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DESCRIPTIVE TEXT

AND

INDEX

FOR

CRPL-F PART B

SOLAR - GEOPHYSICAL DATA

ISSUED

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SOLAR - GEOPHYSICAL DATA

INTRODUCTION

This pamphlet describes the data published in the monthly CRPL-F Part B report series* which are intended to keep research workers abreast of the major particulars of solar activity and the associated ionospheric, radio propagation and other geophysical effects. This report series is made possible through the cooperation of many observatories, laboratories and agencies as recorded in the detailed description of the tables and graphs which follow. The report is prepared in the Radio Warning Services Section, edited by Miss J. Virginia Lincoln. These reports should not be considered as definitive publications because of the rapid publication schedule involved. Errata or revisions are included from time to time. Additions to the descriptive text will appear with the data when new material is added or revision is made.

I DAILY SOLAR INDICES

Relative Sunspot Numbers -- The table includes (1) the daily American relative sunspot numbers, R_A' as compiled by Sarah J. Hill, Wellesley College, Wellesley, Massachusetts, for the Solar Division of the American Association of Variable Star Observers, and (2) the provisional daily Zürich relative sunspot numbers, R_Z, as communicated by M. Waldmeier of the Swiss Federal Observatory. Because of the time required to collect and reduce the observations, R_A' will appear one month later than R_Z.

The relative sunspot number is an index of the activity of the entire visible disk. It is determined each day without reference to preceding days. Each isolated cluster of sunspots is termed a sunspot group and it may consist of one or a large number of distinct spots whose size can range from 10 or more square degrees of the solar surface down to the limit of resolution (e.g. 1/8 square degree). The relative sunspot number is defined as $R = K (10g + s)$, where g is the number of sunspot groups and s is the total number of distinct spots. The scale factor K (usually less than unity) depends on the observer and is intended to effect the conversion to the scale originated by Wolf. The observations for sunspot numbers are made by a rather small group of extraordinarily faithful observers, many of them amateurs, each with many years of experience. The counts are made visually with small, suitably protected telescopes.

*Contents are also available at cost through IGY World Data Center-A for Airglow and Ionosphere as "Compilations of Solar-Geophysical Data".

Final values of R_Z appear in the IAU Quarterly Bulletin on Solar Activity, the Journal of Geophysical Research, these reports, and elsewhere. They usually differ slightly from the provisional values. The American numbers, R_A', are not revised.

Solar Flux Values, 2800 Mc -- The table also lists the daily values of solar flux at 2800 Mc recorded in watts/m^2/cycle/second (x 10^{-22}) in two polarizations by A. E. Covington of the National Research Council at Ottawa, Canada. (See Section IV SOLAR RADIO WAVES for more detail.) These solar radio noise indices are being published in accordance with CCIR Report 162 as a possible basic index for ionospheric propagation which can be observed objectively. It is related to the main ionizing photon radiation which is responsible for the normal E and F layers and which determines ionospheric frequencies during undisturbed conditions.

Graph of Sunspot Cycle -- The graph illustrates the recent trend of Cycle 19 of the 11-year sunspot cycle and some predictions of the future level of activity. The customary "12-month" smoothed index, R, is used throughout, the data being final R_Z numbers except for the current year. Predictions shown are those made for one year after the latest available datum by the method of A. G. McNish and J. V. Lincoln (Trans. Am. Geophys. Union, 30, 673-685, 1949) modified by the use of regression coefficients and mean cycle values recomputed for Cycles 8 through 18. Cycle 19 began April 1954, when the minimum $\overline{R}$ of 3.4 was reached. Tabular values of the smoothed index, R, appear regularly in the CRPL-F Part A "Ionospheric Data" reports and CRPL "Ionospheric Predictions" series and are available upon request.

II SOLAR CENTERS OF ACTIVITY

Calcium Plage and Sunspot Regions -- The table gives particulars of the centers of activity visible on the solar disk during the preceding month. These are based on estimates made and reported on the day of observation and are therefore of limited reliability. The calcium plage region identifications, in particular, should be considered preliminary, subject to change after more detailed scrutiny.

The table gives the heliographic coordinates of each center (taken as the calcium plage unless two or more significantly and individually active sunspot groups are included in an extended plage) in terms of the Greenwich date of passage of the sun's central meridian (CMP) and the latitude: the serial number of the plage as assigned by McMath-Hulbert Observatory: the serial number of the center in the previous solar rotation, if it is a persisting region: particulars of the plage at CMP: area, central intensity: a summary of the development of the plage during the current transit of the disk, where b = born on disk, ℓ = passed to or from invisible hemisphere, d = died on disk, and / = increasing, - = stable, \ = decreasing: and age in solar rotations: particulars of the associated sunspot group, if any, at CMP: area and spot count and the summary of development during the current disk transit, similar to the above. The unit of area is a millionth of the area of a solar hemisphere: the central intensity of the calcium plages is roughly estimated on a scale of 1 = faint to 5 = very bright. Parentheses indicate region was not observed on CMP date; values are those nearest CMP date.

Calcium plage data are available through the cooperation of the McMath-Hulbert Observatory of the University of Michigan. The sunspot data are compiled from reports from the U. S. Naval Observatory, and from reports from Europe and Japan received through the daily ursigram network.

Mount Wilson Magnetic Classifications of Sunspots -- This table lists the date and time (UT) of the observations, the approximate heliocentric coordinates, and the magnetic classification of the sunspot groups, as observed at the Mt. Wilson Observatory. Only those groups for which magnetic measures are available will be listed; no attempt will be made to number groups.

The classification system gives the maximum magnetic information. The classifications are defined as follows:

αp — All the magnetic measures in the group are of the same polarity which is that corresponding to the preceding spots in that hemisphere for that cycle.

αf — All the magnetic measures in the group are of the same polarity which is that corresponding to the following spots in that hemisphere for that cycle.

βp — A bipolar group in which the magnetic measures indicate that the preceding spots are dominant.

β — A bipolar group in which the magnetic measures indicate a balance between the preceding and following spots.

βf — A bipolar group in which the magnetic measures indicate that the following spots are dominant.

$\beta\gamma$ — A group which has general β characteristics but in which one or more spots are out of place as far as the polarities are concerned.

γ — A group in which the polarities are completely mixed.

Coronal Line Emission Indices -- In the table entitled Provisional Coronal Line Emission Indices are summarized emission intensity indices for the green (Fe XIV at $\lambda 5303$) and red (Fe X at $\lambda 6374$) coronal lines. The indices are based on measurements made at $5°$ intervals around the periphery of the solar disk by the High Altitude Observatory at Climax, Colorado, and by Harvard University observers at Sacramento Peak (the USAF Sacramento Peak Observatory at Sunspot, New Mexico, under contract AF 19(604)-146). The measurements are expressed as the number of millionths of an Angstrom of the continuum of the center of the solar disk (at the same wavelength as the line) that would contain the same energy as the observed coronal line. The indices have the following meanings:

G_6 = mean of six highest line intensities in quadrant for $\lambda 5303$.

R_6 = same for $\lambda 6374$.

G_1 = highest value of intensity in quadrant for $\lambda 5303$.

R_1 = same for $\lambda 6374$.

The dates given in the table correspond to the approximate time of CMP of the longitude zone represented by the indices. The actual observations were made for the northeast and southeast quadrants 7 days before; for the southwest and northwest quadrants 7 days after the CMP date given.

Once every three months Final Coronal Line Emission Indices are printed. These tables contain data from Pic du Midi and Kislovodsk as well as Sacramento Peak and Climax. The indices are computed in the same manner as for the provisional table.

To obtain rough measures of the integrated emission of the entire solar disk in either of the lines, assuming the coronal changes to be small in a half solar rotation, it is satisfactory to perform the following type of summation given in example for 15 October:

$$\begin{pmatrix}\text{MEAN DISK EMISSION}\\ \text{IN } \lambda 5303\end{pmatrix}_{15\text{ OCT}} = \frac{1}{N}\left[\sum_{15\text{ OCT}}^{22\text{ OCT}}\left\{(G_6)_{NE} + (G_6)_{SE}\right\} + \sum_{8\text{ OCT}}^{14\text{ OCT}}\left\{(G_6)_{SW} + (G_6)_{NW}\right\}\right]$$

where N is the number of indices entering the summation.

Such integrated disk indices as well as integrated whole-sun indices are computed for each day and are published by the High Altitude Observatory at Boulder, Colorado.

Preliminary summaries of solar activity, prepared on a fast schedule, are issued Friday of each week from High Altitude Observatory in conjunction with CRPL and include solar activity through the preceding day. These are useful to groups needing information on the current status of activity on the visible solar disk, but are not recommended for research uses unless such a prompt schedule of reporting is essential.

Notes: From calibrations in February - March 1960 it was determined that all intensities from the Climax and Sacramento Peak Observatories during the years 1956 - 1959, inclusive, if multiplied by the factor 0.60, will be expressed in millionths of equivalent Angstroms to a somewhat lower precision. Intensities prior to 1956 cannot be compared precisely with those obtained later because of changes in observing and reduction techniques. They may be converted roughly to millionths of equivalent Angstroms by the use of the table given by Billings and Varsavsky, 1955, Zs.f Ap. 38, 160. In F185B several corrections were made to October and November 1959 coronal line emission indices published in F183B and F184B, respectively.

