events are reported at any of the single radio frequencies, with the exception of a minor burst at 526 Mc.

167 This minor proton event of October 16 is listed in the NASA proton manual, and appears to have had a small ground level effect at 1530 UT.

168 See note for Event No. 127. The αp spot No. 14483 is a return of the large βγ spot No. 14425 in region 5360 (Event No. 155).

169 No known flare is reported at the time of the large 10 cm. bursts on October 17 at 0150 and 0222 UT., therefore plage and spot data are not available. No SWF is reported, and no dynamic spectrum observations exist at the time of large 10 cm. bursts. No radio events are reported at any other single radio frequencies.

171 No known flare is reported at the time of the large 10 cm. burst on October 20 at 0012 UT., therefore plage and spot data are not available. The minor SWF appears in the CRPL check-lists, and is an unconfirmed event. Although observations were in progress, no dynamic spectrum event is reported at the time of the 10 cm. burst. At other single radio frequencies, the only event which is reported is a major burst of short duration at meter wavelengths.

172 - 176 It is difficult to find any major solar events to connect with the various geomagnetic storms which occurred during the interval October 25 - November 4.

177 The large, bright and active plage, Region 5452, contains one of the largest spots of the year - βp spot No. 14543 - with an area equal to 1100 millionths of the solar hemisphere (Greenwich data). The activity of this plage does not produce any solar optical or radio events of sufficient magnitude to warrant their inclusion in this catalogue.

178 No flare observations exist at the time of the Type II burst on November 11 at 0657 UT., therefore plage and spot data are not available. No SWF, and no radio events at any of the single frequencies, are reported at the time of the Type II burst.

179 Although only a minor disturbance, the gradual geomagnetic storm on Nov. 14 at 00h UT. was classified as "moderately severe" by SITKA (Alaska) and HUANCAYO (Peru).

180 No known flare is reported at the time of the Type II burst on November 18 at 0043 UT., therefore plage and spot data are not available. The SWF is taken from the CRPL check-list, and is an unconfirmed event. No distinctive radio events are reported at any of the single radio frequencies at the time of the Type II burst.

181 No 10 cm. event is reported in association with the Type II burst on November 21 at 1741 UT. The SWF is taken from the CRPL check-list, and is an unconfirmed event. The Type II burst was observed at Ft. Davis over a frequency range of 125 - < 25 Mc. No radio events are reported at any of the other single radio frequencies at the time of the Type II burst.

182 Three of the seven stations report an earlier start for this gradual geomagnetic storm on November 23 at 00h UT. This earlier beginning is at ~ 21d 1000 UT - but the 3-hr. Kp values do not reach storm level at this time, although they do show a gradual increase from extremely quiet conditions (Kp = 0) to a value of 4.

183 This event is included as a part of this catalogue only because of the presence of a very large sunspot. The αp spot in plage region 5468 is a return of the βp spot No. 14526 in region 5439, and is also one of the largest spots of the year, with an area equal to 1090 millionths of the solar hemisphere (Greenwich data). Although plage 5468, with its large spot, did not produce any major solar optical and radio events of great magnitude, it was the source of strong radio noise during its transit across the solar disk, as indicated by interferometer measures made at Nancay (169 Mc.) and at Nera (255 Mc.).

184 No dynamic spectrum observations exist at the time of the large 10 cm. burst on November 26 at 0928 UT. Strong radio bursts occur at all of the single radio frequencies, and it is possible that some form of Type IV emission may have occurred especially at centimeter wavelengths.

186 The Type II and Type IV bursts on November 28 at 2017 UT. are associated with major flare activity in a very large, bright and active plage region 5476 which also contains a very large spot. The βp spot No. 14579 is one of the largest spots of the year, with an area equal to 1400 millionths of the solar hemisphere (Greenwich data). The region is in its fourth rotation, and is now extremely active, although this was not the case during earlier rotations (see Events No. 155 and 168). Region 5476 is responsible for 10 major events in this catalogue - the solar events Nos. 186, 187, 188, 190, 191, 192, 194 and the related terrestrial events Nos. 189, 193 and 195. The Type II burst at 2017 UT. was observed by Ft. Davis over a frequency range of 240 - < 25 Mc. The weak Type IV emission at 2013 UT. was reported only by Michigan, where it was observed at the high frequency end of their spectrum sweep, on their B and C bands. The start of the weak Type IV emission seems to occur near the onset of a temporary period of burstiness of weak Type I bursts and strong Type III bursts. The 10 cm. event consists of a major burst which is followed by a post-burst increase in flux, still in progress at sunset, but not very strong. No radio event is reported at meter wavelengths. However bursts of very short duration are reported at lower frequencies, coincident with groups of strong Type III bursts with continuum emission. Because of the burst at centimeter wavelengths, Mme. Pick-Gutmann classifies this event as "probable Type IV." The flare was also accompanied by strong cosmic noise absorption at 18 Mc., from 2014 - 2105 UT. It should be pointed out that region 5476 is unusually prolific in the production of Type II and Type IV bursts in the dynamic spectrum. During its transit across the solar disk, at least six Type II bursts and five Type IV events were associated with activity in the plage, which evidently also was the source of "radio noise" between November 30 - December 4.

