PART B

SOLAR - GEOPHYSICAL DATA

ISSUED
NOVEMBER 1956

U. S. DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS
CENTRAL RADIO PROPAGATION LABORATORY
BOULDER, COLORADO

CRPL-F 147
PART B

NATIONAL BUREAU OF STANDARDS
CENTRAL RADIO PROPAGATION LABORATORY
BOULDER, COLORADO

Issued
30 Nov. 1956

SOLAR - GEOPHYSICAL DATA

CONTENTS

SOLAR - GEOPHYSICAL DATA

INTRODUCTION

This monthly report series is intended to keep research workers abreast of the major particulars of solar activity and the associated ionospheric, radio propagation and other geophysical effects. It is made possible through the cooperation of many observatories, laboratories and agencies as recorded in the detailed description of the tables and graphs which follows. The Editor is Miss J. V. Lincoln.

I RELATIVE SUNSPOT NUMBERS

American and Zürich Daily Numbers -- The table lists (1) the daily American relative sunspot numbers, R_A', as compiled by 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 the Swiss Federal Observatory. Because of the time required to collect and reduce the observations, R_A' will normally 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 degrees). 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.

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

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, $\bar{R}$, 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 $\bar{R}$ of 3.4 was reached.

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 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 with age of plage in number of rotations given in parentheses; the serial number of the center in the previous solar rotation, if it is a persisting region; particulars of the plage at three times during its transit of the visible disk (first appearance, maximum development, last appearance): the date, the area, the central intensity; particulars of the associated sunspot group, if any, at analogous times: the date, the area, the spot count. The unit of area is a millionth of the area of a solar hemisphere with measurements corrected for foreshortening; the central intensity of calcium plages is roughly estimated on a scale of 1=faint to 5=very bright.

Calcium plage data are available through the cooperation of the McMath-Hulbert Observatory of the University of Michigan and the Mt. Wilson Observatory. The sunspot data are compiled from reports from the U. S. Naval Observatory (preliminary data), Mt. Wilson Observatory, and from reports from Europe and Japan received through the daily Ursigram messages.

Coronal Line Emission Indices -- In the table are summarized solar coronal emission intensity indices for the green (Fe XIV at λ5303) and red (Fe X at λ6374) 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 Upper Air Research 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 λ 5303.

R_6 = same for λ6374.

G_1 = highest value of intensity in quadrant, for λ5303.

R_1 = same for λ6374.

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 North East and South East quadrants 7 days before; for the South West and North West quadrants 7 days after the CMP date given.

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:

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

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 quarterly in the "Solar Activity Summary" issued by the High Altitude Observatory at Boulder, Colorado. In the same reports are given maps of the intensity distribution of coronal emission derived from all available Climax and Sacramento Peak observations, as well as other information on solar activity, such as maps made from daily limb prominence surveys in Hα and notes regarding the history of active regions on the solar disk.

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. The same information is included in the subsequent quarterly reports, with extensive additions, corrections and evaluations.

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 Quarterly Bulletin of Solar Activity, I.A.U., 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: Mt. Wilson, McMath-Hulbert, U. S. Naval, Wendelstein, and Sacramento Peak. The remainder report through the URSIgram centers in Europe and Japan. Observations are 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 Upper Air Research Observatory at Sunspot, New Mexico, by Harvard University observers, under contract AF 19(604)-146.

For each flare are listed the reporting observatory, date, times of beginning and ending of observing period (b or a preceding the number denotes true start or end of flare unknown), duration of flare (when known), total area in millionths of visible disk (uncorrected for foreshortening), the McMath serial number of the region with which the flare is associated, the heliographic coordinates in degrees, the time of maximum phase, maximum intensity of flare, fractional area having nearly maximum brightness, and finally the flare importance on the IAU scale of 1- to 3+. 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). Subflares (importance 1-) are listed by date, time of beginning and number of McMath region with which associated.

Ionospheric Effects -- SID (and GID--gradual ionospheric disturbances) may be detected in a number of ways: short wave fadeouts, enhancement of low frequency atmospherics, increases in cosmic absorption, and so forth. The table lists events that 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., and Anchorage, Alaska (CRPL Stations: PR, BE, AN); Huancayo, Peru, and College, Alaska (CRPL-Associated Laboratories: HU, CO); and White Sands, N. Mex., Adak, Alaska, and Okinawa (U. S. Signal Corps Stations: WS, AD, OK). McMath-Hulbert Observatory (MC) also contributes such reports. In addition, reports are volunteered by RCA Communications Inc., Marconi Wireless, Netherlands Postal and Telecommunications Services, Swedish Telecommunications, and others; these usually specify times of SID and the radio paths involved.

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: sudden drop-out and gradual recovery
Slow S-SWF: drop-out taking 5 to 15 minutes and gradual recovery
G-SWF: gradual disturbance; fade irregular in both drop-out and recovery.

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 widespread, ranging from 1 (possible) to 5 (definite). The times given in the table for the event are from the report of a station (underlined in table) 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 and confidence; greater consideration is given to reports on paths near the subsolar point in arriving at the summary importance rating given in the table.
Note: The tables of SID observed at Washington included in CRPL F-reports prior to F-135 were restricted to events classed here as S-SWF.

IV SOLAR RADIO WAVES

The data on solar radio waves are from observations at 167 Mc and 460 Mc made at the Gunbarrel Hill (Boulder) station of the National Bureau of Standards. The half-width of the antenna lobe is appreciably greater than the solar disk. Polarization has not been determined. All times are in Universal Time (UT or GCT); when the observing period extends slightly into the next Greenwich day, the time scale is extended beyond 24 hours.

3-hourly and Daily Flux -- Flux is given in power units. These units are approximately 10^{-22} watt meter^{-2}(c/s)$^{-1}$ for both polarizations together. They will be subject to a correction factor when gain measurements of the antenna have been made. The median flux is measured for every one-hour period that contains a usable calibration and at least thirty minutes of usable record. A three-hour value of flux is obtained by averaging the available one-hour medians (at least two required). A daily value of flux is obtained by averaging all available one-hour medians (at least 4 required). A dash indicates that insufficient measurements were made to meet the above requirements or that the records were not of usable quality. Parentheses indicate that the value is somewhat doubtful because of atmospheric noise or local interference.

The variability index, given for each three-hour interval, is on a scale 0 to 3 defined as follows:

0 - The instantaneous flux did not drop below one-half the median level or exceed twice the median level at any time.

1 - The instantaneous flux made from one to ten excursions outside the range described above.

2 - The instantaneous flux made from ten to one hundred excursions outside the range described above.

3 - The instantaneous flux made more than one hundred excursions outside the range described above.

For the purpose of the variability index, an excursion whose maximum intensity is M times the median level is counted as M excursions. A dash is used to indicate that measurements were made for less than one hour during the period. Parentheses surround variability indices which are in doubt because of atmospheric noise or local interference.

Outstanding Events -- A separate table lists the occurrences that are not adequately described by the three-hourly values of median flux and variability. These are classified in general accordance with the system described and illustrated by Dodson, Hedeman, and Owren (Ap. J. 118, 169, 1953). The categories of events are identified in the table by numbers, which do not necessarily indicate the magnitude of the event:

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 -- Bursts 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.

5 - Noise storm ends -- A noise storm (see 6) which ceases at some time during the observing period.

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.

9 - Major burst and second part -- A double rise in flux, the first part of which is a major burst. The second part may consist of a rise in base level, a group or series of bursts, or the onset of a noise storm.

Starting times and durations are enclosed in parentheses when they are limited by the period of observation. The maximum instantaneous flux (Inst. Flux) is measured from the sky level as are the hourly medians. The maximum smoothed flux (Smd. Flux) is that obtained by taking the difference of the maximum value of a smooth curve drawn through the outstanding occurrence with a smoothing period of 20 percent to 50 percent of the total duration, and the value of the interpolated hourly median at that same time had the event not occurred, both measured from the sky level.

V 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 Disturbance 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 quarterly in the Journal of Geophysical Research along with data on sudden commencements (sc) and solar flare effects (sfe).

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 thirds of a unit, e.g. 5- is 4 2/3, 5o is 5 0/3, and 5+ is 5 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 the Polar Year 1932/33 and for the years 1937 onwards.

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 by solar rotations is furnished through the courtesy of Dr. J. Bartels, Geophysikalisches Institute, Göttingen.

VI 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 usually 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

S - forecast quality one grade different from observed

U - forecast quality two or more grades different from observed when <u>both</u> forecast and observed were $\geqslant 5$, or both $\leqslant 5$

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 Defense Research Board, Canadian Broadcasting Company, 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 transmissions 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, issued twice weekly by the NARWS (CRPL-J reports) and applicable 1 to 3 or 4 days ahead, 4 or 5 to 7 days ahead, and 8 to 25 days ahead. These forecasts are scored against the whole-day quality indices.

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

A chart compares the short-term forecasts with Qa-figures. A second chart compares the outcome of advance forecasts (1 to 3 or 4 days ahead) 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. Time is the angular coordinate and radio frequency in Mc is the radius vector. 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 Fernmeldetechnischen Zentralamtes, Darmstadt, Germany, being observations every one and a half hours of selected transmitters located in the eastern portion of North America.

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 included 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 Alaskan Communications Service, Aeronautical Radio, Inc., U. S. Air Force and Civil Aeronautical Administration. In addition, there are CRPL monitoring, direction-finder observations and field strength measurements of suitable transmissions.

The original reports are on various scales and for various time intervals. The observations for each 9 hours 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:

03-12 hours UT	5.33
09-18	5.33
18-03	6.00
00-24	5.67

The 9-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.