III SOLAR FLARES

Optical Observations -- The table presents the preliminary record of solar flares as reported to the CRPL on a rapid schedule at the sacrifice of detailed accuracy. Definitive and complete data are published later in the I.A.U. Quarterly Bulletin on Solar Activity, in various observatory publications and elsewhere. The present listing serves to identify and roughly describe the phenomena observed.

Reporting directly to the CRPL are the following observatories: McMath-Hulbert, Wendelstein, Sacramento Peak, Lockheed and Swedish Astrophysical Station on Capri. The remainder report through the ursigram centers or are available through the IGY World Data Center-A for Solar Activity, High Altitude Observatory, Boulder, Colorado. Observations are made in the light of the center of the H-alpha line unless noted otherwise. The reports from Sacramento Peak, New Mexico (communicated to CRPL by the High Altitude Observatory at Boulder), are from observations at the USAF Sacramento Peak Observatory at Sunspot, New Mexico, by Harvard University observers, under contract AF 19 (604)-4961.

For each flare or subflare are listed the reporting observatory using I.A.U. Quarterly Bulletin on Solar Activity designations, the date, beginning and ending times, time of maximum phase, the heliographic coordinates in degrees, McMath serial number of the region, duration (flares only), the flare importance on the IAU scale of 1- to 3+, observing conditions where 1 means poor, 2 fair and 3 good, time of measurement for tabulated width of Hα or tabulated area, measured (i.e. projected) maximum area in square degrees, corrected maximum area in square degrees (which equals measured area times secant h where h is the heliocentric angle), maximum effective line-width in Hα expressed in Angstroms, and maximum intensity of Hα expressed in percent of the continuous spectrum. The following symbols are used in the table:

D = Greater than	U = Approximate
E = Less than	□ = Not reported
(In older lists & = Plus)	

A final column lists provisionally the occurrence of simultaneous ionospheric effects as observed on selected field-strength recordings of distant high-frequency radio transmissions: a more nearly definitive list of these ionospheric effects, including particulars, appears in these reports after the lapse of a month (see below). All times are Universal Time (UT or GCT). Beginning with January 1962 data the times of no patrols for flare observations, from the observatories whose data are published and which give such information, are inserted in chronological order with the flare data. Because some observatories report flares, but not the periods covered by their observations, flares may be included in the table during hours of reported no patrol. A graph also presents these intervals for which there were no patrols for flare observations, the observatories whose data are included are indicated in a footnote.

Notes: All the flare data are recorded on IBM punch cards. As errata are received the punch cards are corrected. These errata are not always published in these reports. Copies of the cards or tabulations from them are available at cost through the IGY World Data Center A for Ionosphere and Airglow, CRPL, National Bureau of Standards, Boulder, Colorado, U.S.A.

Major errors have occurred in the area listing in these reports for the Russian flares until 1960 data. We at NBS misunderstood some of the original entries. The Simeiz flares in F156B for example, were for June 1957, not July 1957. Revised flare lists, as well, have been received for IGY-IGC flares from the following observatories: Abastumani, Alma-Ata, Moscow Gaish, Kiev University, Pirculi, Simeiz, Tashkent, and Voroshilov and are available as described above.

The flare position reports from Hawaii have been corrected from July 1, 1957 to December 10, 1960. Flare coordinates reported since December 10, 1960 have been computed correctly. The measured and corrected areas for flares from Hawaii as published for July 1957 through November 1959 should be divided by two to make the entries correct.

The flares incorrectly labelled "Boulder" in F178B and F179B are those for Greenwich Royal Observatory, Herstmonceux. As stated above the corrected data are available on IBM punch cards.

Beginning October 1, 1960 the following U. S. observatories: Climax, Hawaii, Lockheed and Sacramento Peak, are reporting maximum area in square degrees corrected according to a method proposed by C. S. Warwick of the

National Bureau of Standards. These observatories are now basing their flare importances on this corrected area in accordance with IAU rules. Previously they had based their importances on the measured areas. The formula being used is:

$$\text{Corrected area} = \frac{\text{measured area}}{\cos \phi + 0.2 \sin \phi}$$ where ϕ is the central distance. This factor represents the variation in apparent area that depends only on central distance, and avoids an infinity at the limb. (Graph published in CRPL-F 197 Part B, January 1961).

Ionospheric Effects -- SID, sudden ionospheric disturbance (and GID -- gradual ionospheric disturbance) may be detected in a number of ways: short-wave fadeouts (SWF), enhancement of low frequency atmospherics (SEA), increases in cosmic absorption (SCNA), sudden phase anomalies at VLF (SPA) and sudden signal enhancements at VLF (SES).

A table lists these phenomena jointly giving: date; beginning, ending and maximum phase in UT; type and importance rating if SWF; percent absorption and importance if SCNA; importance if SEA; or degrees of phase change if SPA with path designated; a geographically widespread index for type of event; stations observing event; and associated solar flare, if known. (SES by AAVSO observers recording NBA or NPM are noted in the date column).

The SWF events are listed in first columns and have been recognized on field-strength recordings of distant high-frequency radio transmissions. Under a coordinated program, the staffs at the following ionospheric sounding stations contribute reports that are screened and synthesized at CRPL-Boulder: Puerto Rico, Ft. Belvoir, Va., Boulder, Colo. and Anchorage, Alaska (CRPL Stations: PR, BE, BO, AN); Huancayo, Peru (CRPL-Associated Laboratory: HU); and Ft. Monmouth, N.J., White Sands, N. Mex., Adak, Alaska, and Okinawa (U.S. Signal Corps Stations: FM, WS, AD, OK). McMath-Hulbert Observatory (MC) and Hiraiso Radio Wave Observatory, Japan (TO) also contribute such reports. In addition, reports are volunteered by Cable and Wireless (CW+ = Hong Kong, CW++ = Singapore, CW+++ = Accra, CW* = Barbadoes, CW** = Somerton, England, CW*** = Brentwood, England); Netherlands Postal and Telecommunications Services at NERA (NE) and Paramaribo (PA); Swedish Telecommunications, Enköping, Sweden (SW); New Zealand Post and Telegraph Department (NZ) and others: these usually specify times of SWF and the radio paths involved. Through the Ursigrams, reports are available from still other stations: such as Breisach, GFR (BR), Canberra, Australia (CA), Darmstadt, GFR (DA), Juhlesruh, GDR (JU), Kuhlungsborn, GDR (KU), Lindau, GFR (LI), Predigstuhl, GFR, (PS).

In the coordinated program, the abnormal fades of field strength not obviously ascribable to other causes, are described as short-wave fadeouts with the following further classification:

S-SWF (S): sudden drop-out and gradual recovery
Slow S-SWF (SL): drop-out taking 5 to 15 minutes and gradual recovery
G-SWF (G): gradual disturbance: fade irregular in either drop-out or recovery or both.

When there is agreement among the various reporting stations on the time (UT) of an event, it is accepted as a widespread phenomenon and listed in the table.

The degree of confidence in identifying the event, a subjective estimate, is reported by the stations and this is summarized in an index of certainty that the event is geographically widespread, ranging from 1 (possible - single station) to 5 (definite - many stations). The times given in the table for the event are from the report of a station (listed first in the group of stations) that identified it with high confidence. The criteria for the subjective importance rating assigned by each station on a scale of 1- to 3+ include amplitude of the fade, duration of event and confidence of reality of event. The published summary importance rating is also subjective with greater consideration given to reports on paths near the subsolar point for the particular event.

Note: The table of SID observed at Washington included in CRPL F-reports prior to F-135 were restricted to events classed here as S-SWF.

Sudden ionospheric disturbances are next listed in the table which have been recognized on recorders for detecting cosmic absorption at about 18 Mc (SCNA) or on recorders for detecting enhancements of low frequency atmospherics at about 27 kc (SEA) together with solar radio bursts at 18 Mc as identified on the SCNA records.

Reports are received either directly or through the IGY World Data Center A for Solar Activity at the High Altitude Observatory, Boulder, Colo. The following observatories report SCNA: McMath-Hulbert Observatory (MC); High Altitude Observatory, Boulder, Colo. (BO); University of Hawaii, Makapuu Pt., Hawaii (HA); Manila Observatory (MA). These four stations also report solar noise bursts observed at 18 Mc. The SEA reports come from the following: Dunsink Observatory, Ireland (DU); Observatorio del Ebro, Tortosa, Spain (TR); Research Institute of Atmospherics, Toyokawa, Japan (TY); two stations operated by the Netherlands PTT at Nederhorst den Berg, Netherlands (NE), and Paramaribo, Dutch West Indies (PA); Panska Ves Observatory near Prague, Czech. (PU); High Altitude Observatory, Boulder, Colo. (BO); McMath-Hulbert Observatory (MC); University of Hawaii (HA); Manila Observatory (MA); Neustrelitz, GDR, (NU); Kuhlungsborn, GDR, (KU); a group of American Association of Variable Star Observers located at Brooklyn, N.Y. (A1), Pittsburgh, Pa. (A2), Paterson, N.J. (A3), Powell, Ohio (A4), Ramsey, N.J. (A5), Oshkosh, Wis. (A6), China Lake, Calif. (A7), Manhattan, Kansas (A8), Oakland, Calif. (A9), Blauvelt, N.Y. (A10), Manila, Philippines (A11), Addis Ababa, Ethiopia (A12) and Beverley Hills, Calif. (A14) and an amateur astronomer in Hobart, Tasmania (TA).

