PART B

SOLAR - GEOPHYSICAL DATA

ISSUED
FEBRUARY 1957

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

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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 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, $\bar{R}$, 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; the serial number of the center in the previous solar rotation, if it is a persisting region; particulars of the plage at CMP: area, central intensity; a summary of the development of the plage during the current transit of the disk, where b = born on disk, ℓ = passed to or from invisible hemisphere, d = died on disk, and / = increasing, - = stable, \ = decreasing; and age in solar rotations; particulars of the associated sunspot group, if any, at CMP: area and spot count and the summary of development during the current disk transit, similar to the above. The unit of area is a millionth of the area of a solar hemisphere; the central intensity of 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:

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

where N is the number of indices entering the summation.

Such integrated disk indices as well as integrated whole-sun indices are computed for each day and are published 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

2800 Mc Observations

The data on solar radio wave events made in Ottawa, Canada by the Radio and Electrical Engineering Division of the National Research Council at 2800 Mc (10-cm emission) are presented. Near local noon (about 1700 UT) the sensitivity of the radiometer is determined and the steady flux for the whole day calculated. These values are given in a tabular form (see table I-1) in units of 10^{-22} watts/M^2/c/s. Burst phenomena are measured above this level and are given in terms especially suitable for the variations observed on this frequency. These classifications are described by Dodson, Hedeman and Covington, Ap. J. 119, 541, 1954:

1 - Single -- Any one burst without reference to structure, but usually applied to bursts of short duration and with intensity only a few times receiver noise. For the smallest single bursts there is a 50-50 chance that the event is set-noise rather than a distinctive event associated with the flare.

2 - Single-simple -- A single burst with only one maximum.

3 - Rise and fall -- A distinct, but less sudden, increase in flux than the usual burst. It may last from tens of minutes to several hours. These events range from large distinct features on the records to tiny bursts, only a few times receiver noise. For the smallest examples of this type there is a 50-50 chance that the event is set-noise rather than a distinctive event associated with the flare.

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

5 - Absorption following burst (negative post).

6 - Single complex - A single burst which shows two or more comparable maxima before the activity has declined to zero.

7 - Period of irregular activity.

167 Mc and 460 Mc Observations

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 both 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 excluded CRPL observations and included three additional reports received after a considerable lag. Qa was first published to the nearest one-third of a unit at the same time.

North Pacific Radio Path -- The CRPL quality figures, Qp, are compiled by the North Pacific Radio Warning Service (NPRWS), the CRPL forecasting center at Anchorage, Alaska, from radio traffic data for moderately long transmission paths in the North Pacific equivalent to Seattle-to-Anchorage or Anchorage-to-Tokyo. These include reports to CRPL by the Alaska Communications System, 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 8 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:

03-10 hours UT	5.33
11-18	5.33
19-02	6.00
00-24	5.67

The 8-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 8-hourly quality figures; whole day quality figures; short term forecasts issued by NPRWS three times daily at 02^h, 10^h, and 18^h UT, applicable to the stated 8-hour periods; advance forecasts issued twice weekly by NPRWS (CRPL-Jp report); and half-day averages of geomagnetic K indices from Sitka.

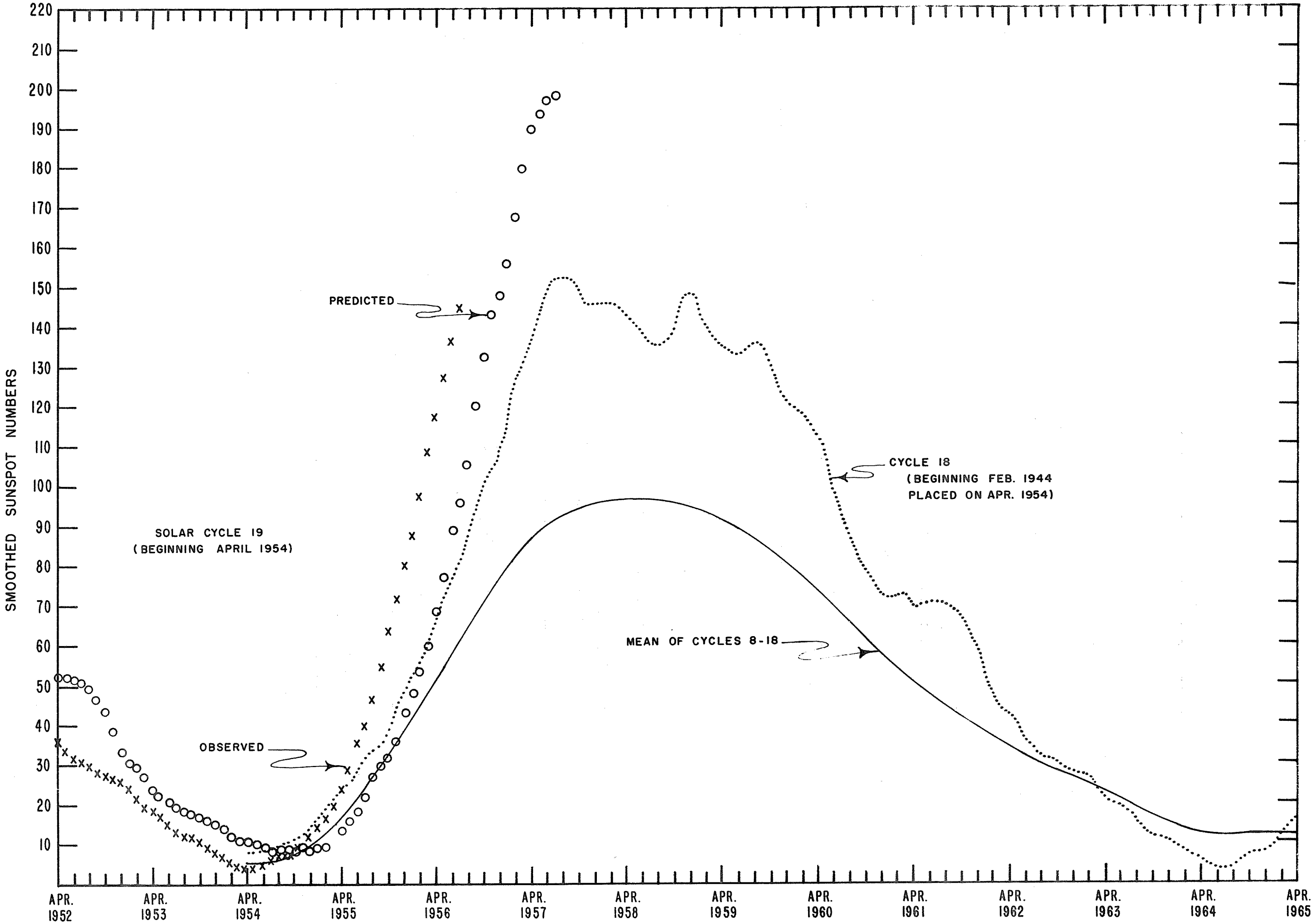
The chart compares the outcome of advance forecasts, on the same basis as the similar chart for the North Atlantic Radio Path.

Note: Beginning with November 1956 the short-term forecast formerly made at 0900 UT was changed to 1000 UT. The North Pacific quality figures used for evaluation are now 8-hourly rather than 9-hourly.