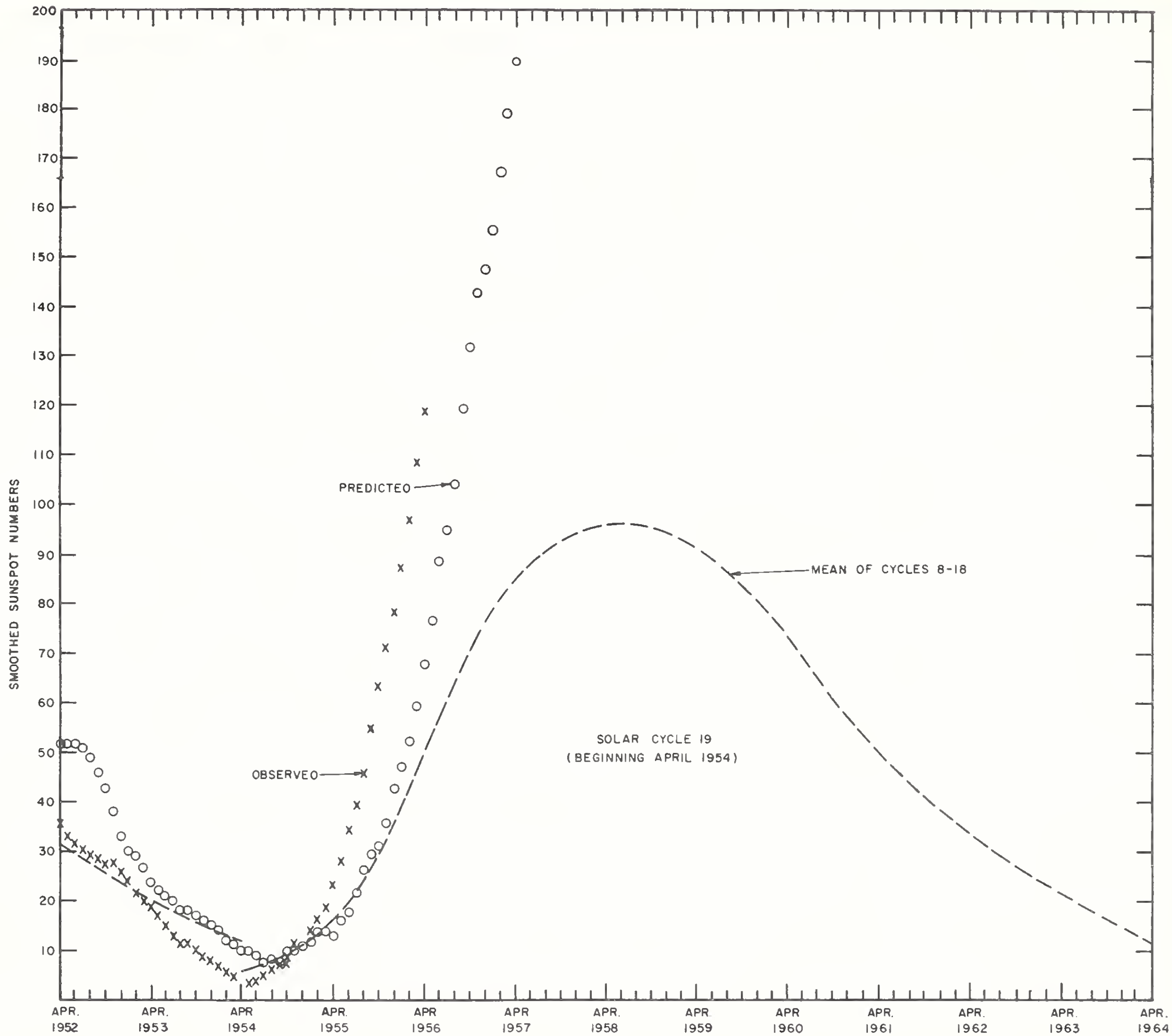
The table, analagous to that for Qa, includes the 9-hourly quality figures; whole day quality figures; short term forecasts issued by NPRWS three times daily at 02^h, 09^h, and 18^h UT, applicable to the stated 9-hour periods; advance forecasts issued twice weekly by NPRWS (CRPL-Jp report); and half-day averages of geomagnetic K indices from Sitka.

The chart compares the outcome of advance forecasts, on the same basis as the similar chart for the North Atlantic Radio Path.

RELATIVE SUNSPOT NUMBERS

American Relative Sunspot Numbers September 1956	
Date	R_A'
1	147
2	157
3	133
4	121
5	116
6	137
7	141
8	128
9	113
10	123
11	160
12	205
13	222
14	249
15	245
16	230
17	222
18	210
19	209
20	215
21	175
22	129
23	128
24	132
25	130
26	150
27	110
28	110
29	117
30	121
Mean	159.5

Zürich Provisional Relative Sunspot Numbers October 1956	
Date	R_Z
1	170
2	183
3	192
4	195
5	192
6	160
7	160
8	189
9	198
10	189
11	166
12	175
13	170
14	121
15	108
16	104
17	90
18	106
19	126
20	145
21	150
22	155
23	126
24	167
25	173
26	160
27	154
28	162
29	187
30	216
31	195
Mean	160.8



PREDICTED AND OBSERVED SUNSPOT NUMBERS

CALCIUM PLAGE AND SUNSPOT REGIONS

OCTOBER 1956

CMP Oct. 1956	Lat.	McMath Plage Number	Return of Region	Calcium Plage Data Date-Area-Intensity First seen	Maximum	Last seen	Sunspot Data Date-Area-Count First seen	Maximum	Last seen
01.0	S26	3689	New	25-1500-4	27- 2000-4	29-1000-3	26- 20 -1	---	27- XX -1
01.6	N22	3688	New	24-1000-2	28- 5000-4	08-2000-2	24- XX -1	26- 530 -4	06- 10 -XX
01.8	N34	3687 (2)	3646	24-1000-2	26- 3000-2.5	06-1500-2	24- XX -1	25- 100 -1	01- 10 -1
03.2	N32	3690	New	27-2000-2.5	28- 4000-3.5	10-2000-2	27- XX -1	29- 90a-XX	06- 10 -XX
05.4	S28	3692	New	28- 800-2.5	09- 2500-2	10-2000-2	01- 20 -1	03- 100 -4	05- 50 -1
07.0*	S18	3695 (2)	3654	01-4000-3	02- 5500-3.5	12-5000-3	03-190 -2	10- 170 -6	---
07.1	N22	3694	New	01-4000-3.5	11- 9000-4	13-8000-3.5	01-180 -6	11-1550 -15	13- XX -7
08.1*	S23	3696 (7)	3656,8	02-2000-2.5	11- 4600-3	13-5000-2.5	---	---	13-340 -3
08.4	S24	3699	New	04- 800-2.5	13- 3000-4	15-1000-2.5	05- 40 -2	13- 460 -11	14- XX ->10
08.7	S14	3697	New	02-1000-3	13- 3000-3.5	14-3000-2.5	03-240 -1	12- 440 -2	14- XX -2
09.1	N28	3707	New	10- 500-1.5	14- 1200-3	15-1000-2.5	11- 50 -3	12- 120 -2	14- XX -2
09.7	S24	3698 (7)	3656,8	03-2000-2.5	14- 6000-4	15-3000-2.5	03-290 -1	14- 680 -2	15- XX -6
11.0	N27	3701 (4)	3660	04-1000-3	06- 2500-4	16-2500-2.5	05-120 -1	08- 170 -4	15- XX -4
13.0	S22	3703 (3)	3666	06-4000-2	16- 4000-3	19-1000-2.5	16- 60 -1	17- 100 -3	18- 10 -XX
13.2	N23	3702 (4)	3665	06-3000-3	08- 4000-3	19-3000-2.5	06- 10 -XX	09- 530 -2	19- XX -1
14.6	S19	3704 (3)	3666	08-3000-2.5	16- 4500-3.5	20-4200-3	08-190 -1	16- 620 -20	20-150a-X
16.6	S15	3706 (2)	3670	10-1500-2	13- 2000-2.5	17-1000-2	13- 40 -3	14- 100 -2	16- XX -3
16.8	N27	3709	New	11-1000-2	22- 3000-3	23-1500-3	16- XX -4	19- 170 -5	23-150a-XX
17.6	S20	3711 (5)	3674	12-1000-2	16- 2000-2	19-1500-2	13-140 -4	13- 140 -4	18- 10 -1
18.5	S11	3721	New	18- 300-3	23- 4000-3	24-2000-2.5	18-100 -4	19- 460 -13	24- 50a-X
19.2	N35	3710 (2)	3676	15-1200-2	16- 1600-2.5	25-2000-3	23- 50 -3	24- 150a-XX	24-150a-XX
19.7	N27	3712 (2)	3677	13-1500-3	25- 2500-3	26-1000-3	24- 50a-XX	25- 190 -1	25-190 -1
21.5	N37	3715	New	17-2000-2.5	18- 2200-2	24-2000-2			
21.7	N26	3716 (3)	3678	15-1000-2	17- 2000-3	27- 600-1.5	15- XX -3	16- 100 -3	22-150a-X
23.9	S46	3720	New	18-2000-3	23- 4000-3	29-3000-2.5	18- 10 -XX	23- 100 -10	28- XX -5
24.4	N17	3719	New	17-1000-2.5	20-12000-2.5	31-1500-3	17- 10 -XX	19- 510 -8	27- XX -5
25.3	S18	3724 (2)	3684	19-2000-2.5	24- 3000-2.5	31-1000-2	20- 50a-XX	25- 110 -4	28- XX -4
26.0	N32	3726	New	19-1000-2	21- 1400-2.5	27- 800-1.5	20- 50a-XX	---	22- 50a-XX
26.4	N22	3740	New	28- 500-2.5	30- 800-2	01-1000-2	29- XX -4	31- 100 -1	31-100 -1
26.7	N09	3727	New	21-1200-2.5	21- 1200-2.5	27- 400-1.5			
26.8	N43	3725	New	19-1000-2	22- 4500-2.5	02-2000-2	20- XX -3	---	21- XX -1
27.3	S32	3728 (3)	3686,9	21-1000-2	27- 2800-2.5	01-1500-2	21-150a-XX	23- 340 -2	31-150 -2
28.6	S25	3729 (3)	3686,9	21-1000-2	31- 7000-4	02-6500-4	23-360 -5	25- 560 -16	03- XX ->10
29.0	N16	3730 (2)	3688	22-3000-3	26- 8000-3	03-5700-1	22-150a-XX	23- 290 -4	03- XX -2
29.6	S17	3731	New	23-2000-3	25- 2000-3.5	04-2000-1	23-530 -2	25- 820 -3	03- XX ->10

*Spot group fluctuated between these two plages.