These reports are coordinated at CRPL-Boulder. When there is agreement among the various reporting stations on the time (UT) of an event, it is accepted as a widespread phenomenon and listed in the table. Some phenomena are listed, if noted at only one location, if there has been a flare or another type of flare-associated effect reported for that time.

In the table under the type of event the subjective importance of the event is given on a scale of 1 minus to 3 plus. Next there is the index of geographic widespread certainty ranging from 1 (possible) to 5 (definite). The times of beginning, end and maximum phase of the event in UT are given as reported by the station listed first in the group of observing stations. If the event is an SCNA, a percent absorption figure is given. This absorption is calculated by the formula:

$$\text{SCNA } \% = \frac{I_n - I_f}{I_n} \times 100$$

where I_n = noise diode current required to give a recorder deflection equal to that which would have occurred in the absence of a flare, i.e. a value extrapolated from cosmic noise level trend before and after a flare. The previous day's record may be considered if necessary.

and I_f = noise diode current required to give a recorder deflection equal to the level at the time of maximum absorption.

Finally sudden phase anomalies as observed at NBS - Boulder, Colorado are listed. These recordings are for the two transmissions GBR - England (16 kc) (BO+) or NBA - Panama Canal Zone (18 kc) (BO). Instead of an importance rating the degrees of phase change are given with the path used for the measurement indicated.

In the final column, if known, a flare beginning time is given that may be associated with each listed ionospheric event. An asterisk indicates that there was no known flare patrol being made at that time.

IV SOLAR RADIO WAVES

<u>2800 Mc Observations</u> -- Beginning with the start of 1962, the routine solar noise observations at 2800 Mc (10.7 cm) of the Radio and Electrical Engineering Division of the National Research Council are made at the new Algonquin Radio Observatory (ARO) which has been established at Lake Traverse, Ontario, 150 miles northwest of Ottawa under direction of A. E. Covington.

At this site, the patrol observations will be carried out by the use of two Dicke type radiometers which are both connected to a single 1.8 metre (6 foot) parabolic reflector. This system is operationally equivalent to the original installation at Goth Hill, Ottawa, but differs from it in that the diameter of the reflector has been increased from 1.2 metres (4 feet) and newer components used in the radiometers. These differences have resulted in an increase in the signal-to-noise ratio by at least a factor of 2, so that smaller bursts are more evident on the records from ARO than on those from Goth Hill.

Simultaneous observations have been carried out at the two observatories for a period of 15 months and it is believed that the new equipment has been satisfactorily calibrated in terms of the older apparatus. By comparing the daily calibrations at ARO with those at Goth Hill for this whole period, a transfer constant has been found which should ensure that the daily flux values reported from ARO will be consistent with those reported in the past from Goth Hill. This transfer constant (.256) has been found from 374 observations with a standard deviation of .00575.

As in the past, the calibrations from two independent radiometers will be averaged to provide the daily flux value. The ratios of the calibrations from the two radiometers at ARO have been found for the year 1961, and the 362 values had a mean of 0.9915 with a standard deviation of .00977. The ratios of the calibrations from the two radiometers at Goth Hill for the same period had a mean of 1.0006 with a standard deviation of .01326 (309 values). It is interesting to note that the standard deviation of the ARO values is 25% less than that of the Goth Hill values.

Even though the new station is now supplying the daily reports, it is planned to continue to use the Goth Hill equipment, at least intermittently, until the forthcoming sunspot minimum. These additional observations will provide further checks on the transfer constant mentioned above.

The transfer of the patrol observations to ARO has taken place at a time when interference at 2800 Mc from radars has grown to an exceedingly high and troublesome level at Goth Hill. Unfortunately, some interference at this same frequency has been observed at ARO but should not increase to the same extent. This continuing interference raises the possibility that observations will have to be transferred to the near-by frequency of 2700 Mc, which has been allocated by the International Telegraph Union, Geneva Conference 1959, for use in radio astronomy. Plans are now being made to construct apparatus for this allocated frequency in order to conduct tests. If this frequency band shows less interference, the transfer of patrol observations from 2800 Mc to 2700 Mc may be undertaken. Such a transfer would not be achieved as simply as the present one since spectral differences would have to be examined in addition to the calibration of the apparatus.

Near local noon (about 1700 UT) the sensitivity of the radiometer is determined and a mean flux for the whole day calculated. These values are given in tabular form (see table I-1) in units of 10^{-22}watts/m^2/c/s. Burst phenomena are measured above this level and are given in terns especially suitable for the variations observed on this frequency. The basis for the classifications is described by Covington-J.R. Astro. Soc. Can.45, 1951 and Dodson, Hedeman and Covington, Ap. J. 119, 541, 1954. A modification in terminology with a view to simplification has been introduced and consists essentially of the omission of the descriptive word "Single" from the "Single-Simple" and "Single-Complex" classes; in designating the "Single", "Single-Simple" and "Rise and Fall" bursts into a single classification designated as "Simple Bursts" with an appropriate type number; in the addition of the letter "f" to indicate that the burst deviates from the basic pattern by the presence of one or more small fluctuations in intensity; and by the addition of the letter "A" to indicate that the event has another smaller duration event superimposed upon it.

Simple Burst

Any single burst which rises to one maximum and then decreases to pre-burst level.

1 - Simple 1 -- Simple burst, type 1 (formerly "single"). Bursts of intensity less than 7 1/2 flux units and duration less than 7 1/2 minutes.

2 - Simple 2 -- Simple burst, type 2 (formerly "single-simple"). Bursts of impulsive nature with intensity greater than 7 1/2 flux units.

3 - Simple 3 -- Simple burst, type 3 (formerly "rise and fall"). Bursts of moderate intensity with duration greater than 7 1/2 minutes.

4 - Post-burst increase -- Postburst level is greater than the preburst level. The gradual return to normal flux may require as long as several hours.

5 - Absorption following burst (negative post).

6 - Complex -- (formerly "single-complex"). A single burst which shows two or more comparable maxima before the activity has declined to zero.

7 - Period of irregular activity of fluctuations -- Series of overlapping bursts of moderate intensity and duration.

8 - Group -- Series of single isolated bursts occurring in succession with intensity between the events equal to the level before and after the group.

9 - Precursor -- A small increase of intensity occurring before a larger increase.

Great Burst

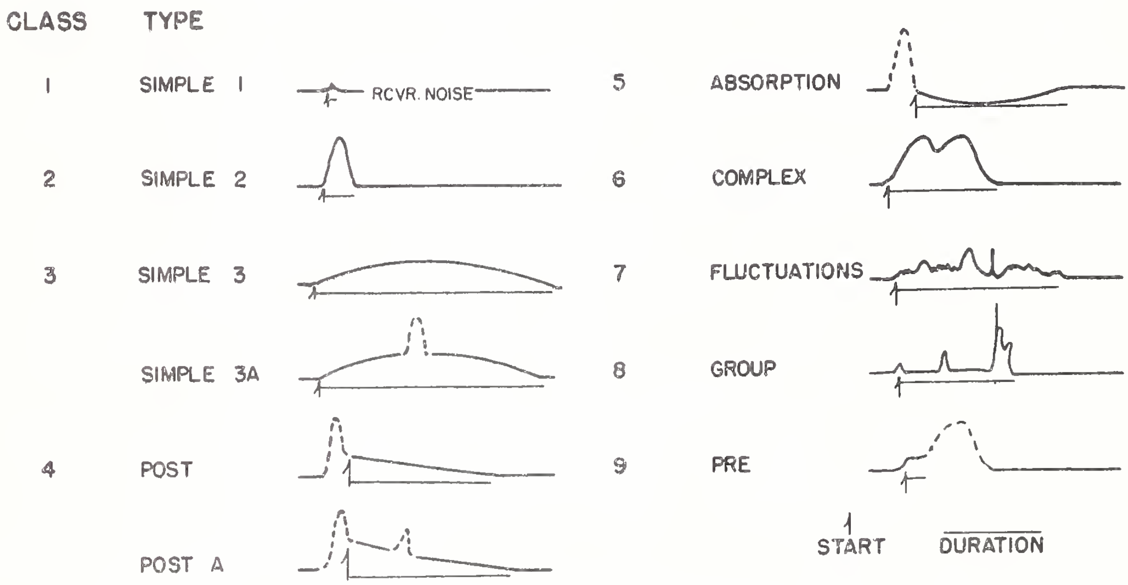
Infrequently occurring bursts of great intensity, often of complicated structure.

