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Solar - Geophysical Data

NO. 390 FEBRUARY 1977

Supplement

NATIONAL GEOPHYSICAL AND SOLAR - TERRESTRIAL DATA CENTER
BOULDER, COLORADO

For obtaining bulletins on a data exchange basis, send request to: World Data Center A for Solar-Terrestrial Physics, NOAA, Boulder, Colorado 80302.

For sale through the National Geophysical and Solar-Terrestrial Data Center, NOAA, Boulder, CO 80302. Subscription Price: $34.00 annually for both Part I (Prompt Reports) and Part II (Comprehensive Reports) or $18.00 annually for either part. Annual supplement containing explanation is included. For foreign mailing add $32.00 for both parts or $16.00 for either part. Single issue price $1.50 for either part and $1.40 for the extra issue. Make checks and money orders payable to: Department of Commerce, NOAA/NGSDC.

To standardize referencing these reports in the open literature, the following format is recommended:

Solar-Geophysical Data, 390 Part I (or Part II), pages, February 1977, U.S. Department of Commerce, (Boulder, Colorado, U.S.A. 80302).

SOLAR-GEOPHYSICAL DATA

EXPLANATION OF DATA REPORTS

INTRODUCTION

This pamphlet contains the description and explanation of the data in the monthly publication, *Solar-Geophysical Data,* compiled by the National Geophysical and Solar-Terrestrial Data Center (NGSDC) in Boulder, Colorado, U.S.A. NGSDC is one of the several components of the Environmental Data Service in the National Oceanic and Atmospheric Administration. The monthly bulletins are available on a data exchange basis through the World Data Center A for Solar-Terrestrial Physics, which is operated by NGSDC, or at a nominal cost.* These data reports continue a series which was issued by the Central Radio Propagation Laboratory of the National Bureau of Standards, known begining November 1955 and for many years as the CRPL-F Series Part B. The title Solar-Geophysical Data was first used in 1955. The name of the organization compiling the data reports has changed many times but the personnel involved have stayed pretty much the same. From June 1965 to January 1977 the compilations and editing have been done by Miss Hope I. Leighton under the supervision of Miss J. Virginia Lincoln. As of February 1977 Helen E. Coffey has become editor. Mr. A. H. Shapley is Director of NGSDC.

Solar-Geophysical Data is intended to keep research workers abreast on a timely schedule of the major particulars of solar activity and the associated interplanetary, ionospheric, radio propagation and other geophysical effects. This report series is made possible through the cooperation of many observatories, laboratories and agencies as recorded in the detailed descriptions which follow.

For many data types, the material published in *Solar-Geophysical Data* is only a fraction of what is available from the NGSDC archives. The published data is considered to be that in greatest demand and thus the dissemination in this form is efficient and economical for both the user and the data center. *Users are invited to avail themselves of the data services of NGSDC and the collocated World Data Center A for STP.*

Beginning with the July 1969 issue the publication was divided into two Parts (I and II). Part I (Prompt Reports) contains data for 1 and 2 months prior to the month of publication. Part II (Comprehensive Reports) contains data for 6 and 7 months prior to the month of publication plus, from time to time, data from miscellaneous earlier months. These reports may be referenced in the open literature.** It must be understood, however, that because of the rapid publication schedule, some data categories are not considered to be definitive. This applies particularly to the Prompt Reports where such data sets are marked as provisional. Errata or revisions are included from time to time. Additions to the descriptive text will appear with the data when new material is added, or revision is made.

The first page of each issue of Part I and II gives the general contents and is backed by a running index to locate data for a specific month for the past year. A complete index for data since July 1957 is given in the blue section of this pamphlet.

*For sale from the National Geophysical and Solar-Terrestrial Data Center, NOAA, Boulder, CO 80302, Subscription Price: $34.00 annually for both Part I (Prompt Reports) and Part II (Comprehensive Reports) or $18.00 annually for either part. This supplement is included. For foreign mailing add $32.00 for both parts or $16.00 for either part. Single issue price $1.50 for either part and $1.40 for this extra issue. Make checks and money orders payable to: Department of Commerce, NOAA/NGSDC.

**To standardize referencing these reports in the open literature, the following format is recommended (with this issue as the example):

> *Solar-Geophysical Data,* 390 Part I (or Part II), pages, February 1977, *U.S. Department of Commerce* (Boulder, Colorado, U.S.A. 80302).