DAILY SOLAR INDICES

Dec. 1956 Date	American Relative Sunspot Numbers R_A'
1	183
2	147
3	155
4	175
5	155
6	146
7	149
8	148
9	164
10	147
11	153
12	185
13	171
14	211
15	152
16	161
17	163
18	100
19	94
20	112
21	134
22	151
23	160
24	185
25	195
26	199
27	186
28	190
29	160
30	153
31	170
Mean:	159.8

Jan. 1957 Date	Zurich Provisional Relative Sunspot Numbers R_Z	Daily Values Solar Flux at 2800 MC, Ottawa, Canada Flux
1	150	---
2	180	275
3	203	274
4	195	283
5	217	286
6	244	291
7	215	264
8	196	248
9	156	233
10	146	216
11	145	215
12	148	217
13	123	206
14	114	197
15	90	191
16	90	184
17	100	194
18	126	203
19	150	215
20	150	233
21	155	223
22	183	226
23	171	233
24	201	252
25	170	232
26	146	241
27	134	237
28	125	207
29	117	197
30	88	188
31	92	176
Mean:	152.3	227.9



PREDICTED AND OBSERVED SUNSPOT NUMBERS

CALCIUM PLAGE AND SUNSPOT REGIONS

JANUARY 1957

CMP Jan. 1957	Lat.	McMath Plage Number	Return of Region	Calcium Plage Data: CMP Values Area	Calcium Plage Data: CMP Values Int.	Calcium Plage Data: History	Calcium Plage Data: Age	Sunspot Data: CMP Values Area	Sunspot Data: CMP Values Count	Sunspot Data: History
01.4	S19	3807	3781	2,000	3	ℓ—ℓ	3	320	3	ℓ\ℓ
02.6	N19	3808	3782	5,000	4	ℓ/ℓ	2	2070	21	ℓ⌐ℓ
03.6	S28	3809	New	2,400	3	b—ℓ	1	(60)	(2)	b—ℓ
05.3	N27	3810	3784	2,000	2.5	ℓvℓ	6	(50)	(1)	b—ℓ
06.3	S20	3811	3785	4,800	2.5	ℓvℓ	3	190	1	ℓ└ℓ
07.0	N04	3812	New	800	2	ℓ—d	1	70	2	b—d
07.1	N12	3816	New	(800)	(2.5)	b—ℓ	1			
09.7	S21	3813	3788	16,000	3	ℓ—ℓ	3	1520	61	ℓ⌐ℓ
09.8	N29	3814	3787	400	2.5	ℓ—ℓ	3			
13.4	S16	3815	3790	900	1.5	ℓ/ℓ	5			
15.4	S18	3817	3792	1,200	2	ℓ⌐ℓ	5	110	2	b—d
17.0	S08	3819	New	1,200	3	ℓ—ℓ	1	40	2	ℓ—ℓ
17.1	N17	3818	3795	4,000	3	ℓ—ℓ	2	240	2	ℓ—ℓ
19.0	S28	3820	3794,7	8,000	3	ℓ—ℓ	3,6*	600	3	ℓ—ℓ
19.3	N25	3825	New	300	3	b—ℓ	1	70	2	b—d
21.5	S18	3822	3800	2,000	1	ℓ—ℓ	4	80	3	ℓvℓ
22.8	N19	3823	3801	17,000	3.5	ℓ—ℓ	3	1470	19	ℓ/ℓ
24.4	S16	3824	New	4,800	3	ℓ—ℓ	1	530	12	ℓ—ℓ
24.4	N43	3826	New	2,000	2.5	ℓ—ℓ	1	100	1	b\d
26.0	S13	3827	3805	1,200	2.5	ℓ—d	3			
26.5	N26	3828	3806	3,500	2.5	ℓ—ℓ	2	110	1	ℓ—ℓ
27.7	S15	3829	3805	1,400	1.5	ℓ¬d	3			
29.1	N33	3832	3806	2,400	2.5	ℓ—ℓ	2	100	1	ℓ—ℓ
29.5	N38	3834	New	1,000	2	ℓ¬d	1			
29.5	N26	3835	3810	1,600	2	ℓ¬d	7			
29.6	S19	3831	3807	4,000	2.5	ℓ—ℓ	4	120	1	ℓ—ℓ
30.2	N21	3830	3808	8,500	3	ℓ—ℓ	3	310	9	b—ℓ
31.0	S24	3840	New	500	2	b—ℓ	1			

* Resurgence of activity.
( ) values indicate several days' extrapolation to CMP.
ℓ = limb passage; b = born on disk; d = died on disk.
— = stable; / = increasing; \ = decreasing.

CORONAL LINE EMISSION INDICES

JANUARY 1957

CMP Date 1957	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
Jan.																
1	118	177	35	65	121	149	42	84	X	X	X	X	X	X	X	X
2	97*	132	31	50	117	154	30	42	X	X	X	X	X	X	X	X
3	80	112	25	44	107*	146	44	62	X	X	X	X	X	X	X	X
4	137*	208	46	86	127	168	33	48	73	94	61	98	50	63	59	116
5	113	175	36	85	176	244	38	72	X	X	X	X	X	X	X	X
6	122	177	43	60	166	188	59	93	X	X	X	X	X	X	X	X
7	72[a]	87[a]	32[a]	66[a]	151*	197	53	72	X	X	X	X	X	X	X	X
8	119	157	48	83	262*	300	57	93	X	X	X	X	X	X	X	X
9	85	94	32	67	126*	153	39	56	127	161	32	46	55	66	22	35
10	X	X	X	X	X	X	X	X	162[a]	234[a]	33	62	45[a]	72[a]	29	42
11	X	X	X	X	X	X	X	X	138	200	38	70	65	80	28	40
12	X	X	X	X	X	X	X	X	113	156	21	36	58	92	14	18
13	60	73	X	X	100	144	X	X	86[a]	122[a]	21[a]	24[a]	51[a]	56[a]	25[a]	48[a]
14	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
15	X	X	X	X	X	X	X	X	121[a]	170[a]	55[a]	132[a]	124[a]	260[a]	37[a]	52[a]
16	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
17	X	X	X	X	X	X	X	X	143[a]	206[a]	39[a]	75[a]	118[a]	180[a]	27[a]	52[a]
18	53	77	30	48	58	87	46	86	X	X	X	X	X	X	X	X
19	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
20	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
21	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
22	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
23	85	120	42	53	68	80	23	30	X	X	X	X	X	X	X	X
24	84[a]	135[a]	27	44	72[a]	120[a]	38	72	X	X	X	X	X	X	X	X
25	159	196	43	62	133	219	57	107	117	164	34	48	139	164	30	44
26	144	194	54	105	132	194	50	84	73[a]	100[a]	29[a]	40[a]	117[a]	132[a]	32[a]	50[a]
27	123[a]	172[a]	45[a]	60[a]	73[a]	110[a]	60[a]	110[a]	X	X	X	X	X	X	X	X
28	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
29	183[a]	230[a]	47[a]	66[a]	111[a]	160[a]	51[a]	82[a]	X	X	X	X	X	X	X	X
30	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
31	94[a]	132[a]	73[a]	104[a]	86[a]	106[a]	49[a]	72[a]	X	X	X	X	X	X	X	X