*Spot group fluctuated between these two plages.

CORONAL LINE EMISSION INDICES

OCTOBER 1956

CMP Date 1956	North East Quadrant (observed 7 days earlier)				South East Quadrant (observed 7 days earlier)				South West Quadrant (observed 7 days later)				North West Quadrant (observed 7 days later)			
	G_6	G_1	R_6	R_1	G_6	G_1	R_6	R_1	G_6	G_1	R_6	R_1	G_6	G_1	R_6	R_1
Oct																
1	117	152	32	43	65	104	23	32	58	68	29	36	98	116	39	80
2	97	162	32	65	40	60	20	22	71[a]	90[a]	26[a]	37[a]	143[a]	180[a]	55[a]	80[a]
3	96	144	24	41	47	56	27	35	40	56	20	39	88	162	48	88
4	X	X	X	X	X	X	X	X	67	96	X	X	126	200	X	X
5	78	100	X	X	98	200	X	X	X	X	X	X	X	X	X	X
6	114	160	20	32	105	150	58	128	93	139	73	111	95*	161	49	90
7	115	190	X	X	111	223	X	X	170*	300	80	147	122*	176	38	100
8	117	164	28	46	119	232	59	110	134	192	75	105	172	268	63	126
9	85	142	24	30	132	194	44	95	99	116	43	81	126	240	43	74
10	78	110	25	33	98	144	31	66	103[a]	150[a]	34	54	106[a]	189[a]	39	62
11	140	235	X	X	115[a]	134[a]	X	X	122	177	21	31	108	191	29	52
12	133	200	X	X	108	146	X	X	177	256	29	46	130	194	26	46
13	130	180	40	70	128	162	37	78	113	143	28	69	77	98	28	54
14	107	128	X	X	150	198	X	X	119*	176	33	48	102	124	31	50
15	97	117	40	58	131	218	37	88	141	205	32	48	99	127	19	24
16	85	106	46	61	98	153	49	67	117	158	41	68	106*	164	30	44
17	54	78	44	70	80	132	35	62	X	X	X	X	X	X	X	X
18	114	131	37	66	X	X	27	40	86	102	24	61	80	120	30	40
19	X	X	X	X	X	X	X	X	62	75	22	36	105	172	27	45
20	130	191	48	87	59	77	17	24	X	X	22	27	X	X	48	84
21	100	134	46	102	65	84	X	X	82	97	14	24	102	151	38	60
22	121	196	69	93	X	X	24	30	X	X	X	X	X	X	X	X
23	61	70	66	102	61	91	42	57	91	172	34	62	126	280	84	228
24	96[a]	136[a]	48[a]	85[a]	85[a]	132[a]	X	X	134	191	40	60	137	259	41	96
25	158	175	59	74	114	150	48	105	X	X	X	X	X	X	X	X
26	153	185	44	52	142	215	35	52	122	136	60	100	91	116	29	50
27	98	112	50	75	86	106	40	66	X	X	X	X	X	X	X	X
28	83*	107	37	54	110*	188	43	84	114	140	57	71	106	150	41	69
29	139	162	50	76	149	182	48	59	136	184	45	69	96	124	27	40
30	X	X	X	X	59	88	X	X	126	195	48	61	87	100	28	29
31	X	X	X	X	X	X	X	X	143	209	40	48	75	91	27	35

a = index computed from low weight data.

* = yellow line observed.

SOLAR FLARES

OCTOBER 1956

Observatory	Date Oct. 1956	Time Observed Start UT	End UT	Duration Min.	Total Area Mill.	McMath Plage Region Number	Approx. Position Lat.	Mer. Dist.	Time Max. Phase UT	Max. Int. Arb.	Rel. Area of Max. Tenths	Importance	Provis. Ionospheric Effect
Capri-S.	01	0748	0811	23	102	3688	N24	E04				1	
Capri-S	01	1240	1412	92	316	3694	N20	E71				1+	
Capri-S	01	1309	1340	31	156	3684	S12	W40				1	
S.Peak	01	1800	1810	10	135	3686	S28	W29	1801	25	5	1	S-SWF
Capri-S	02	1149	1230	41	156	3695	S21	E58				1	S-SWF
Capri-S	02	1217	1238	21	194	3691	N47	W65				1	
Capri-S	03	1156	1224	28	141	3695	S21	E48				1	Slow S-SWF
McMath	03	b1434	1510	>36		3694	N20	E40				1	
S.Peak	03	1800	1950	110	285	3688	N27	W26	1850	15	1	1	
Neder.	04	b0824				3694	N20	E31				2	Slow S-SWF
S.Peak	04	b1512	1550	>38	225	3694	N22	E31	1516	27	7	1+	
Capri-S	04	1510	1547	37	224	3694	N28 N22 N21	E34 E29 E25				1+	S-SWF
McMath	04	b1513	1605	>52		3694	N20	E28				2+	
McMath	04	b1724				3694	N20	E30				1*	Slow S-SWF
McMath	04	1950	2020	30		3694	N20	E25				1*	Slow S-SWF
McMath	05	b1344	1410	>26		3694	N20	E18				1	Slow S-SWF
Capri-S	06	0733	0749	16	102	3694	N18	E08				1	S-SWF
Capri-S	06	0906	1000	54	117	3697	S12	E31				1	S-SWF
Capri-S	07	1145	1224	39	107	3702	N20	E69				1	
S.Peak	07	1905	1936	31	155	3694	N17	W14	1910	23	5	1	Slow S-SWF
S.Peak	07	1945	2025	40	115	3701	N27	E34	2000	18	3	1	
S.Peak	07	2055	2125	30	105	3695	S23	W16	2103	15	7	1	
S.Peak	08	1425	1439	14	150	3694	N18	W21	1430	25	5	1	Slow S-SWF
McMath	08	1427	1440	13		3694	N18	W22				1+	
McMath	09	1814	1855	41		3694	N20	W40				1	G-SWF
S.Peak	10	1655	1725	30	224	3704	S18	E45	1705	20	2	1+	G-SWF
McMath	10	b1710	1725	>15		3704	S23	E50				1	
Capri-S	11	1013	1113	60	267	3694	N21 N21	W58 W63				2	S-SWF
Capri-S	11	1332	1334	2	194	3694	N21	W60				1	G-SWF
Wendel.	11	1331	1346	15		3694	N24	W55	1334			1	
McMath	11	b1337				3694	N20	W60				1	
Neder.	11	1317	1347	30		3694	N21	W57				1	
Capri-S	11	1410	1517	67	267	3694	N21	W60				2	S-SWF
Wendel.	11	1411	1452	41		3694	N24	W56	1413			2+	
McMath	11	1412	1515	73		3694	N20	W60				2	
Neder.	11	b1419		>50		3694	N22	W62				2	
S.Peak	11	~1410	1530	~80	150	3694	N24	W61	~1415	20	6	1	

*S.Peak lists as importance 1-

SOLAR FLARES

OCTOBER 1956

Observatory	Date Oct. 1956	Time Observed Start UT	Time Observed End UT	Duration Min.	Total Area Mill.	McMath Plage Region Number	Approx. Position Lat.	Approx. Position Mer. Dist.	Time Max. Phase UT	Max. Int. Arb.	Rel. Area of Max. Tenths	Importance	Provis. Ionospheric Effect
Capri-S	13	1119	1143	24		3694	N19	W90				1+	S-SWF
McMath	13	b1426	1435	> 9		3694	N20	W90				1	Slow S-SWF
Capri-S	13	1424	1437	13		3694	N19	W90				1	
Tokyo	15	2322		~20		3704	S25	W15				1	
Tokyo	16	0420		~10		3704	S15	W35				1	
McMath	16	b1355	1420	>25		3704	S20	W27				1	
Capri-S	16	1425	1513	48	102	3704	S23	W19				1	
McMath	16	1424	1450	26		3704	S20	W27				1	
S.Peak	16	1420	1500	40	130	3704	S25	W21	1433	15	8	1	
Capri-S	20	0911	0930	19	146	3720	S47	E44				1	
Capri-S	20	1018	1105	47	296	3719	N16	E49				2	
Capri-S	20	1045	1105	20	151	3704	S24	W68				1	
Capri-S	21	0744	0831	47	292	3720	S45	E32				1	
Kanzel.	21	1122	1147	25		3704	S25	W75				1	
Capri-S	21	1323			117	3719	N16	E39				1	
							N15	E24					
							N18	E24					
Capri-S	22	0703	0901	118	248	3719	N18	E21				2	G-SWF
							N18	E18					
Kanzel.	22	b0717		>55		3719	N15	E25				1	
Meudon	22	b1206		>15		3729	S25	E75				1	
Capri-S	22	1354	1447	53	258	3720	S46	E17				2	S-SWF
Capri-S	23	0749	0832	43	296	3730	N18	E72				2	S-SWF
Schaus.	23	b0755		>12		3729	S23	E68				1	
Capri-S	23	1015	1049	34	141	3725	N36	E41				1	
Neder.	24	1339				3731	S17	E66				1	
Capri-S	25	0947	1008	21	233	3712	N32	W77				1+	S-SWF
Nedér.	25	b0945		>45		3712	N28	W72				1	
S.Peak	26	2200	2219	19	165	3729	S27	E35	2206	20	2	1+	
S.Peak	27	1755	1815	20	125	3729	S27	E25	1800	22	9	1	
S.Peak	27	2055	2115	20	145	3736	N25	E90	2100	16	8	1	
Capri-S	29	1317	1329	12	102	3730	N15	W08				1	
Capri-S	29	1408	1447	39	253	3736	N20	E61				2	S-SWF
McMath	29	1420	1435	15		3736	N20	E60				1+	
McMath	29	b1505				3719	N18	W65				1?	
S.Peak	30	1650	1729	39	135	3731	S17	W15	1659	15	4	1	
Capri-S	31	1348	1415	27	126	3729	S27	W31				1	
Capri-S	31	1354	1415	21	190	3736	N19	E35				1+	Slow S-SWF