In various places in this text, data types are identified both by name and an alphanumeric designation (A.2, C.3, etc.). The latter come from the data categories given in *Guide to International Data Exchange*, issued in 1973 by the ICSU Panel on World Data Centres.

A useful reference containing descriptions of many solar and geophysical phenomena as well as directing the reader to more detailed discussions is the *Handbook of Correlative Data*, issued February 1971 by the National Space Science Data Center, NASA, Goddard Space Flight Center, Greenbelt, Md. 20771. (The Handbook is also available through World Data Center A for Solar-Terrestrial Physics.)

TABLE OF CONTENTS

DATA FOR ONE MONTH BEFORE MONTH OF PUBLICATION

TABLE OF CONTENTS

ALERT PERIODS (H.60)

The table gives the Advance Geophysical Alerts (PRESTO) as initiated by (or received by) the Western Hemisphere Regional Warning Center of the International Ursigram and World Days Service (IUWDS) at Boulder, Colorado, and also the World-wide Geophysical Alerts (GEOALERTS) as designated by the IUWDS World Warning Agency, Boulder, Colorado.

These alerts are of the types recommended by the International Ursigram and World Days Service. A description of the IUWDS program can be found in *Synoptic Codes for Solar and Geophysical Data*, Third Revised Edition 1973, revised by RWC Circular Letters. This code book and its revision are available from the IUWDS Acting Secretary for Ursigrams, G. R. Heckman, NOAA, Boulder, Colorado, U.S.A., 80302.

The PRESTO messages are originated by the reporting observatory or at the Regional Warning Centers. They are for advance reporting of major events. The format of these messages follows (extracted from *Synoptic Codes for Solar and Geophysical Data)*:

PRESTO

1. Content.

- Report of major events to the other RWC and to the local or regional customers.

2. General form.

PRESTO observatory JJHHmm report

3. Definition of symbols.

PRESTO = key word for RAPID reporting of major events

observatory = name of reporting observatory in clear text

JJHHmm = Greenwich date and time of issue of message in hours and minutes UT

report = one or more of statements as below

For GEOMAGNETIC ACTIVITY

MAGSTORM BEGINS	JJHHmm	
STRONG MAGSTORM IN PROGRESS	JJHHmm	$(A \geq 50)$
WEAK MAGSTORM IN PROGRESS	JJHHmm	$(30 \leq A < 50)$

Note: One may add plain language comments related to auroral reports or Forbush effect expected

For MAJOR FLARES

SOFLARE - importance class - coordinates (i.e. N20 E78) - JJHHmm (date and time) - "duration in minutes given" or statement "in progress"

Note: One may add plain language comments like "Y-shaped" or "covering spots" or "suspected proton flare"

For TENFLARE (solar radio emission outburst at 10 cm>100% over background)

TENFLARE - XX units - JJHHmm for onset - duration in minutes, or statement "in progress" at the time of PRESTO, or statement "observed until hours and minutes UT"

Note: Units give the increase of the flux density over the pre-burst level in conventional units ($10^{-22} Wm^{-2} Hz^{-1}$) by significant digits and words such as "1700 units over backgound"

For PROTON EVENT

COSMIC RAY INCREASE - JJHHmm - percent increase above normal based on neutron monitor

POLCAP ABSORPTION - JJHHmm - dB of absorption by riometer or ionospheric forward scatter technique

PROTON EVENT - JJHHmm - specify energy range from a spacecraft report

Notes:

1. PRESTO should be circulated as soon as the event has been recognized.
2. The PRESTO will only report events and no forecasts. Any change of a forecast would be sent to the interested customers as a GEOSOL, GEOALERT or in plain language.
3. If the observatories follow this scheme, it is not necessary to report the kind of experiment

   SOFLARE signifies a chromospheric report
   TENFLARE signifies a centimetric outburst
   COSMIC RAY INCREASE signifies a neutron monitor count increase
   POLCAP ABSORPTION signifies a ground based polar cap report
   PROTON EVENT signifies spacecraft reports only

The GEOSOL or GEOALERT messages are originated by the Regional Warning Center or by the World Warning Agency in Boulder, Colorado, U.S.A. They are for the purposes of reporting the current level of solar activity and for forecasting solar-geophysical events. The format of these messages follows:

