PART B

SOLAR - GEOPHYSICAL DATA

ISSUED
DECEMBER 1956

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

CRPL-F 148
PART B

NATIONAL BUREAU OF STANDARDS
CENTRAL RADIO PROPAGATION LABORATORY
BOULDER, COLORADO

Issued
31 Dec. 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 report is edited by Miss J. V. Lincoln of the Sun-Earth Relationships Section.

I DAILY SOLAR INDICES

Relative Sunspot Numbers -- The table includes (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 Zurich 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.

Solar Flux Values, 2800 Mc -- The table also lists the daily values of solar flux at 2800 Mc recorded in watts/M^2/cycle/second bandwidth ($x\ 10^{-22}$) in two polarizations by the National Research Council at Ottawa, Canada. These solar radio noise indices are being published in accordance with CCIR Report 25 that a basic solar index for ionospheric propagation should be measured objectively and "preferably refer to a property of the sun such as radiation flux which has direct physical relationship to the ionosphere."

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

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; 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; 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, 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:

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

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, Sacramento Peak, and Swedish Astrophysical Station on Capri. 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 (Sacramento Peak uncorrected for foreshortening; Swedish Astrophysical Station corrected 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.

<u>3-hourly and Daily Flux</u> -- 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.

<u>Outstanding Events</u> -- 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. <u>118</u>, 169, 1953). The categories of events are identified in the table by numbers, which do not necessarily indicate the magnitude of the event:

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

1 - <u>Series of bursts</u> -- 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.

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

<u>North Pacific Radio Path</u> -- 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

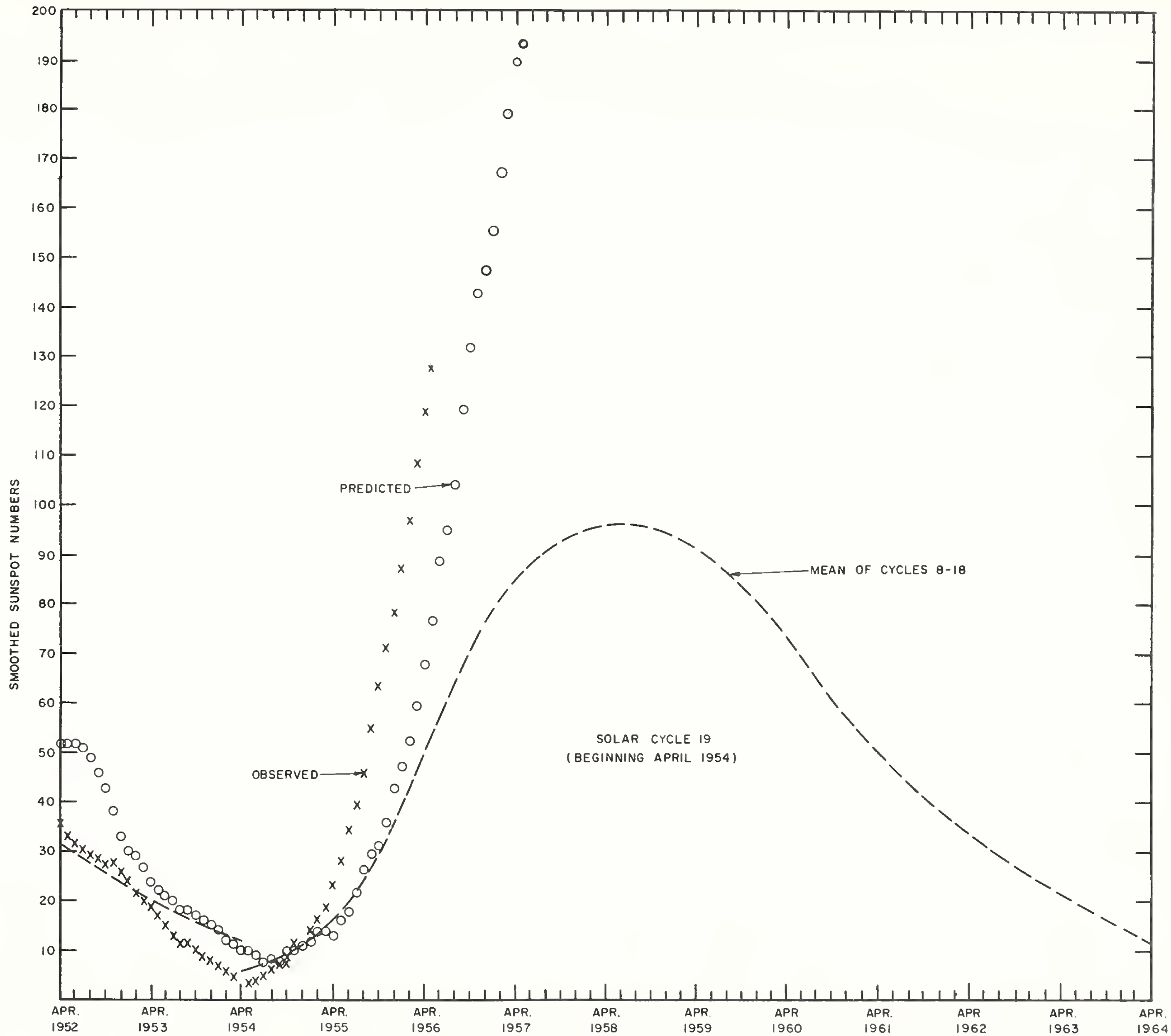
The 9-hour and 24-hour indices Qp are determined separately. Each index is a weighted mean where the CRPL observations have unit weight and the others are weighted by the correlation coefficient with the CRPL observations.

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.

SOLAR INDICES

American Relative Sunspot Numbers, October 1956		Zürich Provisional Relative Sunspot Numbers, November 1956		Daily Values Solar Flux at 2800 MC, Ottawa, Canada, November 1956
Date	$R_{A'}$	Date	R_Z	Flux
1	154	1	157	241
2	184	2	175	225
3	207	3	187	225
4	197	4	198	251
5	140	5	220	274
6	142	6	274	301
7	163	7	321	302
8	150	8	295	319
9	139	9	242	305
10	160	10	236	284
11	143	11	256	283
12	159	12	262	293
13	133	13	205	278
14	115	14	205	269
15	94	15	246	251
16	100	16	236	257
17	89	17	231	255
18	95	18	180	228
19	104	19	178	223
20	113	20	180	216
21	125	21	183	205
22	162	22	154	230
23	134	23	165	203
24	124	24	175	199
25	128	25	190	213
26	143	26	130	214
27	124	27	122	205
28	133	28	115	217
29	157	29	164	218
30	164	30	198	238
31	162			
Mean:	139.9	Mean:	202.7	Mean: 247.4