SOLAR FLARES

OCTOBER 1956

Subflares noted as follows (Date, time (UT), region):

October 1,	b1553	(3684)
	b1816	(3691)+
	1850	(3688)
	1945	(3688)
2,	b1529	(3686)+
	2035	(3694)
	2055	(3695)
	2100	(3691)
	2200	(3695)
3,	b1355	(3694)
	1520	(3694)+
	1647	(3695)
	1800	(3694)
	1921	(3694)+
	2135	(3694)
4,	b1440	(3694)+
	1545	(3694)
	1720	(3694)+
	1900	(3694)
	2220	(3694)
5,	1410	(3686)
	1445	(3694)
	1510	(3694)+
	1624	(3694)+
	1800	(3694)+
	1915	(3694)+
	2015	(3694)+
	2115	(3694)
6,	1405	(3694)+
October 6,	b1625	(3694)
	1705	(3694)
	1720	(3694)
	b1958	(3694)
	b2217	(3701)
	b2217	(3694)
	2230	(3701)
7,	1505	(3694)
	1544	(3701)
	1553	(3695)
	1615	(3694)
	1710	(3701)
	1715	(3694)
	1755	(3702)
	1805	(3701)
	1916	(3692)
	1922	(3702)
	2101	(3694)
8,	1436	(3695)
	1700	(3702)
	1705	(3694)
9,	1355	(3702)+
	1900	(3697)
	2105	(3695)
	2215	(3697)
10,	1420	(3702)
	1520	(3695)
	1735	(3694)
	1945	(3694)+

SOLAR FLARES

OCTOBER 1956

Subflares noted as follows (Date, time (UT), region):

October 11,	1440 (3695)	October 22,	1625 (3729)
	1545 (3704)		1810 (3721)
	1730 (3704)		1815 (3730)
	1805 (3704)		b1827 (3731)+
13,	1420 (3694)	23,	1850 (3710)
	1540 (3695)		2000 (3710)
	b1615 (3704)+		2105 (3710)
	1755 (3695)	25,	1450 (3729)+
	2055 (3694)		1700 (3729)
	2120 (3694)		1820 (3720)
14,	1955 (3697)	26,	1935 (3731)
	b2018 (3704)		1940 (3729)
	2035 (3697)		1835 (3730)
	2120 (3697)	27,	1505 (3730)
15,	1420 (3698)		1610 (3730)
	1605 (3704)+		1800 (3736)
	1900 (3704)		1835 (3739)
16,	b1400 (3704)		2120 (3730)
	1420 (3704)	28,	1325 (3735)
	2030 (3703)		1720 (3729)
19,	1720 (3720)+	30,	1440 (3729)
	2039 (3719)		1506 (3729)
20,	1455 (3720)		2040 (3729)
	1524 (3704)		2145 (3731)
	2220 (3719)	31,	1530 (3730)
21,	1505 (3704)		1540 (3719)
	1555 (3720)		1630 (3739)
	1608 (3721)		1728 (3736)
22,	1505 (3721)		

+ McMath or McMath and Sac. Peak.

IONOSPHERIC EFFECTS OF SOLAR FLARES

SEPTEMBER 1956

Sept. 1956	Start UT	End UT	Type	Wide-spread Index	Impor-tance	Observation Stations
1	1330	1520	G-SWF	2	1-	MC, PR
2	2000	2025	S-SWF	4	2	HU, MC, PR, WS
4	0120	0156	S-SWF	1	1+	OK
	1302	1318	Slow S-SWF	5	1	HU, MC, PR, NE*
	1622	1650	S-SWF	5	1	BE, HU, MC, WS
	2022	2036	S-SWF	5	2+	AN, BE, HU, MC, PR, WS, RCA+
	2039	2055	Slow S-SWF	5	1	BE, HU, MC, PR, WS
5	0225	0258	Slow S-SWF	1	1	OK
	1154	1220	S-SWF	5	1	HU, PR, NE*, RCA**
	1322	1407	Slow S-SWF	5	3-	BE, HU, MC, PR, NE*
	1640	1820	Slow S-SWF	5	3	BE, HU, MC, PR, WS, NE*
	1918	1940	G-SWF	4	1	BE, HU, MC, PR
	2102	2122	Slow S-SWF	5	1	AN, BE, HU, MC, PR, WS
	2322	2400	S-SWF	5	2-	AN, HU, OK, WS
6	1402	--	Slow S-SWF	5	3-	BE, HU, MC, PR, NE*
	1440	1510	S-SWF			WS, TO++, RCA*****, NE*
	1529	1554	Slow S-SWF	2	1-	MC, PR
	1835	1925	G-SWF	3	1	HU, MC, PR
	2023	2045	Slow S-SWF	5	1+	BE, HU, MC, PR, WS
	2055	2135	G-SWF	3	1-	BE, HU, MC
	2204	2240	Slow S-SWF	4	1-	AN, BE, HU, WS, RCA+
7	1230	1250	S-SWF	3	1	BE, MC, NE*
	1252	1348	S-SWF	5	1+	BE, HU, MC, PR, NE*
	1838	1900	S-SWF	5	2	BE, HU, MC, PR, WS, NE*, RCA+, CW, RCA***
8	0914	0946	Slow S-SWF	1	1	NE*
	1458	1520	Slow S-SWF	5	1	BE, HU, MC, PR
	1710	1800	S-SWF	5	2+	BE, HU, MC, PR, WS
	2141	2232	Slow S-SWF	5	2	AN, BE, CO, HU, MC, PR, WS, RCA+
9	0746	0834	S-SWF	3	3-	NE*, CW, RCA***
	1347	1420	S-SWF	5	2	BE, HU, PR, WS, NE*, RCA****
	1511	1525	S-SWF	4	1	BE, HU, PR, NE*
	1857	1952	S-SWF	5	2	BE, HU, PR, WS, NE*, RCA+
	2048	2222	G-SWF	2	1	BE, WS
10	0250	0356	S-SWF	1	2	OK
	1533	1600	Slow S-SWF	4	1	BE, HU, MC, PR
	1721	1755	Slow S-SWF	4	2-	BE, HU, MC, PR, WS
11	0300	0420	S-SWF	1	2-	OK
	0641	0712	S-SWF	1	1-	OK
	1956	2008	Slow S-SWF	3	1-	HU, MC, PR
12	0049	0152	S-SWF	4	1+	OK, WS, TO++
	0200	0300	G-SWF	1	1+	OK

IONOSPHERIC EFFECTS OF SOLAR FLARES

SEPTEMBER 1956

Sept. 1956	Start UT	End UT	Type	Wide-spread Index	Impor-tance	Observation Stations
	0615	0714	S-SWF	1	1	OK
	1352	1420	G-SWF	3	1	HU, MC, PR
	1905	1940	Slow S-SWF	5	2	BE, HU, MC, PR
	1945	2020	G-SWF	2	1-	HU, MC
	2240	0011	Slow S-SWF	5	2+	AN, BE,CO,HU,MC,OK,PR,WS,TO++,RCA+
13	0216	0312	G-SWF	1	1+	OK
	0315	0356	Slow S-SWF	1	1+	OK
	0404	0435	S-SWF	4	1+	OK, TO++, CW
	1350	1405	S-SWF	4	1	HU, PR, NE*
	1425	1450	G-SWF	2	1	HU, MC
	1514	1550	S-SWF	5	2	AN, BE, HU, MC, PR, NE*
	1740	1805	S-SWF	5	3-	BE, HU, MC, PR, WS
	2018	2042	S-SWF	5	1-	AN, BE, PR, WS
14	0120	0228	Slow S-SWF	5	2+	OK, TO++, RCA+, CW
	0315	0340	G-SWF	1	1	OK
	0930	1000	S-SWF	3	2-	NE*, RCA***
	1422	1452	Slow S-SWF	4	1	HU, MC, PR, NE*
	1810	1825	G-SWF	5	1-	BE, HU, MC, PR, WS
15	1410	1450	G-SWF	5	1-	BE, HU, MC, PR, DA**
	1505	1540	G-SWF	2	1-	MC, PR
16	1051	1107	S-SWF	1	1	NE*
	1112	1127	Slow S-SWF	3	1	HU, PR
	1755	1807	Slow S-SWF	2	1-	HU, MC
17	1941	2102	Slow S-SWF	5	3-	AN,BE,HU,MC,PR,WS,RCA+
18	1215	1300	Slow S-SWF	5	1+	HU,MC,PR,NE*,RCA***
20	1940	2000	S-SWF	5	1-	BE, HU, MC, PR, WS
22	2332	2358	S-SWF	1	1-	OK
23	0128	0150	Slow S-SWF	1	1-	OK
24	1400	1518	G-SWF	5	2-	BE, HU, MC, PR, DA**
27	0448	0517	S-SWF	3	1	AN, OK
28	2110	2142	Slow S-SWF	5	1+	BE, HU, MC, PR, WS, TO++
29	1400	1425	S-SWF	3	1-	HU, MC, PR

NE* Nederhorst den Berg, Netherlands.
DA** Darmstadt, Germany.
RCA* RCA Communications Inc., Riverhead, N. Y.
RCA** RCA Communications Inc., Brentwood, N. J.
RCA*** RCA Communications Inc., Somerton, England.
RCA+ RCA Communications Inc., Pt. Reyes, California.
TO++ Hiraiso Radio Wave Observatory, Japan.
CW Cable & Wireless

