PART B

SOLAR - GEOPHYSICAL DATA

ISSUED
OCTOBER 1956

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

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PART B

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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 $\lambda 5303$.

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 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 $H\alpha$ 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

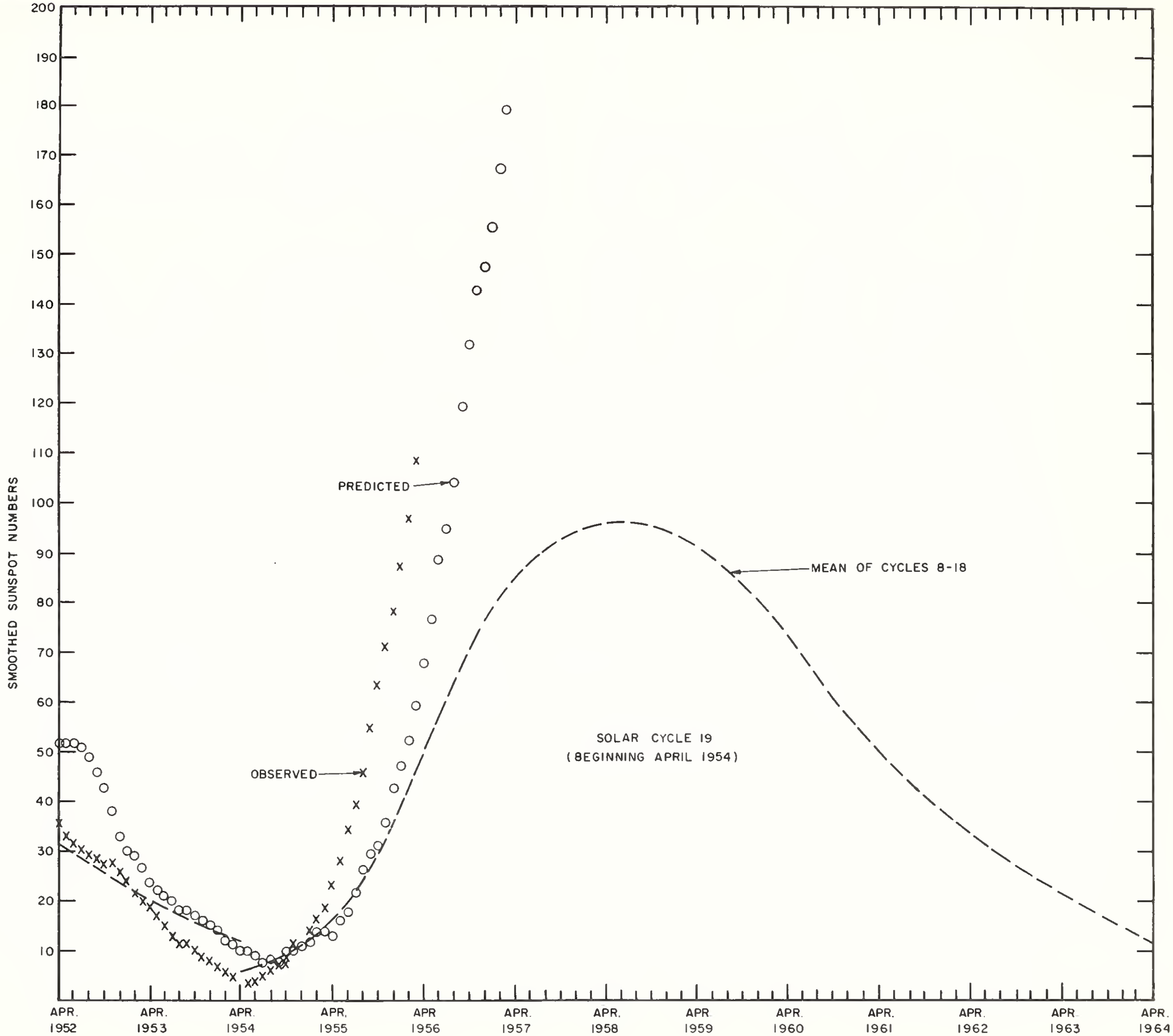
The 9-hour and 24-hour indices Qp are determined separately. Each index is a weighted mean where the CRPL observations have unit weight and the others are weighted by the correlation coefficient with the CRPL observations.

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.

American Relative Sunspot Numbers August 1956	
Date	$R_{A'}$
1	133
2	137
3	141
4	141
5	134
6	119
7	122
8	107
9	110
10	102
11	123
12	126
13	122
14	127
15	125
16	137
17	145
18	159
19	192
20	198
21	211
22	217
23	224
24	196
25	170
26	182
27	209
28	175
29	203
30	175
31	164
Mean:	155.7

Zürich Provisional Relative Sunspot Numbers September 1956	
Date	R_Z
1	168
2	158
3	136
4	138
5	146
6	168
7	176
8	174
9	161
10	136
11	175
12	208
13	244
14	280
15	276
16	253
17	250
18	219
19	228
20	240
21	216
22	153
23	139
24	125
25	132
26	136
27	131
28	127
29	172
30	201
Mean:	182.2



PREDICTED AND OBSERVED SUNSPOT NUMBERS

CALCIUM PLAGE AND SUNSPOT REGIONS

SEPTEMBER 1956

CMP Sept. 1956	Lat.	McMath Plage Number	Return of Region	Calcium Plage Data Date-Area-Intensity			Sunspot Data Date-Area-Count		
				First seen	Maximum	Last seen	First seen	Maximum	Last seen
Aug.30.3	N10	3647	New	29- 300-2		30- 300-2	29- XX -1		30- 10 -1
31.4	N22	3648	New	30- 300-2	05- 5500-3	06- 4000-3.5	30- 10 -XX	05-1090 -11	06-510 -5
Sept.01.2	S30	3641	New	26-2000-3	02- 7500-3	06- 5000-3.5	26-240 -2	30- 810 -32	06-410 -4
01.6	N27	3645(3)	3598	28- 700-2.5		31- 700-2			
01.9	N16	3643(3)	3598	26-2000-3	01-11500-3.5	08- 3000-1	26-700 -4	27-1620 -8	07-630 -3
02.0	S22	3642	New	26-1500-2	02- 6500-3	06- 6000-2	27-410 -2	27- 410 -2	01- 40 -2
02.8	N30	3644(2)	3610	26- 800-2	02- 5400-3.5	09- 4000-2.5	28- 50 -2	08- 780 -2	08-780 -2
04.1	N26	3646	New	28-2500-3	30- 4100-3	09- 4500-2.5	30- 10 -XX	06- 180 -6	08-100 -2
05.5	S19	3661	New	06- 500-2		08- 500-1			
05.7	N16	3650(3)	3605	01-2000-2	02- 4000-2	05- 1500-2	04- 40 -3		04- 40 -3
06.2	S33	3662	New	06- 800-2		08- 700-1			
06.2	N27	3649	New	01-1800-2	03- 3200-2	05- 2000-2			
07.5	N19	3652(4)	3607	03-1000-2.5		05- 800-2			
07.9	S14	3651	New	01-1000-2	02- 3000-3.5	13- 1500-2	02-100 -1	08- 170 -3	10- 30 -2
08.9	N23	3653(4)	3607	02-2500-2.5	04- 3500-3.5	15- 2000-2	12-170 -7	14- 340 -5	14-340 -5
09.3	S18	3654	New	03-6000-3	04- 6000-3	14- 3000-2			
10.0	N28	3664	New	08- 700-2	09- 800-3	12- 700-1	08- 50 -1	08- 50 -1	10- 10 -1
10.5	S15	3656(6)	3613,5	04-3500-2.5	06- 6200-3.5	14- 5500-3	05-350≥10	09- 560 -10	14-190 -1
10.5	N15	3663(4)	3612	06-1300-2	06- 1300-2	12- 300-1			
10.9	N30	3657(3)	3609	06-2300-2	13- 4000-2	14- 4000-2			
11.7	S22	3658(6)	3613,5	05-5000-3.5	09-12000-4	17-12000-3	05-850 -4	11-2580≥10	17-390 -1
12.0	N15	3667	New	11- 500-1.5	15- 700-3	17- 5000-3.5	14- 20 -1		14- 20 -1
12.7	N43	3671	New	13- 700-3	18- 3000-2	18- 3000-2	13-120 -5	14- 220 -5	17- 70 -1
13.4	N33	3660(3)	3614,8	08-3000-1.5	09- 6000-2.5	14- 2000-2			
13.8	S23	3659(3)	3621	06-4500-2.5	06- 4500-2.5	12- 1000-1			
14.0	N20	3668	New	11- 300-2	14- 800-2.5	17- 800-2	11- 20 -1	12- 90 -4	15- XX -3
16.5	S22	3666(2)	3631,25	09-4500-2.5	13-20000-4	22- 7000-3.5	09-290 -1	12-2180 -56	22- XX -2
16.8	N22	3665(3)	3624	09-4000-2.5	15-11400-2	22- 6000-3.5	10-150 -1	12- 340 -6	21-260 -6
18.7	S27	3673(2)	3628	15-2800-2	17- 7000-2	24- 2000-2	15- XX -3	17- 150 -1	22- XX -1
18.7	N25	3669(6)	3629	12-4500-2.5	14- 7000-3.5	25- 2000-2	13-120 -2	18- 200 -6	24- XX -1
19.5	S15	3670	New	13-3000-3	14- 5000-3.5	25- 3000-2.5	14-240 -2	17- 420 -13	24- XX -1
20.8	N32	3672(6)	3629	14-5000-3.5	15- 8000-2	27- 2000-3	14-510 -2	14- 510 -2	22- XX -1
21.3	S24	3674(4)	3630	15-2800-2	22- 3000-2	27- 2000-2	15- XX -1	17- 390 -1	26-270 -1
21.4	N23	3675	New	17-6000-4	19- 8000-3	28- 3000-3	17-290 -9	18- 430 -11	25- 70 -1
22.5	N13	3679	New	18- 300-2.5	25- 2000-2.5	28- 1500-2	20-160 -5	25- 190 -1	28-150a-XX
22.7	N35	3676	New	17-3000-4	17- 3000-4	28- 3000-2.5			
22.9	N27	3677	New	17-3000-4	18- 5000-4	29- 3000-2	17-700 -4	18- 750 -4	27- XX -2
23.6	S13	3680	New	18- 700-2.5	28- 2000-3	28- 2000-3	19-100 -3	19- 100 -3	22- XX -1
24.9	N27	3678(2)	3636	18-5000-2	18- 5000-2	01- 2000-2	18- 50 -1		18- 50 -1
25.2	S28	3681(3)	3637	20-2500-2	20- 2500-2	27- 2000-2			
26.6	N25	3682(8)	3639	20-1000-2	21- 2000-2	24- 1000-2	20-240 -1	20- 240 -1	24-120 -1
27.2	S17	3683	New	21-1000-2	24- 1200-4	02- 1000-2	24- XX -5	26- 80 -2	26- 80 -2
27.3	N45	3691	New	28- 500-2	03- 4000-3.5	04- 2000-3	28- 50a-XX	03- 580 -2	03-580 -2
28.6	S15	3684	New	22-1000-1.5	26- 3000-4	04- 3000-2.5	24- XX -5	25- 180 -8	03- 20 -1
28.8	N19	3685(4)	3643,5	22-3000-3	03- 7500-3	05- 2000-2	28-200a-XX	02- 800 -8	04- XX -2
29.8	S28	3686(2)	3641,2	23-4000-3.5	30- 8000-2	05- 6000-3.5	24-440 -3	03-1200 -5	05-490 -1