GEOSOL
or
GEOALERT

1. Content.

- For sending combined data and forecasts to other RWCs and for general data users
- For sending ADVICE information to other RWCs

2. General form.

GEOALERT or GEOSOL IIINN DDHHmm

- DDHHmm: date time group of message in UT
- IIINN: warning center of origin, serial number of message
- GEOALERT or GEOSOL: key word - [use GEOALERT when ADVICE included in message]

9HHJJ 1aaab 2cccd 3eeef 4gggh

- 4gggh: cosmic ray intensity and events
- 3eeef: geomagnetic A index and events
- 2cccd: 10 cm flux and number of bursts
- 1aaab: relative sunspot number, and number of new spot groups
- 9HHJJ: signifies indices for preceding 24 hours follow

```
[repeat for each region]
 QXXYY     nnijk      ]  ...FLARE    JJHHmm     QXXYY
```

- QXXYY — heliographic coordinates of active region
- nnijk — total number of flares, number > Imp I, number of M and X flares in active region
- ...FLARE — key word
- JJHHmm — date and UT of <u>Outstanding</u> flare
- QXXYY — heliographic coordinates of flare

```
MAGSTORM    JJHHmm    8HHJJ    7777C
```

- MAGSTORM — key word
- JJHHmm — date and UT of beginning of magnetic storm
- 8HHJJ — key numbers signify solar forecast to follow for day
- 7777C — key numbers and observations used for forecast

```
[may be repeated or omitted]
 QXXYY     ZZZZZZ···ZZZZ    ]  ---ALERT    FIN
```

- QXXYY — heliographic coordinates of active region
- ZZZZZZ···ZZZZ — active region description
- ---ALERT — type of alert
- FIN — end of message

3. <u>Definition of symbols.</u>

GEOSOL = key word for sending combined data and forecasts
GEOALERT = key word for sending combined data and forecasts including ADVICE information

III = warning center of origin
MEU - Meudon | TOK - Tokyo
WWA - Boulder (SOLTERWARN) | SYD - Sydney
MOS - Moscow | DAR - Darmstadt
NN = originating center's serial number
DDHHmm = date (DD) hour (HH) and minutes (mm) in UT of issue of message

9 = key number to indicate indices follow
HHJJ = the middle of the 24-hour period for which the indices apply in UT; HH - hour; JJ - date
1 = key number to indicate sunspot data follows
aaa = relative sunspot number (Wolf number)
b = number of new sunspot groups that have appeared (by rotation or birth) during this period
2 = key number to indicate 10 cm solar flux data follows
ccc = value of 10 cm solar flux in $10^{-22}Wm^{-2}Hz^{-1}$ units
d = number of known IMPORTANT 10 cm bursts during this period

3 = key number to indicate magnetic activity follows
eee = A_k index for Greenwich date
f important event, if any, where

- 0 - no event
- 1 = end of magnetic storm
- 2 = storm in progress
- 6 = gradual storm commencement
- 7 = sudden storm commencement(sc)
- 8 = very pronounced sudden storm commencement

4 = key number to indicate cosmic radiation data observed by neutron monitor follows
ggg = median level in thousandths of an arbitrary normal level
h = important event, if any, where

- 0 = no event
- 1 = pre-decrease
- 2 = beginning of a Forbush decrease
- 3 = Forbush decrease in progress
- 4 = end of Forbush decrease
- 5 = arrival of solar particles (GLE)

Q = quadrant (heliographic coordinates) of the active region where
1 = NE (north-east) | 3 = SW (south-west)
2 = SE (south-east) | 4 = NW (north-west)
[XX = distance to central meridian in degrees (longitude)
YY = heliographic latitude in degrees]
[heliographic location of active region]

nn total number of flares
[i = number of flares greater than Importance I
j = number of M flares
k = number of class X flares]
[in this region during this period]

Note: <u>Definitions of class C, M or X flares follow:</u>

CLASS C: A solar flare which is not associated with significant X-ray production.

CLASS M: Solar flares which are accompanied by significant X-ray production, greater than 10^{-2}ergs $cm^{-2}sec^{-1}$ in 0-8A band, or 10^{-3}ergs $cm^{-2}sec^{-1}$ in 0.5-5A band, comparable SID (SWF or SPA).