PREDICTED AND OBSERVED SUNSPOT NUMBERS

CALCIUM PLAGE AND SUNSPOT REGIONS

NOVEMBER 1956

CMP Nov. 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
01.4	N36	3734 (2)	3690	27-1300-2	————	28-1000-2			
01.4	S25	3735 (2)	3692	27-6000-2.5	07- 3000-3	07-3000-3	27- XX -3	06- 110-3	07- 20 -2
02.3	S22	3738 (3?)	3695	28-2000-2	30- 2400-2	01-1400-2	28-340 -2	28- 340-2	01- XX -9
03.1	N20	3736 (2)	3694	27-3500-3	03-11400-3	09-6000-2.5	28-580 -5	28- 580-5	09-240 -1
03.4	N47	3737	New	27-2000-3	27- 2000-3	30-1000-2			
03.5	N37	3749	New	03-1000-1	09- 4000-3	09-4000-3	04-240 -11	06- 320-9	09-50a -XX
03.7	S19	3739 (8?)	3696	28-4000-2.5	03-15400-3	09-6000-3	28-390 -1	31- 460-12	09-50a -XX
04.8	N24	3741 (2)	3699	29-1000-2	31- 3500-2.5	11-2800-2	06-120 -5	10- 480-2	11-150a-XX
05.1	S25	3742 (2?)	3697	30-1000-2	31- 1800-2	02-1200-2	31-240 -1		31-240 -1
06.9	S27	3744 (8)	3698	31-2500-2	10- 5000-2	12-2000-2	01- XX -1	06- 240-1	11-190 -1
07.3	S15	3746	New	01-2500-3	12- 4000-3	12-4000-3	01- XX -3	08- 820-15	12-290 -1
07.9	N27	3745 (5)	3701	31-1000-1.5	02- 2500-2	05-1800-2			
08.8	S18	3748 (4)	3703	02-1000-2	10- 5000-2	12-4000-2	09-100 -5	09- 100-5	12- 60 -3
09.3	N27	3747 (4)	3702	02-2000-2.5	09- 3000-3.5	14-3500-3	02- XX -6	05- 830-19	14-190 -1
10.0	S18	3751 (4)	3704	05-6000-4	05- 6000-4	15-8000-1	04-490 -3	08- 990-11	15-290 -2
10.2	N25	3750 (4)	3702	04-2000-1	14- 3500-3	16-2000-1	04-240 -2	14- 480-6	16-190 -1
11.4	S22	3752	New	07-6000-3.5	14- 8000-3	17-7500-3	04-390 -1	07-1840-14	18- 70 -4
12.9	N26	3761	New	16- 700-1	18- 2500-2.5	18-2500-2.5	16- 70 -6	16- 70-6	18- 50 -1
13.1	N16	3753 (2)	3709	07-5000-4.5	11- 8000-2	19-3000-2	06-240 -1	10- 920-13	18-150 -1
13.6	S10	3754 (2)	3721	09-2400-2	18- 2000-3.5	19-2000-2	13- 60 -3	13- 60-3	18- 50a-XX
15.3	N22	3762	New	15-1000-2	16- 1400-1	19-1200-2	15- 80 -3	16- 190-5	19- 70 -3
16.2	S14	3755	New	09-1000-2	20- 8000-3	22-5000-3	10-580 -2	19-1550-33	22-820 -3
16.2	S24	3757	New	14- 400-3	21- 2500-4	21-2500-4	14- 10 -XX	19- 160-9	20-160 -5
16.7	N31	3756 (3)	3710	10-1500-3	14- 3500-2	23-2400-2			
19.4	N40	3763 (2)	3715	17-1100-1.5	17- 1100-1.5	18- 700-2			
21.2	S18	3764 (3)	3724	15-1400-1	24- 7000-3	26-4000-2	15- 10 -XX	24- 580-6	25-150a-XX
21.2	S42	3766 (2)	3720	17-2100-1.5	17- 2100-1.5	24- 500-2			
21.3	N17	3765 (2)	3719	15-2000-1	17- 4900-3	27-5000-3	15-290 -1	18- 490-3	27-100 -1
23.8	N35	3768 (2)	3725	18- 700-2	19- 1000-3	22- 300-1	19- 70 -2	19- 70-2	20- 20 -1
23.9	S23	3767 (4)	New,3729	17-3500-3	29- 7000-3	29-7000-3	17-200 -XX	19-1220-17	29-150 -1
25.0	N17	3769 (3)	3730	18-1000-2	19- 2000-2.5	24-1200-2.5			
25.6	S28	3770 (4)	3729	22-1500-2	24- 1800-2	27-1500-2			
26.7	S31	3772 (4)	3729	22-1500-2.5	22- 1500-2.5	24- 700-2.5			
27.0	S23	3773 (2)	3743	22-1200-2	30- 2800-1	30-2800-1	25-150a-XX	26- 150-3	30- 20 -2
28.2	N17	3774	New	22-4000-3.5	24- 5000-3.5	04-2000-1	22-100 -4	26- 360-10	02- 10 -XX

a signifies area approximate.

CORONAL LINE EMISSION INDICES

NOVEMBER 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
Nov.																
1	101	225	12	16	90	240	33	60	137	207	46	84	104	146	26	36
2	133	185	28	36	129	211	40	66	141	299	40	60	240	338	29	54
3	140	180	30	48	177	240	48	60	137	182	40	78	159	202	31	57
4	116	136	16	18	132	160	54	94	130	178	32	60	120	165	31	75
5	X	X	X	X	X	X	X	X	153	202	25	42	120	187	29	54
6	56	92	34	39	106	184	58	110	162	204	34	44	87	156	32	51
7	103	201	26	40	162	222	30	46	X	X	X	X	X	X	X	X
8	X	X	X	X	X	X	X	X	161	192	32	63	93	158	29	66
9	106	140	45	105	122	172	42	63	291	428	30	50	160	370	37	54
10	X	X	X	X	X	X	X	X	196*	269	44	96	138	238	44	64
11	90	140	30	48	93	112	32	53	90*	120	42	84	103	152	55	88
12	82*	100	25	46	67*	98	30	50	X	X	X	X	X	X	X	X
13	86	139	20	36	147	275	38	58	80	110	18	35	81	136	26	39
14	55[a]	70[a]	19[a]	26[a]	87[a]	128[a]	26	38	98*	156	33	54	79*	108	X	X
15	69	90	38	50	139	200	37	81	90*	132	25	42	77	116	52	84
16	110	183	34	48	124	205	31	71	X	X	X	X	X	X	X	X
17	96	143	32	48	62	80	17	21	88	126	37	42	103	162	45	62
18	119	151	56	98	57	76	15	20	72*	76	25	26	110	140	30	61
19	131	153	49	87	75	113	16	21	70	132	30	42	100	161	50	121
20	112	168	45	129	76	114	17	24	119	184	23	50	121	192	41	101
21	X	X	X	X	X	X	X	X	97	128	34	39	98	153	46	95
22	102	138	24	36	51	64	27	48	105	156	26	39	110	150	23	61
23	186	273	31	68	253	320	37	58	109	132	40	62	91	129	29	48
24	93	134	43	98	122	147	43	93	118	149	44	76	90	199	27	60
25	77	109	35	56	114	140	53	84	132	167	37	60	76	140	33	50
26	X	X	X	X	X	X	X	X	151	202	49	93	79	106	51	118
27	67	86	32	68	128	136	48	76	148	177	X	X	101	173	X	X
28	85	115	28	78	140	236	32	87	X	X	X	X	X	X	X	X
29	86	132	34	54	109	160	36	87	101	125	26	73	83	125	21	32
30	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