CORONAL LINE EMISSION INDICES

September 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
Sept.																
1	X	X	X	X	X	X	X	X	104	151	X	X	126	173	X	X
2	144	247	X	X	133	219	X	X	107	128	44	44	169	245	67	78
3	174	349	46	85	95	132	34	40	60	73	31	42	184	232	37	47
4	112	218	46	67	58	66	39	46	52	74	30	50	158*	200	38	60
5	90	150	30	40	48	65	32	50	40	52	31	55	92	172	23	33
6	138	200	14	18	66	82	14	30	63	88	28	74	64	90	17	30
7	93	110	21	30	41	60	16	35	56	88	30	60	65	96	16	24
8	87	147	11	15	57	90	16	26	75	120	40	78	61	85	10	15
9	110	158	40	69	85	165	33	63	108	201	33	75	87*	124	19	33
10	97	126	44	51	X	X	X	X	82*	124	27	38	78	94	23	39
11	59	80	29	55	47	68	X	X	106*	147	30	53	106	128	31	60
12	64	97	27	45	69*	104	29	55	102	116	31	55	97	124	41	75
13	72	109	25	33	99	160	23	39	111	131	41	87	100	122	34	72
14	61	90	31	48	90	149	13	20	124	172	35	49	77	82	43	53
15	X	X	X	X	X	X	X	X	141	192	42	48	101*	192	55	108
16	140	233	54	109	144*	185	45	67	167	239	41	47	110*	170	51	90
17	174	300	43	66	118*	160	41	74	86	119	39	66	84	121	46	75
18	131	220	36	59	176	386	58	111	105	160	46	90	89	156	56	102
19	117	172	40	69	130	215	50	90	120	145	51	69	121	176	69	123
20	143	220	63	117	167	216	75	90	74	108	44	49	149	192	57	100
21	126	210	35	80	128	190	38	50	69	95	31	40	120	200	47	59
22	104	160	35	93	57	80	25	35	69	100	20	32	143	235	59	74
23	76	124	30	65	65	107	15	22	43	48	X	X	137	210	X	X
24	63	107	27	48	43	59	33	75	49	57	23	46	81	127	52	108
25	80	130	29	70	65	85	18	28	37	49	37	60	65	110	45	58
26	82	124	36	80	56	92	35	60	63	80	23	36	78	91	36	50
27	94	154	41	70	84	125	34	46	70	108	57	88	104	135	73	88
28	104	155	39	73	89	126	36	45	96	130	60	82	166	205	40	40
29	123	174	31	48	104*	167	40	54	73	113	34	60	107	130	51	88
30	103	148	39	83	79	101	35	77	73	116	27	45	109	123	38	64

a = index computed from low weight data.
* = yellow line observed.

SOLAR FLARES
SEPTEMBER 1956

Observatory	Date Sept. 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
S.Peak	01	1314	1503	116	100	3644	N33	E17	1354	18	3	1-	G-SWF
Schaus.	01	b1300		>99		3644	N33	E18				1	
S.Peak	02	1550	1625	35	155	3641	S30	W21	1603	20	6	1	
Capri-S	02	1553	1620		156	3641	S29	W20				1	
S.Peak	02	1955	2050	55	75	3648	N23	W40	2010	20	8	1-	S-SWF
McMath	02	b2004	2032	28		3648	N22	W40				1+	
Capri-S	03	0835	0848	13	112	3642	S23	W18				1	
Capri-S	03	0953	1015	22	117	3643	N15	W23				1	
Schaus.	04	b0713		12		3648	N24	W60				1+	
McMath	04	1303	1335	32		3648	N22	W51				1	Slow S-SWF
Capri-S	04	1305	1343	~38	151	3643	N18	W49				1	
S.Peak	04	b2021	a2145	>84	175	3643	N19	W49	2022	16	2	1	
McMath	04	b2028	a2039	>11		3648	N22	W50				1	S-SWF
S.Peak	04	2038	2055	17	155	3648	N21	W68	2044	18	4	1	Slow S-SWF
Capri-S	05	1146	1214	28	146	3658	S24	E90				1	S-SWF
McMath	05	b1340	a1350	>10		3658	S23	E85				1	Slow S-SWF
Capri-S	05	1645	1704	19	146	3658	S24	E90				1+	
S.Peak	05	1645	1709	24	155	3658	S26	E80	1650	20	7	1	Slow S-SWF
McMath	05	1645	1800	75		3658	S23	E85				1	
Wendel.	05	1658		28		3658	S24	E72				1	
Capri-S	06	1129	1144	15	194	3648	N20	W85				1	
McMath	06	1450				3658	S23	E70				1	Slow S-SWF
Capri-S	07	1245	1401	76	287	3656	S15	E38				1+	
McMath	07	b1250	1345	>55		3656	S17	E45				1+	Slow S-SWF
S.Peak	07	b1305	1355	>50	160	3656	S17	E43	1317	18	2	1	
Tokyo	08	0557		~20		3658	S25	E55				2	
McMath	08	b1738	1800	>22		3658	S23	E45				2	S-SWF
McMath	09	1518	1543	25		3658	S25	E30				1	S-SWF
Schaus.	10	b0813		52		3658	S17	E11				2	
Capri-S	10	0904	0958	54	102	3658	S18	E07				1	
S.Peak	11	1345	1545	120	380	3658	S18	E07	1425	15	2	2-	
Schaus.	11	b1350		15		3658	S22	E08				2	
McMath	11	1340	1500	80		3658	S22	E02				2	
McMath	11	b1955	a2003	>8		3666	S20	E70				1	
Tokyo	12	b0614		~10			S35	W15				1	
S.Peak	12	b1355	1440	>45	125	3666	S17	E55	1355	12	6	1	
McMath	12	1418	1430	12		3666	S20	E60				1	
S.Peak	12	1445	1605	80	200	3666	S15	E51	1455	12	3	1	