CLASS X: Solar flares which are accompanied by great X-ray production, greater than 10^{-1}ergs $cm^{-2}sec^{-1}$ in 0-8A band, or 10^{-2}ergs $cm^{-2}sec^{-1}$ in 0.5-5A band, comparably great SID, or by a 10 cm radio noise outburst of more than 1000 flux units over background and duration greater than 10 minutes.

This classification is designed to give an indication of the geophysical effect which is likely to be associated with a solar event. Class C events will usually be accompanied by only minor sudden ionospheric disturbances (SID), class M by significant SID, and class X by major SID.

OUTSTANDING EVENTS

...FLARE = key word to indicate OUTSTANDING event data follows, where
<u>PROTON</u>FLARE - protons from this flare <u>have been observed</u> in the earth's <u>vicinity</u>
<u>MAG</u>FLARE - a geomagnetic and/or cosmic storm <u>has been associated</u> with this flare
<u>MAJOR</u>FLARE - this flare is the basis for the forecast of geomagnetic storm, cosmic storm and/or protons in the earth's vicinity

JJHHmm = UT of beginning of OUTSTANDING flare

Q = quadrant of the OUTSTANDING flare location, where
1 = NE (north-east) | 3 = SW (south-west)
2 = SE (south-east) | 4 = NW (north-west)
[XX = distance to central meridian in degrees
YY = heliographic latitude in degrees]
[heliographic location of OUTSTANDING FLARE]

MAGSTORM = key to indicate magnetic storm data follows
JJHHmm = UT of beginning of magnetic storm

<u>Notes:</u> Omit these groups if no events to be reported;
Use clear text if event does not correspond to conventional classification.
Include data from earlier PRESTO messages for this period.

DETAILED FORECASTS

8 = key number to indicate 24-hour forecast information follows
HHJJ = the UT hour (HH) and date (JJ) of the beginning of the 24-hour forecast period
7777 = key numbers to indicate available local observatories follow
C = definitions of available local observatories, where
0 = none | 3 = all (optical and radio)
1 = solar radio observations | 4 = all including solar magnetic field measurements
2 = partial solar optical observations

Q = quadrant of PREDICTED ACTIVE REGION, where
1 = NE (north-east) | 3 = SW (south-west)
2 = SE (south-east) | 4 = NW (north-west)
[XX = distance to central meridian in degrees
YY = heliographic latitude in degrees]
[heliographic location of ACTIVE REGION at HHJJ]

ZZZ···ZZZ = key word to describe the PREDICTED ACTIVE REGION, where
[SPOTNIL - indicates spotless disc
PLAGENIL - indicates spotless disc free of calcium plage]
[when these are used, QXXYY omitted]

QUIET = less than one chromospheric event per day
ERUPTIVE = at least one radio event (10cm) and several chromospheric events per day (Class C Flare)
ACTIVE = at least one geophysical event or several larger radio events (10cm) per day (Class M Flare)
PROTON = at least one high energy event (Class X Flare)

Notes: 1. Events are classified as below:

a) Chromospheric Events: some flares are just Chromospheric Events without Centimetric Bursts or Ionospheric Effects. (SID). (Class C flare)

b) Radio Event: flares with Centimetric Bursts and/or definite Ionospheric Event. (SID).

c) Geophysical Event: flare (Importance two or larger) with Centimetric Outbursts (maximum of the flux higher than the Quiet Sun flux, duration longer than 10 minutes) and/or strong SID. Sometimes these flares are followed by Geomagnetic Storms or small PCA. (Class M flare)

d) High Energy Event: flare (class two or more) with outstanding Centimetric Bursts and SID. High Energy Protons are reported at the Earth in case of most of these events occurring on the western part of the solar disk. (Class X flare)

2. Some quiet groups being of very little importance, these can be reported only by their number.

3. If the word CAUTION is inserted between QXXYY group and the description word, it signifies one cannot forecast real evolution of the group at time of the message.

4. If the word DOUBTFUL is inserted between QXXYY group and description word, it signifies it is impossible to determine definitely the true class of activity expected.