Letter "A"

Indicates that this event has another event superimposed upon it.

Letter "f"

Indicates that the basic form of the event is modified by secondary fluctuations.



From time to time burst profiles of the more interesting solar noise bursts are also published.

169 Mc Interferometric Observations

The 169 Mc interferometric observations are recorded around local noon at Nançay, France, (N47°23', E8^{m}47^{s}), the field station of the Meudon Observatory.

The main lobes are parallel to the meridian plane: the half-power width is 3.8 minutes of arc in the East-West direction and much larger than the solar diameter in the North-South direction. The main lobes are about 2° apart (Ann. Astrophys. 20, 155, 1957). The records give the strip intensity distribution from the center of the disk to 30' to the West and East.

These daily distributions are plotted on the same chart giving diagrams of evolution (C.R. 244, 1460, 1957). Points of intensity 0.5 - 0.75 - 1.0 - 1.5 and 2.0 times 10^{-22} watts/m^2/c/s are joined day after day in the form of isophotes. A bracketed line indicates the width of the recorded lobe pattern in the East-West direction. A short East-West line is used where the source width is not known. The direction of the horizontal pip indicates whether the radio source is in the northern solar hemisphere (pip points toward earlier dates), or in the southern hemisphere (pip points towards later dates). If a pip extends on both sides of the line, the radio source was observed to be close to the solar equator. A circle or semicircle replaces the pip when the North-South coordinate of the position is unknown. For each radio noisy region the smoothed intensity around noon is given in 10^{-22}watts/m^2/c/s.

Note that the isophotes cannot be measured when a radio noisy region of large intensity is on the disk.

108 Mc Observations

Data on solar radio emission at the nominal frequency of 108 Mc recorded at the Table Mesa (Boulder) station of the National Bureau of Standards are presented. The antenna is equatorially mounted and linearily polarized. The plane of polarization is parallel to the solar rotation axis.

Note: Data on solar radio emission at 167 Mc recorded at the Gunbarrel Hill (Boulder) station of the National Bureau of Standards were terminated September 30, 1960. (See earlier CRPL-F Part B reports for details.)

Only the outstanding occurrences are reported. A scale of 1 to 3 is now used where for the estimate of smoothed maximum flux:

1 signifies <10 x quiet sun
2 signifies >10< 100 x quiet sun
3 signifies >100 x quiet sun

Starting and maximum times are read to the nearest 1/10 minute if they are very definite and otherwise to the nearest minute. If the duration is less than five minutes, it is given to the nearest 1/10 minute: otherwise to the nearest minute. The following qualifying symbols are used:

E = Event in progress before observations began.
D = Event continues after observations cease.
S = Measurement may be influenced by interference or atmospherics.

The types of the outstanding occurrences follow the classification described for 200 Mc observations originally by Dodson, Hedeman and Owren (Ap J. 118, 169, 1953), in which the types are identified by numbers which describe the character of the trace, but not the magnitude of the event, as follows:

0 - Rise in base level -- A temporary increase in the continuum with duration of the order of tens of minutes to an hour.

1 - Series of bursts -- Burst or groups of bursts, occurring intermittently over an interval of time of the order of minutes or hours. Such series of bursts are assigned as distinctive events only when they occur on a smooth record or show as a distinct change in the activity.

2 - Groups of bursts -- A cluster of bursts occurring in an interval of time of the order of minutes.

3 - Minor burst -- A burst of moderate or small amplitude, and duration of the order of one or two minutes.

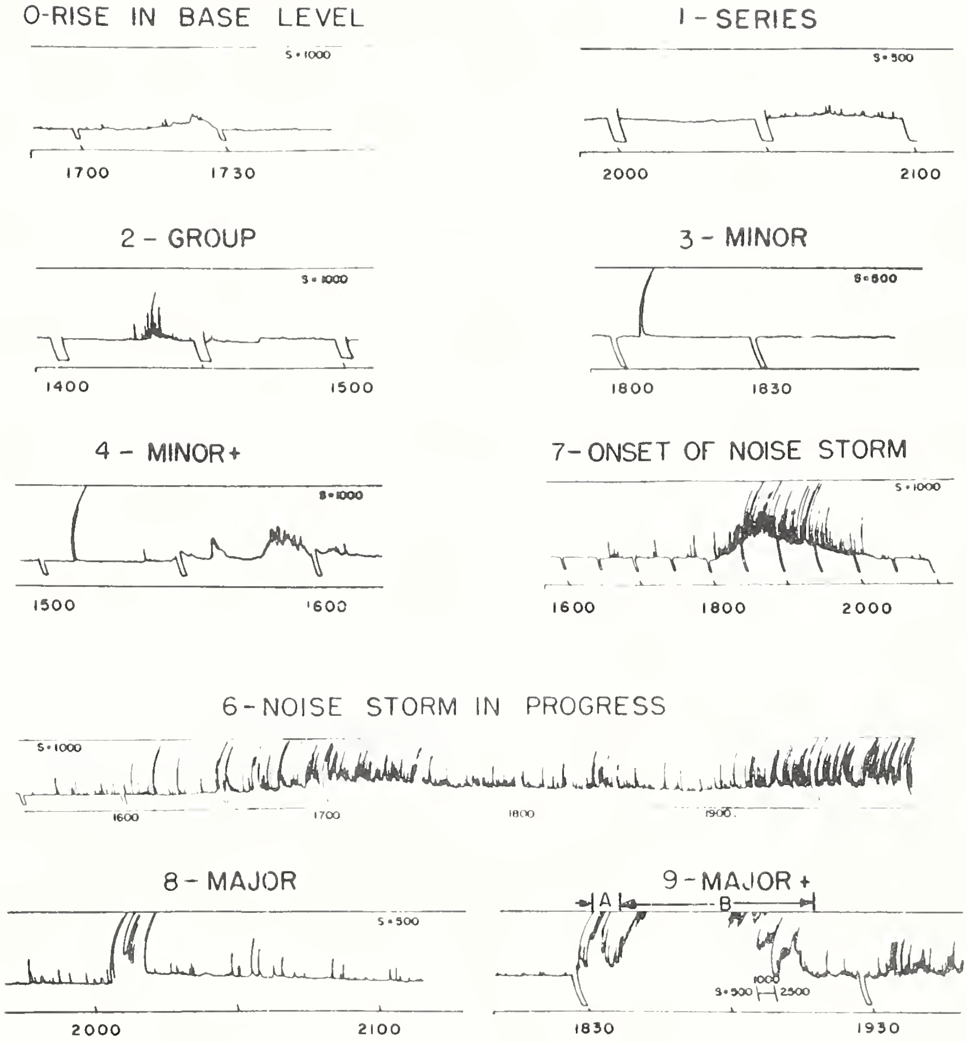
4 - Minor burst and second part -- A double rise in flux in which the early rise is a minor burst.

6 - Noise storm -- A temporary increase in radiation characterized by numerous closely spaced bursts, by an increase in the continuum, or by both. Duration is of the order of hours or days.

7 - Noise storm begins -- The onset of a noise storm occurs at some time during the observing period.

8 - Major burst -- An outburst, or other burst of large amplitude and more than average duration. A major burst is usually complex, with a duration of the order of one to ten minutes.

9A, 9B, or 9 -- Major burst and second part or large event without distinct first and second parts -- If there is a double rise in flux, the first part, a major burst, is listed as 9A and the second part as 9B. The second part may consist of a rise in base level, a group or series of bursts, a noise storm. A major increase in flux with duration greater than ten minutes but without distinct first and second parts, is listed simply as 9.



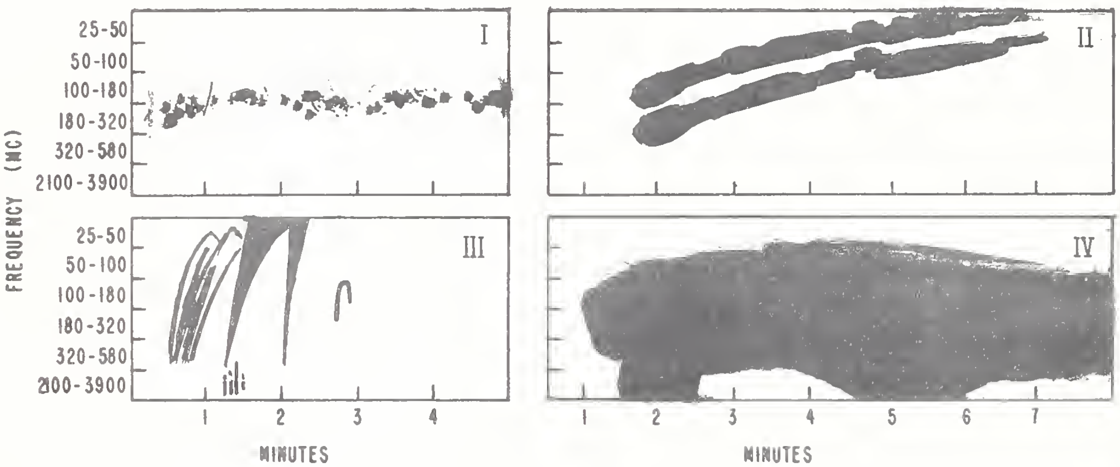
Notes: In the present table, the type classification 0 is not used: it has been included above only for information.