SOLAR FLARES

SEPTEMBER 1956

Observa-tory	Date Sept. 1956	Time Observed Start UT	End UT	Dura-tion 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	Impor-tance	Provis. Iono-spheric Effect
McMath	12	b1500	1600	>60		3666	S18	E60				1	
S.Peak	12	1635	1715	40	175	3656	S16	W24	1645	12	5	1	
S.Peak	12	1905	1940	35	155	3666	S27	E70	1915	15	2	1	Slow S-SWF
S.Peak	12	1930	2025	55	160	3666	S18	E55	1950	15	3	1	
McMath	12	1940	2035	55		3666	S18	E60				1	
McMath	12	2110	a2141	>31		3666	S20	E55				1+	
S.Peak	12	2125	2200	35	141	3666	S23	E47	2140	12	5	1	
S.Peak	12	2235	2353	78	690	3666	S21	E46	2248	35	7	2+	S-SWF
S.Peak	13	1416	1510	54	280	3665	N23	E48	1427	15	3	1+	
McMath	13	b1425	1515	>50		3665	N20	E46				1+	
S.Peak	13	1429	1441	12	105	3658	S26	W25	1433	14	8	1	
S.Peak	13	1430	1600	90	130	3666	S18	E43	1505	14	2	1	S-SWF
McMath	13	1624				3666	S22	E38				1	
S.Peak	13	1625	1635	10	70	3666	S24	E34	1625	15	7	1-	
S.Peak	13	1740	1815	35	120	3666	S17	E43	1745	15	7	1	S-SWF
S.Peak	13	2020	2045	25	130	3666	S24	E33	2025	12	5	1	S-SWF
S.Peak	13	2210	2240	30	110	3666	S18	E40	2215	15	3	1	
Schaus.	14	0745				3666	S21	E30				1	
Kodai.	14	0813		45		3666	S25	E25				2	
Wendel.	14	0927	0950	23	583	3666	S18	E25	0933			1+	S-SWF
Kodai.	14	0935		15		3666	S18	E35				1	
Capri-S	14	1036			165	3666	S26	E45				1	
Wendel.	14	1041	1102	21	292	3658	S25	W48	1041			1+	
McMath	14	b1445	1510	>25		3666	S21	E38				1	Slow S-SWF
S.Peak	14	1803	~1853	~50	170	3666	S18	E27	1813	22	6	1	
McMath	14	1810	1855	45		3666	S15	E36				1	G-SWF
S.Peak	14	1828	1838	10	110	3658	S23	W47	1828	15	7	1	
McMath	14	2137	a2148	>11		3666	S15	E30				1	
S.Peak	14	2140	2205	25	120	3666	S20	E20	2140	15	5	1	
S.Peak	14	~2215	2255	~40	180	3665	N22	E30	2227	20	2	1	
Schaus.	15	b0940		>11		3658	S16	W59				1+	
Capri-S	15	1416	1453	37	156	3658	S18	W49				1	
S.Peak	15	1405	1455	50	57	3658	S22	W50	1430	14	6	1-	G-SWF
Wendel.	15	1417	1457	40		3658	S23	W57	1428			1	
Wendel.	15	1425	1451	26	389	3667	N16	W54	1437			2	
Wendel.	15	1517	1537	20	486	3658	S21	W51	1524			1	
Wendel.	16	b0633	0644	>11	680	3658	S26	W71	0633			1-2	
Wendel.	16	1033	1054	21	486	3666	S23	E11	1040			1	
Capri-S	16	1031	1112	41	53	3666	S23	E15				1-	
Wendel.	16	1112	1137	25	535	3658	S26	W72	1118			1-2	
Capri-S	16	1357	1500	63	112	3665	N29	E02				1	

SOLAR FLARES

SEPTEMBER 1956

Observatory	Date Sept. 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
S.Peak	16	1402	1515	73	335	3665	N30	E05	1419	20	4	2-	
Wendel.	16	1403	1504	61	583	3669	N27	E33	1421			1	
S.Peak	16	1745	1925	100	120	3674	S22	E60	1809	20	6	1	
S.Peak	17	b1404	~1416	>12	110	3675	N26	E57	1405	18	4	1	
S.Peak	17	b2012	~2120	>68	770	3666	S21	W17	2014	22	2	3	Slow S-SWF
Tokyo	18	b0417		~40			N05	W25				1	
S.Peak	18	2115	~2230	~75	190	3666	S22	W33	2135	18	3	1	
Schaus.	19	b0740		65		3666	S22	W46				1	
{ Wendel.	19	1442	1503	21	389	3666	S21	W49	1452			2- }	
{ S.Peak	19	1435	1515	40	84	3666	S22	W50	1450	15	9	1- }	
Wendel.	19	1505	1521	16	340	3666	S21	W49	1511			1+	
Schaus.	19	b1622		24		3679	N12	E37				1	
Mt.Wilson	19	b1745		30		3666	S25	W55				1	
Wendel.	20	1014	1031	17	243	3666	S16	W59	1018			1	
Wendel.	20	1131	1200	29	729	3682	N23	E83	1139			1	
{ Mt.Wilson	20	b1938		40		3670	S15	W15				1 }	S-SWF
{ S.Peak	20	1940	2240	180	125	3670	S17	W19	1945	20	3	1 }	
Mt.Wilson	20	b1945		10		3665	N25	W65				1	
Mt.Wilson	20	b2340		10		3674	S25	E05				1	
Tokyo	21	0054		~10		3673	S25	W25				1	
S.Peak	21	1705	a1738	>33	170	3670	S14	W30	1725	15	3	1	
Neder.	22	1158		37		3666	S15	W90				1	
Tokyo	22	b2337		~20			N35	W85				1	
Tokyo	23	0148		~20		3682	N25	E45				1	
{ S.Peak	24	b1407	1435	>28	85	3673	S30	W85	1410	20	6	1 }	G-SWF
{ Schaus.	24	b1407		43		3673	S31	W78				2 }	
Schaus.	24	b1630		04		3670	S16	W65				1	
S.Peak	24	2005	a2035	>30	110	3680	S15	W18	2030	15	8	1	
Meudon	25	b1240		05		3685	N25	E35				1	
Schaus.	25	b1605		05		3689	S26	E79				1	
Schaus.	25	b1650		05		3686	S28	E58				1	
{ Capri-S	28	1257	1405	68	112	3683	S13	W19				1	
{ Capri-S	29	0654	0800	66	117	3688	N22	E28				1 }	
{ Schaus.	29	b0655				3688	N20	E29				1 }	
Capri-S	29	1020	1030	10	97		S17	W90				1	
S.Peak	30	2055	2107	12	110	3691	N47	W49	2100	16	8	1	