ADVICES AND ALERTS

---ALERT--- key word(s) to describe one or more of the following situations during the next 24 hours or longer:

SOLNIL, MAGNIL, PROTONNIL – End of active period or Beginning of period of very low activity

SOLQUIET - No active regions on the solar disk
MAGQUIET - Only sporadic weak geomagnetic activity

SOLALERT JJ/KK - increased solar activity expected between days JJ and KK
MAGALERT JJ/KK - increased geomagnetic activity expected between days JJ and KK

MAJOR FLARE ALERT JJ/KK QXXYY - large bright flare (Class X) expected between days JJ and KK in region QXXYY
PROTON FLARE ALERT JJ/KK QXXYY - protons expected in earth's vicinity as a result of proton flare predicted to occur between days JJ and KK in region QXXYY

PRESTO PROTON ARRIVAL ALERT KK/JJHHmm - forecast of arrival of protons in earth's vicinity on day KK from flare which occurred on day JJ at HHmm (UT)

STRATWARM STARTS ----, STRATWARM EXISTS ---- – includes day of week and geographical area
STRATWARM ENDS

Notes: 1) The Alert section is always included in the GEOALERT code format as it is used as ADVICE by RWCs & WWA.
2) More than one type of Alert may be included in a message
3) Previous transmission of ALERT (SOL, MAG, MAJOR FLARE, PROTON FLARE, PRESTO PROTON ARRIVAL) requires the eventual transmission of appropriate NIL (SOL, MAG, PROTON)
4) Transmission of STRATWARM STARTS or EXISTS requires the eventual transmission of STRATWARM ENDS
5) GEOALERTS are converted by WWA to plain language and broadcast on WWV and WWVH as described in Circular letter RWC-123.

DAILY SOLAR INDICES (A.2, A.8)

Relative Sunspot Numbers and Adjusted 2800 MHz Solar Flux -- The first table presents Zürich relative sunspot numbers, R_Z, for the month. The corresponding data for eleven earlier months are reprinted to permit the trend of solar activity to be followed. On the same page is presented a similar table of twelve months of daily solar flux values at 2800 MHz adjusted to one Astronomical Unit, S_a, as reported by the Algonquin Radio Observatory (ARO) of the National Research Council near Ottawa.

Combined Sunspot Numbers and Solar Flux Values -- The next table gives several available daily indices for the month preceding that of publication. In addition to the calendar date, the table gives the day-number of the year and the day-number of the standard 27-day (solar rotation) cycles. The data presented are Zürich relative sunspot numbers, (R_Z), American relative sunspot numbers, (R_A'), daily solar flux values at 2800 MHz, (S), and daily solar flux values, (S_a), adjusted to 1 A.U. for 15400, 8800, 4995, 2800, 2695, 1415, 606, 410 and 245 MHz.

Graph of Sunspot Cycle and Table of Predicted and Observed Relative Sunspot Numbers -- As of this publication date the minimum smoothed sunspot number based on Zürich relative sunspot numbers is 12.5. This centers on March 1976. A graph and table of observed and predicted smoothed numbers are therefore produced with March as the beginning of cycle 21.

If a later month shows a lower number a new graph and table will be prepared. Smoothed sunspot numbers are used for these purposes and are defined by:

$$R_{12} = 1/12 \left\{ \sum_{n-5}^{n+5} (R_k) + 1/2\,(R_{n+6} + R_{n-6}) \right\}$$

in which R_k is the mean value of R for a single month k and R_{12} is the smoothed index for the month represented by k = n. 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 computed for Cycles 8 through 20. The last prediction made also shows the 90% prediction interval, an indication of the uncertainty above and below the predicted number. The values of observed and predicted Zürich smoothed relative sunspot numbers are given in the table. The predicted values are based on observed data available and will change as calculated each month and new observations are included. The 90% prediction interval is shown in parentheses for each month.

Relative Sunspot Numbers -- The relative sunspot number is an index of the activity of the entire visible disk of the sun. 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. 1/25 square degree). The relative sunspot number is defined as $R = K (10g + s)$, where g is the number of sunspot groups and s is the total number of distinct spots. The scale factor K (usually less than unity) depends on the observer and is intended to effect the conversion to the scale originated by Wolf. The provisional daily Zürich relative sunspot numbers, R_Z, based upon observations made at Zürich and its two branch stations in Arosa and Locarno are communicated by M. Waldmeier of the Swiss Federal Observatory. The daily American relative sunspot numbers, R_A', are compiled by Casper Hossfield, for the Solar Division of the American Association of Variable Star Observers. The R_A' 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,* these reports, and elsewhere. They usually differ slightly from the provisional values. The American number, R_A', being computed solely from observations made under favorable conditions selected from the reports of numerous observers, are final numbers and do not require revision.