In the nominal times of observation table, the times preceded by I signify periods of interference that could mask solar events.

From time to time photographic copies of the more interesting outstanding occurrences are published.

Spectrum Observations - Fort Davis

Data are presented on solar radio emission in the spectral ranges 25-580 Mc and 2100-3900 Mc recorded at the Radio Astronomy Station of Harvard College Observatory, Fort Davis, Texas. The research program is supported by financial assistance from the Sacramento Peak Observatory and the Geophysics Research Directorate of the United States Air Force. The equipment used at the Station has been described elsewhere (Thompson, Astrophys. J. 133, 643, 1961). Commencing 1 January 1960 the following activity is listed: limited information on noise storms (type I); slow-drift bursts (type II); groups of fast-drift bursts with more than 10 individual bursts (type III G); continuum bursts (type IV). Idealized examples of the bursts are shown below: photographic examples have been published by Swarup, Stone, and Maxwell (Astrophys J. 131, 725, 1960).



Observations are made daily from sunrise to sunset (see UT times listed in column 2 of the table). Entries in the tables are given in Universal Time (UT), and the accuracy is to the nearest half minute, except in the case of major outbursts which are specified to the nearest 0.1 minute. The symbol → is used to indicate continuity of solar activity between two Greenwich days. Three classes of intensity are listed: 1 (faint), 2 (moderate), and 3 (strong). At 100 Mc these correspond to 5-40, 40-200, and 200, x 10^{-22} watts $m^{-2}cps^{-1}$, respectively. The frequency range in Mc for the burst is also given as well as additional remarks when appropriate.

Spectrum Observations - High Altitude Observatory, Boulder, Colorado

The research program is supported by the Electronics Research Directorate, Air Force Cambridge Research Laboratories and Goddard Space Flight Center, National Aeronautics and Space Administration.

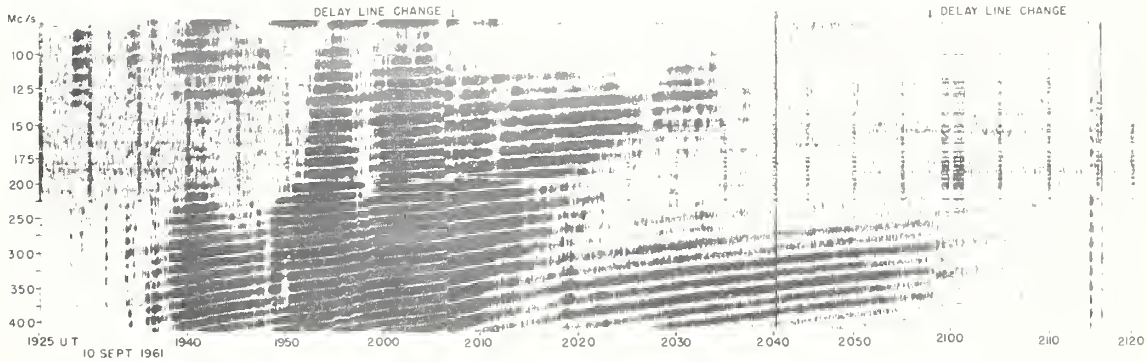
The spectral range is from 7.6 to 41 Mc, scanned in 1.3 seconds. The collecting area of the antennas is approximately 1000 square meters, in two corner reflectors forming an interferometer pair. Observations are taken routinely throughout the Boulder observing day from about 1400 UT to 2400 UT. On the low-frequency side, bursts are frequently limited by an external reflection of the waves above the ionosphere. Examples of Type III (fast drift) and continuum records taken with this equipment are published in A. Boischot, R. H. Lee, and J. W. Warwick, Ap. J., 131, 61 (1960). An example of Type II (slow drift) and Type IV burst is included herewith; the Type II is detected not only by means of the (relatively small) enhancement it produces against a background of continuum, but also by means of the fast fluctuations of fringe position produced as the burst drifts through the low-frequency range. Continuum of two kinds is reported: (a) in close association with Type III burst storms, and often also with reverse drift bursts. This is described simply as "continuum" and is often but not always, associated with noise storms on metric wavelengths; (b) following major outbursts of Type III or Type II associated with flares. These latter cases of continuum are labelled Type IV in the tables; the attached photograph illustrates an outstanding example. Intensities are on a rough scale from 1- to 3+, crudely convertible to flux densities as follows:

1- to 1+; $5 \times 10^{-22} < S < 2 \times 10^{-21}$

2 to 2+; $2 \times 10^{-21} < S < 8 \times 10^{-21}$

3 to 3+; $8 \times 10^{-21} < S \leq 3 \times 10^{-20}$

Above about 3×10^{-20} watts m^{-2} $(cps)^{-1}$, the equipment saturates and does not indicate relative intensities satisfactorily.



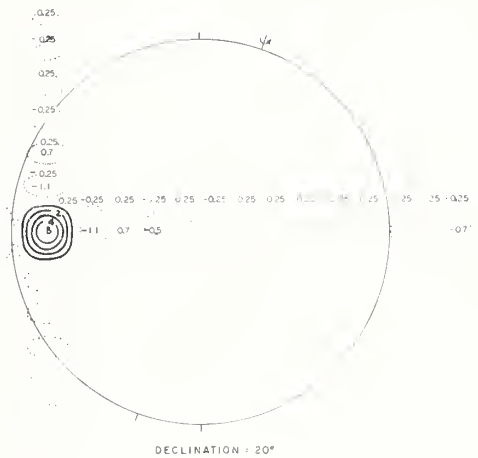
9.1 cm Spectroheliograms

A daily series of radio spectroheliograms obtained with a 3 minute-of-arc pencil-beam antenna located at the Radio Astronomy Institute of the Stanford University, Stanford, California (N 37° 24', W 122° 11'), are presented.

The maps show the distribution of radio emission across the solar disk at a wavelength of 9.1 cm by means of brightness temperature values. The brightness unit, which varies from map to map, is usually about 3000°K. Its value is determined after each map is plotted by reference to the flux density, S, of the whole sun as measured by Covington at 10.7 cm wavelength. Readings of 10, 20, 50 and 100 are joined by lines of constant brightness temperature. A total of all readings, flux-density S at 10.7 cm in units of 10^{-22}w m^{-2}cps^{-1}, and brightness unit in °K are presented at the bottom of each map. The axis of rotation of the sun is shown by a curly arrow placed near the North Pole. A circle shows the photosphere; a correction has been applied for the variation of the sun's semi-diameter, so that the photospheric circle is reproduced with a constant diameter of 5 cm. This is an integral submultiple of the IAU standard of 15 cm used on the full size originals, which are available on request from the Stanford Radio Astronomy Institute. A set of Stonyhurst disks with a diameter of 5 cm is reproduced on transparent paper at the end of this text.

A detailed description of the Stanford microwave spectroheliograph has been given by Bracewell and Swarup (IRE Trans., Vol. AP 9, January 1961). The instrument scans the sun from West to East with rotation of the earth. At the end of each scan, pencil-beams are shifted in a North-South direction by means of 16 variable phase-shifters placed in the North-South array. Recently the Stanford spectroheliograph has been digitized so that the finished maps are available within a few hours after the observations. A positional accuracy of better than $\pm 1/2$ minute-of-arc in the location of bright features is maintained.

Observations are made each day near local noon. The width of the antenna beams which scan the sun change from nearly 3' x 3' in mid-summer to nearly 3' x 6' in mid-winter. At a declination δ on the meridian the beamwidths are 3.1 minutes East-West and 3.1 sec $(38.^\circ 2 - \delta)$ North-South. The theoretical response of the antenna to a point source is shown below. Further details are given in the above mentioned reference. The response to a source of finite size is the convolution of this pattern with the source distribution. The subsidiary lobes, which are positive and negative, may be reduced by smoothing the maps but this would also widen the primary beam. A simple procedure for smoothing is to average four alternate values located at the corner of a rectangle with horizontal and vertical sides. Any spurious lobes arising because of antenna maladjustments are kept in control by periodic phase adjustment of the antenna.