SOLAR FLARES

SEPTEMBER 1956

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

September 1,	1439	(3646)
	1525	(3644)
	1739	(3636)
	2235	(3643)
	2320	(3643)
2,	1320	(3642)
	1540	(3644)
3,	1400	(3644)
	1730	(3648)
	2230	(3642)
	2315	(3644)
4,	1440	(3648)
	1443	(3648)+
	1535	(3648)
	1615	(3648)
	1625	(3648)+
	1725	(3648)
5,	1500	(3641)
	1520	(3644)
	1515	(3651)
	1535	(3643)
	1605	(3643)
	1615	(3644)
	b1933	(3643)+
	2104	(3643)+
6,	b2241	(3658)
	b2325	(3658)
7,	1315	(3658)+
	2133	(3656)+
9,	b1339	(3666)
	1415	(3665)
	1420	(3658)
	1540	(3658)
	1625	(3658)
	b1904	(3666)
	2050	(3658)
	2353	(3666)
10,	1350	(3666)
	1410	(3666)
	1425	(3658)
	1600	(3666)
	1700	(3658)
	1735	(3658)
	1800	(3658)
	1848	(3666)
	1950	(3666)
	2130	(3658)
	2200	(3666)
	2205	(3665)
	2305	(3658)
11,	1415	(3666)
	1430	(3658)
	1430	(3666)
	1545	(3666)
	1725	(3666)
	1730	(3666)+
	1759	(3666)+
	1820	(3658)
September 11,	1906	(3666)+
	1910	(3658)
	1915	(3666)+
	2000	(3666)
	2100	(3658)+
	2105	(3658)
	2200	(3666)
	2245	(3666)
	2315	(3658)
12,	1435	(3666)
	1559	(3665)+
	1600	(3658)
	1635	(3666)
	1850	(3666)
	1905	(3666)+
	1909	(3665)
	2105	(3666)
	2350	(3658)
	2353	(3666)
13,	1346	(3658)
	1410	(3666)
	1516	(3669)+
	1523	(3669)+
	1537	(3666)+
	1617	(3656)+
	1618	(3666)+
	1700	(3666)
	1715	(3666)
	1730	(3666)
	1740	(3666)+
	1950	(3658)
14,	1327	(3653)
	1347	(3670)
	1400	(3658)
	1405	(3666)
	1430	(3665)
	1456	(3668)
	1625	(3658)
	1708	(3669)
	1708	(3658)
	1935	(3658)
	2030	(3666)
	2030	(3658)
	2100	(3658)
	2110	(3670)
	2150	(3658)
15,	1418	(3667)
	1500	(3658)
	1550	(3658)
	1710	(3669)
	1900	(3665)
	2010	(3667)
	2240	(3658)
16,	0648	(3658)
	1149	(3677)
	1202	(3677)
	1445	(3677)
	1455	(3658)
September 16,	1548	(3658)
	1825	(3666)
	1955	(3677)
	2225	(3658)
17,	1410	(3666)
	1435	(3658)
18,	1600	(3670)
	1605	(3666)+
	2138	(3666)+
19,	0923	(3674)++
	1645	(3666)
	1755	(3666)
	2000	(3666)
	b2040	(3679)
	2230	(3666)
20,	1310	(3676)+
	1455	(3670)+
	1550	(3670)
	1645	(3666)
	1910	(3666)
	1910	(3676)
	2215	(3665)
	2230	(3666)
21,	1420	
22,	1445	(3673)
	1555	(3666)
	1610	(3673)
	1745	(3682)
23,	1401	(3684)
24,	0942	(3683)
	1440	(3683)
	1458	(3683)++
25,	1720	(3686)
	1735	(3686)
	1820	(3688)
	1825	(3686)
	1855	(3686)
	2145	(3686)
26,	1540	(3686)
	1735	(3686)+
	2205	(3686)
	b2220	(3686)
27,	1355	(3686)
	1500	(3686)
	1600	(3680)
	1740	(3683)
	1815	(3686)
28,	b1353	(3683)
	1355	(3686)
	1400	(3690)
	1635	(3690)
	2200	(3688)
	2235	(3686)
29,	1322	(3686)+
	b1347	(3686)
	1350	(3695)
	2105	(3695)
	2200	(3695)
30,	2120	(3695)

\+ McMath or McMath and Sac. Peak.

++ Wendelstein.

IONOSPHERIC EFFECTS OF SOLAR FLARES

AUGUST 1956

Aug. 1956	Start UT	End UT	Type	Wide-spread Index	Impor-tance	Observation stations
2	1940	1953	Slow S-SWF	3	1	BE, HU, MC
8	1137	1400	S-SWF	3	2	MC, PR, NE*
9	0140	0225	S-SWF	5	3	AN, OK, RCA+, TO++
	0543	0647	Slow S-SWF	1	2+	OK
	1734	1801	S-SWF	3	1	BE, MC, WS
	1812	1823	S-SWF	5	1	AN, BE, MC, PR
10	1058	1119	S-SWF	3	1+	BE, DA**
11	1647	1700	Slow S-SWF	3	1-	BE, PR
	2247	0005	G-SWF	5	1	AN, MC, OK, WS
13	1129	1224	S-SWF	3	2	NE*, DA**
14	1600	1612	S-SWF	5	1	BE, HU, MC, WS, NE*, DA**
16	1833	1855	G-SWF	3	1-	MC, PR
17	1800	1807	G-SWF	3	1-	BE, MC, WS
	2035	2050	G-SWF	3	1-	MC, PR, WS
18	0815	0837	S-SWF	1	2	NE*
	1358	1420	G-SWF	3	1-	MC, PR, DA**
	2333	2353	S-SWF	4	1-	PR, TO+
19	0117	0150	S-SWF	1	3	OK
	1623	1648	G-SWF	4	1-	BE, MC, PR
	1930	1942	Slow S-SWF	4	1-	BE, MC, PR
21	0140	0304	Slow S-SWF	1	3	OK
	0845	0909	S-SWF	2	1	NE*, DA**
	1948	2040	S-SWF	5	2+	AN, BE, HU, MC, PR
22	2023	2040	G-SWF	4	1-	BE, MC, PR
23	0208	0242	S-SWF	5	3	OK, TO++
	1126	1222	S-SWF	1	2	NE*
	1324	1332	Slow S-SWF	4	1	MC, PR, NE*
24	1756	1858	G-SWF	3	1-	BE, PR, WS
25	1818	1840	G-SWF	5	1	BE, HU, PR
26	0215	0305	Slow S-SWF	1	4	OK

IONOSPHERIC EFFECTS OF SOLAR FLARES

AUGUST 1956

Aug. 1956	Start UT	End UT	Type	Wide-spread Index	Impor-tance	Observation stations
	1820	1838	G-SWF	2	1-	BE, PR
	2018	2027	S-SWF	5	2	BE, HU, MC, PR
27	0945	1020	S-SWF	1	3	NE*
	1321	1344	S-SWF	5	2-	BE, HU, MC, PR, NE*
	1531	1628	Slow S-SWF	5	2	BE, HU, MC, PR, NE*
	1734	1810	G-SWF	2	1-	BE, MC
	1815	1855	G-SWF	3	1	BE, MC, PR
	2043	2106	S-SWF	4	1	BE, MC, PR
28	0440	0501	S-SWF	1	2+	OK
	0815	0850	S-SWF	5	2+	AN, OK, NE*
	1419	1444	S-SWF	2	1	BE, PR, WS
	1527	1557	Slow S-SWF	5	2+	BE, HU, MC, PR, NE*, DA**
	2007	2100	Slow S-SWF	4	1-	BE, HU, MC, WS
	2243	2313	Slow S-SWF	5	2+	AN, BE, HU, MC, OK, PR, RCA+
	2356	0022	Slow S-SWF	4	2	MC, OK
29	0450	0554	S-SWF	1	2+	OK
	0938	1058	S-SWF	2	2	NE*, DA**
	1728	1810	G-SWF	3	1	MC, PR, WS
	1843	1920	Slow S-SWF	5	2	AN, BE, HU, MC, PR
30	0157	0308	S-SWF	5	3+	OK, NE*
	0825	0857	Slow S-SWF	5	1	AN, OK, NE*
	1000	1030	S-SWF	1	3	NE*
	1540	1600	Slow S-SWF	3	1	HU, PR
	1940	2000	Slow S-SWF	2	1-	HU, PR
31	1239	1400	S-SWF	5	3	BE,HU,MC,PR,NE*,DA**,RCA*
	1725	1815	G-SWF	2	1	HU, MC

NE* Nederhorst den Berg, Netherlands
DA** Darmstadt, Germany
RCA* RCA Communications Inc, Riverhead, N. Y.
RCA+ RCA Communications Inc, Pt. Reyes, Calif.
TO++ Hiraiso Radio Wave Observatory, Japan

SOLAR RADIO WAVES (BOULDER) -- 167 MC

3-HOURLY AND DAILY FLUX

SEPTEMBER 1956.[1]

Sep. 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	--	76	63	48	64	2	2	2	3	3	1228-2516
2	20	18	17	16	18	2	2	2	1	2	1229-2514
3	--	12	12	--	12	1	2	3	2	3	1229-2513
4	--	--	--	--	--	2	1	3	1	3	1230-2510
5	--	--	--	--	--	1	1	1	2	2	1231-2509
6	--	--	13	32	25	2	(1)	2	2	2	1232-2508
7	--	--	--	--	--	2	2	2	2	2	1233-2506
8	--	--	--	65	--	--	--	--	3	3	2200-2505
9	--	--	--	--	--	--	3	(1)	2	3	1649-2503
10	--	--	--	--	--	2	2	2	1	2	1236-2501
11	--	19	21	23	21	3	3	3	3	3	1237-2459
12	--	--	--	--	--	3	2	2	3	3	1238-2457
13	--	--	--	--	--	2	2	3	1	3	1239-2455
14	--	--	--	--	--	1	1	1	1	1	1240-2453
15	--	--	--	--	--	2	2	2	0	2	1241-2451
16	--	--	--	--	--	0	2	1	0	2	1242-2450
17	--	--	--	--	--	0	1	2	3	3	1243-2449
18	--	--	--	--	--	0	0	1	0	1	1244-2447
19	--	--	--	--	--	2	2	2	1	2	1245-2446
20	--	--	--	--	--	--	--	--	--	--	---------
21	--	--	--	--	--	--	--	--	--	--	---------
22	--	--	--	--	--	--	--	--	--	--	---------
23	--	--	--	--	--	--	--	--	--	--	---------
24	14	13	14	13	13	0	0	1	0	1	1249-2437
25	--	14	14	13	14	1	2	(2)	(1)	2	1250-2436
26	14	13	14	13	13	0	2	2	2	2	1251-2433
27	--	13	14	14	14	2	2	0	2	2	1252-1818, 1910-2432
28	--	13	14	13	13	--	2	1	3	3	1433-2330
29	--	15	14	13	14	--	2	(1)	(2)	2	1408-2429
30	--	13	--	14	13	1	(1)	(1)	(1)	(1)	1255-1915, 2115-2427

1. From September 1 to September 20, 1956 the 167 mc/s receiver was less sensitive than normal and therefore low flux levels could not be measured satisfactorily. Only approximate flux values for the more active periods are reported.