Daily Solar Flux Values - Ottawa-ARO -- Daily observations of the 2800 MHz radio emissions which originated from the solar disk and from any active regions are made at the Algonquin Radio Observatory (ARO) of the National Research Council of Canada with a reflector of 1.8 meters diameter. These are a continuation of observations which commenced in Ottawa in 1947. Numerical values of flux in the tables are in units of $10^{-22}Wm^{-2}Hz^{-1}$ and refer to a single calibration made near local noon at 1700 UT. When the flux changes rapidly, or there is a burst in progress at that time, the reported value is the best estimate of the undisturbed level and provides the reference level for measuring the burst intensity. The various types of outstanding events are listed separately in another table. The observed flux values have variations resulting from the eccentric orbit of the earth in its annual path around the sun. Although these radio values are suitable to use with observed ionospheric and other data, an adjustment must be introduced when the observations are used in studies of the absolute or intrinsic variation of the solar radio flux. Thus the tables show both the observed flux, S, and the flux adjusted to 1 A.U., S_a. The observations are made for a single North-South polarization but reduced for the assumption of two equal orthogonal polarizations. Graphs showing the monthly mean adjusted flux and the monthly high and low values since 1947 are shown on page 9. Relative errors over long periods of time are believed to be ±2%, over a few days may be ±0.5%. The characteristics of the observations are surveyed in "Solar Radio Emission at 10.7 cm" by A. E. Covington [*J. Royal Astron. Soc., Canada, 63,* 125, 1969]. Values of the quiet sun for the minima of January 1954, and July 1964 have been derived as 65.0 and 67.2 s.f.u. using the solar flux adjusted to 1 A.U. [Covington, *J. Royal Astron. Soc., Canada, 68,* 31, 1974]. When the same method is applied to the daily values for 1975-1976, it would appear that the basic quiet sun was observed on a number of days from March 1975 to March 1976, and that the average of the eight quietest days is 67.3 s.f.u. A minimum value of 2.7 s.f.u for the slowly varying component was observed in February 1976 and will define radio sunspot minimum if the slow increase in both the monthly quiet sun values and the s.v.c. continue. Though experiments have indicated that a multiplying factor of 0.90 should be applied to the reported flux values in order to derive the absolute flux values, the published flux values have not been corrected by this factor because of the number of data series which have been computerized listing these values. Maintaining homogeneity of the published series is considered of greater value than having the absolute flux values published. A review of the history of the absolute calibration of the Ottawa series as well as a number of other series of observations made within the microwave region has been prepared by H. Tanaka of the Research Institute of Atmospherics, Nagoya University, as convener of a Working Group of Commission 5 of URSI [H. Tanaka *et al.*, "Absolute calibration of solar radio flux density in the microwave region," *Solar Physics, 29,* 243, 1973].

The factor of 0.90 stated above applies directly only to "Series C" data beginning in 1966. The reported correction factor includes a correction of 0.01 for the atmospheric attenuation referred to the zenith as well as the appropriate modification for the zenith angle of the sun at the times of calibrations. In data taken previous to 1966, this correction was neglected. A provisional summary of corrected daily flux values prior to 1966 has been made so that the early values may be compared on the same basis as later values and is available in World Data Center A. It has also been found necessary to incorporate a correction of -4% for the period July 1967 to May 1968. [*ERB 790 Radio and Electrical Engineering Division,* NRC.]

These solar radio noise indices are being published in accordance with a CCIR Recommendation originally from the Xth Plenary Assembly, Geneva, 1963 (maintained at XIth, XIIth, and XIIIth Plenaries), which states "that the monthly-mean value of solar radio-noise flux at wavelengths near 10 cm should be adopted as the index to be used for predicting monthly median values of foE and foF1, for dates certainly up to 6, and perhaps up to 12 months ahead of the date of the last observed values of solar radio-noise flux".