SOLAR RADIO WAVES (BOULDER) -- 167 MC

3-HOURLY AND DAILY FLUX

OCTOBER 1956

	Flux					Variability					Observed Periods
	Hours UT					Hours UT					
Oct. 1956	12 15	15 18	18 21	21 24	Daily	12 15	15 18	18 21	21 24	Daily	Hours UT
1	--	14	15	14	14	--	1	1	1	1	1445-2426
2	--	18	19	20	19	--	1	2	2	2	1422-2330
3	--	--	--	--	--	--	--	--	--	--	---------
4	--	13	14	15	14	--	(1)	(1)	(1)	(1)	1414-2420
5	--	14	--	--	14	2	(1)	--	--	2	1300-1715;2329-2419
6	70	30	23	--	36	3	3	2	2	3	1301-2211
7	--	63	56	52	60	2	2	2	2	2	1302-2416
8	--	60	74	80	68	3	3	3	3	3	1303-2414
9	--	53	45	--	59	3	3	3	(2)	3	1304-2413
10	--	15	17	18	17	(1)	2	2	(1)	2	1305-2411
11	--	12	12	17	14	(0)	1	1	2	2	1306-2410
12	--	17	39	20	23	2	2	3	2	3	1307-2409
13	--	14	13	12	13	(1)	2	(1)	(1)	2	1308-2408
14	--	13	12	12	12	0	2	2	2	2	1309-2407
15	--	11	12	11	12	0	1	1	1	1	1310-2406
16	--	12	11	--	12	1	1	1	--	1	1311-2404
17	--	11	12	12	12	0	(0)	(0)	1	1	1312-2403
18	--	11	11	11	11	0	1	(0)	2	2	1314-2402
19	--	12	12	11	12	0	2	2	1	2	1315-2401
20	--	10	11	10	10	0	0	(0)	2	2	1316-2359
21	--	13	14	22	15	2	(2)	2	2	2	1317-2358
22	--	11	--	--	--	(1)	(2)	1	--	(2)	1318-1930
23	--	--	--	--	--	--	--	--	--	--	---------
24	--	10	--	--	--	(1)	2	--	(1)	2	1400-1820;2204-2354
25	--	--	--	--	--	--	--	--	--	--	---------
26	--	15	13	--	16	--	2	3	(1)	3	1434-2352
27	--	12	12	11	12	2	(1)	1	1	2	1323-2350
28	--	11	11	12	12	0	(0)	2	2	2	1325-2349
29	--	11	9	9	10	2	1	0	(0)	2	1326-2348
30	--	10	11	12	11	0	(0)	1	1	1	1327-2347
31	--	13	10	--	11	1	2	(0)	(0)	2	1328-2345

SOLAR RADIO WAVES (BOULDER) -- 460 MC

3-HOURLY AND DAILY FLUX

OCTOBER 1956

Oct. 1956	Flux Hours UT 12-15	15-18	18-21	21-24	Flux Daily	Variability Hours UT 12-15	15-18	18-21	21-24	Variability Daily	Observed Periods Hours UT
1	--	67	67	72	68	--	(0)	0	(0)	(0)	1445-2426
2	--	78	76	75	76	--	2	0	(1)	2	1423-2424
3	--	70	70	69	70	--	(0)	0	(0)	(0)	1415-2423
4	67	71	73	72	71	(0)	(0)	0	(0)	(0)	1259-2420
5	72	72	71	73	72	(0)	(0)	0	(0)	(0)	1300-2419
6	70	72	74	--	72	(0)	(0)	0	--	(0)	1301-2103; 2202-2340
7	77	79	75	72	75	0	0	1	0	1	1302-2416
8	73	86	88	85	84	(0)	(1)	(0)	(0)	(1)	1303-2414
9	97	87	83	--	88	(0)	(0)	(0)	(0)	(0)	1304-2116; 2238-2143
10	73	74	76	73	74	(0)	(0)	(0)	(0)	(0)	1305-2411
11	73	73	75	--	74	(1)	(0)	(0)	(0)	(1)	1306-2410
12											
13											
14											
15											
16	Receiver inoperative after October 11, 1956[1]										
17											
18											
19											
20											
21											
22											
23											
24											
25											
26											
27											
28											
29											
30											
31											

1. Receiver operation temporarily suspended after October 11, 1956 to facilitate shifting to a frequency having less interference.

SOLAR RADIO WAVES (BOULDER) -- 167 MC

OUTSTANDING EVENTS

OCTOBER 1956

Oct. 1956	Type	Start UT	Duration Hrs:Mins	Time UT	Maximum Inst. Flux	Smd. Flux	Remarks
1	4	1605	(08:21)	1607.3	160	2	
2	6	(1422)	(09:08	2315.6	360	7	
4	1	(1414)	(10:06)	2050.2	160	--	
5	4	1312	(04:03)	1312.2	~1300	--	
6	6	(1301)	(09:10)	1350.9	3700	43	
6	3	2124.0	00:00.9	2124.3	2900	--	
7	6	(1302)	(11:14)	~1500	260	60	
8	6	(1303)	(03:59)	1340.0	790	15	
8	9	1702.7	(07:11)	1704.7	790	70	
9	6	(1304)	(11:09)	~1400	--	63	
9	3	2021.8	00:02.6	2022.2	4200	520	Note 2
10	6	(1305)	(11:06)	~1900	350	5	
11	6	2100	(03:10)	2136.8	140	6	
12	6	(1307)	(11:02)	1956.9	720	19	
13	1	(1308)	(11:00)	1618.1	250	--	
14	4	1756.1	04:02	1757.0	1500	--	
16	1	(1311)	(08:19)	1718.6	110	--	
18	1	2306	00:49	2322	220	--	
19	1	1535.3	05:50	2033.9	230	--	
19	3	2028.4	(00:01.5)	2029	4200	--	
20	2	2218.4	00:17.0	2222.9	91	18	
21	6	(1316)	(10:43)	~2300	--	9	
21	3	1637.5	00:01	1638.2	670	45	
22	1	(1318)	(06:12)	1822.6	240	--	
26	6	(1434)	(10:56)	1501	410	19	
26	1	1633.1	05:17	1633.4	2200	--	
26	3	1838.2	00:02.0	1839	>5600	1800	
27	2	1328.7	00:12.5	1329	~570	--	
28	1	2045.1	03:01	2045.8	660	--	
29	2	2149.9	00:01.5	2151.0	170	--	
31	1	1328	04:47	1726	580	--	

1. Interference may sometimes obscure or be mistaken for solar events. Relatively small events not reported.

2. Additional large bursts at 1947.1 and 2001.1.

SOLAR RADIO WAVES (BOULDER) -- 460 MC

OUTSTANDING EVENTS

OCTOBER 1956

Oct. 1956	Type	Start UT	Duration Hrs:Mins	Time UT	Maximum Inst. Flux	Smd. Flux	Remarks
1	1	(1445)	(09:41)	1748.3	110	--	
2	6	(1423)	(10:01)	~1700	--	16	
2	3	1738.4	00:00.4	1738.5	>1700	--	
3	6	(1415)	(10:08)	~1900	--	9	
4	6	(1259)	(11:21)	~2100	--	13	
5	6	(1300)	(11:19)	~2200	--	11	
6	6	(1301)	(10:39)	~1800	--	12	
7	6	1400	(10:16)	~1500	--	19	
7	2	1927	(00:03)	1928	~250	18	
8	6	(1303)	(11:11)	1730	--	34	
8	8	1702.8	00:05.0	~1706	~240	84	
9	6	(1304)	(11:09)	~1430	--	30	
10	6	(1305)	(11:06)	~1800	--	14	
11	6	(1306)	(11:04)	~1800	--	13	
11	2	1324.3	00:03.0	1324.8	260	14	

1. Severe interference has probably obscured some solar events. Receiver operation temporarily suspended after October 11, 1956 to facilitate shifting to a frequency having less interference.

SOLAR RADIO WAVES (BOULDER) -- 460 MC

3-HOURLY AND DAILY FLUX

AUGUST 1956 (REVISED)

Aug. 1956	Flux Hours UT 12-15	15-18	18-21	21-24	Flux Daily	Variability Hours UT 12-15	15-18	18-21	21-24	Variability Daily	Observed Periods Hours UT
1	--	--	--	56	56	--	--	0	0	0	1929-2557
2	58	60	58	57	58	0	0	0	0	0	1159-2556
3	76	67	62	63	66	0	0	0	0	0	1200-2555
4	71	69	66	67	68	1	0	0	0	1	1201-2553
5	68	70	67	--	69	0	0	1	0	1	1202-2552
6	--	69	67	--	68	0	0	0	0	0	1203-2110; 2224-2551
7	--	73	69	--	71	--	0	(0)	(1)	(1)	1204-1507; 1554-1750 /1
8	69	70	69	67	69	0	0	(0)	1	1	1205-1953; 2142-2550
9	68	69	69	--	69	0	0	1	(0)	1	1206-2054
10	70	73	76	75	74	0	0	0	0	0	1207-2548
11	69	73	68	--	71	0	0	0	--	0	1208-2547
12	67	70	69	--	69	1	0	0	--	1	1208-2546
13	70	71	68	67	69	0	(0)	0	(0)	(0)	1210-2005; 2045-2544
14	68	--	--	68	68	0	--	--	(0)	(0)	1210-1452; 2048-2541
15	69	70	69	67	69	0	0	0	(0)	(0)	1211-2539
16	68	77	69	--	72	0	2	0	(0)	2	1212-2538
17	--	66	68	68	67	0	(0)	(0)	2	2	1213-2537
18	73	71	72	--	72	1	(1)	(0)	(0)	1	1214-2535
19	--	--	--	--	--	--	--	--	--	--	---- ----
20	--	75	72	72	74	--	0	0	3	3	1438-2149; 2257-2533
21	78	83	111	105	96	0	0	2	0	2	1217-2532
22	76	78	87	--	81	1	1	1	--	1	1218-2051
23	--	101	--	--	95	0	0	--	0	0	1219-1330; 1440-1730 /1
24	76	92	85	83	85	0	0	0	(0)	(0)	1220-1500; 1513-2528
25	81	79	78	77	79	0	0	1	(0)	(0)	1221-2526
26	--	--	85	88	87	0	--	1	0	1	1222-1330; 1900-2524
27	--	--	--	81	--	--	--	--	(0)	(0)	2203-2523
28	84	84	93	101	91	(0)	(0)	(0)	3	3	1224-2522
29	97	94	--	79	90	0	(0)	--	2	2	1225-1639; 2238-2520
30	75	74	74	--	74	(0)	0	0	(1)	(1)	1226-2519
31	294	77	--	--	164	3	0	--	--	3	1227-1730; 2157-2517