187 The Type II burst on November 29 at 1854 UT. is associated with flare activity in plage region 5476. Plage and spot data for this region are given in Event No. 186. The 10 cm. event consists of a major burst which is superposed on a weak but long-enduring rise and fall in flux. This gradual increase in 10 cm. flux begins near the start of the flare, at 1820 UT., and some 23 minutes before the burst. The start of the 10 cm. burst at 1843 UT. is coincident with the SWF, with an important 18 Mc. cosmic noise absorption event from 1843 - 1950 UT., and with groups of Type III bursts in the dynamic spectrum. It seems obvious that a strong burst swept through the radio spectrum and occurred almost instantaneously, at least at centimeter and decimeter wavelengths at 1843 UT. The strong Type II burst at 1854 UT. was observed at Ft. Davis over a frequency range of 150 - 35 Mc. Mme. Pick-Gutmann classifies the event as a "probable Type IV," because of the burst at centimeter wavelengths. There is no Type IV emission in the dynamic spectrum - only the onset of a weak noise storm.

188 The major events on November 30 at 0247 UT. (and following) are associated with flare activity in Region 5476. Plage and spot data for this region are given in Event No. 186. The strong 10 cm. burst at 0347 UT. is coincident with the start of the flare, and with the very great radio bursts which occur at all wavelengths at this same time. It should be noted that all of the strong radio bursts at other centimeter wavelengths (9400 - 1000 Mc.) are followed by a post-burst decrease in flux which lasts for several hours. It has been pointed out before that such absorption events are rather unusual (see Event No. 151). In the dynamic spectrum, the strong Type II burst at 0251 UT. has an unusually long duration - it continues until 0358 UT. at reduced intensity, and is coincident with the start of the very great burst which occurred on the 200 Mc. record. The weak Type IV emission begins at 0312 UT. and soon degenerates into a Type I noise storm that begins at 0344 UT.

189 Most observers agree with the classification of this geomagnetic disturbance on November 30 at 0545 UT. as a gradual storm. However, two stations start the storm earlier, with a sudden commencement, at 0247 UT. Since this is the time of the start of the flare and the great 10 cm. burst of Event No. 188, it is highly probably that the effect on the magnetogram at 0247 UT. is a magnetic crochet which is related to the solar event.

190 This major flare on November 30 at 1730 UT., which was followed by Type II and Type IV bursts, occurred in the active plage 5476 when it was at the center of the solar disk. Plage and spot data for this region are given in Event No. 186. The 10 cm. event consists of a strong, but not exceptionally great, burst which is

follow by a long burst modest post-burst increase in flux. The 200 Mc. event is reported at the time of the flare, and other low frequency reports indicate that a large major burst occurred at meter wavelengths. The strong Type II burst at 1741 UT, and the strong Type IV emission at 1739 UT, were observed by Ft. Davis over the entire frequency range 580 - 35 Mc., covered by their frequency sweep. Because of the 10 cm. burst, Mme. Pick-Gutmann suggests that Type IV emission at centimeter wavelengths was also "probable".

191 The Type IV burst on December 1 at 1400 UT, is associated with flare activity in region 5476. Plage and spot data for this region are given in Event No. 186. The Type IV emission was observed at Ft. Davis in progress at 1400 UT, over a frequency range of 580 - 350 Mc. Observations began at Ft. Davis at 1358 UT, while Michigan began observing earlier at 1230 UT. Michigan starts the Type IV at 1330 UT, and ends it at 1718 UT, while Ft. Davis continues the Type IV emission until 2240 UT., with the comment that it is "intermittent three short bursts during day." The 10 cm. event consists of a gradual rise and fall in flux which continues throughout the entire period of observations at Ottawa. No events are reported at 200 Mc., in association with the Type IV event. Other single radio frequency reports indicate that major bursts occur at decimeter and meter wavelengths. The 600 Mc. burst appears to be related to the Type IV emission in the dynamic spectrum, and the 167 Mc. burst is associated with groups of Type I and Type III bursts and the onset of a weak noise storm.

192 The major SWF on December 1 at 1705 UT., and Type II burst at 1733 UT., are associated with flare activity in Region 5476. Plage and spot data for this region are given in Event No. 186. The flare is accompanied by very strong 18 Mc. cosmic noise absorption which begins with the SWF, at 1705 UT. No 10 cm. events are reported at the time of the SWF and Type II, except for the period of increased flux which was reported for Event No. 191 and which is still in progress. No events are reported at any of the other single radio frequencies. The weak Type II burst was observed by Ft. Davis over a frequency range of 140 - 50 Mc.