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

SOLAR FLARES
JANUARY 1957

Observatory	Date Jan. 1957	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
Wendel.	02	1208	1251	43		3808	N18	E02	1215			1+	S-SWF
S.Peak	02	2115	2150	35	118	3808	N22	W04	2118	18	2	1	
Capri-S	04	1419	1449	30	160	3808	N22	W15				1	
Capri-S	05	0941	1012	31	224	3807	S17	W63				1	
Capri-S	05	1004	1038	34	214	3806	N28	W56				1+	
Capri-S	05	1123	1134	11	112	3808	N21	W37				1	
McMath	05	b1730				3818	S20	E50				2	Slow S-SWF
{ Capri-S	06	1038	1443	245	1264	3809	S18	E38				3 }	
{ Kanzel.	06	b1105		≥100		3809	S15	E35				3 }	
Capri-S	06	1329	1435	66	194	3808	N21	W47				1+	G-SWF
S.Peak	06	b2025	a2052	>27	275	3813	S23	E38	2030	~20	3	2	
{ Kanzel.	07	0805		≥100		3808	N15	W55				2 }	
{ Schaus.	07	b0805	0838	>33		3808	N17	W62				1+ }	
{ Schaus.	07	b0920	0937	>17		3808	N17	W61				2 }	
{ Capri-S	07	0920	0940	20	175	3808	N17	W64				1 }	
Arcetri	07	b1344				3808	N18	W60				2+	Slow S-SWF
McMath	07	1830	1840	~10		3808	N20	W65				2+	Slow S-SWF
Mitaka	08	0306				3808	N18	W70				1	
{ Arcetri	08	b0956				3808	N18	W79				1+ }	
{ Capri-S	08	0954	1003	9	180	3808	N18	W78				1- }	
Capri-S	08	1006	1142	96	418	3813	S18	E12				2	
{ Capri-S	08	1304	1408	64	214	3811	S16	W19				1+ }	Slow S-SWF
{ Wendel.	08	1316	1354	38		3811	S13	W20	1323			1 }	
{ Capri-S	08	1324	1440	76	583	3808	N18	W78				2+ }	S-SWF
{ Wendel.	08	1326	1455	89		3808	N16	W76	1340			2+ }	
{ Schaus.	08	b1340	1425	>45		3808	N15	W75				3 }	
Arcetri	09	b0829				3813	S20	W05				1	
{ Crimea	09	b1134				3808	N31	W73	1134			1 }	
{ Capri-S	09	1139	1205	26		3808	N26	W70				1- }	
Capri-S	10	0855	1030	95	160	3813	S22	W11				1+	
{ Capri-S	10	1105	1157	52	267	3813	S18	W15				2 }	G-SWF
{ Stckhlm.	10	b1126	1154	>28		3813	S25	W15				1 }	
McMath	10	1557	1615	18		3813	S22	W18				1	G-SWF
Crimea	11	b0432				3813	S14	W28	0432			1	
Crimea	11	b0546				3813	S21	W34	0546			2	
Crimea	11	b0546				3816	N12	W53				1	
Crimea	11	b0647				3813	S28	W16	0647			1	
Crimea	11	b0650				3813	S26	W27	0650			1	
McMath	11	1425	1442	17		3813	S16	W30				1	Slow S-SWF
S.Peak	11	b1615	a1624	>9	165	3813	S16	W46	~1618	20	6	1	
S.Peak	11	b1705	a1720	>15	102	3813	S23	W32	~1705	14	3	1	Slow S-SWF
S.Peak	12	1645	1715	30	100	3813	S23	W45	1700	18	6	1	S-SWF

SOLAR FLARES
JANUARY 1957

Observatory	Date Jan. 1957	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
Schaus.	17	b1132	1139	>7		3820	S25	E18				1+	
Schaus.	17	b1413	1423	>10		3820	S25	E17				1+	
S.Peak	17	b1507	1550	>43	172	3820	S26	E16	1520	19	2	1	Slow S-SWF
S.Peak	17	2030	2110	40	100	3820	S26	E14	2100	15	9	1	
S.Peak	17	2145	2230	45	288	3820	S29	E13	2200	2	23	2	
{ Capri-S	18	1139	1213	34	107	3820	S27	E06				1 }	
{ Schaus.	18	b1150	1215	>25		3820	S27	E05				1 }	
Wendel.	18	b1218	1234	>16		3820	S24	E06	1221			1	Slow S-SWF
{ McMath	18	1420	1442	22		3820	S28	E02				1+ }	G-SWF
{ Wendel.	18	1420	1430	10		3820	S29	E05	1424			1 }	
{ Capri-S	19	1058	1230	92	165	3823	N12	E40				1+ }	S-SWF
{ Wendel.	19	1103	1127	24		3823	N12	E40	1106			1 }	
{ Schaus.	19	b1140				3823	N21	E38				1 }	G-SWF
{ Capri-S	19	1140	1210	30	63	3823	N17	E33				1- }	
Wendel.	19	1438	1453	15		3822	S15	E22	1441			1	Slow S-SWF
{ Schaus.	20	b0928	0947	>19		3820	S29	W18				1 }	
{ Capri-S	20	0920	0945	25	58	3820	S29	W18				1- }	
{ Schaus.	20	b1013				3820	S27	W18				1 }	
{ Capri-S	20	1029	1100	31	87	3820	S26	W19				1- }	
{ Capri-S	20	1116	1515	239	617	3820	S25	W18				3 }	
{ Schaus.	20	b1100	1400	>180		3820	S29	W18	1120			3 }	S-SWF
{ Wendel.	20	1104	1417	193		3820	S27	W24	1128			1+ }	
S.Peak	20	1750	1845	55	245	3823	N15	E16	1829	17	7	2	
S.Peak	20	1850	2015	85	600	3823	N14	E14	1920	20	4	2+	Slow S-SWF
{ Schaus.	21	b1046	1050	> 4		3820	S27	W38				1 }	S-SWF
{ Capri-S	21	1045	1055	10	49	3820	S27	W35				1- }	
Capri-S	21	1122	1134	12	117	3820	S28	W32				1	
Schaus.	21	b1200	1223	>23			S20	W14				1	
Capri-S	21	1213	1240	27	102	3822	S14	W01				1	
Capri-S	21	1242	1400	78	107	3820	S27	W36				1	
Schaus.	21	b1513	1538	>25		3820	S30	W35				2	Slow S-SWF
Mitaka	22	0247	0307	20		3820	S15	W45				1	
Mitaka	22	0315	0335	20		3822	S05	W05				1	
Mitaka	22	b0412	0422	>10		3828	N25	E65				1	G-SWF
Mitaka	22	b0454		>90		3823	N25	W05				2	
{ Capri-S	22	1005	1010	5	112	3820	S24	W45				1 }	
{ Wendel	22	0949	1028	39		3820	S24	W49	1003			1-2 }	
S.Peak	22	1640	1815	95	130	3824	S16	E20	1705	15	8	1	
S.Peak	22	1730	1755	25	130	3820	S27	W57	1745	18	2	1	
S.Peak	22	1820	~2030	~130	370		N23	E26	1854	17	3	2	
{ Stckhlm.	23	b1055	1142	~47		3823	N13	W14				2 }	S-SWF
{ Schaus.	23	b1107	1145	>38		3823	N14	W15				2 }	

SOLAR FLARES

JANUARY 1957

Observatory	Date Jan. 1957	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
McMath	23	1516	1526	10		3823	N18	W25				1	G-SWF
McMath	23	1835	1845	10		3823	N18	W25				1+	S-SWF
Mitaka	24	b0137		>10		3820	S15	W75				1	
Mitaka	24	0156	0236	40		3820	S15	W75				1	
Mitaka	24	0258	0358	60		3823	N15	W25				2	G-SWF
Mitaka	24	0550	0600	10		3823	N25	W35				1	
{ McMath	24	1638	1653	15		3820	S30	W85				2 }	S-SWF
{ S.Peak	24	b1643	a1653	>10	300	3820	S25	W75	≯1643	18	4	2 }	
S.Peak	24	2115	2205	50	177	3823	N15	W40	2123	26	9	1+	G-SWF
S.Peak	24	2139	2200	21	160	3820	S26	W90	2140	20	1	1	
Capri-S	25	0832	0858	26	121	3823	N12	W40				1	
Capri-S	25	1059	1430	211	151	3823	N12	W44				1	
Mitaka	26	b0436	0516	>40		3823	N15	W55				1	G-SWF
Mitaka	26	0537	0557	20		3823	N15	W55				1	
Arcetri	26	0951				3823	N22	W63				1	
Mitaka	27	0110	0130	20		3823	N15	W65				1	
Mitaka	27	b0446	0506	>20		3828	N25	E05				1	
Mitaka	27	0530	0550	20		3823	N15	W65				1	
Capri-S	27	0830	1100	150	335	3823	N13	W70				2	
Capri-S	27	1139	1150	11	102	3810	N17	E18				1	
Capri-S	30	1229	1231	2		3842	S04	E90				1	