SOLAR RADIO WAVES (BOULDER) -- 460 MC

3-HOURLY AND DAILY FLUX

SEPTEMBER 1956

Sept. 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	63	66	0	0	(0)	1	1	1228-2516
2	--	63	64	61	63	1	0	2	0	2	1229-2514
3	65	73	76	70	71	C	0	0	0	0	1229-2513
4	72	72	71	70	71	1	1	3	(2)	3	1230-2510
5	58	60	67	72	64	1	0	0	(0)	1	1231-2509
6	--	66	65	--	66	0	0	0	--	0	1232-2000
7	--	--	--	66	--	--	--	--	(0)	(0)	2100-2506
8	--	--	--	73	--	--	--	--	(0)	(0)	2216-2505
9	---	--	71	--	--	--	0	0	2	2	1655-1947; 2348-2503
10	69	71	71	68	70	2	(0)	(0)	(0)	2	1236-2501
11	--	72	72	71	72	0	(0)	1	(0)	1	1237-2459
12	73	75	73	74	74	1	(0)	(0)	(1)	(1)	1238-2457
13	77	77	75	71	75	2	(0)	0	(0)	2	1239-2455
14	68	69	70	71	70	0	(0)	0	(0)	(0)	1240-2453
15	69	70	72	73	71	0	(0)	0	0	(0)	1241-2451
16	74	74	76	75	75	0	0	0	0	0	1242-2450
17	74	74	74	76	74	0	(0)	2	(0)	2	1243-2449
18	69	71	70	70	70	1	(0)	1	(0)	1	1244-2447
19	68	69	69	69	69	1	(0)	0	(0)	1	1245-2446
20	66	68	65	81	70	(0)	(0)	0	(2)	(2)	1245-2443
21	65	67	--	68	67	0	(0)	(0)	(0)	(0)	1247-1911; 2133-2442
22	--	67	68	66	67	(0)	(0)	(0)	(0)	(0)	1247-2441
23	64	65	66	64	65	0	0	0	(0)	(0)	1248-2203; 2236-2439
24	63	65	65	64	65	(0)	(0)	0	(0)	(0)	1249-2437
25	63	64	64	64	64	(0)	(0)	0	(0)	(0)	1250-2436
26	--	63	61	61	62	0	(1)	0	(0)	(1)	1251-2433
27	60	62	--	63	62	(0)	(0)	0	(0)	(0)	1252-1818; 1915-2432
28	--	62	63	63	63	--	(0)	0	(0)	(0)	1434-2430
29	--	69	65	64	66	--	(0)	(0)	(0)	(0)	1408-2429
30	66	66	--	67	66	0	0	--	0	0	1255-1915; 2116-2427

1. Recently discovered calibration difficulties necessitate a revision of the August 460 mc/s flux levels. The revised tables will be included with the November issue of Part B.

SOLAR RADIO WAVES (BOULDER) -- 167 MC

OUTSTANDING EVENTS [1]

SEPTEMBER 1956

Sept. 1956	Type	Start UT	Duration Hrs:Mins	Maximum Time UT	Maximum Inst. Flux	Maximum Smd. Flux	Remarks
1-3	6	(1228)	(3 days)	Sept. 1	--	64	
1	9	2238.8	00:07.1	2240.4	>2800	320	
1	8	2439.8	00:00.9	2439.8	>5100	--	
2	8	1957	00:04	1957.9	500	110	
3	9	2306.9	00:15.6	2318.7	>4100	130	
4-6	1	(1230)	(~ 3 days)	1549.6*	120	--	*Sept. 5, 1956
4	2	2021	00:26	2042	>1600	19	
5	6	2236	02:33	~2400	290	130	
6	6	1957	(05:11)	1959.2	180	26	
6	8	2417.8	00:02.0	2418.8	1100	280	
7	8	1252.8	00:02.7	1253.4	150	--	
7	1	(1233)	(12:33)	1643	1400	--	
8	9	2200	(03.05)	2341.3	>4000	74	
9	1	1649	(08:14)	2246.7	>1800	--	
9	8	1718.1	00:01.6	1718.9	>4400	950	
10	1	(1236)	(12:25)	2018.9	530	--	
10	8	2034.9	00:01.0	2034.9	>5900	560	
11	6	(1237)	(12:22)	1625.9	820	13	
12	1	(1238)	(12:19)	2044.2	560	--	
12	3	1249.7	00:00.4	1249.8	>3100	--	
12	8	2245.3	00:03.2	2247.2	>4000	760	
13	8	1350.8	00:02.4	1351.1	710	270	
13	8	1949.7	00:03.0	1959.4	>1600	520	
15	1	(1241)	(08:19)	2055.6	680	--	
17	1	1613	(08:36)	2235	>4000	--	
19	1	1327	(11:19)	1447	230	--	
26	2	1737.5	00:06.1	1741.4	620	250	
26	3	2212.8	00:01.7	2213.7	1100	14	
27	1	1310	03:20	1311.8	1500	--	
27	3	2122.1	00:02.8	2122.3	1100	470	
28	2	1643.8	00:00.9	1644.5	540	--	
28	8	2110.1	00:03.6	2110.8	1600	170	
28	3	2325.5	00:00.3	2325.7	4000	--	
29	6	(1408)	(10:21)	2119.5	2700	180	

Note: 1. Interference may sometimes obscure or be mistaken for solar events. Relatively small events not reported. See note 1 under 167 mc/s flux table.

SOLAR RADIO WAVES (BOULDER) -- 460 MC

OUTSTANDING EVENTS [3]

SEPTEMBER 1956 [1]