1. Additional observed periods: Aug. 7, 1902-2551; Aug. 23, 2334-2529.

SOLAR RADIO WAVES (BOULDER) -- 460 MC

OUTSTANDING EVENTS[1]

AUGUST[2] 1956 (REVISED)[4]

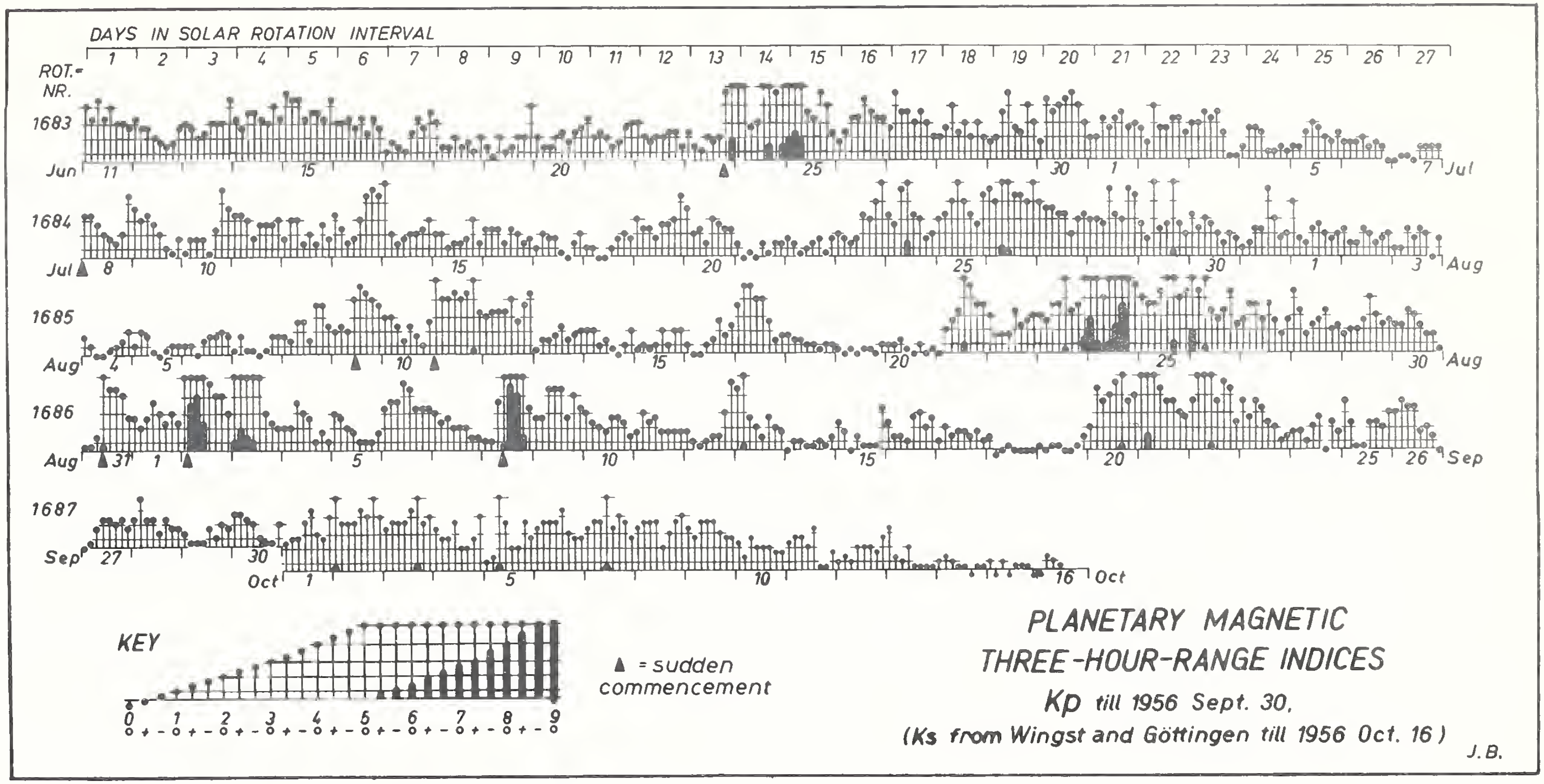
Aug. 1956	Type	Start UT	Duration Hrs:Mins	Time UT	Maximum Inst. Flux	Smd. Flux	Remarks
2	1	(1159)	(06:31)	1734.6	120	--	
3	6	(1200)	(05:00)	~1300	--	20	
4	1	(1201)	(13:52)	~1400	250	--	
5	1	(1202)	(06:58)	1811.1	170	--	
9	2	1810.0	00:08.7	1810.2	180	6	
10	6	(1207)	(13:41)	2056.5	150	18	
12	3	1237.9	00:00.4	1238.2	500	--	
16	8	1719	00:33	1747.8	570	230	
17	8	2324.9	00:04.8	2324.9	>2700	230	
18	6	(1214)	(13:21)	~1300	150	16	
18	3	2517.0	00:00.9	2517.4	~800	--	
20	6	(1438)	(10:55)	~1500	~600	19	
20	8	2117.1	00:01	2117.2	>3000	--	Off scale
20	3	2328.1	00:00.6	2328.2	~1400	--	
21	6	(1217)	(07:30)	1805.4	220	71	
21	9	1947	(05:45)	2027.7	~930	81	
22	6	(1218)	(08:33)	1933.3	~1400	31	
23	6	(1219)	(13:10)	1634.8	200	45	
24	6	(1220)	(13:08)	~1600	140	36	
25	6	(1221)	(13:05)	~1800	360	25	
26	6	(1222)	(13:02)	~2200	360	31	
27	6	(2203)	(03:20)	--	--	25	
28	6	(1224)	(10:17)	~1900	--	45	
28	9	2241	(02:41)	2255.2	>4000	~1900	Off scale
29	6	(1225)	(12:55)	~1300	--	42	
29	3	2240.5	00:00.4	2240.6	>780	--	
30	6	(1226)	(12:53)	~1500	--	20	
30	3	(2229.6)	(00:09.8)	2230.0	>740	--	
31	9	1237	01:53	1328	>4000	>4000	Off scale See Note 3
31	6	1430	(03:00)	~1700	--	26	

Notes:
1. Some relatively small 460 mc/s events are unreported or may have been obscured by interference.
2. The period August 2 thru 31 could be considered to be one continuous noise storm (type 6 event). The level of activity from August 18 thru 31 was considerably greater than August 2 thru 17.
3. The most energetic outburst to date during the present sunspot cycle.
4. Calibration errors discovered after the August data were published have necessitated this revision. Flux values greater than 500 are less accurate than normal due to the approximations used in correcting the data.

GEOMAGNETIC ACTIVITY INDICES

SEPTEMBER 1956

Sept. 1956	C	Values Kp, Three hour Gr. interval: 1 2 3 4	5 6 7 8	Sum	Ap	Final Selected Days
1	0.8	3- 2o 3- 4-	3o 2+ 3o 2+	22-	13	Five
2	1.9	5o 8- 8o 7-	5- 4o 4o 3o	43o	82	Quiet
3	1.5	6- 6+ 6o 6-	5o 3o 2+ 2o	36o	48	
4	0.4	2o 2o 4- 3o	3- 1o 2- 1o	17o	10	14
5	0.3	3o 3- 2o 2-	1o 1o 1o 2-	14o	7	17
						18
6	1.0	3+ 4- 4- 5-	4+ 3+ 3+ 3+	30-	23	19
7	0.4	3o 2+ 3- 2o	2o 2o 1+ 1+	17-	8	29
8	1.7	1o 1o 4- 5+	8+ 8o 6o 3+	37-	78	
9	1.1	3- 3- 4+ 4+	4+ 3- 4o 3+	28+	22	
10	0.5	3o 2+ 2o 2-	3- 3- 2+ 1+	18o	9	
11	0.4	2- 3o 2+ 3-	2- 2- 2- 2-	16+	8	Five
12	0.6	2- 1o 1- 1o	1+ 1+ 3o 5-	15-	10	Disturbed
13	0.8	4+ 5+ 3- 2o	1+ 3- 2o 2-	22o	17	
14	0.1	0+ 1o 1o 1-	1- 1o 1- 1+	7-	4	2
15	0.3	2+ 2- 0+ 1+	1- 1- 1- 3+	11o	6	3
						8
16	0.6	2+ 1+ 1+ 1o	3- 3o 2o 3-	16+	9	21
17	0.1	1o 2o 1+ 2-	2- 1+ 2- 1o	12-	5	22
18	0.0	1+ 0o 0+ 1-	0+ 0+ 0+ 0+	4-	2	
19	0.0	1- 0+ 1- 1-	0+ 0+ 1- 1+	5o	3	
20	1.4	2o 4+ 4- 4o	5- 5+ 4- 4o	32-	29	
21	1.3	5o 6o 5o 4+	4- 4- 3o 3-	33+	35	Ten
22	1.4	4- 5o 5o 5+	4- 5- 4+ 2+	34o	34	Quiet
23	0.6	4- 3- 4- 3+	2+ 2o 1o 1+	20o	12	
24	0.4	2- 2- 1o 2o	3- 0+ 2+ 2-	13+	6	5
25	0.6	4- 2+ 1- 1-	2+ 2+ 2o 3o	17o	10	14
						15
26	0.5	3o 4- 3+ 3+	2- 2o 1+ 0+	19-	12	17
27	0.4	0+ 1- 2- 2+	2+ 2o 2+ 2-	13+	6	18
28	0.4	2+ 4- 2+ 2+	1+ 2+ 2- 2-	18-	9	19
29	0.2	1+ 1- 1- 1-	2- 1o 2o 2-	10-	5	24
30	0.3	3- 3- 2+ 2o	1o 1- 1- 2o	14o	7	27
Mean:	0.67			Mean:	18	29
						30



DAYS IN SOLAR ROTATION INTERVAL
ROT.-NR.
1683
1684
1685
1686
1687
Jun
Jul
Aug
Sep
Oct
KEY
▲ = sudden commencement
PLANETARY MAGNETIC
THREE-HOUR-RANGE INDICES
Kp till 1956 Sept. 30,
(Ks from Wingst and Göttingen till 1956 Oct. 16)
J.B.