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

SOLAR FLARES
NOVEMBER 1956

Observatory	Date Nov. 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	01	1200	1221	21	122	3739	S21	E29				1	
Capri-S	01	1219	1243	24		3746	S15	E90				1	
S. Peak	01	1905	1940	35	105	3739	S20	E22	1913	18	6	1	
McMath	01	b1910				3746	S14	E80				1	
S. Peak	04	1555	1645	50	100	3746	S15	E36	1605	16	3	1	Slow S-SWF
Capri-S	05	0946	1000	14	185	3751	S15	E57				1	
Capri-S	05	1106	1157	51	262	3749	N36	W48				2	
Capri-S	05	1349	1411	22	102	3751	S18	E55				1	
Capri-S	05	1417	1439	22	112	3746	S15	E25				1	
S. Peak	05	1730	1800	30	200	3751	S16	E54	1735	18	6	1+	Slow S-SWF
S. Peak	05	1825	1930	65	155	3753	N17	E90	1840	18	9	*	G-SWF
McMath	05	1858	1937	39		3753	N20	E90				1?	
Capri-S	06	0907	0947	40	136	3739	S23	W40				1	
Capri-S	06	1000	1018	18		3753	N18	E90				1	
Neder.	06	b1005	1030	>25		3753	N15	E90				2	
Capri-S	06	1140	1235	56	350	3736	N21	W49				2	Slow S-SWF
S. Peak	06	1545	1610	25	155	3739	S24	W51	1556	18	4	1	Slow S-SWF
McMath	06	b1552				3739	S20	W45				1	
S. Peak	06	1715	1725	10	115	3753	N18	E90	1715	18	6	1	S-SWF
S. Peak	06	2140	a2219	>39	100	3739	S23	W53	2150	15	5	1	
Tokyo	06	b2309		>30		3753	N15	E75				1	
Tokyo	07	0108	0128	20		3751	S15	E35				1	
Capri-S	07	0838	0902	24	330	3753	N17	E78				2	
Neder.	07	b0836	0845	> 9		3753	N15	E80				1	
Capri-S	07	0909	1034	85	282	3753	N17	E70				1+	
Capri-S	07	0937	1003	26	146	3751	S13	E28				1	
Kanzel.	07	b0941		> 30		3753	N15	E75				2	
Capri-S	07	1109	1403	174	603	3751	S16	E30				3	S-SWF
Kanzel.	07	b1122		> 50		3751	S15	E35				3	
S. Peak	07	b1415	~2100	405	140	3753	N17	E67		18	8	1	
Tokyo	08	b0613		> 20		3752	S25	E25				2	
Capri-S	08	0954	1026	32	151	3751	S17	E18				1	
Wendel.	08	0950	1013	23	195	3751	S16	E17	0956			1	
Wendel.	08	0950	1010	20	245	3753	N16	E66	0958			1-2	
Capri-S	08	1139	1355	136	160	3751	S17	E17				1+	
Wendel.	08	b1219	1334	> 75	245	3751	S15	E16	1229 1328			1	
Neder.	08	1147	1207	20		3752	S24	E34				1	
Capri-S	08	1150	1218	28		3752	S25	E32				1	
Neder.	08	1315	1336	21		3751	S15	E14				1	Slow S-SWF
S. Peak	08	1445	1550	65	100	3751	S16	E17	1505	16	3	1	
Capri-S	08	1443	1514	31	190	3751	S17	E16				1	
S. Peak	08	1835	1850	15	110	3752	S21	E36	1835	18	8	1	Slow S-SWF
Neder.	09	b0748	0818	>30		3741	N22	W58				2	
Kanzel.	09	b0753	0758	> 5		3741	N25	W55				2	
Capri-S	09	0828	0851	23	107	3748	S17	W14				1	
Capri-S	09	1207	1234	27	112	3747	N28	E05				1	
Capri-S	09	1216	1231	15	165	3753	N16	E44				1	
Wendel.	09	b1219	1229	> 10	290	3753	N19	E49				1	
S. Peak	09	1519	1527	8	100	3753	N19	E46	1520	15	3	1**	Slow S-SWF
Capri-S	10	1118	1135	17	112	3753	N18	E33				1	
McMath	10	1823	1905	42		3741	N24	W75				1	

* Judged by area alone, flare importance = 1, but since there was a large spray with it, the event importance = >1.

** McMath, Capri-S list as importance 1-.

SOLAR FLARES

NOVEMBER 1956

Observatory	Date Nov. 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	10	1915	1940	25	100	3755	S13	E75	1924	30	9	1***	
Wendel.	11	b1001	1013	> 13	145	3746	S14	W64	1005			1	
Capri-S	11	1240	1300	20	112	3751	S21	W34				1	
S. Peak	11	1645	1800	75	120	3746	S14	W66	1700	15	4	1	
S. Peak	11	1725	2035	190	225	3751	S18	W24	1950	12	3	1+	
S. Peak	11	2055	a2219	> 84	245	3753	N16	E15	2210	12	6	1+	G-SWF
Neder.	12	b1114	1118	> 4		3756	N10	E51				1	
S. Peak	12	1505	1600	55	145	3753	N18	E05	1511	20	6	1	
S. Peak	12	1600	1650	50	105	3752	S17	W20	1620	15	6	1	Slow S-SWF
McMath	12	b1845				3746	S15	W90				2	Slow S-SWF
S. Peak	12	1835	1855	20	40	3746	S12	W90	1840	18	9	1-	
Tokyo	13	b0157		> 60		3750	N25	W45				3	Slow S-SWF
S. Peak	13	b1430	1555	> 85	385	3753	N17	W12	1501	25	6	2	Slow S-SWF
McMath	13	1442	1516	34		3753	N15	W07				2	
McMath	13	2000	2012	12		3752	S20	W40				1+	
Tokyo	14	0214	0249	35		3752	S25	W15				1	
Tokyo	14	b0501		> 25		3753	N15	W35				2	S-SWF
Capri-S	14	1137	1427	170	554	3751	S20	W56				2+	
S. Peak	14	1925	1950	25	150		S03	W90	1935	16	6	1	
Tokyo	14	b2325		> 30		3752	S25	W35				1	
Neder.	15	b0815	0830	> 15		3755	S12	E11				1	S-SWF
Neder.	15	b0900	0920	> 20		3757	S24	E10				1	
S. Peak	15	2150	a2220	> 30	305	3751	S26	W66	2156	18	8	2	
S. Peak	16	1435	1505	30	105	3750	N25	W80	1445	16	8	1	S-SWF
S. Peak	16	1605	1620	15	130	3755	S10	W06	1609	14	9	1	
Capri-S	17	1131	1325	114	243	3764	S16	E51				1	Slow S-SWF
S. Peak	17	1844	1901	17	130	3755	S13	W25	1848	18	9	1	
Tokyo	17	0109	0129	20		3752	S15	W75				1	
Tokyo	17	b0257		> 10		3752	S25	W75				1	
Tokyo	17	0401	0411	10		3755	S15	W15				1	Slow S-SWF
Tokyo	17	b0426		> 40		3752	S15	W75				1	
Wendel.	19	b0834	0924	> 50	680	3755	S14	W42	0850			1	
Meudon	19	b0843		>100		3755	S15	W45				2	
Wendel.	19	0925	0950	25	680	3755	S14	W42	0936			1	
S. Peak	19	2135	2210	35	110	3764	S17	E16	2140	14	7	1	
Tokyo	19	b2349		> 30		3755	S15	W65				1	
Capri-S	20	0830	0840	10	204		S22	E56				1+	
Meudon	20	1004		>100		3755	S14	W60				3	S-SWF
Capri-S	20	1010	1310	180	413	3755	S14	W56				2+	
Neder.	20	b1015		>100		3755	S13	W56				2+	
Capri-S	20	1256	1328	32	136		S18	E20				1	
Neder.	21	1030	1036	6		3755	S11	W70				1	
Neder.	21	1052	1058	6		3755	S11	W70				1	
Meudon	21	1140	1150	10		3767	S25	E41				1	
S. Peak	21	1500	1555	55	140	3767	S24	E30	1510	16	3	1	
S. Peak	21	1524	1537	13	102	3755	S10	W79	1530	17	5	1	G-SWF
Wendel.	22	b0907	0932	> 25		3755	S14	W90	0916			1	
Neder.	22	0920	0930	10		3755	S15	W90				1	
S. Peak	22	2000	2115	75	350	3764	S18	W18	2005	18	3	2	
Capri-S	23	1312	1327	15	107	3765	N15	W22				1	
McMath	23	1435	1445	10		3764	S17	W36				1	
Capri-S	26	1219	1352	93	131	3767	S24	W42				1	
S. Peak	26	b1439	1500	> 21	250	3767	S24	W48	1445	15	1	2	
S. Peak	26	1755	a1811	> 16	130	3767	S26	W46	1805	20	4	1	Slow S-SWF
S. Peak	26	2150	a2223	>33	105	3767	S27	W50	2215	19	3	1	
S. Peak	30	1835	1915	40	325	3779	N26	E13	1850	17	2	2	

***McMath lists as importance 1-.

SOLAR FLARES

NOVEMBER 1956

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

S. Peak:	unmarked	McMath:	++
Capri-S:	+	Wendel.:	+++

November 01,	1016 (3719)+
	1142 (3729)+
	1156 (3731)+
	1226 (3719)+
	b1420 (3719)
	1425 (3739)
	1515 (3739)
	1550 (3719)
	1820 (3736)
02,	1840 (3729)
03,	1912 (3744)
04,	1430 (3751)
	1435 (3746)
	1920 (3746)
	1945 (3741)
	2035 (3746)
05,	b1420 (3746)
	1535 (3753)
	1540 (3739)
	1600 (3746)
	2210 (3747)
06,	1131 (3753)+
	1135 (3747)+
	1440 (3753)
	1635 (3753)
	1915 (3751)
	2110 (3753)
07,	0759 (3753)+
	1100 (3736)+
	1435 (3751)
	1550 (3752)