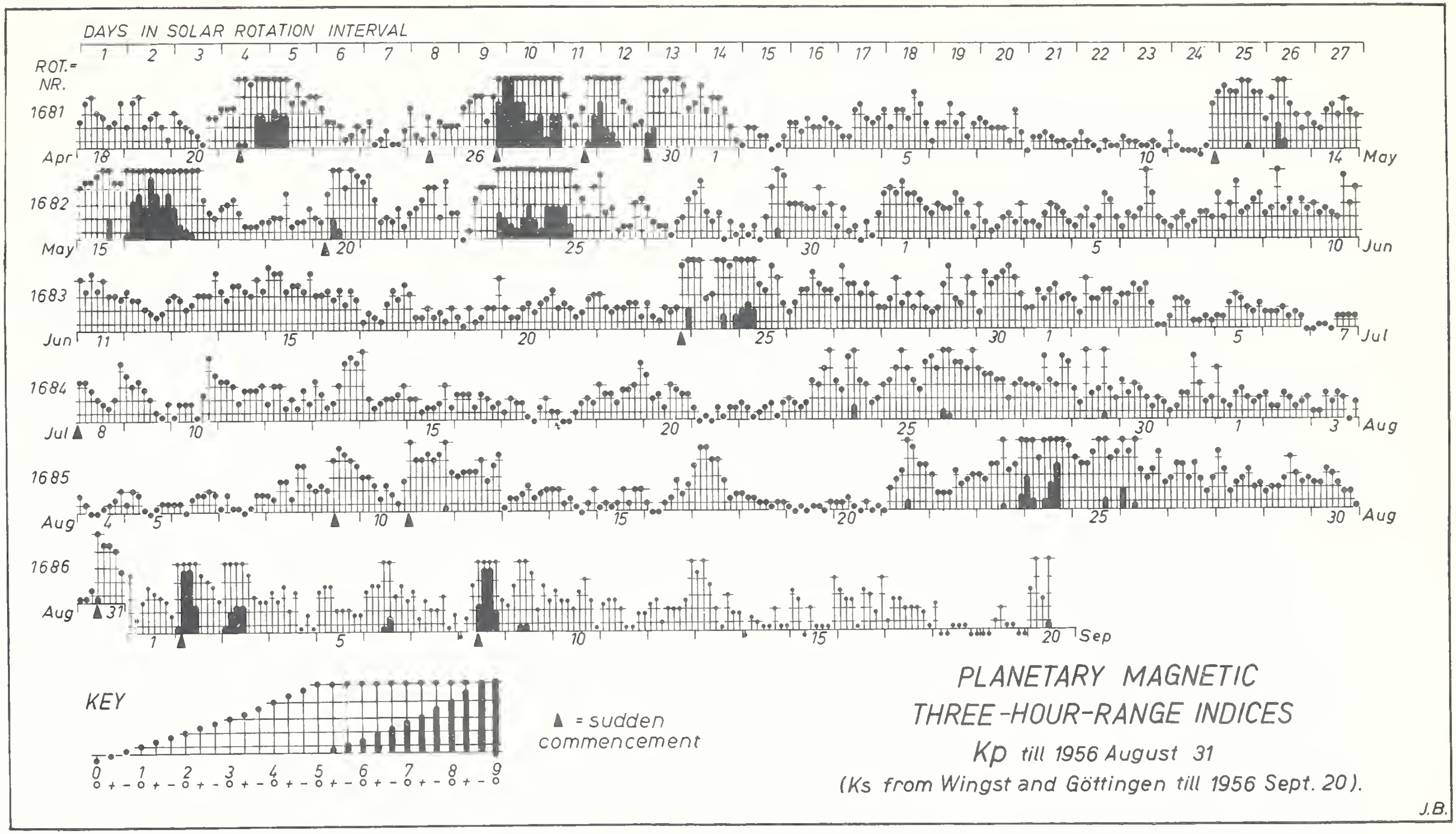
Sept. 1956	Type	Start UT	Duration Hrs:Mins	Maximum Time UT	Maximum Inst. Flux	Maximum Smd. Flux	Remarks
1	3	1623.9	00:00.3	1623.9	190	--	
1	3	2241.8	00:02.3	2242.5	>1200	--	
2	8	1956.4	00:05.7	1958.0	>2000	52	
3	6	(1229)	(12:44)	~1900	--	14	
4	6	(1230)	(12:40)	1534.8	200	10	
4	8	2022.5	00:04.0	2025.0	>4500	>1600	Off scale
4	8	2041.9	00:03.0	2042.8	>3500	>2200	
4	2	2505.7	00:01.1	2506.7	>1400	460	
5	2	1444.7	00:01.1	1445.8	190	60	
5	6	1910	(05:59)	~2200	--	11	
9	3	2203.8	(00:05.9)	(2207.8)	~500	--	Note 2.
10	2	1413.9	00:10.9	1424.2	>1800	120	
11	6	(1237)	(12:22)	1926.7	400	10	
12	6	(1238)	(12:19)	2242.0	190	12	
13	6	(1239)	(12:16)	1342.0	810	14	
15	6	(1241)	(12:10)	~2100	--	11	
16	6	(1242)	(12:08)	~1800	--	14	
17	6	(1243)	(12:06)	~1400	--	14	
17	8	1343.1	00:08.9	1345.9	720	230	
18	3	1325.4	00:00.7	1325.7	620	--	
19	2	1446.2	00:06.3	1446.5	420	--	
20	6	(2300)	(01:43)	~2335	190	20	
26	2	1740.0	00:02.9	1741.2	140	26	

Notes:
1. Flux values for September 1 thru 6 are less accurate than normal.
2. This event was only partially observed.
3. Severe interference has probably obscured some solar events.
4. The note under the 460 mc/s flux table also applies to August outstanding events.

GEOMAGNETIC ACTIVITY INDICES

AUGUST 1956

Aug. 1956	C	Values Kp								Sum	Ap	Final Selected Days
		Three-hour Gr. interval										
		1	2	3	4	5	6	7	8			
1	0.5	4o	2-	1+	2+	3-	2o	2-	2o	18-	10	Five
2	0.4	2+	1+	1+	2+	2o	1+	2-	2o	14+	7	Quiet
3	0.2	1o	1o	2+	2-	2+	2o	0+	2-	12+	6	
4	0.1	2-	1o	0+	0+	1-	1o	1+	2o	8+	4	4
5	0.1	1o	2o	2-	1-	0+	1-	1o	1o	8+	4	5
												7
6	0.2	1o	1o	0+	1+	2-	2-	2o	2-	11-	5	19
7	0.2	1-	2-	1-	1-	0+	1-	2-	2-	8o	4	20
8	0.9	2-	1+	3-	3-	1+	4-	4-	2+	19+	12	
9	1.1	2o	2+	2o	4o	5-	4+	4o	4-	27o	21	
10	0.6	3o	3o	2+	1+	2+	2-	1o	3-	17+	9	
11	1.5	5o	4o	4o	4+	4o	4+	5+	3+	34+	33	Five
12	1.1	3o	3+	3+	3+	4o	3-	4-	4+	28-	20	Disturbed
13	0.4	1-	1+	1+	2-	2+	1+	2-	2o	12+	6	
14	0.2	2o	2o	1o	1+	1-	0+	1o	2o	10+	5	11
15	0.2	1-	1o	1-	1o	2o	1o	2o	2o	10+	5	23
												24
16	0.3	1o	0+	0+	1o	1+	3-	2-	2+	11-	6	25
17	1.0	4-	5-	5-	4o	4o	3-	1+	2-	27-	22	26
18	0.1	2-	1+	1+	1o	1o	1-	1o	1o	9o	4	
19	0.0	1-	0+	1-	0+	1-	1-	0+	1o	5-	3	
20	0.0	1o	1o	1+	1-	0+	1o	0+	1-	6+	3	
21	1.2	0+	2o	3-	3+	6-	5-	4-	4-	26o	24	Ten
22	0.7	3o	2-	2-	2-	3+	2+	3-	3o	19+	11	Quiet
23	1.2	3o	3-	4-	4-	5+	3+	4-	6o	31+	31	
24	1.8	7o	6-	4o	6-	7-	8-	5o	5-	46+	84	4
25	1.4	4o	4-	4-	4+	5o	6-	4o	4+	35-	35	5
												6
26	1.3	6+	4+	5+	3+	3-	3+	4+	2+	32o	34	7
27	0.8	3-	4-	4-	3-	4-	3-	2-	3-	23+	15	14
28	0.8	4+	3+	2-	2+	3-	3+	2o	2+	22o	14	15
29	0.7	2-	2o	2o	3-	4o	3o	2+	3-	20+	12	16
30	0.6	2+	2+	3+	3o	2+	2-	2-	1-	17+	9	18
31	1.1	1-	1-	1+	5+	4+	4+	4o	3-	23+	21	19
Mean:	0.67									Mean:	15	20



PLANETARY MAGNETIC THREE-HOUR-RANGE INDICES

Kp till 1956 August 31

(Ks from Wingst and Göttingen till 1956 Sept. 20).