CRPL RADIO PROPAGATION QUALITY FIGURES AND FORECASTS

NORTH ATLANTIC

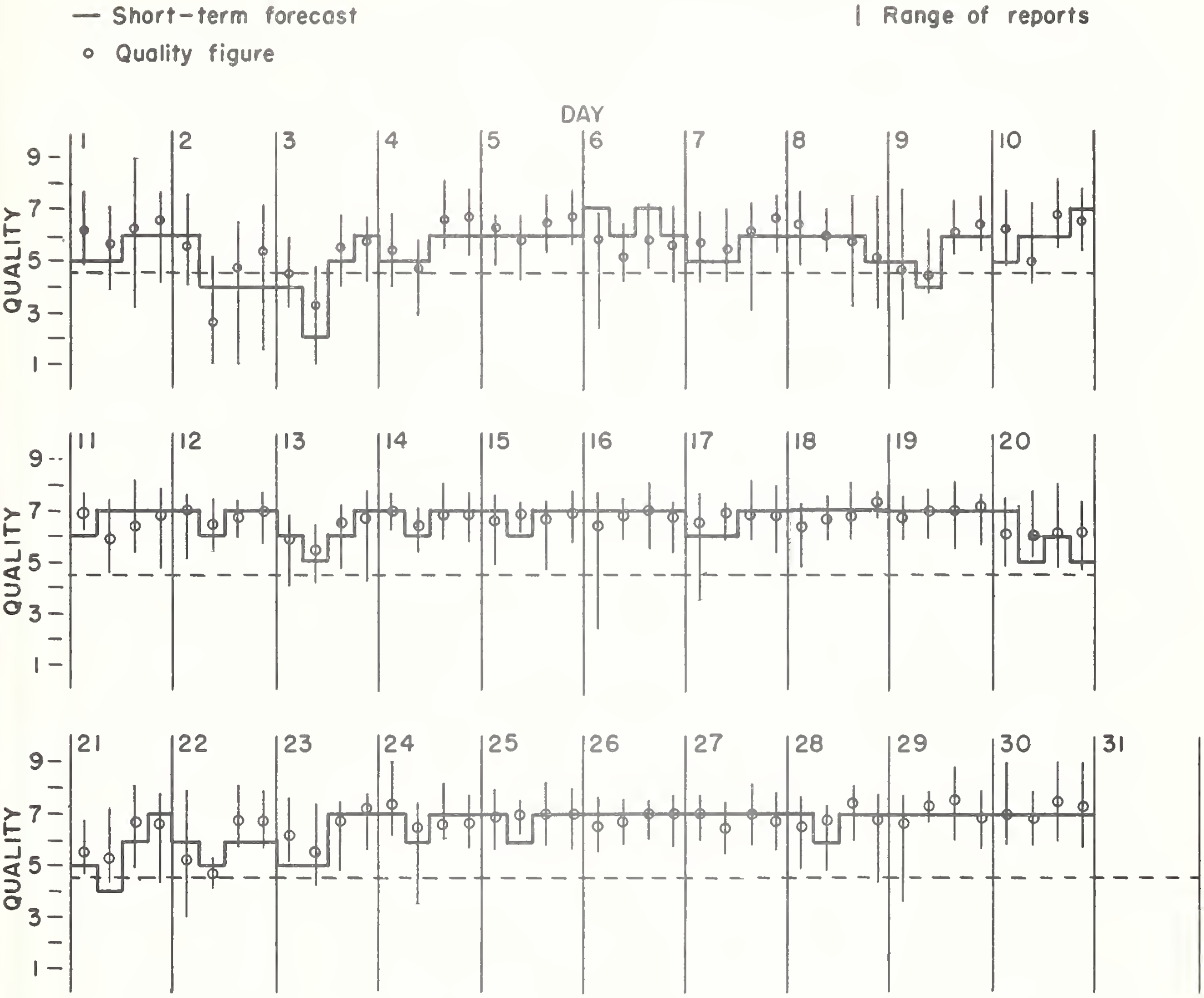
SEPTEMBER 1956

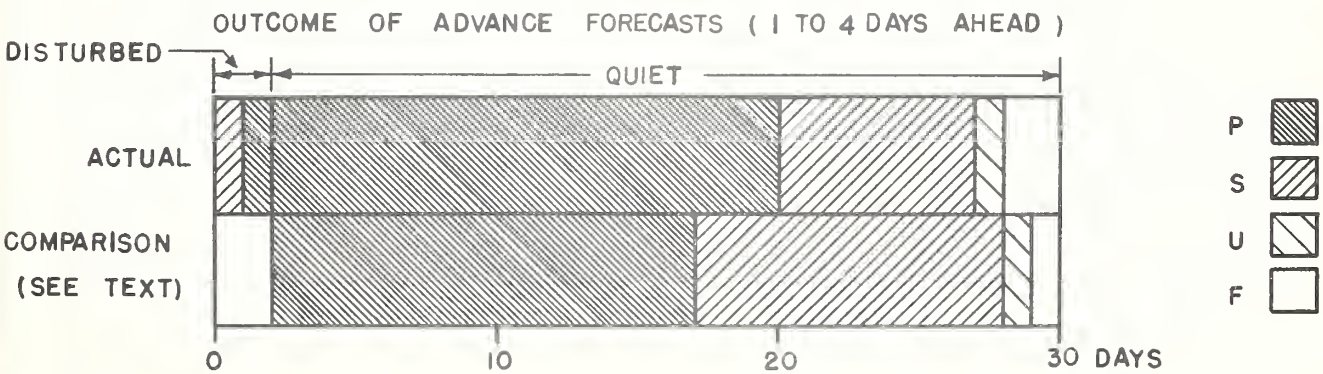
Sept. 1956	North Atlantic 6-hourly quality figures					Short-term forecasts issued about one hour in advance of				Whole day index	Advance forecasts (J-reports) for whole day; issued in advance by:			Geomagnetic K_{Ch}	
	00 to 06	06 to 12	12 to 18	18 to 24		00	06	12	18		1-4 days	4-7 days	8-25 days	Half Day (1)	(2)
1	6+	6-	6+	7-		5	5	6	6	6+	4	7		3	2
2	6-	3o	5-	5+		6	4	4	4	(4+)	4	7		(6)	3
3	4+	3+	6-	6-		4	2	5	6	(4+)	5	7		(6)	2
4	5+	5-	7-	7-		5	5	6	6	6o	5	6		2	1
5	6+	6-	7-	7-		6	6	6	6	6+	6	6		2	1
6	6o	5+	6o	6-		7	6	7	6	6-	7	6		(4)	3
7	6-	6-	6+	7-		5	5	6	6	6+	6	7		3	2
8	7-	6o	6-	5+		6	6	6	5	6o	6	7		2	(6)
9	5-	5-	6+	7-		5	4	6	6	6-	6	7		3	3
10	6+	5+	7o	7-		5	6	6	7	7-	6	7		2	2
11	7o	6o	6+	7o		6	7	7	7	7-	6	6		2	1
12	7o	6+	7-	7o		7	6	7	7	7-	5	6		1	2
13	6o	5+	7-	7-		6	5	6	7	6+	5	5		3	2
14	7o	6+	7o	7o		7	6	7	7	7-	7	6		1	1
15	7-	7-	7-	7-		7	6	7	7	7-	7	6		1	1
16	6+	7-	7o	7-		7	7	7	7	7-	7	6		1	2
17	7-	7o	7-	7-		6	6	7	7	7-	6	6		2	1
18	6+	7-	7o	7+		7	7	7	7	7o	7	6		0	1
19	7-	7o	7o	7o		7	7	7	7	7o	7	6		1	1
20	7-	7-	7-	7-		7	5	6	5	7-	7	6		3	(4)
21	6-	5+	7-	7-		5	4	6	7	6+	4	7		(4)	3
22	5+	5-	7-	7-		6	5	6	6	6o	5	7		(5)	3
23	6+	6-	7-	7o		5	5	7	7	7-	7	7		3	2
24	7+	6+	7-	7-		7	6	7	7	7-	7	7		1	2
25	7-	7o	7o	7o		7	6	7	7	7o	7	7		1	2
26	7-	7-	7o	7o		7	7	7	7	7-	7	7		(4)	1
27	7o	6+	7o	7-		7	7	7	7	7-	7	7		1	2
28	7-	7-	7+	7-		7	6	7	7	7-	7	7		2	2
29	7-	7+	7+	7o		7	7	7	7	7o	7	7		0	2
30	7o	7o	7+	7+		7	7	7	7	7o	7	7		3	1
Score	Quiet Periods				P	17	14	19	22		18	12			
					S	12	13	11	7		7	16			
					U	0	1	0	1		1	0			
					F	0	0	0	0		2	0			
	Disturbed Periods				P	1	0	0	0		1	0			
					S	0	2	0	0		1	0			
					U	0	0	0	0		0	0			
					F	0	0	0	0		0	2			

( ) represent disturbed values.