November 07,	a1555 (3751)
	1610 (3753)
	1645 (3748)
	1820 (3751)
	1955 (3750)
08,	0728 (3753)+++
	1036 (3741)+++
	1620 (3735)
	1730 (3751)
	1845 (3753)
	1905 (3751)
	2000 (3752)
09,	b1421 (3755)
	1507 (3755)+
	1521 (3739)
	1728 (3741)
	1840 (3753)
	2155 (3755)
10,	1258 (3755)
	1520 (3751)
	1800 (3747)
	b1815 (3741)++
	1938 (3751)
	2030 (3752)
11,	1842 (3750)
	1852 (3751)
	1906 (3750)
	1940 (3750)
12,	1540 (3746)
	1645 (3746)
	1715 (3755)

November 12,	1735 (3748)
	1905 (3755)
	b1959 (3752)
	2030 (3755)
13,	1524 (3755)
	1650 (3751)
14,	1605 (3752)
	1619 (3744)
	b1840 (3764)
	2055 (3750)
15,	1435 (3755)
	1700 (3755)
	1935 (3752)
	2025 (3752)
16,	1730 (3752)
	1825 (3767)
	2015 (3750)
	2130 (3750)
	2145 (3752)
17,	1210 (3755)+
	1430 (3755)
	1500 (3765)
	1505 (3755)
	1520 (3752)
	1535 (3764)
	1620 (3767)
	1715 (3764)
	1810 (3765)
	1819 (3764)
	2005 (3767)
	2055 (3755)

SOLAR FLARES

NOVEMBER 1956

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

S. Peak: unmarked   McMath: ++
Capri-S: +   Wendel.: +++

November 17, 2058 (3754)
2059 (3764)
2110 (3767)
2200 (3767)
18, 1403 (3755)+++
1445 (3754)
1450 (3755)
1510 (3755)
1535 (3764)
1550 (3755)
1815 (3755)
1825 (3767)
19, 0733 (3755)+++
1445 (3767)
1450 (3755)
1615 (3753)
1630 (3767)
1646 (3752)
1705 (3767)
1720 (3755)
1730 (3765)
1730 (3767)
1930 (3765)
1955 (3767)
2208 (3767)
20, 1344 (3764)+
1407 (3755)+
1505 (3764)
1615 (3755)
1825 (3767)
1945 (3764)

November 20, 2100 (3767)
2200 (3764)
21, 1550 (3767)
1550 (3755)
2050 (3767)
2100 (3764)
2145 (3765)
22, 0928 (3767)+++
b1446 (3767)
1640 (3767)
1750 (3774)
1835 (3767)
2029 (3757)
23, 1337 (3764)+
24, 1309 (3767)+
1635 (3767)
1710 (3774)
1845 (3767)
1930 (3767)
25, 1315 (3774)+
1407 (3767)+
1510 (3774)
1545 (3774)
1550 (3767)
1605 (3767)
1640 (3764)
1715 (3767)
1720 (3774)
2030 (3767)
2120 (3765)
2200 (3767)

November 26, 0839 (3767)+
1532 (3779)
1640 (3767)
2200 (3774)
27, 1600 (3767)
1620 (3767)++
1625 (3780)
1925 (3767)
2100 (3767)
28, 1815 (3767)
1850 (3767)
1920 (3780)
2125 (3780)
2150 (3767)
2210 (3780)
2210 (3779)
29, b1446 (3767)
b1446 (3780)
1635 (3773)
1750 (3767)
1825 (3774)
30, 1525 (3785)
1615 (3779)
1720 (3777)
1810 (3779)
2000 (3775)
2010 (3779)
2025 (3767)
2210 (3774)

IONOSPHERIC EFFECTS OF SOLAR FLARES

(SHORT-WAVE RADIO FADEOUTS)

OCTOBER 1956

Oct. 1956	Start UT	End UT	Type	Wide-spread Index	Impor-tance	Observation stations
1	0537	0610	Slow S-SWF	4	2	OK, NE*
	1758	1815	S-SWF	5	1	BE, HU, MC, PR, WS
2	1158	1250	S-SWF	5	1	HU, PR, NE*, DA**
	2035	2115	G-SWF	4	1-	HU, MC, PR, WS
3	1111	1117	Slow S-SWF	3	1-	PR, DA**
	1156	1230	Slow S-SWF	5	1	HU, PR, NE*, DA**
	1637	1705	Slow S-SWF	5	1-	BE, HU, MC, PR, WS
4	0630	0720	S-SWF	1	1	OK
	0815	0855	Slow S-SWF	5	1	OK, NE*, RCA*, CW+, DA**
	1310	1335	Slow S-SWF	4	1	HU, MC, PR, NE*
	1442	1500	Slow S-SWF	2	1-	MC, PR
	1511	1650	S-SWF	5	2+	BE, HU, MC, PR, WS, NE*, DA**, RCA**
	1720	1800	Slow S-SWF	4	1+	BE, HU, MC, PR
	1955	2020	Slow S-SWF	5	2-	AN, BE, HU, MC, PR
5	1133	1144	Slow S-SWF	3	1-	MC, PR
	1345	1405	Slow S-SWF	5	1	BE, HU, MC, PR, NE*
	1517	1523	S-SWF	2	1-	PR, NE*
	1630	1702	G-SWF	3	1	BE, HU, MC
	1920	1958	Slow S-SWF	5	2-	BE, HU, MC, PR, WS
6	0543	0630	Slow S-SWF	1	2-	OK
	0731	0756	S-SWF	5	1+	AN, OK, NE*, RCA*, DA**
	0900	0936	Slow S-SWF	1	1+	NE*, DA**
	1138	1148	S-SWF	2	1	PR, DA**
	1325	1355	G-SWF	3	1	HU, MC, PR
	1417	1440	Slow S-SWF	5	1	BE, HU, MC, PR, NE*
	1612	1635	Slow S-SWF	5	1	BE, HU, MC, PR, WS
	1712	1750	G-SWF	4	1-	HU, MC, PR, WS
	1940	2010	S-SWF	4	1	HU, MC, PR
7	1910	2010	Slow S-SWF	5	1	AN, BE, HU, MC, PR
8	1425	1450	Slow S-SWF	4	1	HU, MC, PR
9	0001	0035	S-SWF	1	2	OK
	0819	0847	S-SWF	1	2	NE*
	1520	1535	Slow S-SWF	4	1-	HU, MC, PR
	1810	1900	G-SWF	5	1	BE, HU, MC, PR, WS
10	1705	1815	Slow S-SWF	5	1	AN, HU, MC, PR, WS

IONOSPHERIC EFFECTS OF SOLAR FLARES

(SHORT-WAVE RADIO FADEOUTS)

OCTOBER 1956

Oct 1956	Start UT	End UT	Type	Wide-spread Index	Impor-tance	Observation stations
11	1012	1102	Slow S-SWF	4	3-	PR, NE*, SW
	1335	1358	G-SWF	4	1+	HU, MC, PR, NE*
	1411	1530	S-SWF	5	3-	BE, HU, MC, PR, WS, NE*, RCA**, CW*
12	1950	2007	G-SWF	4	1-	HU, MC, PR, WS
13	1124	1138	Slow S-SWF	3	1-	PR, NE*, DA
	1425	1510	Slow S-SWF	5	2-	BE, HU, MC, PR, WS, NE*, DA**
14	0930	0945	S-SWF	1	2	NE*
	1006	1030	S-SWF	1	2	NE*
	2008	2050	Slow S-SWF	5	1	BE, HU, MC, PR, WS
19	0127	0207	S-SWF	1	2+	OK
	1728	1800	Slow S-SWF	5	1	AN, BE, HU, MC, PR
21	1605	1630	S-SWF	5	1+	BE, HU, MC, PR, WS
22	0703	0722	G-SWF	4	1	OK, NE*
	1353	1410	S-SWF	4	1	BE, HU, PR, NE*
23	0749	0817	S-SWF	1	1	NE*
25	0945	1022	S-SWF	1	1	NE*
28	0523	0600	Slow S-SWF	4	2	AN, OK
	0620	0640	S-SWF	1	1	OK
	1535	1600	G-SWF	5	1+	BE, HU, MC, PR, WS
	1954	2024	G-SWF	5	1	HU, MC, PR, WS
29	1417	1440	S-SWF	5	1+	BE, HU, MC, PR, NE*
	1525	1630	Slow S-SWF	3	1+	HU, PR
	2102	2125	Slow S-SWF	3	1	HU, PR
30	1505	1620	G-SWF	3	1	HU, PR
31	1355	1402	Slow S-SWF	4	1-	BE, HU, PR, NE*

NE* Nederhorst den Berg, Netherlands.
DA** Darmstadt, Germany.
SW Enköping, Sweden.
RCA* RCA Communications Inc. Brentwood, N. J. and Somerton, England.
RCA** RCA Communications Inc. Riverhead, N. Y.
CW* Cable & Wireless, Barbadoes.
CW+ Cable & Wireless, Singapore.