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

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

January 02,	b1802 (N19,E03)
	b1850 (S25,E90)
	2030 (N18,W04)
04,	1309 (S21,E65)+
05,	0914 (N15,W38)+
	1034 (N16,W39)+
	1058 (S14,E52)+
	b1600 (S20,E50)++
06,	0922 (S13,E23)+
	1053 (N22,W52)+
	b1822 (N16,W53)
07,	1013 (S16,W72)+
	2050 (S17,W90)
	2052 (N19,W70)
	b2145 (N18,W70)
08,	1022 (S20,E15)+++
09,	1211 (S22,E01)+
	1213 (S16,W16)+
10,	1048 (N15,W90)+
	1238 (S11,W15)+
	1311 (S18,W16)+
11,	1024 (S13,W26)+
January 12,	1830 (S15,W44)
	2230 (S25,E80)
14,	b1945 (S28,W85)
15,	1655 (S20,W87)
	1705 (N14,E90)
	1935 (S14,E87)
	2005 (S30,E37)
16,	1600 (S29,E25) S.Peak & ++
	1613 (S12,W90)
	1635 (S12,W87)
	1645 (S29,E24)
	1900 (S15,W18)
	1940 (S29,E24)
17,	1705 (N13,E75)
	1735 (S27,W87)
	b1845 (N20,E75)++
	1940 (S26,E09)
18,	1010 (S06,W19)+++
	b2140 (N12,E48)
19,	2130 (S23,W19)
20,	1037 (S27,W22)+++
	1700 (N18,E34)
January 20,	2135 (S15,E90)
	2235 (S13,E05)
21,	1134 (S09,W64)+
	1415 (S15,E00)+
22,	0844 (N10,E12)+
	1520 (N25,E24)
	1535 (S31,W50)
	1725 (N16,W10)
	1935 (N22,W02)
	2015 (N24,W01)
	2205 (N10,W05)
23,	b1706 (S20,W71)
	1707 (N19,W25)
24,	b1535 (N20,W35)++
	1800 (S22,E64)
	1810 (N24,E80)
	2050 (S21,W90)
	2135 (S20,W90)
25,	1023 (S25,W90)+
	1202 (S24,W90)+
26,	0738 (N17,E35)
27,	1022 (N17,E19)+
	1105 (S16,E33)+

Final summary from Mitaka received after table prepared. The Mitaka final values for January 1957 will be published in CRPL-F 151 Part B.

IONOSPHERIC EFFECTS OF SOLAR FLARES

(SHORT-WAVE RADIO FADEOUTS)

DECEMBER 1956

Dec. 1956	Start UT	End UT	Type	Wide-spread Index	Impor-tance	Observation stations	Known Flare, UT CRPL-F 149B
1	0249	0400	S-SWF	1	2+	OK	
	2039	2050	Slow S-SWF	3	1-	HU, MC, PR	
2	1305	1325	S-SWF	5	2	BE, HU, MC, PR, NE*	
	1359	1605	Slow S-SWF	5	3-	BE,HU,MC,PR,NE*,RCA***,CW*	
	1913	1940	G-SWF	5	1	BE, HU, MC, PR, WS	b1915
4	1621	1705	G-SWF	5	1+	BE, HU, MC, PR, WS	1620
6	1338	1416	S-SWF	5	3-	BE, HU, MC, PR, NE*	1402
	1602	1635	S-SWF	5	3-	AN,BE,HU,MC,PR,WS,NE*,RCA*	1600
	1742	1840	S-SWF	5	3-	AN,BE,HU,MC,PR,WS	
7	0457	0628	Slow S-SWF	1	3	OK	
8	0236	0352	S-SWF	1	2+	OK	b0242
	1732	1745	S-SWF	4	1	AN, HU, PR, WS	1730
10	0638	0719	S-SWF	4	2	OK, NE*	b0648
	0935	1000	S-SWF	1	2	NE*	0934
	1657	1708	S-SWF	2	1	MC, PR	
	1732	1755	Slow S-SWF	3	1	HU, MC, PR	
	1942	1955	S-SWF	3	1	HU, PR	
11	0230	0252	S-SWF	1	1+	OK	
12	2127	2135	S-SWF	4	1	HU, MC, PR, WS	
13	0822	0854	Slow S-SWF	1	1	NE*	b0845
14	1820	1832	Slow S-SWF	5	1	AN,BE,HU,MC,PR,WS	a1820
15	0522	0610	S-SWF	4	3	OK, CW++	
	1755	1820	Slow S-SWF	5	2-	BE, HU, MC, PR, WS	
17	0122	0200	S-SWF	1	2+	OK	b0123
	0200	0330	Slow S-SWF	4	3-	OK, CW++	
	0427	0450	G-SWF	1	1-	OK	
	0450	0559	Slow S-SWF	4	3-	OK, CW++	0453
	1015	1100	S-SWF	1	---	RCA***	b1015
	1229	1330	Slow S-SWF	5	3-	HU, PR, NE*, RCA***	1227
	1545	1700	Slow S-SWF	5	3	BE,HU,MC,PR,WS,NE*,RCA*	1535
	2357	0121	G-SWF	1	1+	OK	
18	0358	0430	S-SWF	4	3-	OK, CW+	
	0826	0906	S-SWF	5	3	NE*, RCA**, CW++	0834
	1620	1705	Slow S-SWF	5	2	BE,HU,MC,PR,WS,NE*	
	2040	2140	G-SWF	5	3	AN,BE,HU,MC,PR,WS	2045
	2145	2205	S-SWF	4	2+	AN, HU, WS	2205
19	0050	0130	Slow S-SWF	5	2	AN, OK, TO+	
	0603	0703	S-SWF	5	3	OK, TO+, RCA***, CW++	
	0745	0815	Slow S-SWF	1	1	NE*	0745
	0839	0941	S-SWF	5	3	NE*, RCA***, CW++	0840
	1324	1417	Slow S-SWF	3	2-	PR, NE*	
	1450	1515	Slow S-SWF	5	2	BE, HU, MC, PR, NE*	1452
	1521	1545	Slow S-SWF	5	1+	BE, HU, MC, PR, NE*	
	1551	1630	G-SWF	3	1+	HU, MC, PR	
20	0005	0040	Slow S-SWF	4	1	OK, TO+	0001
	0442	0603	S-SWF	5	3	OK, TO+, CW++	0447
	0637	0710	S-SWF	5	2-	OK, RCA**, CW++	
	1257	1310	Slow S-SWF	3	1	HU, MC, NE*	
	1830	1920	S-SWF	5	2+	AN, BE, HU, MC, PR, WS	
	1930	1945	Slow S-SWF	5	1	AN, BE, HU, MC, PR	
21	0350	0433	S-SWF	1	1	OK	
	0442	0555	Slow S-SWF	3	2	AN, OK	
	1150	1200	S-SWF	2	1-	HU, MC	
	1600	1640	S-SWF	5	2+	BE, HU, MC, PR, WS, NE*	b1613
23	2035	2101	G-SWF	3	1	HU, PR, WS	2015
25	2218	2245	S-SWF	5	2	AN, BE, HU, PR, WS	
26	0447	0620	S-SWF	5	3+	OK, TO+, CW++	b0507
	1254	1328	Slow S-SWF	5	2+	BE, HU, PR, NE*	1252
	1403	1540	Slow S-SWF	5	3-	BE,HU,MC,PR,NE*,RCA***	1401
	1752	1802	S-SWF	5	1+	BE, HU, MC, PR, WS	
27	0225	0242	S-SWF	1	1	OK	b0226
	0621	0650	S-SWF	4	2	OK, CW++	
	1330	1350	Slow S-SWF	2	1+	HU, PR	
	1650	1720	G-SWF	4	1	MC, PR, WS	1647
28	0248	0310	G-SWF	3	1-	AN, OK	
29	0044	0230	S-SWF	1	3+	OK	0040
	0313	0333	S-SWF	1	1-	OK	0315
	1455	1510	Slow S-SWF	5	1	AN,BE,HU,MC,PR,NE*	1458
30	1739	1810	S-SWF	5	2	BE, HU, MC, PR, WS	1730
31	0230	0245	S-SWF	1	1	OK	