194 The large 10 cm. burst on December 2 at 1245 UT., and the accompanying Type II and Type IV bursts, are associated with flare activity in Region 5476. Plage and spot data for this region are given in Event No. 186. The flare data is fragmentary, but it seems obvious that an important flare is in progress at the time. The 10 cm. event consists of a great burst which starts with the SWF and a SEA sudden enhancement of atmospherics. The burst, which is intermingled with the sunrise oscillations on the Ottawa record, is followed by a long period of increased flux. Major bursts are also reported at decimeter and meter wavelengths. The 200 Mc event consists of a very strong burst, followed by a rise in base level apparently associated with the strong Type II burst at 1250 UT, and the onset of the Type IV emission at 1305 UT. The dynamic spectrum events were recorded at Michigan. Observations at Ft. Davis did not begin until 1400 UT., at which time the Ft. Davis observers report continuum emission and Type I noise in progress. Because of the strong burst at centimeter wavelengths, Mme. Pick-Gutmann classifies this event as a "probable Type IV."

196 The large 10 cm. burst on December 5 at 1219 UT. is associated with flare activity near the center of the solar disk in plage region 5478. This large, very bright and active plage, with its complex $\beta\gamma$ spot, is associated with four events in this catalogue - Nos. 196, 197, 198 and 199 - but these apparently produce very little terrestrial effect (in the form of geomagnetic activity). No dynamic spectrum observations exist at the time of the large 10 cm. burst. From the single radio frequency reports, it seems evident that major radio bursts occurred at all wavelengths.

197 The Type II burst of December 8 at 0121 UT. is associated with flare activity in plage region 5478. Plage and spot data for this region are given in Event No. 196. From the single radio frequency reports, it is evident that a strong burst occurred at all radio wavelengths, coincident with the start of the flare and of the group of strong Type III bursts, at 0116 UT. The second strong burst at centimeter wavelengths at 0130 UT. has no counterpart at the lower radio frequencies.

198 The strong 10 cm. burst on December 8 at 0757 UT. is associated with flare activity in Region 5478. Plage and spot data for this region are given in Event No. 196. No dynamic spectrum observations exist at the time of the 0757 burst. From the single radio frequency reports, it appears that a strong burst moved rather slowly through the radio spectrum, starting as early as 0752 UT. at meter wavelengths, and as late as 0757 UT. at centimeter wavelengths. The duration of the burst is longer at the low frequencies, and diminishes in the direction of the higher frequencies.

199 The Type II burst on December 10 at 0521 UT. is associated with flare activity in Region 5478 which is now near the west limb of the sun. Plage and spot data for this region are given in Event No. 196. The strong Type II burst occurs after flare maximum, and is preceded by a group of Type III bursts. The latter apparently are related to the major bursts which are reported at all of the single radio frequencies, prior to flare maximum.

200 No known flare is reported at the time of the Type II burst on December 11 at 0432 UT., therefore plage and spot data are not available.

202 The βp spot No. 14603 in Region 5491 is one of the largest spots of the year, with an area equal to 3000 millionths of the solar hemisphere (Greenwich data). Although Region 5491 is a large and very bright plage, it is not very active, and contributes no major solar optical or radio events to this catalogue.

203 The Type II burst on December 18 at 0640 UT. and Type IV burst at 0653 UT are associated with flare activity in a region which has not been very active, and which is approaching the west limb of the sun. No 10 cm. observations exist at the time of the Type II and Type IV bursts, but a major burst was recorded at other centimeter wavelengths. The single radio frequency reports indicate that a very strong burst of short duration occurred simultaneously at all wavelengths in the radio spectrum, in coincidence with the group of strong Type III bursts at 0634 UT. in the dynamic spectrum.

204 The Type II burst on December 21 at 0055 UT. and Type IV burst at 0120 UT. are associated with flare activity near the southwest limb of the sun. The SWF appears in the CRPL checklist, and is an unconfirmed event. The large 10 cm. burst at 0045 UT. occurs near the start of the flare and SWF. There is some indication, from the single radio frequency reports and the Type III bursts in the dynamic spectrum that a radio burst has moved slowly through the radio spectrum, beginning first at the low frequencies at 0043 UT., and reaching the highest frequency at 0059 UT. The Sydney observers report that the Type II burst continues until 0120 UT. at reduced intensity, and that the Type IV emission increases in intensity with the onset of the Type I noise storm at 0207 UT. Because of the strong burst at centimeter wavelengths Mme. Pick-Gutmann classifies this event as "probable Type IV."

MSC 60/7-05