SOLAR RADIO WAVES (BOULDER) -- 167 MC

3-HOURLY AND DAILY FLUX

NOVEMBER 1956

Nov. 1956	Flux: Hours UT 12-15	Flux: Hours UT 15-18	Flux: Hours UT 18-21	Flux: Hours UT 21-24	Flux: Daily	Variability: Hours UT 12-15	Variability: Hours UT 15-18	Variability: Hours UT 18-21	Variability: Hours UT 21-24	Variability: Daily	Observed Periods: Hours UT
1	--	12	11	9	11	1	1	2	2	2	1329-2344
2	--	11	10	10	10	0	1	(0)	2	2	1330-2343
3	--	11	10	8	10	1	1	2	2	2	1331-2342
4	--	13	20	23	18	2	2	2	2	2	1332-2341
5	--	14	14	15	14	1	2	2	2	2	1334-2340
6	--	32	21	30	27	2	3	3	2	3	1335-2339
7	--	45	25	11	29	1	1	0	2	2	1336-2337
8	--	103	74	--	89	1	(1)	(1)	(1)	(1)	1337-2200
9	--	76	78	122	88	--	1	(2)	2	2	1444-1630, 1706-2336
10	--	177	166	144	168	1	1	2	1	2	1339-2335
11	--	179	173	168	183	1	2	1	1	2	1340-2334
12	--	145	178	132	157	0	1	1	2	2	1342-2245
13	--	153	78	32	103	2	1	2	2	2	1343-2332
14	--	37	37	20	36	1	2	3	3	3	1344-2331
15	--	18	13	--	16	1	(2)	(2)	(2)	(2)	1345-2218
16	--	23	22	24	23	2	3	3	3	3	1346-2330
17	--	30	56	66	47	3	3	3	3	3	1347-2329
18	--	43	42	37	43	2	2	2	2	2	1349-2328
19	--	52	40	31	46	2	2	2	2	2	1350-2327
20	--	86	70	83	83	1	2	2	2	2	1351-2326
21	--	62	78	97	76	1	2	2	2	2	1352-2324
22	--	108	106	96	106	3	2	2	3	3	1353-2323
23	--	247	228	151	215	2	2	2	2	2	1354-2323
24	--	--	--	455	--	--	--	--	1	--	2047-2323
25	--	242	131	128	162	--	1	2	2	2	1558-2322
26	--	112	100	101	105	--	1	2	2	2	1436-2321
27	--	26	22	15	23	2	3	3	3	3	1359-2321
28	--	12	--	--	12	1	1	--	1	1	1400-1730, 2037-2321
29	--	13	12	12	12	--	1	1	2	2	1401-2320
30	--	16	13	12	14	--	3	3	3	3	1533-2320

SOLAR RADIO WAVES (BOULDER) -- 460 MC

3-HOURLY AND DAILY FLUX

NOVEMBER 1956

Nov. 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												
2												
3	Receiver inoperative November 1 thru 15, 1956											
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												
14												
15												
16	--	--	--	--	--	(0)	(0)	(0)	(0)	(0)	1346-2330	Note 1
17	--	--	--	--	--	1	(1)	(1)	(0)	1	1347-2329	
18	--	--	--	--	--	0	(0)	(0)	(0)	(0)	1349-2328	
19	--	--	--	--	--	(1)	(0)	2	(0)	2	1350-2327	
20	--	--	--	--	--	0	(0)	(0)	(0)	(0)	1351-2326	
21	--	--	--	--	--	(0)	(0)	(2)	(0)	(2)	1352-2324	
22	--	--	--	--	--	2	0	0	0	2	1353-2323	
23	--	--	--	--	--	(0)	(0)	(0)	(1)	(1)	1354-2323	
24	--	--	--	--	--	---	---	---	---	---	---------	
25	--	--	--	--	--	---	---	---	---	---	---------	
26	--	104	97	92	98	---	(0)	(1)	(1)	(1)	1433-2321	
27	--	82	79	80	80	(0)	(0)	(1)	(1)	(1)	1359-2321	
28	--	78	76	76	77	(0)	(0)	(0)	(0)	(0)	1400-2321	
29	--	79	79	79	79	---	(0)	(0)	(1)	(1)	1401-2320	
30	--	82	82	76	80	---	(0)	2	(0)	2	1533-2320	

1. No median flux values are given for November 16-23, 1956 due to calibration difficulties.

SOLAR RADIO WAVES (BOULDER) -- 167 MC

OUTSTANDING EVENTS

NOVEMBER 1956

Nov. 1956	Type	Start UT	Duration Hrs:Mins	Time UT	Maximum Inst. Flux	Smd. Flux	Remarks
1	1	1622	03:38	1622.6	140	--	
2	1	1722	04:55	2213.4	270	--	
3	1	(1331)	(10:11)	2024.0	250	--	
3	2	2056.1	00:15.3	2100.9	470	44	
3	2	2301.1	00:10.7	2310.3	630	24	
4	2	1339.2	00:08.1	1340.1	2100	~38	
4	1	1423	04:14	1455.5	150	--	
4	6	1837	(05:04)	2111	2600	17	
5	1	(1334)	(10:06)	1448	450	--	
6-14	6	(1335)	9 days	Nov.11	---	180	Note 2
6	8	1716	00:04	1716.8	2600	710	
14	3	1501	00:01	1500.8	920	--	
15	1	(1345)	(08:33)	1529	170	--	
16-27	6	(1346)	12 days	Nov.24	---	250	Note 2
17	3	1624.0	00:00.9	1624.4	2600	--	
17	8	1721.5	00:01.1	1721.8	> 5100	2100	Off scale
17	8	1848.0	00:02.3	1848.4	2300	230	
17	3	2035.7	00:00.3	2035.8	3700	--	
18	3	1820.5	00:00.6	1820.7	> 4700	--	
21	3	1938.3	00:00.8	1938.8	3400	--	
21	8	2058.8	00:01.3	2058.9	4000	600	
25	8	2044.3	00:01.5	2044.4	> 5700	2200	Off scale
26	3	1803.9	00:00.6	1804.1	> 6000	--	Off scale
26	8	2028.3	00:09	2029.6	~ 1600	~570	
27	8	1742	00:05	1746.3	3200	160	
27	8	1858.0	00:02.2	1858.7	> 5400	400	Off scale
27	3	1928.9	00:00.2	1929.0	> 5400	--	Off scale
27	8	2100.4	00:06.4	2104.5	2500	340	
29	3	2158.0	00:01.8	2158.9	220	96	
29	3	2316.6	00:00.5	2316.7	~ 490	--	
30	1	(1533)	(06:39)	2210.3	2500	--	
30	3	1639.3	00:00.8	1639.5	> 5200	--	Off scale
30	8	1951.4	00:04	1952.9	4400	210	

1. Occasional interference may obscure or be mistaken for solar events. Relatively small events not reported.
2. The noise storms of November 6-14 and November 16-27 were the most prolonged periods of sustained high level activity observed during the present sunspot cycle.