NE* Nederhorst den Berg, Netherlands.
RCA* RCA Communications Inc. Riverhead, N. Y.
RCA** RCA Communications Inc. Somerton, England.
RCA*** RCA Communications Inc. Brentwood, N. J.
CW* Cable and Wireless, Barbadoes.
CW+ Cable and Wireless, Hong Kong.
CW++ Cable and Wireless, Singapore.

SOLAR RADIO WAVES (OTTAWA)--2800 MC

OUTSTANDING EVENTS

JANUARY 1957

Jan. 1957	Type	Start UT Hrs:Mins	Duration Hrs:Mins	Maximum Time UT Hrs:Mins	Maximum Peak Flux	Remarks
1	Single-Simple	13 37.5	7	13 41	60	
1	Rise and Fall	15 15	1	15 51	15	
1	Single-Simple	15 19	2	15 19.5	25	(Superimposed on (Rise and Fall
1	Single-Simple	18 27	2	18 27.5	30	
1	Single-Simple	20 22.5	2.5	20 23.5	30	
2	Single-Simple	13 26	1.5	13 26.5	20	
2	Single	16 40	1.5	16 40.5	10	
2	Group (2)	20 34.5	12			
	Single-Simple	20 34.5	2	20 35.5	20	
	Single	20 45.5	1	20 46	8	
3	Single	14 45	2	14 45.5	8	
3	Single	16 15.5	1.5	16 16	6	
3	Single	16 34	1.5	16 34.5	5	
4	Group (3)	15 09.5	2 7.5			
	Single-Simple	15 09.5	2.5	15 10	14	
	Rise and Fall	15 15	1 45	15 19	25	
	Rise and Fall	17 07	10	17 10	7	
4	Single-Simple	20 22	4	20 23	32	
4	Single	20 53	5	20 54	15	
5	Rise and Fall	17 32.5	1 15	18 29	12	
5	Single	17 35	5	17 37	7	(Superimposed on (Rise and Fall
5	Single-Simple	19 33	2	19 33.2	27	
5	Single-Simple	20 20	8	20 23	190	
	Post Increase		30		18	
6	Single-Complex	13 28.5	14	13 32.5	115	
6	Rise and Fall	13 59	30	14 06.5	25	
6	Group (4)	17 01.5	2 32			
	Single-Simple	17 01.5	10	17 03.5	700	
	Single-Complex	17 19	13	17 22.5	70	
	Post Increase		15		10	
	Single-Simple	17 58	1 32	18 27	585	
	Single	19 32	1.5	19 32.5	9	
6	Single-Simple	20 55	4.5	20 57.7	45	
	Post Increase		15		6	
7	Rise and Fall	13 42	1 30	14 10	30	
7	Single-Simple	13 45.5	7	13 47	160	(Superimposed on (Rise and Fall
7	Rise and Fall	17 29.3	3	19 10	32	
7	Group (3)	17 29.3	24.2		)	
	Single-Complex	17 29.3	15	17 37.5	212)	Superimposed on Rise and Fall
	Single	17 45.5	3	17 46.5	17)	
	Single	17 52	1.5	17 52.5	8)	
8	Single-Complex	13 38.5	6	13 39.8	65	
8	Rise and Fall	14 12.5	10	14 14	10	
8	Rise and Fall	15 28	1 35	15 34	14	
9	Single	18 15	1	18 15.5	7	
11	Single-Simple	14 24	4	14 25	18	
11	Single-Complex	16 13.5	3.5	16 15	130	