CRPL RADIO PROPAGATION QUALITY FIGURES AND FORECASTS
NORTH ATLANTIC

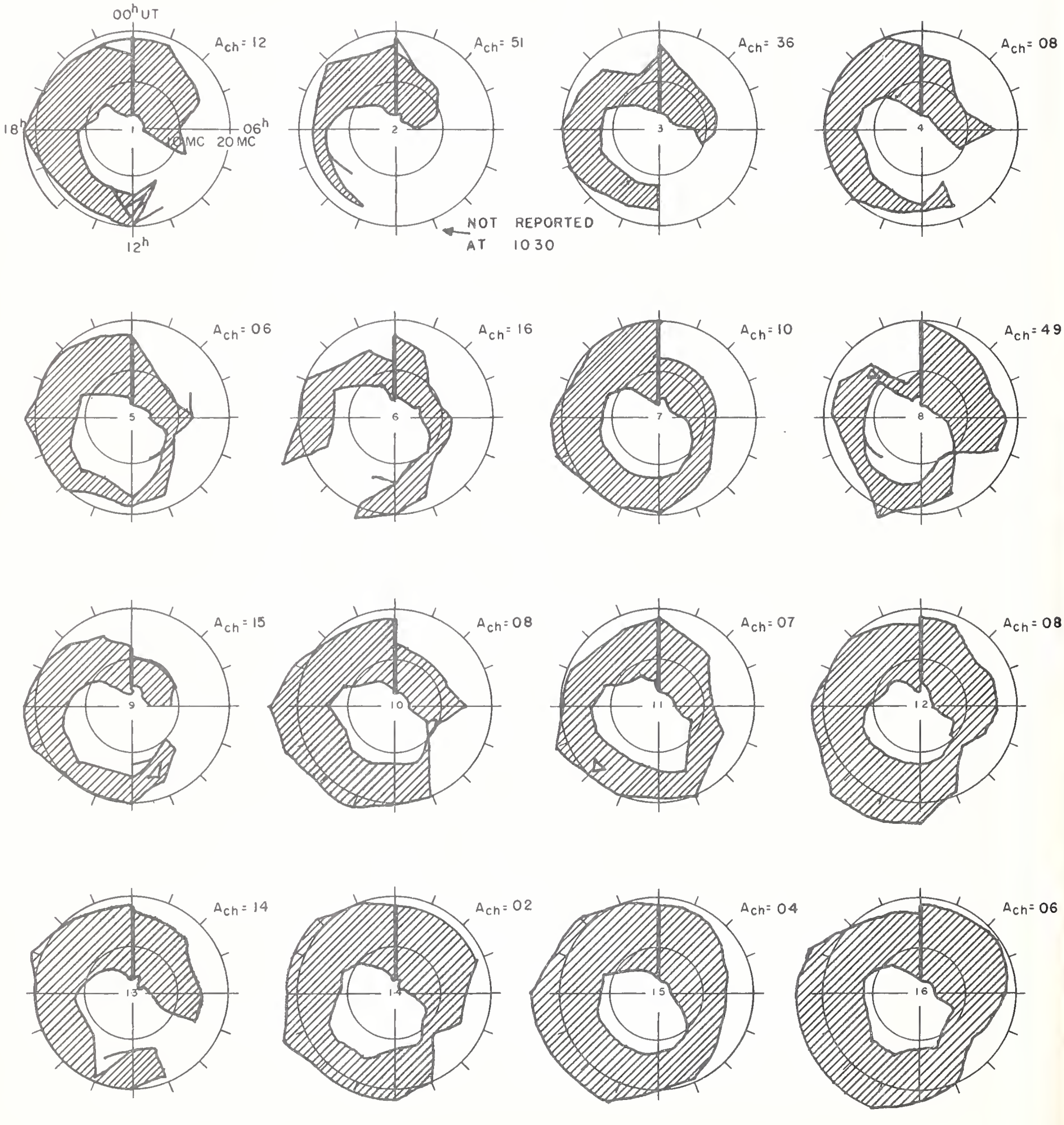
SEPTEMBER 1956



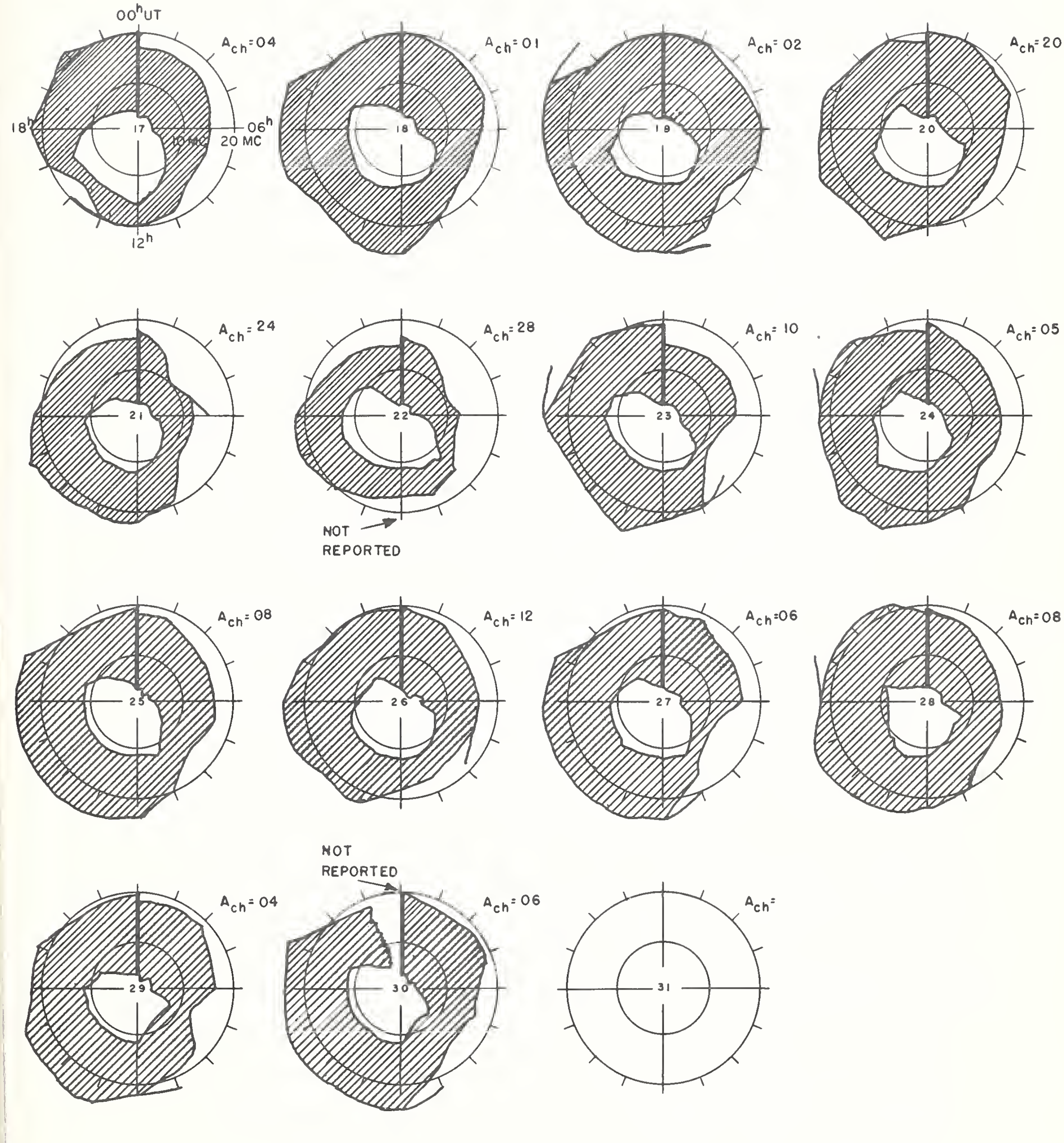


USEFUL FREQUENCY RANGES -- NORTH ATLANTIC PATH

SEPTEMBER 1956



SEPTEMBER 1956



Adapted from Observations by Deutschen Bundespost

CRPL RADIO PROPAGATION QUALITY FIGURES AND FORECASTS

NORTH PACIFIC

SEPTEMBER 1956

Sept. 1956	North Pacific 9-hourly quality figures			Short-term forecasts issued at			Whole day index	Advance Forecasts (Jp reports) for whole day; issued in advance by			Geomagnetic K_{Si}	
	03 to 12	09 to 18	18 to 03	02	09	18		1-4 days	4-7 days	8-25 days	Half day (1)	Half day (2)
1	5	5	6	5	5	6	5	4	4		(4)	3
2	2	2	4	5	2	3	(2)	3	5		(8)	(4)
3	2	2	4	4	2	4	(2)	3	6		(6)	3
4	5	5	5	4	3	6	5	4	6		3	2
5	5	5	6	5	6	6	6	5	5		2	1
6	5	5	5	6	5	5	5	4	5		(4)	(4)
7	5	5	7	5	5	6	6	4	6		2	2
8	4	3	3	5	5	3	(3)	5	5		3	(6)
9	4	4	5	3	4	5	5	6	6		(4)	(4)
10	6	5	6	4	6	6	6	6	6		3	2
11	5	5	7	5	5	6	6	5	6		3	2
12	6	6	6	6	6	7	6	5	5		0	2
13	4	5	6	5	5	6	5	3	6		3	2
14	6	6	6	6	6	6	6	4	6		1	1
15	6	6	6	6	6	6	6	6	5		1	1
16	6	6	7	6	6	6	6	4	5		1	2
17	6	6	7	6	6	7	7	4	6		1	1
18	6	6	7	7	6	7	6	5	6		0	0
19	6	6	7	6	7	7	7	7	6		0	1
20	6	6	6	7	5	5	6	7	6		3	(4)
21	4	5	7	5	4	5	5	6	6		(5)	3
22	3	3	5	5	4	5	(4)	5	6		(6)	(4)
23	4	5	6	4	3	6	5	5	6		(4)	2
24	5	5	6	6	5	6	5	6	6		1	2
25	5	5	6	6	6	6	6	6	6		1	3
26	5	5	7	6	5	6	6	6	6		(4)	2
27	6	5	5	6	6	6	6	6	6		1	3
28	6	6	6	6	6	6	6	6	6		3	1
29	5	6	6	6	6	6	6	6	6		0	1
30	5	5	6	7	6	6	6	6	6		2	1

Score:		02	09	18	1-4	4-7
Quiet Periods	P	12	15	18	10	13
	S	8	8	8	11	13
	U	1	2	1	1	0
	F	1	0	0	4	0
Disturbed Periods	P	1	3	2	0	0
	S	5	1	1	3	0
	U	2	1	0	1	2
	F	0	0	0	0	2

( ) represent disturbed values.

CRPL RADIO PROPAGATION QUALITY FIGURES AND FORECASTS

NORTH PACIFIC

SEPTEMBER 1956