SOLAR RADIO WAVES (BOULDER) -- 460 MC

OUTSTANDING EVENTS

NOVEMBER 1956

Nov. 1956	Type	Start UT	Duration Hrs:Mins	Time UT	Maximum Inst. Flux	Smd. Flux	Remarks
17	1	1427	07:00	1502.8	240	--	Note 2
19	6	(1350)	(09:37)	1443	330	33	
19	8	1840.9	00:01.7	1841.2	> 900	210	
21	1	1909	03:01	2049.9	440	--	
22	9	1422	02:38	1451	> 630	56	
22	6	1700	(06:23)	2112	110	12	
23	6	(1354)	(09:29)	~1600	---	24	
23	3	2159.7	00:00.9	2200.0	~300	--	
26	6	(1433)	(08:48)	~1600	---	34	
26	3	1820.5	00:00.8	1821.1	270	--	
27	3	2104.2	00:00.6	2104.4	350	--	
30	1	1946.6	00:40	2002.1	700	--	

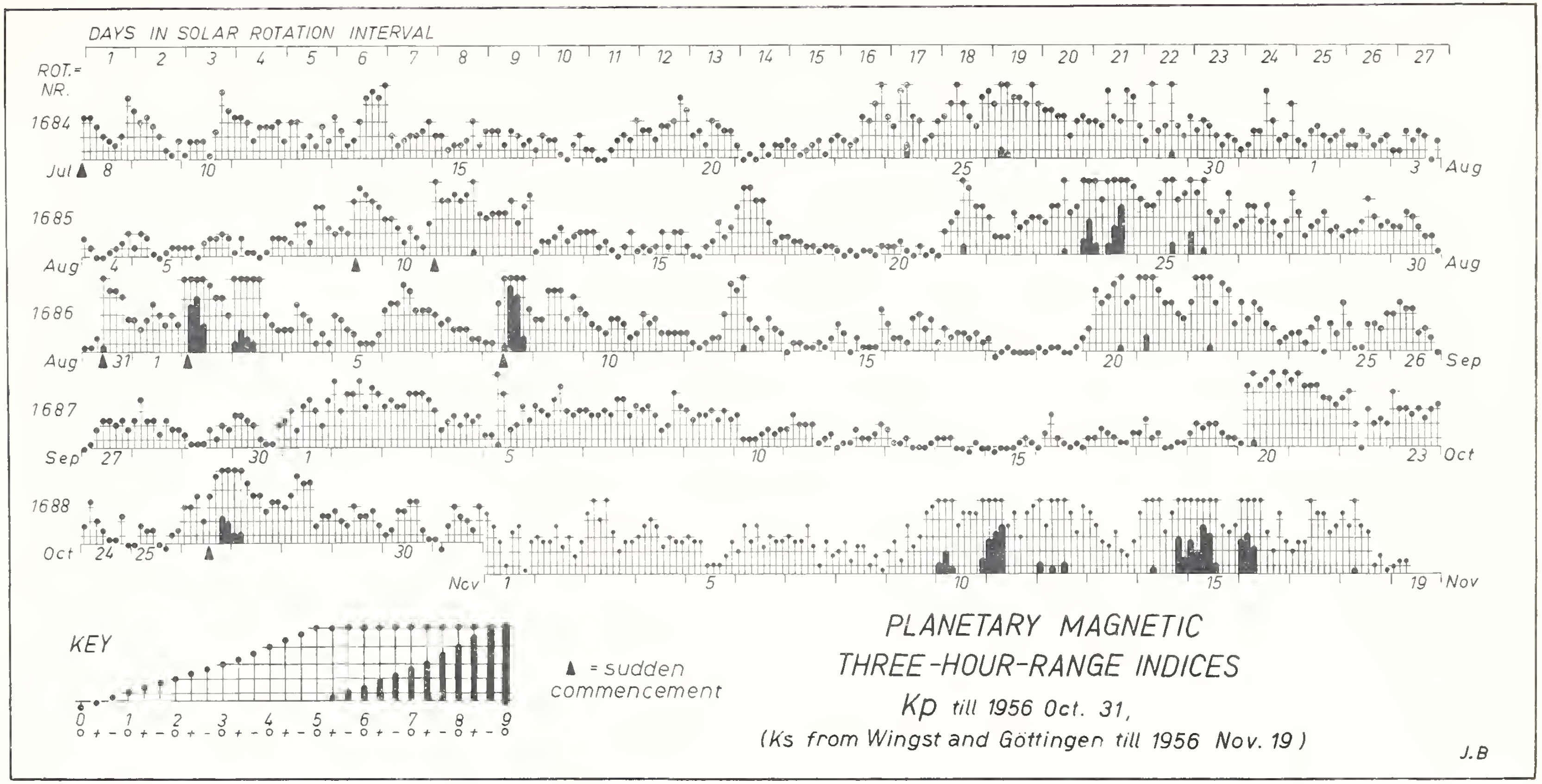
1. Receiver inoperative November 1-15, 1956. Severe interference has probably obscured some solar events.
2. Flux levels for November 16-23, 1956 are approximate due to calibration difficulties.

Errata: For the type 8 event of September 17, 1956 the starting time should read 1943.1 instead of 1343.1 and the time of maximum should read 1945.9 instead of 1345.9.

GEOMAGNETIC ACTIVITY INDICES

OCTOBER 1956

Oct. 1956	C	Values Kp, Three hour Gr. interval 1	2	3	4	5	6	7	8	Sum	Ap	Final Selected Days
1	0.8	2+	3o	2-	3+	4-	3o	2o	4-	23-	14	Five
2	1.2	5-	3o	4o	4o	5-	3+	4+	4o	32o	28	Quiet
3	1.0	3+	4-	3+	3+	4o	4o	4o	4-	29+	22	
4	0.7	3o	2-	2+	3-	2o	3-	2+	3-	19+	10	13
5	0.8	1+	1+	5+	4o	2-	2o	3+	2+	21+	17	14
												15
6	0.9	3+	3o	3-	4-	4+	3o	3-	3o	26-	18	17
7	0.8	3o	3-	3-	3o	3-	4-	4-	3-	24o	14	25
8	0.8	3+	3o	3+	3-	2-	2o	4o	3+	23+	14	
9	0.6	3o	2+	3-	3-	3o	2+	3o	2+	21+	12	
10	0.2	3-	1o	1o	1o	1+	2-	1+	2-	12-	6	
11	0.2	2-	3-	2o	2o	2o	1-	1o	1+	13+	6	Five
12	0.2	0+	1-	1-	2-	1o	1o	1+	2o	9-	4	Disturbed
13	0.1	2-	1-	1-	1o	0+	0+	0+	1-	6-	3	
14	0.0	1o	1o	1o	0+	0+	0o	1-	0+	5-	3	2
15	0.0	0+	0o	0+	0+	0+	1-	1o	1-	4-	2	20
												21
16	0.1	0+	1+	3-	1o	1-	0+	1-	0+	7+	4	26
17	0.2	1o	1o	2-	1+	1o	1-	1-	1+	9-	4	27
18	0.0	1+	2+	1o	1+	0+	0+	1-	1-	8o	4	
19	0.2	1+	2o	2-	2o	2o	1+	1o	1o	12+	6	
20	1.4	1-	4+	5+	4+	5-	5o	4+	5o	34-	36	
21	1.3	5-	5o	4+	4+	4+	4-	4-	3+	33+	31	Ten
22	0.7	4-	4o	2o	0+	3o	2o	2+	2o	19+	12	Quiet
23	0.8	4o	3o	3o	3-	3o	2+	3o	3+	24+	16	
24	0.2	2-	3+	2o	1+	1-	1-	2+	0+	12+	7	10
25	0.1	0+	2-	1+	1+	0+	0o	1o	1+	7+	4	12
												13
26	1.6	3o	3o	4-	2o	4-	5-	7-	6+	33o	41	14
27	1.3	6-	6-	4+	4-	4-	3-	3+	3+	32+	32	15
28	1.0	3o	4-	5-	4+	4+	2-	2+	2+	26+	20	16
29	0.7	3-	2o	2-	3o	2+	2+	3-	2-	18+	10	17
30	0.6	1o	1+	3-	3-	3+	3+	1+	1-	16+	10	18
31	0.6	1-	0o	2-	3o	2+	2o	1+	3o	14o	8	19
Mean:	0.62									Mean:	13	25



PLANETARY MAGNETIC
THREE-HOUR-RANGE INDICES
Kp till 1956 Oct. 31,
(Ks from Wingst and Göttingen till 1956 Nov. 19)