SOLAR RADIO WAVES (OTTAWA)--2800 MC

OUTSTANDING EVENTS

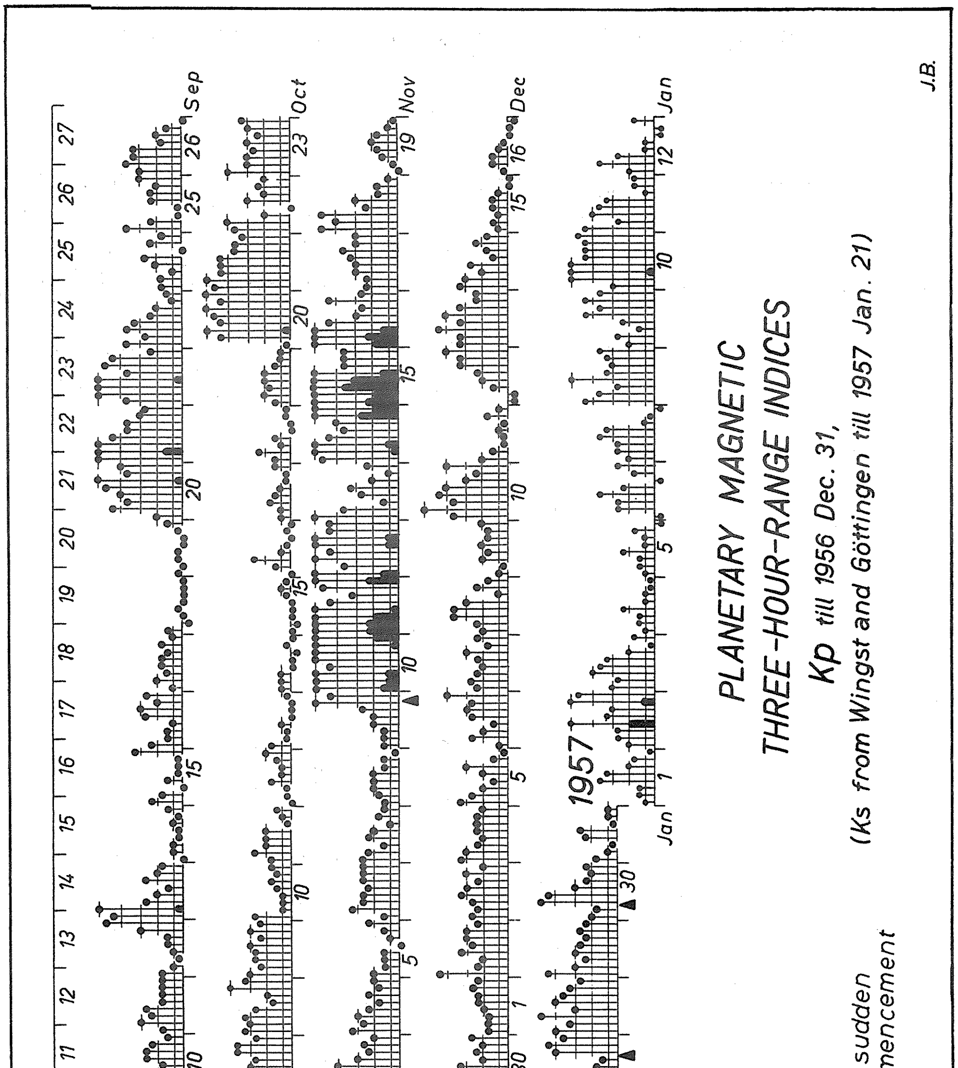
JANUARY 1957

Jan. 1957	Type	Start UT Hrs:Mins	Duration Hrs:Mins	Maximum Time UT Hrs:Mins	Maximum Peak Flux	Remarks
11	Single-Complex	16 54	9	16 58	20	
12	Single	16 49.5	1.5	16 50	12	
12	Single	20 05.5	2.5	20 06.5	4	
13	Single-Simple	19 14	2	19 15.5	18	
	Post Increase		10		6	
14	Single	17 37	1	17 37.5	13	
16	Single	13 25.2	1	13 25.7	8	
16	Group (2)	16 01.5	7			
	Single-Simple	16 01.5	3	16 02.5	15	
	Single	16 06.5	2	16 07.5	7	
17	Group (3)	15 08	3			
	Single-Simple	15 08	1	15 08.5	32	
	Single	15 09	1	15 09.5	18	
	Single-Simple	15 10	1	15 10.3	24	
18	Single	14 20.5	5	14 22.5	12	
18	Single-Simple	20 19	3	20 20	14	
	Post Increase		28		6	
18	Single-Simple	21 13	7	21 15.5	26	
19	Rise and Fall	14 23	42	14 48	19	
19	Single-Complex	14 36.5	5	14 38	35	(Superimposed on (Rise and Fall
19	Single	19 27	7	19 28.5	6	
19	Single	21 23	2	21 24	9	
20	Rise and Fall	18 15	2 45	indet.	30	
20	Single-Complex	18 54.5	13	18 59	125	(Superimposed on (Rise and Fall
21	Single-Complex	15 10	45	15 13	92	
22	Single	18 36	2.5	18 38	10	
23	Single-Simple	14 33	4	14 34	45	
23	Single	17 09.7	1.5	17 09.8	7	
23	Rise and Fall	17 37.5	35	17 44	12	
23	Single	17 43.8	4.5	17 45.8	12)	Superimposed on
23	Single	18 03.5	1	18 04	11)	Rise and Fall
23	Single-Simple	18 32.8	9	18 33.5	480	
23	Single	19 08.5	1	19 09	6	
24	Data Incomplete	b12 35	>10	indet.	>120	In sunrise
24	Single	13 21	5	13 23	7	
24	Single	15 26.7	2	15 27.2	11	
24	Single-Simple	16 37	10	16 38.8	1000	
	Post Increase		2		25	
24	Single	21 23	2	21 24	7	
25	Single-Simple	13 28.3	1	13 28.7	40	
25	Single	16 58	5	17 00	7	
25	Single-Simple	17 27	1	17 27.5	37	
26	Single-Complex	14 13	14	14 14.3	147	
	Post Increase		18		14	
31	Single	15 48	2	15 49	7	

GEOMAGNETIC ACTIVITY INDICES

DECEMBER 1956

Dec. 1956	C	Values Kp, Three hour Gr. interval: 1	2	3	4	5	6	7	8	Sum	Ap	Final Selected Days
1	0.4	2-	2-	2-	2o	2+	2+	3-	2+	17-	8	Five
2	0.9	4+	2+	2o	3+	3-	3o	3o	2+	23o	15	Quiet
3	0.6	3-	2+	3-	3+	3o	2+	3o	2o	21+	12	
4	0.5	3+	3o	2+	2o	2+	2+	2+	2o	20-	10	11
5	0.5	3+	3-	2o	1+	2o	3o	1+	1-	16+	9	15
												16
6	0.8	1o	3-	2o	1+	3-	3o	3-	4o	19+	12	17
7	0.6	2+	3-	2+	2o	2+	3o	2-	2+	19-	10	21
8	0.6	2o	2+	4-	4-	3o	1o	2+	2-	20-	12	
9	0.3	1o	1-	2o	2-	2o	2-	2-	2o	13-	6	
10	1.1	4-	5o	4-	4+	4o	3o	2+	4o	30o	25	
11	0.1	2o	1+	1-	1-	1o	1-	2-	1o	9o	4	Five
12	0.9	0o	0o	1+	2o	2+	3+	3+	4o	16+	10	Disturbed
13	1.1	3+	3+	4+	3+	4o	3+	2+	2+	26+	19	
14	0.6	3+	3o	2o	3-	1+	2-	2+	2-	18o	10	10
15	0.1	1o	1+	1o	1+	1+	1o	0+	0+	8-	4	13
												25
16	0.0	1-	1+	1+	1o	1-	0+	0+	0o	6-	3	28
17	0.0	0+	1+	2-	1+	1-	1-	0o	0+	6+	3	30
18	0.2	0+	1o	2-	2-	3o	2o	1+	0+	11+	6	
19	0.4	0o	0o	2-	1+	1o	1+	1o	3-	9o	4	
20	0.2	2+	2-	1+	2+	1+	1o	1o	1o	12o	6	
21	0.1	1+	1+	1+	2-	1o	1-	1o	1+	10-	5	Ten
22	0.3	1o	2o	2-	3-	3o	1+	2-	0+	14-	7	Quiet
23	0.1	0o	0+	1-	2+	1o	1-	1o	2o	8o	4	
24	0.5	3+	3+	2+	2o	1+	1o	2o	1o	16+	9	9
25	1.2	2-	2-	3o	5-	4+	3+	3+	4+	26+	21	11
												15
26	0.7	4-	5-	4+	3+	2-	1o	1-	0+	20-	16	16
27	1.0	0o	0+	1+	2-	1+	4o	4+	4-	17-	12	17
28	1.2	4o	3+	5-	3o	4o	4-	3+	3-	29-	22	19
29	0.8	4+	3o	2+	3o	3-	2+	3-	2+	23-	14	20
30	0.8	2o	2-	5-	4+	3o	2+	2o	2+	22+	16	21
31	0.2	2-	1o	1-	2+	3-	1-	1o	1o	11o	6	23
Mean:	0.54									Mean:	10	31


PLANETARY MAGNETIC
THREE-HOUR-RANGE INDICES
Kp till 1956 Dec. 31,
(Ks from Wingst and Göttingen till 1957 Jan. 21)
▲ = sudden commencement
KEY
DAYS IN SOLAR ROTATION INTERVAL
ROT.= NR.
1957
J.B.