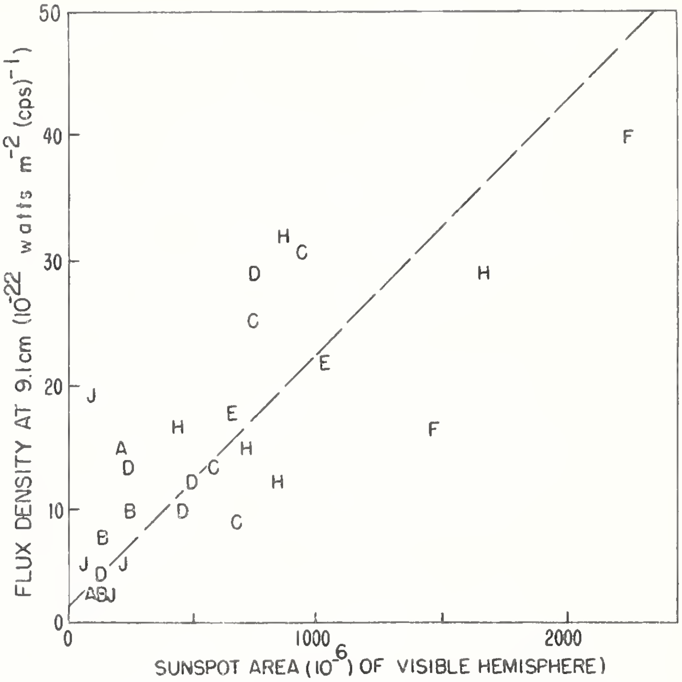


FIG. 1 SCATTER DIAGRAM SHOWING THE RELATION BETWEEN RADIO FLUX AND SUNSPOT AREA

Results of a preliminary investigation of the 9.1 cm solar maps have been reported by Swarup (Stanford Electronics Laboratories Scientific Report No. 13 under Contract AF 18 (603) 53, 1961). Recently it has been found that the size of many strong sources at 9.1 cm is less than that of the antenna beam. Therefore, for strong sources, peak brightness temperatures in the 9.1 cm maps are lower than actual by a factor of more than 3 or 4.

A relation between flux densities of radio sources and area of the associated sunspots is shown above. Each point is represented by a letter denoting Zurich classification of sunspot groups. For a strong source, the flux density decreases to about 25% as the region rotates from the central meridian to the limb. For a weak region, there is less variation. The flux density of a localized region may be found by taking a total of all the readings over the area concerned, subtracting an estimated background, dividing by the total for the day, and multiplying by S. For a compact source, an approximate value of flux density in units of $10^{-22} w\ m^{-2} cps^{-1}$, can be readily obtained by multiplying peak brightness temperature by a factor 3×10^{-5} sec $(38.2 - \delta)$, where δ is the declination of the sun.

V COSMIC RAY INDICES

The table presents the scaled hourly count rate average for each 24 hour interval (Universal Time) from the Climax, Colorado, USA, neutron monitor, station number B305, as communicated by J. A. Simpson and G. Lentz of the Enrico Fermi Institute for Nuclear Studies, University of Chicago. The instrument is a standard Chicago type neutron monitor, utilizing 12 BF_3 counter tubes. The station is located at an altitude of 3400 meters at 39° 22'N, 106° 11'W, geographic, with mean barometric pressure P = 504.0 mm Hg. For a more detailed description of the neutron intensity monitor and its associated electronics see J. A. Simpson, Annals of the IGY, Vol. IV: Part VII, pages 351-373 (1957). The following correction factor is used at Climax:

$$R_{corr} = R_{obs}\ e^{\delta P/L}$$

where $\delta P = P - P_{obs}$, the mean minus the observed pressures, and L is the absorption mean free path of 106.0 mm Hg. The data are in scaled counts per hour; the scaling factor being 128. The publication of these data in this monthly CRPL series began September 1960. Earlier data, beginning June 1957, are available in bihourly form at the IGY World Data Center A for Cosmic Rays.

The chart presents the pressure corrected hourly totals from the Deep River, Ontario, Canada standard neutron monitor, as submitted by H. Carmichael and J. Steljes of Atomic Energy of Canada Limited, Chalk River, Ontario. The station is 145 meters above sea level at 46°06'N, 77°37'W. The magnetic rigidity cut off is 0.87 GV according to the Quenby and Webber formulation. The data are plotted mechanically and the graphs are not in error by more than about the width of the ink trace. The vertical scale lines mark the days in UT. It is possible to count individual hours from any scale line to find the time of an event. The horizontal scale lines are at intervals of 5% based upon 55,500 counts per hour arbitrarily taken as 100%. The standard deviation of the hourly totals is 0.43%.

VI GEOMAGNETIC ACTIVITY INDICES

C, Kp, Ap, and Selected Quiet and Disturbed Days -- The data in the table are: (1) preliminary international character figures, C; (2) geomagnetic planetary three-hour range indices, Kp; (3) daily "equivalent amplitude," Ap; (4) magnetically selected quiet and disturbed days.

This table is made available by the Committee on Characterization of Magnetic Disturbances of IAGA, IUGG. The Meteorological Office, De Bilt, Holland collects the data from magnetic observatories distributed throughout the world, and compiles C and selected days. The Chairman of the Committee computes the planetary and equivalent amplitude indices. The same data are also published in the Journal of Geophysical Research along with data on sudden commencements (sc) and solar flare effects (sfe), and principal magnetic storms.

The C-figure is the arithmetic mean of the subjective classification by all observatories of each day's magnetic activity on a scale of 0 (quiet) to 2 (storm).

Kp is the mean standardized K-index from 12 observatories between geomagnetic latitudes 47 and 63 degrees. The scale is 0 (very quiet) to 9 (extremely disturbed), expressed in third of a unit, e.g. 5- is 4 and 2/3, 5o is 5 and 0/3, and 5+ is 5 and 1/3. This planetary index is designed to measure solar particle-radiation by its magnetic effects, specifically to meet the needs of research workers in the ionospheric field. A complete description of Kp has appeared in Bulletin 12b, "Geomagnetic Indices C and K, 1948" of the Association of Terrestrial Magnetism and Electricity (IATME), International Union of Geodesy and Geophysics.

Ap is a daily index of magnetic activity on a linear scale rather than on the quasi-logarithmic scale of the K-indices. It is the average of the eight values of an intermediate 3-hourly index "ap", defined as one-half the average gamma range of the most disturbed of the three force components, in the three-hour interval at standard stations; in practice, ap is computed from the Kp for the 3-hour interval. The extreme range of the scale of Ap is 0 to 400. The method is described in IATME Bulletin No. 12h (for 1953) p. viii f. Values of Ap (like Kp and Cp) have been published for 1932 to 1961 in IAGA Bulletin No. 18 by J. Bartels, distributed by North-Holland Publishing Company, Amsterdam.

The magnetically quiet and disturbed days are selected in accordance with the general outline in Terr. Mag. (predecessor to J. Geophys. Res.) 48, pp 219-227, December 1943. The method in current use calls for ranking the days of a month by their geomagnetic activity as determined from the following three criteria with equal weight: (1) the sum of the eight Kp's; (2) the sum of the squares of the eight Kp's; and (3) the greatest Kp.

Chart of Kp by Solar Rotations -- The graph of Kp for four solar rotations is furnished through the courtesy of Dr. J. Bartels, Geophysikalisches Institute, Göttingen. Annually a graph of the whole year by solar rotations is included.

VII RADIO PROPAGATION QUALITY INDICES

One can take as the definition of a radio propagation quality index: the measure of the efficiency of a medium-powered radio circuit operated under ideal conditions in all respects, except for the variable effect of the ionosphere on the propagation of the transmitted signal. The indices given here are derived from monitoring and circuit performance reports, and are the nearest practical approximation to the ideal index of propagation quality.

Quality indices are expressed on a scale that ranges from one to nine. Indices of four or less are generally taken to represent significant disturbance. (Note that for geomagnetic K-indices, disturbance is represented by higher numbers.) The adjectival equivalents of the integral quality indices are as follows:

1 = useless	4 = poor-to-fair	7 = good
2 = very poor	5 = fair	8 = very good
3 = poor	6 = fair-to-good	9 = excellent

CRPL forecasts are expressed on the same scale. The tables summarizing the outcome of forecasts include categories P-Perfect; S-Satisfactory; U-Unsatisfactory; F-Failure. The following conventions apply:

P - Forecast quality equal to observed	U - forecast quality two or more grades different from observed when <u>both</u> forecast and observed were >5, or both <5.
S - forecast quality one grade different from observed	F - other times when forecast quality two or more grades different from observed.

Full discussion of the reliability of forecasts requires consideration of many factors besides the over-simplified summary given.

The quality figures represent a consensus of experience with radio propagation conditions. Since they are based entirely on monitoring or traffic reports, the reasons for low quality are not necessarily known and may not be limited to ionospheric storminess. For instance, low quality may result from improper frequency usage for the path and time of day. Although, wherever it is reported, frequency usage is included in the rating of reports, it must often be an assumption that the reports refer to optimum working frequencies. It is more difficult to eliminate from the indices conditions of low quality for reasons such as multipath or interference. These considerations should be taken into account in interpreting research correlations between the Q-figures and solar, auroral, geomagnetic or similar indices.

North Atlantic Radio Path -- The CRPL quality figures, Qa, are compiled by the North Atlantic Radio Warning Service (NARWS), the CRPL forecasting center at Ft. Belvoir, Virginia, from radio traffic data for North Atlantic transmission paths closely approximating New York-to-London. These are reported to CRPL by the Canadian Defence Research Board, Canadian Broadcasting Corporation, and the following agencies of the U.S. Government: -- Coast Guard, Navy, Army Signal Corps, U.S. Information Agency. Supplementing these data are CRPL monitoring, direction-finding observations and field-strength measurements of North Atlantic transmission made at Belvoir.