CRPL RADIO PROPAGATION QUALITY FIGURES AND FORECASTS

NORTH ATLANTIC

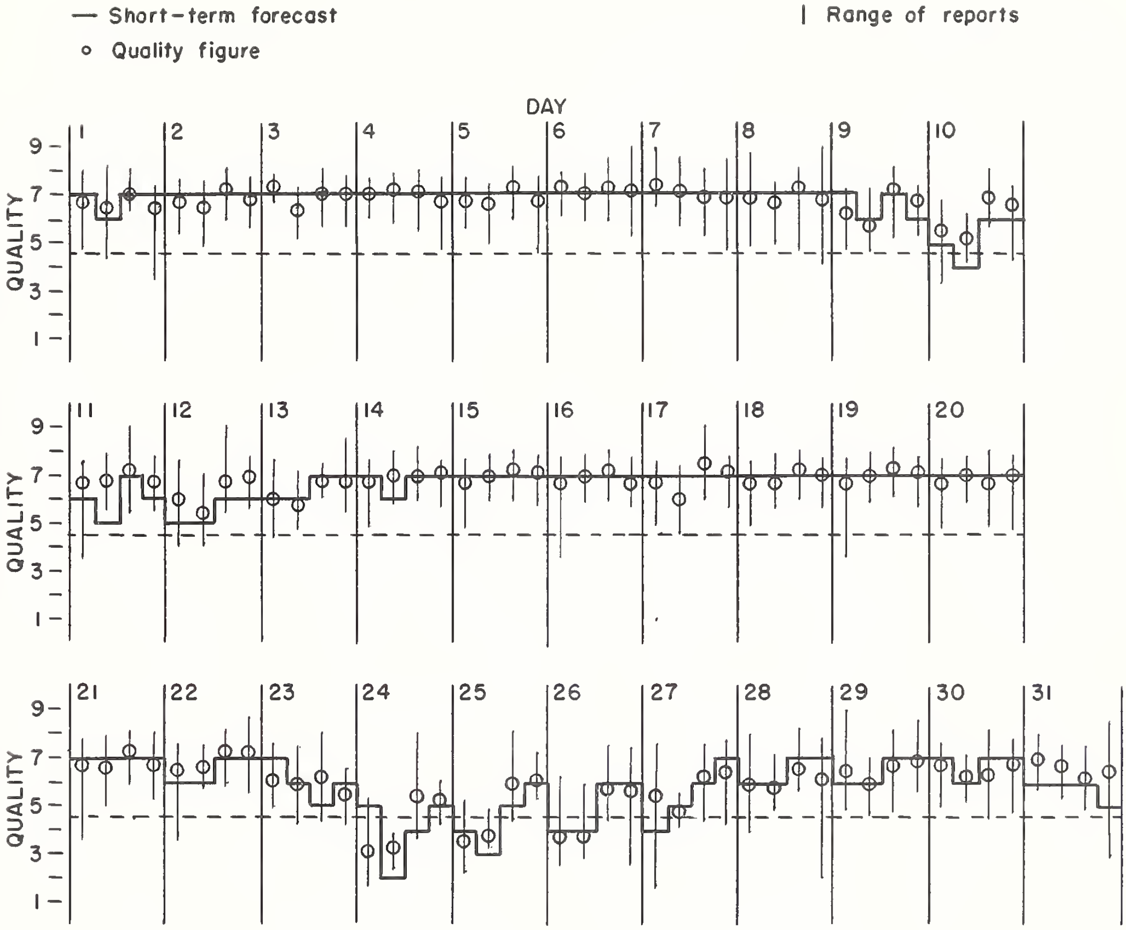
AUGUST 1956

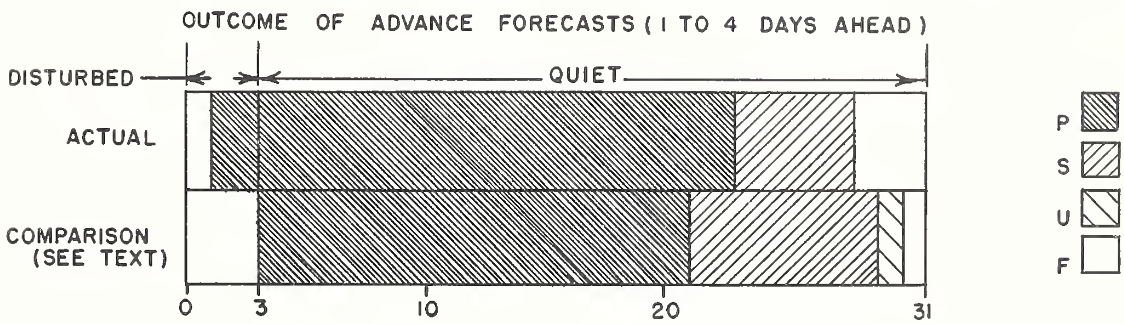
Aug. 1956	North Atlantic 6-hourly quality figures				Short-term forecasts issued about one hour in advance of:				Whole day index	Advance forecasts (J-reports) for whole day; issued in advance by:			Geomagnetic K_{Ch}	
	00 to 06	06 to 12	12 to 18	18 to 24	00	06	12	18		1-4 days	4-7 days	8-25 days	Half (1)	Day (2)
1	7-	6+	7o	7-	7	6	7	7	7-	7	7		2	2
2	7-	7-	7o	7o	7	7	7	7	7-	7	7		2	2
3	7+	6+	7o	7o	7	7	7	7	7o	7	7		1	2
4	7o	7o	7o	7-	7	7	7	7	7o	7	7		1	2
5	7o	7-	7o	7-	7	7	7	7	7-	7	7		2	1
6	7+	7o	7+	7o	7	7	7	7	7+	7	7		0	2
7	7+	7o	7o	7o	7	7	7	7	7o	7	7		2	1
8	7o	7-	7o	7-	7	7	7	7	7o	7	7		3	2
9	6+	6-	7o	7-	7	6	7	6	7-	7	7		2	(4)
10	6-	5o	7o	7-	5	4	6	6	6+	4	7		3	2
11	7-	7-	7o	7-	6	5	7	6	7-	4	7		(4)	(4)
12	6o	5+	7-	7o	5	5	6	6	6+	5	7		3	(4)
13	6o	6-	7o	7o	6	6	7	7	7-	6	6		2	2
14	7-	7o	7o	7o	7	6	7	7	7o	6	6		2	1
15	7-	7o	7+	7o	7	7	7	7	7o	7	7		1	2
16	7o	7o	7+	7o	7	7	7	7	7o	7	7		1	2
17	7-	6o	7+	7o	7	7	7	7	7o	7	7		(4)	2
18	7-	7-	7+	7o	7	7	7	7	7o	7	7		2	2
19	7-	7o	7+	7o	7	7	7	7	7o	7	7		1	1
20	7-	7o	7-	7o	7	7	7	7	7-	7	7		1	1
21	7-	7-	7+	7-	7	7	7	7	7o	7	7		2	(4)
22	7-	7-	7+	7+	6	6	7	7	7o	7	7		2	3
23	6o	6o	6+	6-	7	6	5	6	6o	7	7		3	(4)
24	3o	3+	6-	5+	5	2	4	5	4o	6	7		(5)	(5)
25	4-	4-	6o	6o	4	3	5	6	4+	4	7		(4)	(4)
26	4-	4o	6o	6-	4	4	6	6	4+	4	5		(4)	3
27	6-	5o	6+	6+	4	5	6	7	6-	5	5		3	3
28	6o	6o	7-	6+	6	6	7	7	6+	6	6		2	2
29	7-	6o	7-	7o	6	6	7	7	7-	7	7		2	3
30	7-	6+	6+	7-	7	6	7	7	7-	7	7		3	1
31	7o	7-	6+	7-	6	6	6	5	7-	4	7		2	3
Score: Quiet Periods				P	19	21	25	24		20	22			
				S	8	6	5	6		5	6			
				U	0	1	0	1		0	0			
				F	1	0	1	0		3	0			
Disturbed Periods				P	2	1	0	0		2	0			
				S	0	2	0	0		0	1			
				U	1	0	0	0		0	0			
				F	0	0	0	0		1	2			

( ) represent disturbed values.