CRPL RADIO PROPAGATION QUALITY FIGURES AND FORECASTS

NORTH ATLANTIC

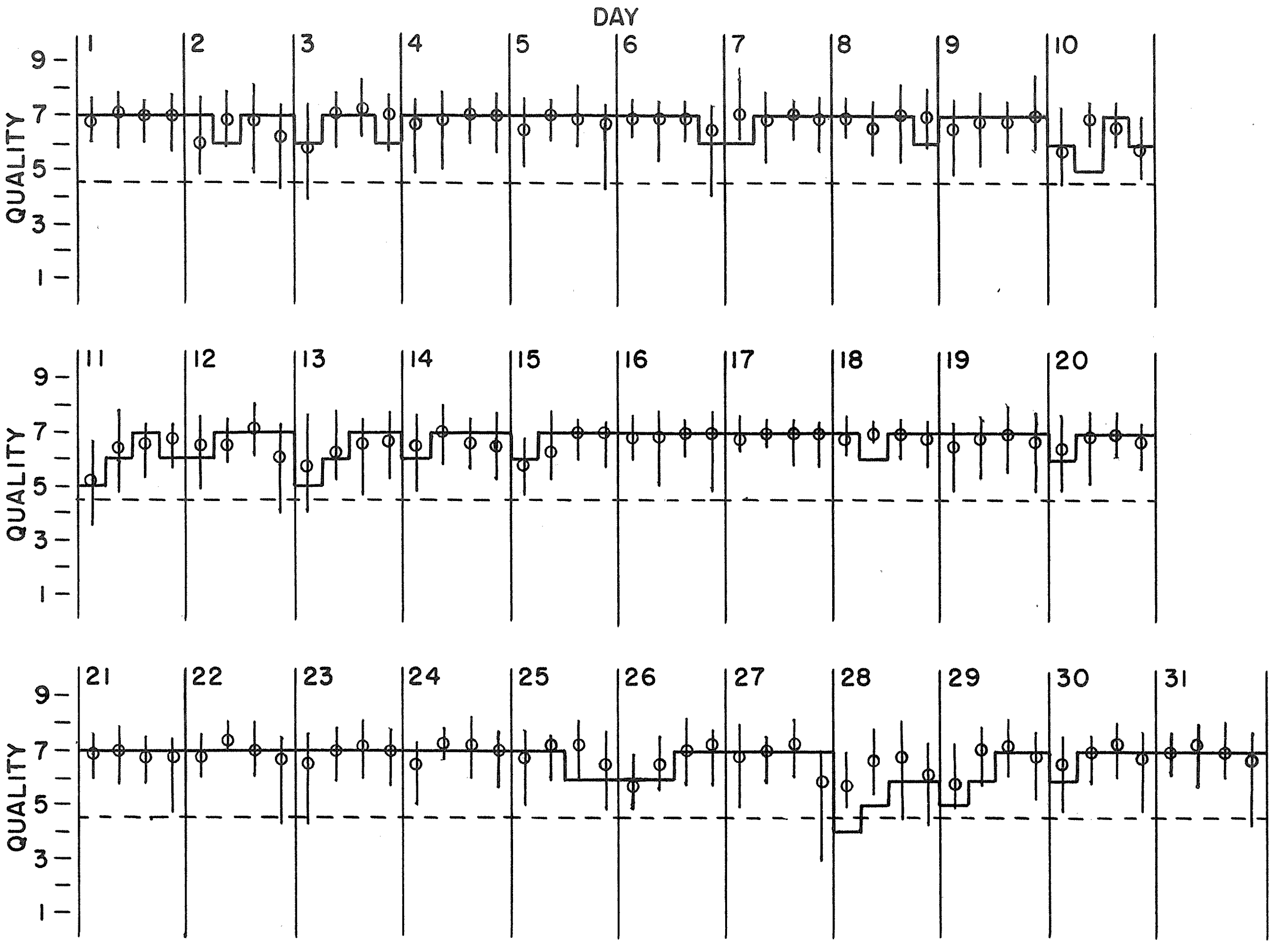
DECEMBER 1956

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

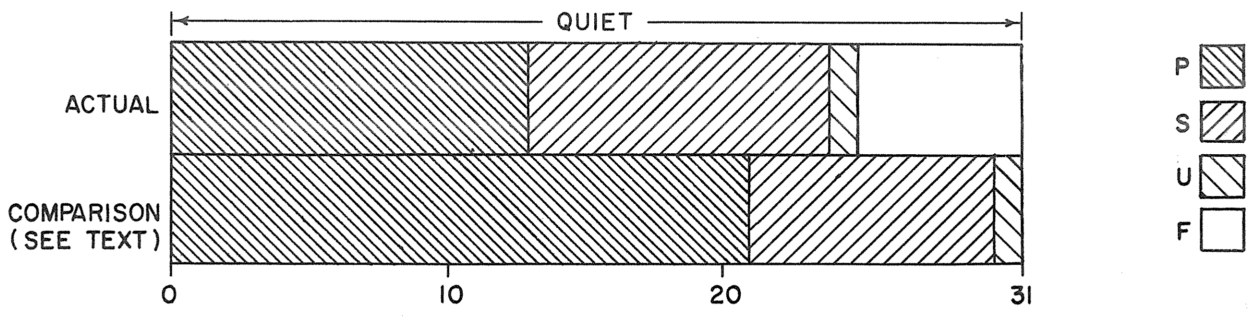
( ) represent disturbed values.

CRPL RADIO PROPAGATION QUALITY FIGURES AND FORECASTS
NORTH ATLANTIC

— Short-term forecast   DECEMBER 1956 | Range of reports
○ Quality figure

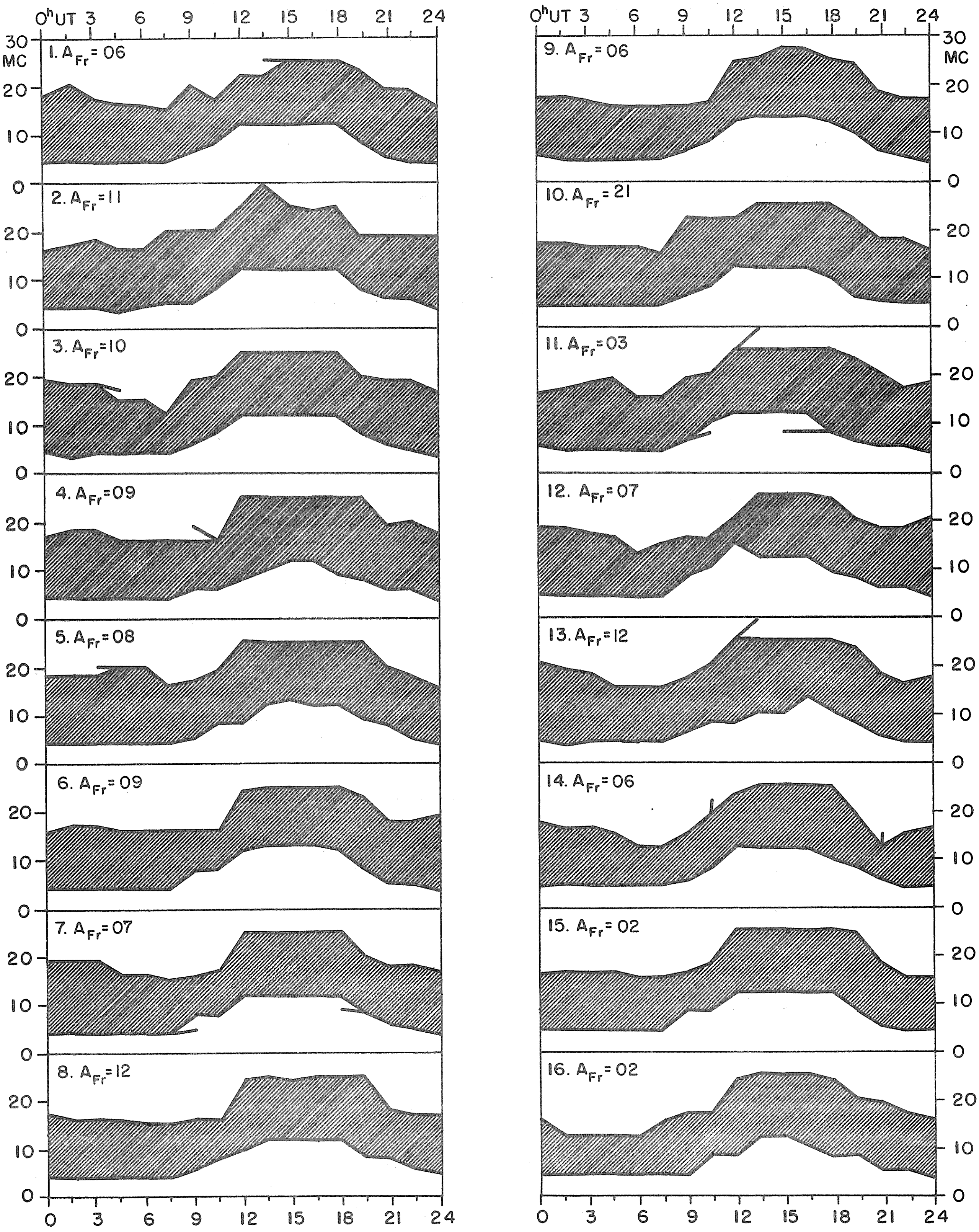


OUTCOME OF ADVANCE FORECASTS (1 TO 4 DAYS AHEAD)