The original reports are submitted on various scales and for various time intervals. The observations for each 6-hour interval are averaged on the original scale. These 6-hour indices are then adjusted to the 1 to 9 quality-figure scale by a conversion table prepared by comparing the distribution of these indices for at least four months, usually a year, with a master distribution determined from analysis of the reports originally made on the 1 to 9 quality-figure scale. A report whose distribution is the same as the master is thereby converted linearly to the Q-figure scale. The 6-hourly quality figure is the mean of the reports available for that period.

The 6-hourly quality figures are given in this table to the nearest one-third of a unit, e.g. 5o is 5 and 0/3; 5- is 4 and 2/3; 5+ is 5 and 1/3. Other data included are:

(a) Whole-day radio quality indices, which are weighted averages of the four 6-hourly indices, with half weight given to quality grades 5 and 6. This procedure tends to give whole-day indices suitable for comparison with whole-day advance forecasts which seek to designate the days of significant disturbance or unusually quiet conditions.

(b) Short-term forecasts, issued every six hours by the North Atlantic Radio Warning Service. These are issued one hour before 00^h, 06^h, 12^h, 18^h, UT and are applicable to the period 1 to 7 hours ahead.

(c) Advance forecasts (CRPL-J) are issued once a week and are applicable to 1 to 7 days ahead. They are modified as necessary by the Special Disturbance Warning (CRPL-SDW) applicable 1 to 3 days ahead, which may be followed by a supplementary forecast (CRPL-Js) applicable to days remaining until next CRPL-J forecast. The forecast entitled "final" consists of the most recent of the above forms and is scored against the whole-day quality index.

(d) Half-day averages of the geomagnetic K indices measured by the Fredericksburg Magnetic Observatory of the U.S. Coast and Geodetic Survey.

Note: Beginning with data for September 1955, Qa has been determined from reports that are available within a few hours or at most within a few days, including for the first time, the CRPL observations. Therefore these are the indices by which the forecasters assess every day the conditions in the recent past. Over a period of several years, they have closely paralleled the former Qa indices which excluded CRPL observations and included three additional reports received after a considerable lag. Qa was first published to the nearest one-third of a unit at the same time.

North Pacific Radio Path -- The CRPL quality figures, Qp, are compiled by the North Pacific Radio Warning Service (NPRWS), the CRPL forecasting center at Anchorage, Alaska, from radio traffic data for moderately long transmission paths in the North Pacific equivalent to Seattle-to-Anchorage or Anchorage-to-Tokyo. These include reports to CRPL by the U. S. Army and U. S. Air Force. In addition, there are CRPL field-strength and fading-rate measurements of suitable transmissions.

The original reports are on various scales and for various time intervals. The observations for each 12-hour or 24-hour period are averaged on the original scale. This average is compared with reports for the same period in the preceding two months and expressed as a deviation from the 3-month mean. The deviations are put on the 1 to 9 scale of quality which is assumed to have a standard deviation of 1.25 and a mean for the various periods as follows:

07-18 hours UT	5.33	00-24 hours UT	5.67
19-06	6.00		

The 12-hour and 24-hour indices Qp are determined separately. Each index is a weighted mean where the CRPL observations have unit weight and the others are weighted by the correlation coefficient with the CRPL observations.

The table includes the 12-hourly quality figures: whole day quality figures; short-term forecasts issued by NPRWS twice daily at 06^h and 18^h UT, applicable to the stated 12-hour periods; advance forecasts issued weekly by NPRWS (CRPL-Jp report) modified as necessary by Special Disturbance Warning (CRPL-SDW) and supplementary forecasts (CRPL-Jps); and half-day averages of geomagnetic K indices from Sitka.

Note: Beginning with March 15, 1959 the short-term forecast schedule was changed from three times daily to twice daily. The North Pacific quality figures used for evaluation are now 12-hourly rather than 8-hourly.

A chart compares the North Atlantic short-term forecasts with Qa-figures. A second chart compares the outcome of the final North Atlantic and North Pacific advance forecasts with a type of "blind" forecast. For the latter, the frequency for each quality grade, as determined from the distribution of quality grades in the four most recent months of the current season, is partitioned among the grades observed in the current month in proportion to the frequencies observed in the current month.

Ranges of useful frequencies on the North Atlantic radio path are shown in a series of diagrams, one for each day. The shaded area indicates the range of frequencies for which transmissions of quality 5 or greater were observed. The blacker the diagram, the quieter the day has been: a narrow strip indicates either high LUHF, low MUF, or both. These diagrams are based on data reported to CRPL by the German Post Office through the Fermeldetechnischen Zentralamtes, Darmstadt, Germany, being observations every one and a half hours of selected transmitters located in the eastern portion of North America. Since January 6, 1958 the transmitters monitored are restricted to those located north of 39° latitude. The magnetic activity index, A_{Fr}, from Fredericksburg, Va., is also given for each day.

VIII ALERT PERIODS AND SPECIAL WORLD INTERVALS

The table gives the Advance Geophysical Alerts as initiated by the Western Hemisphere Regional Warning Center at Ft. Belvoir, Va., and also the Worldwide Geophysical Alerts and Special World Intervals as designated by the World Warning Agency, Ft. Belvoir, Va.

Advance Alerts are of four types, defined as follows:

1 - Solar Flare Alert -- this warning is issued whenever a solar flare of median importance 1 plus or greater has been reported. There will be only one alert issued per flare and only one a day at most.

2 - Magnetic Storm Alert -- this warning is issued whenever a significant magnetic storm K figure 5 or greater at a middle latitude station has begun.

3 - Cosmic Ray Alert -- this warning is issued whenever a very outstanding change in cosmic ray flux has been observed -- increase or decrease.

4 - Aurora Alert -- this warning is issued whenever a magnetic storm in middle latitudes has reached K figure 7 intensity or whenever selected auroral stations report the presence of outstanding aurora.

Worldwide Alerts are of the same types as the Advance Alerts, except that the Solar Flare Alert and Cosmic Ray Decrease Alert are omitted. Alert announcements include the event and time of event upon which the alert is based, and, in the case of the Advance Alerts, also the station reporting the event.

The World Alerts and Special World Intervals are issued by the World Warning Agency on decisions based on Advance Alerts, advice received from Regional Warning Centers and overall policy.

IX INDEX FOR CRPL-F PART B

On the following pages the index gives the number of the CRPL-F Part B report or reports in which data for any month in question will be found beginning with January 1960. The index for July 1957 through December 1959 data was published with the November 1961 descriptive text and is available upon request.

INDEX FOR 1960-1961 DATA PUBLISHED IN CRPL-F Part B

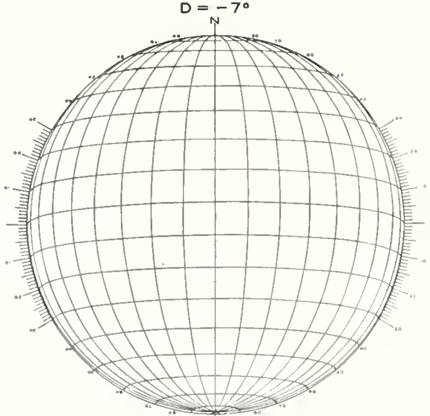
	1960 Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	1961 Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
American Relative Sunspot Numbers R_A'	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210
Zurich Provisional Relative Sunspot Number R_Z	186	187	186	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209
Zurich Final Sunspot Numbers R_Z	199	199	199	199	199	199	199	199	199	199	199	199	211	211	211	211	211	211	211	211	211	211	211	211
Mt. Wilson Magnetic Characteristics of Sunspots																								
2800 Mc-Daily Values of Solar Flux (Ottawa)	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209
Calcium Plage and Sunspot Regions	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209
Coronal Line Emission Indices - Provisional	186	187	188	189	190	191	192	193	195	196	196	197	198	199	200	201	202	203	205	205	207	207	208	209
- Final	189	189	189	193	193	193	196	196	196	199	199	199	204	204	204	205	205	205	208	208	208	212	212	212
Optical Observations Flares	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209
	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	210-	210	211	212
	191	191	194	194	201	195	201	201	201	199	201	201	208	208	208	208	208		208					
	194	194				201				201														
		196																						
Flare Patrol Observations	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209
	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	210	210	211	212
	191	191			202	202	202	202	202	202	202	202	208	208	208	208	208		208					
Subflares	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210
Ionospheric Effects (SWF)	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	207	206	207	208	209	210
(SCNA-SEA-Bursts)	188	189	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210
(SPA)																		204	205	206	207	208	209	210
2800 Mc-Outstanding Occurrences (Ottawa)	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209
																			206		209		209	
2800 Mc-Hours of Observation (Ottawa)	188	188	188	191	191	191	194	194	194	197	197	197	200	200	200	203	203	203	206	206	206	209	209	209
450-1000 Mc - (Owens Valley)											197	197	198	201	202	202	202	203	207	207	207	207		
											198													
25-580, 2100-3900 Mc - (Fort Davis)	197	197	197	198	198	198	199	199	199	200	200	200	203	203	203	204	204	204	208	208	208	209	209	209
169 Mc-Interferometric Observations (Nançay)	186	187	188	189	190	191	192	193	194	195	196	197	198	200	201	201	202	203	204	205	206	207	208	209
108 Mc-Outstanding Occurrences (Boulder)	186	187	188	189	190	191	192	193	194	195*	196	197	198	199	200	201	202	203	204	205	206	207	208	209
7.6-41 Mc-(HAO-Boulder)															207	207	207	207	207	207	207	207	208	209
9.1 cm - (Stanford)				196	197	199	210	211	212	212	212			213	213									
Cosmic Ray Neutron Counts (Climax)									195	196	197	198	199	200	201	202	203	204	205	206	207	208	210	210
Cosmic Ray Neutron Counts (Deep River)	195	195	195	195	195	195	195	195	195	196	197	198	199	200	201	202	203	204	204	206	207	208	209	210
					205														205					
Geomagnetic Indices C, Kp, Ap, - Selected Days	187	188	189	190+	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210
27-Day Charts of Kp Indices for Year	198	198	198	198	198	198	198	198	198	198	198	198	208	208	208	208	208	208	208	208	208	208	208	208
NARWS - CRPL Quality Figures & Forecasts	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210
NARWS - Comparison Graphs	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210
NPRWS - CRPL Quality Figures & Forecasts	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210
NPRWS - Comparison Graphs	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210
NARWS - Graphs of Useful Frequency Ranges	187	188	190	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210
Alert and SWI Decisions	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209