CRPL RADIO PROPAGATION QUALITY FIGURES AND FORECASTS

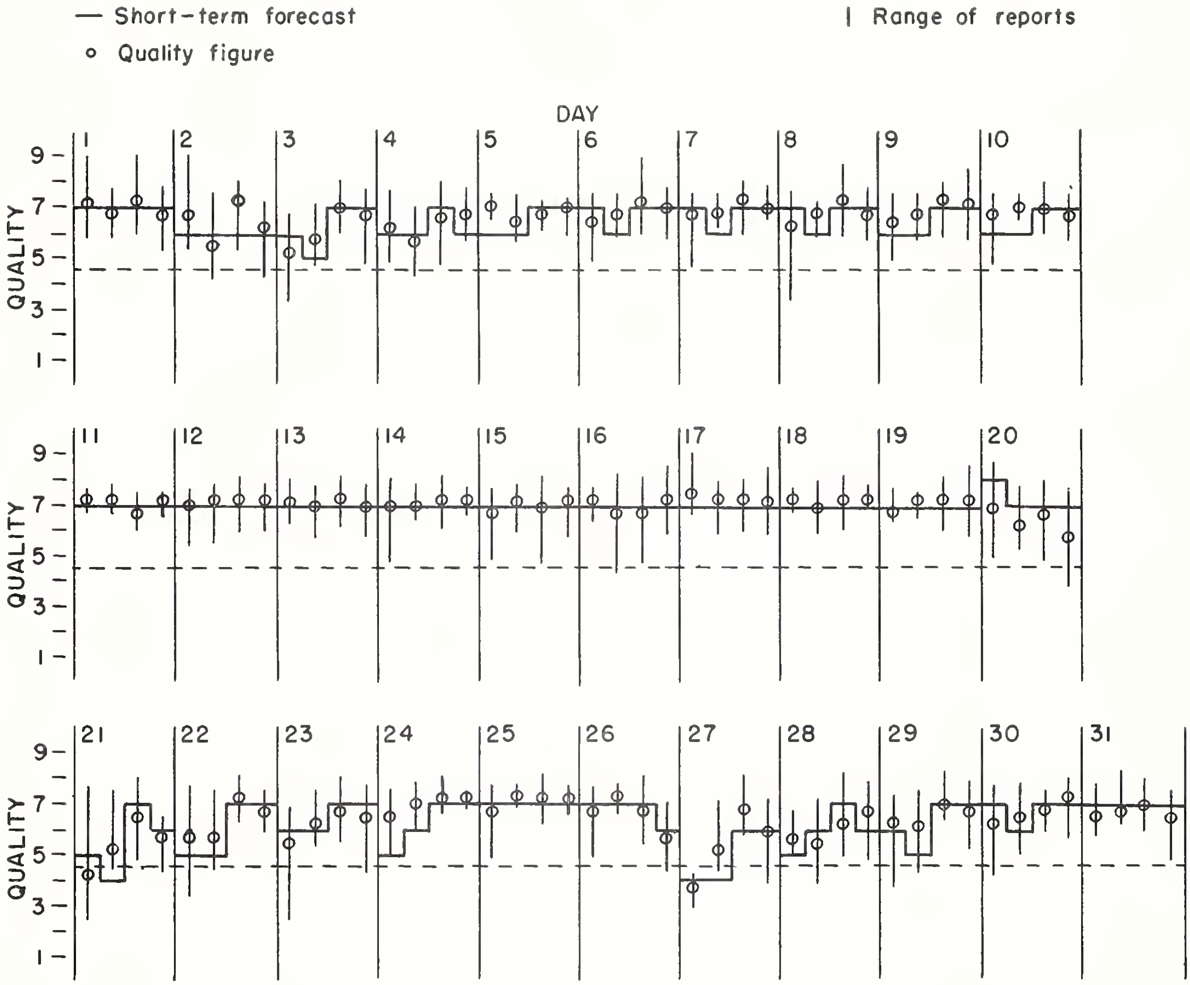
NORTH ATLANTIC

OCTOBER 1956

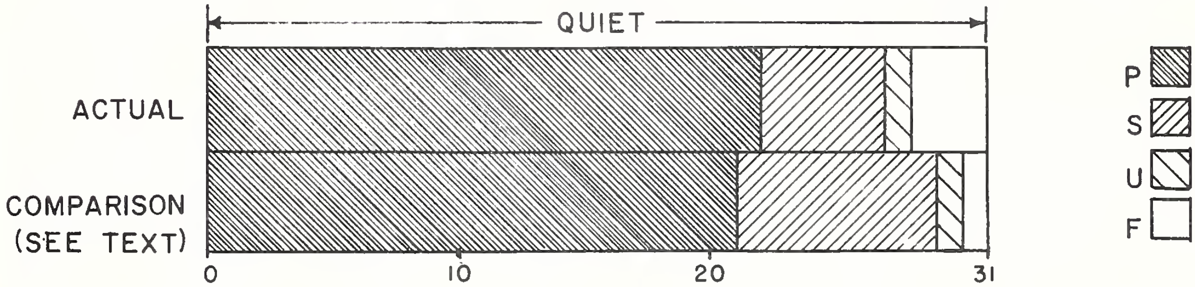
Oct. 1956	North Atlantic 6-hourly quality figures				Short-term forecasts issued about one hour in advance of:				Whole day index	Advance forecasts (J-reports) for whole day; issued in advance by:			Geomag-netic K_{Ch}	
	00 to 06	06 to 12	12 to 18	18 to 24	00	06	12	18		1-4 days	4-7 days	8-25 days	Half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

( ) represent disturbed values.