CRPL RADIO PROPAGATION QUALITY FIGURES AND FORECASTS
NORTH ATLANTIC

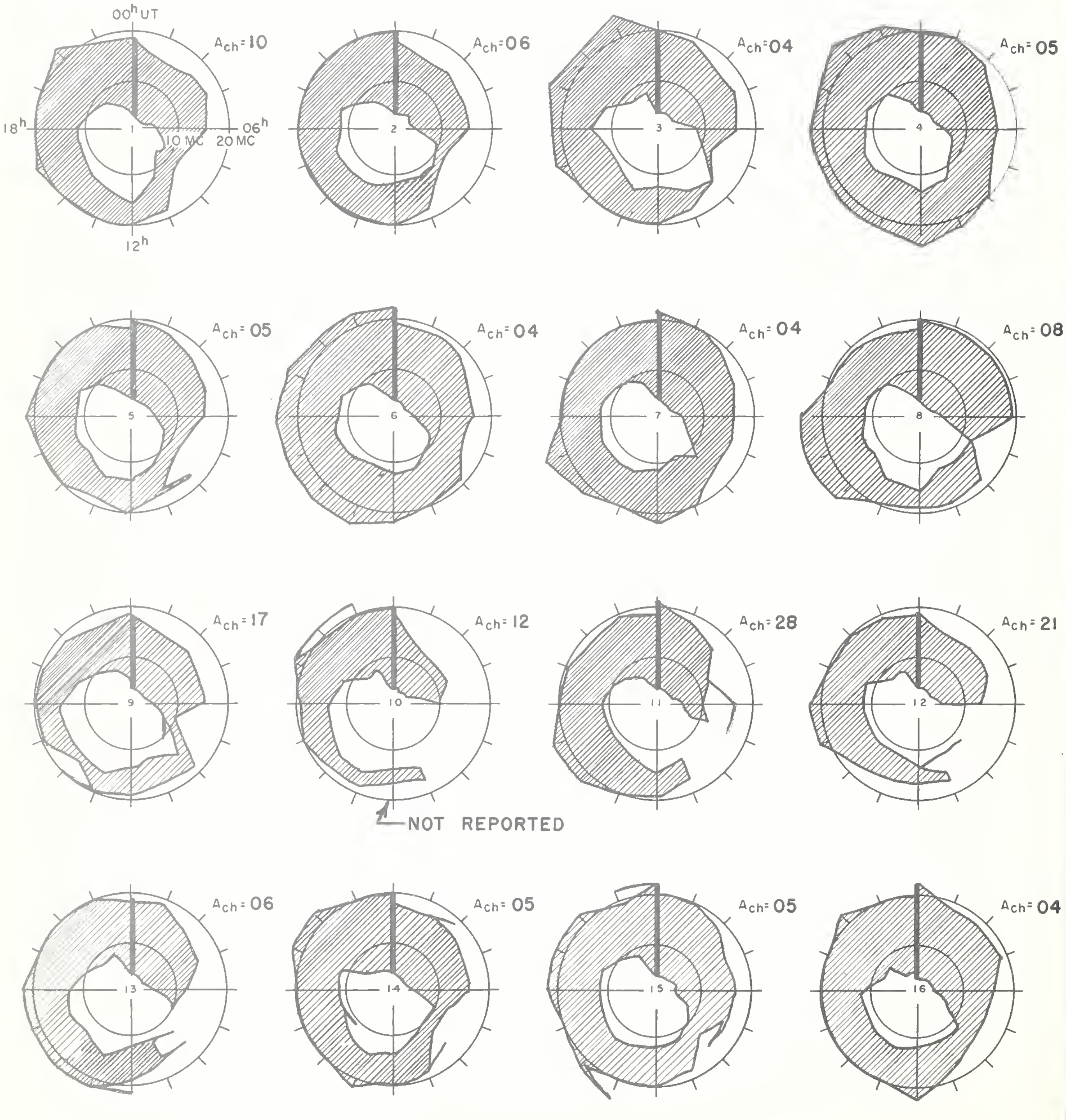
AUGUST 1956



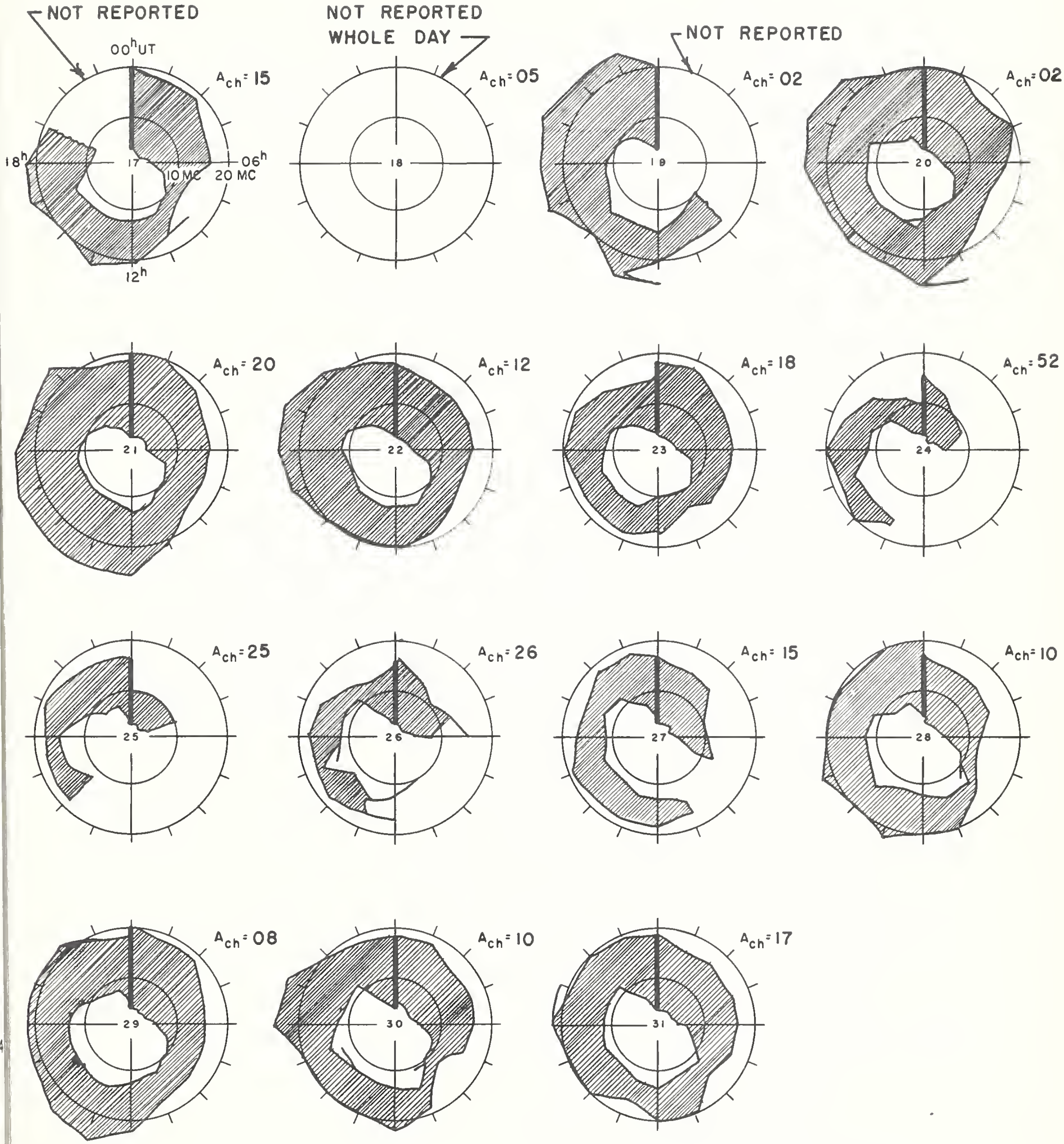


USEFUL FREQUENCY RANGES -- NORTH ATLANTIC PATH

AUGUST 1956



AUGUST 1956


NOT REPORTED
00h UT
Ach = 15
18h
06h
10 MC
20 MC
12h
17
NOT REPORTED WHOLE DAY
Ach = 05
18
NOT REPORTED
Ach = 02
19
Ach = 02
20
Ach = 20
21
Ach = 12
22
Ach = 18
23
Ach = 52
24
Ach = 25
25
Ach = 26
26
Ach = 15
27
Ach = 10
28
Ach = 08
29
Ach = 10
30
Ach = 17
31

CRPL RADIO PROPAGATION QUALITY FIGURES AND FORECASTS

NORTH PACIFIC

AUGUST 1956

Aug. 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	6	5	7	6	7	7	6	6	6		2	2
2	5	6	7	6	7	7	6	6	6		2	2
3	6	6	7	6	6	7	6	6	6		2	1
4	6	7	7	6	6	7	7	6	6		1	1
5	7	7	7	7	7	7	7	6	6		2	1
6	6	6	6	7	7	7	7	5	6		0	2
7	6	5	6	6	6	6	6	5	6		1	2
8	6	6	6	6	6	6	6	6	5		2	3
9	6	5	6	6	6	6	6	6	6		3	(4)
10	5	5	6	5	5	6	6	6	6		2	2
11	6	5	6	6	6	6	6	6	6		(4)	(4)
12	5	5	6	5	5	6	6	6	6		(4)	3
13	6	6	6	5	6	6	6	6	6		1	1
14	5	5	6	6	6	6	6	6	6		2	1
15	6	5	6	6	6	6	6	6	6		0	2
16	6	6	7	5	6	6	6	6	6		1	2
17	5	5	7	6	5	6	6	6	6		(5)	3
18	6	6	7	5	6	6	6	5	6		2	1
19	6	6	8	6	6	7	7	5	6		1	0
20	7	6	8	6	6	7	7	6	6		1	0
21	6	5	7	7	6	5	7	6	6		2	(4)
22	5	6	6	5	6	6	6	4	6		2	2
23	6	6	5	6	5	6	6	4	6		3	(4)
24	3	2	3	4	4	4	(2)	5	6		(6)	(6)
25	3	2	4	3	4	4	(2)	4	5		(5)	(4)
26	3	4	5	3	3	5	(4)	4	6		(6)	3
27	4	4	5	4	4	5	5	5	6		(4)	3
28	5	5	5	4	5	6	5	6	6		2	3
29	5	5	6	6	5	5	5	6	6		2	3
30	4	5	5	5	4	5	5	5	6		3	1
31	5	5	6	4	5	4	5	4	6		2	(4)

Score:		02	09	18	1-4 days	4-7 days
Quiet Periods	P	14	15	18	15	16
	S	12	11	9	9	12
	U	0	1	1	2	0
	F	0	0	1	2	0
Disturbed Periods	P	3	1	1	1	0
	S	2	1	1	0	0
	U	0	2	0	2	1
	F	0	0	0	0	2

( ) represent disturbed values.

CRPL RADIO PROPAGATION QUALITY FIGURES AND FORECASTS

NORTH PACIFIC

AUGUST 1956