FOOTNOTES: +F190 also includes R, relative sunspot number and C9, magnetic index in 27-day diagram January 1959-April 1959.
*Data up to October 1960 for 167 Mc.
Additional optical observations flares, for June 1959 in F 200.
International Geophysical Calendar for 1962 in F 207

INDEX FOR 1962 DATA PUBLISHED IN CRPL-F Part B

	1962 Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
American Relative Sunspot Numbers R_A'	211	212	213	214	215	216	217	218	219	
Zurich Provisional Relative Sunspot Number R_Z	210	211	212	213	214	215	216	217	218	219
Zurich Final Sunspot Numbers R_Z										
Mt. Wilson Magnetic Characteristics of Sunspots	210	211	212	213	214	215	216	217	218	219
Calcium Plage and Sunspot Regions	210	211	212	213	214	215	216	217	218	219
Coronal Line Emission Indices - Provisional	210	211	212	213	214	215	216	217	218	219
- Final	213	213	213	216	216	216				
Optical Observations Flares	210	211	212	213	214	215	216	217	218	219
	213	214	215	216	217	218	219			
Flare Patrol Observations	210	211	212	213	214	215	216	217	218	219
	213	214	215	216	217	218	219			
Subflares	211	From here on subflares included with flares.								
Ionospheric Effects (SWF)	211	212	213	214	215	216	219	219	219	
(SCNA-SEA-Bursts)	211	212	213	214	215	216	219	219	219	
(SPA)	211	212	213	214	215	216	219	219	219	
2800 Mc-Outstanding Occurrences (Ottawa)	210	211	212	213	214	215	216	217	218	219
2800 Mc-Hours of Observation (Ottawa)	212	212	212	215	215	215	218	218	218	
25-580, 2100-3900 Mc - (Fort Davis)	213	213	213	216	216	216	219	219	219	
169 Mc-Interferometric Observations (Nançay)	210	211	212	213	214	215	216	217	219	219
108 Mc-Outstanding Occurrences (Boulder)	210	211	212	213	214	215	216	217	218	219
108 Mc-Hours of Observation (Boulder)	210	211	212	213	214	215	216	217	218	219
7.6-41 Mc - (HAO-Boulder)	210	211	212	213	214	215	216	217	218	219
9.1 cm (Stanford)				213	214	215	216	217	218	219
Cosmic Ray Neutron Counts (Climax)	211	212	213	214	215	216	217	218	219	
Cosmic Ray Neutron Counts (Deep River)	211	212	213	214	215	216	217	218	219	
Geomagnetic Indices C, Kp, Ap, - Selected Days	211	212	213	214	215	216	217	218	219	
27-Day Charts of Kp Indices for Year										
NARWS - CRPL Quality Figures & Forecasts	211	212	213	214	215	216	217	218	219	
NARWS - Comparison Graphs	211	212	213	214	215	216	217	218	219	
NPRWS - CRPL Quality Figures & Forecasts	211	212	213	214	215	216	217	218	219	
NPRWS - Comparison Graphs	211	212	213	214	215	216	217	218	219	
NARWS - Graphs of Useful Frequency Range	211	212	213	214	215	216	217	218	219	
Alert and SWI Decisions	210	211	212	213	214	215	216	217	218	219

D = −7°



D = +7°

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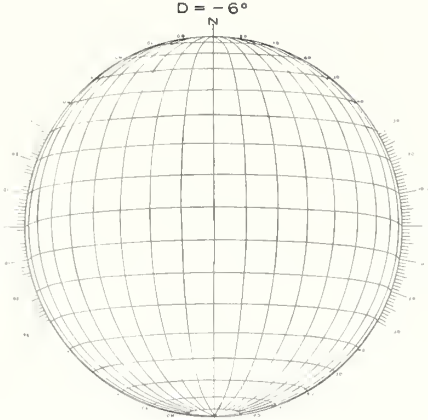

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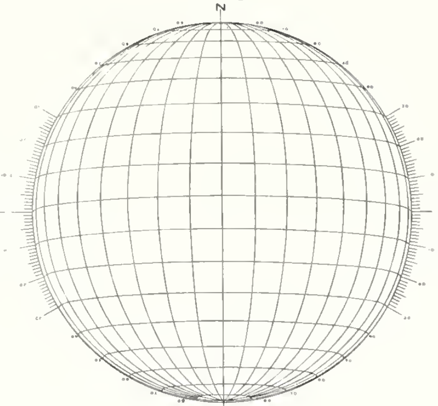

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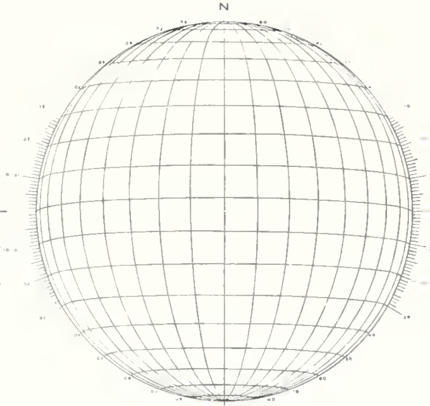

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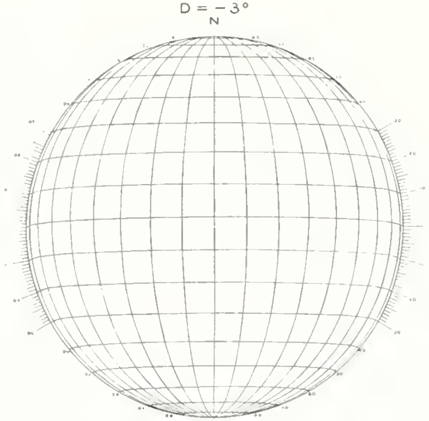

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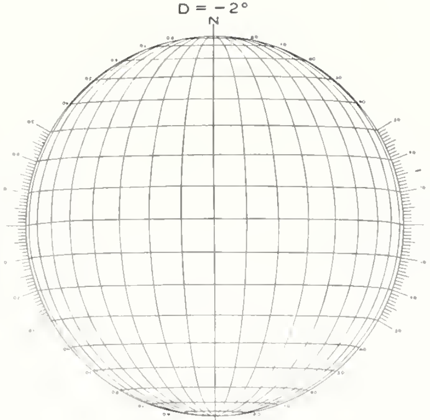

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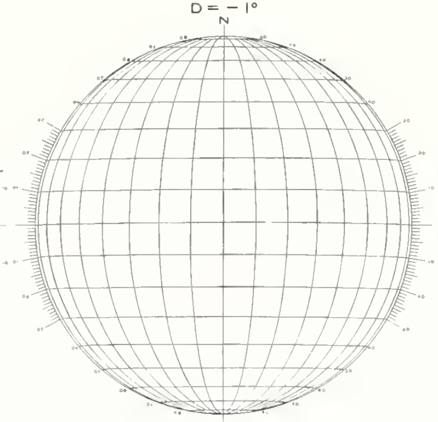
D = −1°



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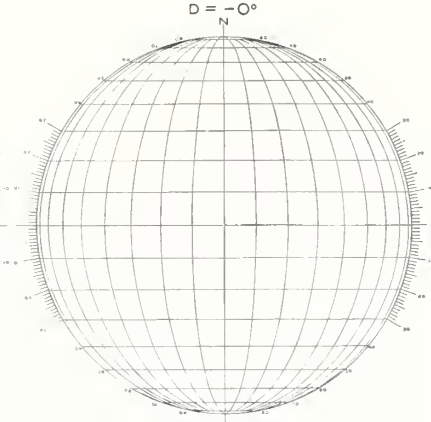

D = +0°