CRPL RADIO PROPAGATION QUALITY FIGURES AND FORECASTS
NORTH ATLANTIC
OCTOBER 1956

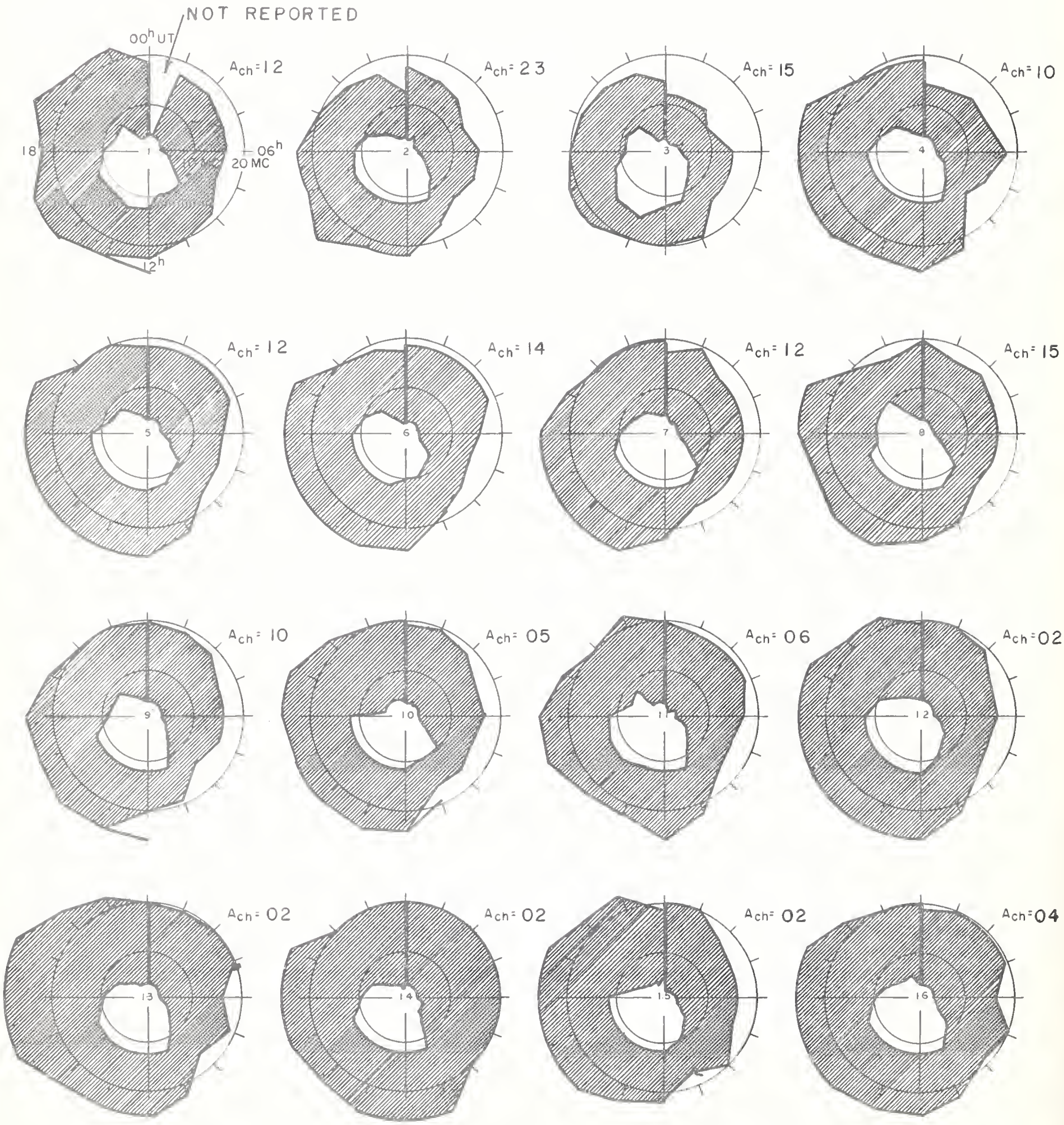


OUTCOME OF ADVANCE FORECASTS (I TO 4 DAYS AHEAD)

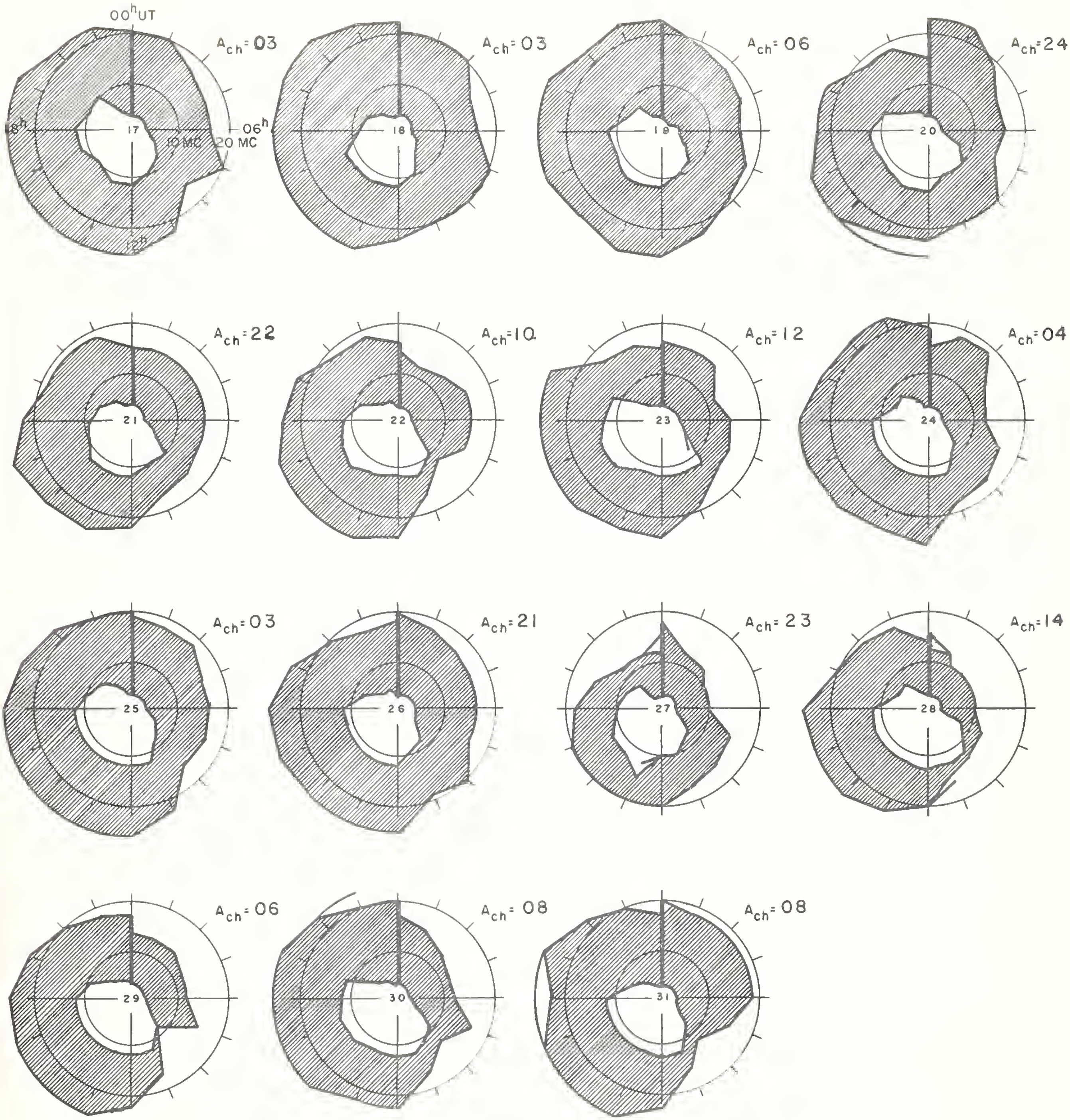


USEFUL FREQUENCY RANGES -- NORTH ATLANTIC PATH

OCTOBER 1956



OCTOBER 1956



Adapted from Observations by Deutschen Bundespost

CRPL RADIO PROPAGATION QUALITY FIGURES AND FORECASTS

NORTH PACIFIC

OCTOBER 1956

Oct. 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)	(2)
1	4	5	6	5	5	6	5	6	6		2	3
2	4	4	5	4	4	5	5	6	6		(4)	(4)
3	4	5	5	3	4	5	5	4	6		3	4
4	6	5	6	5	6	6	6	5	6		2	2
5	5	5	6	6	5	5	5	5	6		3	2
6	6	6	5	5	6	5	6	4	6		3	3
7	6	6	6	6	5	6	6	3	6		3	3
8	6	7	6	6	6	6	6	4	6		3	2
9	6	6	6	6	6	6	6	5	6		2	2
10	6	6	6	6	6	7	6	6	6		1	2
11	6	6	6	6	6	6	6	5	6		2	1
12	6	6	6	6	6	7	6	5	6		1	1
13	6	5	6	6	6	6	6	6	6		0	0
14	6	6	6	6	6	7	6	6	6		1	0
15	6	6	6	6	6	6	6	6	6		0	1
16	6	6	5	6	6	7	6	6	6		1	0
17	6	6	6	6	6	7	6	7	6		1	1
18	5	5	6	7	6	6	6	7	6		1	1
19	6	7	6	7	6	6	6	7	6		1	2
20	4	3	4	6	4	3	(3)	7	7		(4)	(4)
21	3	4	6	3	3	4	(4)	7	7		(4)	(4)
22	4	4	5	5	4	5	(4)	7	6		2	3
23	6	5	5	6	5	6	6	7	6		3	3
24	5	5	6	5	6	6	6	5	7		2	1
25	6	6	6	6	6	6	6	6	7		2	0
26	6	6	5	6	6	4	5	6	7		2	(5)
27	5	5	6	3	4	5	5	3	6		(5)	(4)
28	4	4	6	5	4	5	(4)	4	6		(4)	3
29	5	5	6	5	5	6	5	5	5		2	2
30	6	6	6	5	5	5	6	6	5		2	3
31	6	5	6	6	5	6	6	6	6		2	3
Score:	Quiet Periods		P	17	16	18		10	18			
			S	5	10	10		13	8			
			U	2	0	1		1	1			
			F	0	0	1		3	0			
	Disturbed Periods		P	2	3	0		1	0			
			S	4	2	1		0	0			
			U	0	0	0		0	0			
			F	1	0	0		3	4			

( ) represent disturbed values.

CRPL RADIO PROPAGATION QUALITY FIGURES AND FORECASTS

NORTH PACIFIC

OCTOBER 1956

OUTCOME OF ADVANCE FORECASTS (1 TO 4 DAYS AHEAD)