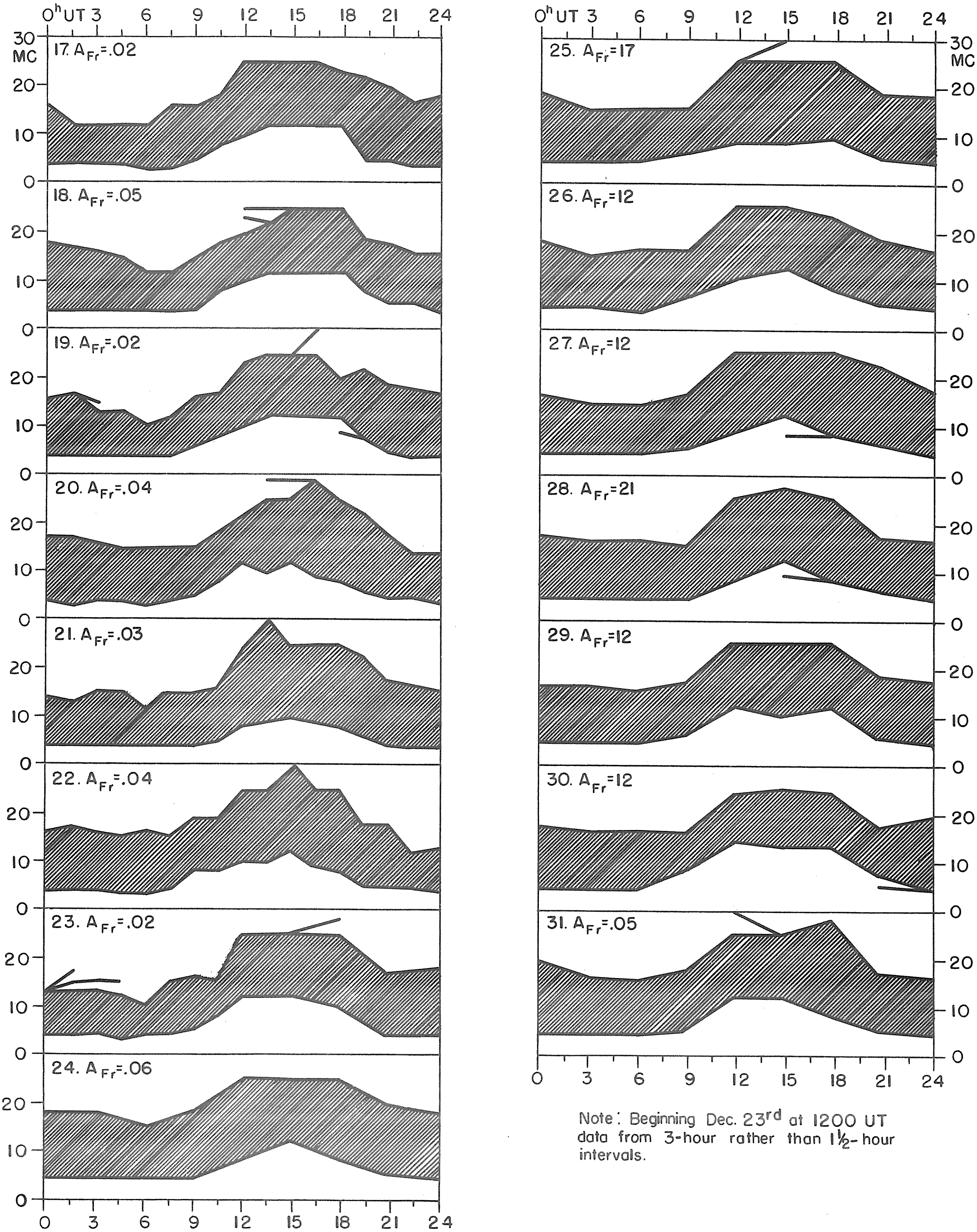


USEFUL FREQUENCY RANGES -- NORTH ATLANTIC PATH

DECEMBER 1956



DECEMBER 1956



Note: Beginning Dec. 23rd at 1200 UT data from 3-hour rather than 1½-hour intervals.

CRPL RADIO PROPAGATION QUALITY FIGURES AND FORECASTS

NORTH PACIFIC

DECEMBER 1956

Dec. 1956	North Pacific 8-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 11	11 to 19	19 to 03	02	10	18		1-4 days	4-7 days	8-25 days	Half day (1)	Half day (2)
1	6	6	6	6	5	6	6	6	6		1	2
2	6	6	6	6	5	5	6	6	6		2	2
3	6	6	7	6	5	6	6	6	6		3	2
4	6	6	6	6	6	6	6	6	6		2	2
5	5	5	6	6	6	6	5	6	6		2	2
6	6	5	5	6	6	5	6	6	6		2	3
7	6	6	6	6	6	6	6	6	6		1	2
8	5	5	6	6	4	5	6	6	6		3	2
9	6	6	6	6	6	6	6	6	5		1	2
10	6	6	6	6	6	5	6	5	5		(4)	(4)
11	6	6	6	6	6	6	7	5	5		1	1
12	6	5	5	6	5	6	6	6	5		1	3
13	5	6	7	6	6	5	6	6	6		3	3
14	6	6	6	6	6	6	6	6	6		2	1
15	5	6	6	6	6	6	6	6	6		1	0
16	5	6	6	6	6	6	6	6	6		1	0
17	5	6	5	6	5	6	6	6	6		1	0
18	4	5	5	6	6	6	5	6	6		1	2
19	5	5	6	6	6	6	5	6	6		0	1
20	5	5	6	6	6	6	5	6	6		2	2
21	6	6	7	6	6	6	6	5	6		1	0
22	6	6	6	6	6	6	6	5	5		2	1
23	6	6	6	6	6	7	6	5	6		1	1
24	6	6	6	6	6	7	6	5	6		2	1
25	6	5	5	6	6	6	5	6	6		2	(4)
26	5	6	6	6	5	6	6	5	6		3	1
27	6	6	6	6	6	5	6	5	6		1	3
28	5	5	7	5	5	6	6	6	6		3	(4)
29	6	6	6	5	6	6	6	5	6		2	2
30	5	5	7	6	6	6	6	6	6		3	2
31	6	6	6	6	6	6	7	6	6		1	1
Score: Quiet Periods			P	19	18	16		16	20			
			S	11	13	14		14	10			
			U	0	0	1		1	1			
			F	0	0	0		0	0			
Disturbed Periods			P	0	0	0		0	0			
			S	0	0	0		0	0			
			U	0	0	0		0	0			
			F	1	0	0		0	0			

( ) represent disturbed values.

CRPL RADIO PROPAGATION QUALITY FIGURES AND FORECASTS
NORTH PACIFIC

DECEMBER 1956