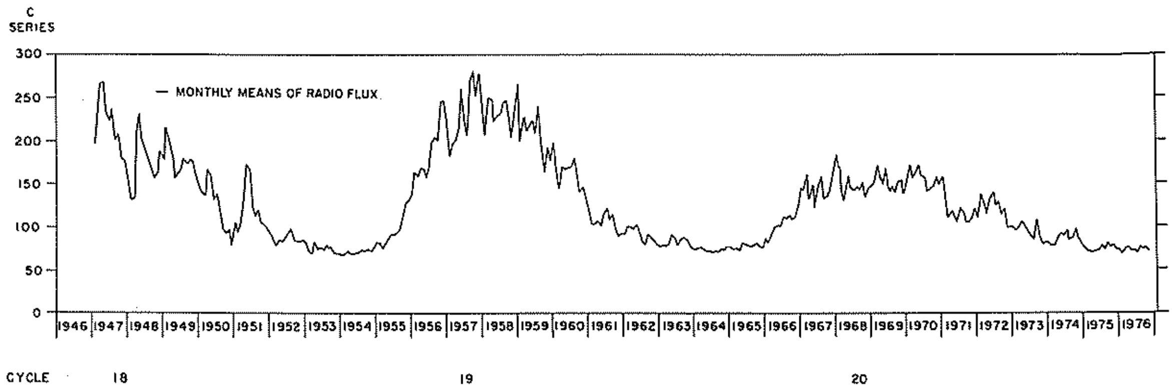
Daily Solar Flux Values - Sagamore Hill -- the Sagamore Hill Solar Radio Observatory of the Air Force Geophysics Laboratories (located at 42° 37'54.36"N, 70°49'15.15"W) in 1966 began operating solar patrols at 8800, 4995, 2695, 1415, and 606 MHz. The patrol was extended to 15400 MHz in 1967, to 245 MHz in early 1969 and 410 MHz was added in early 1971. Flux calibrations in units of $10^{-22}Wm^{-2}Hz^{-1}$ are made at about meridian transit each day. All flux data are corrected to sun-earth distance of 1 A.U. Corrections are also made for atmospheric attenuation based on the following average vertical attenuations:

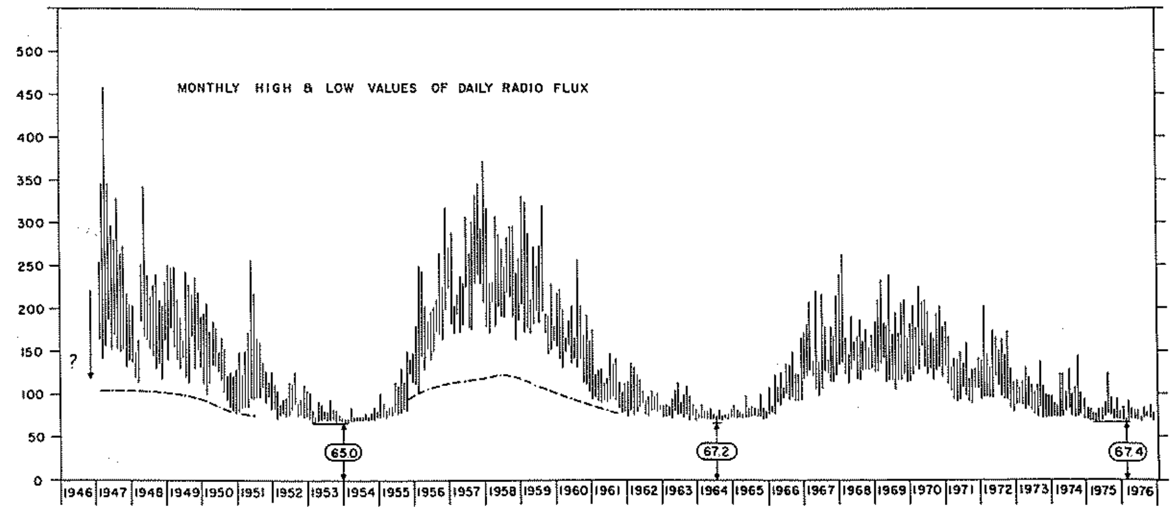
15400 MHz	0.085 dB	1415 MHz	0.05 dB
8800	0.070	606	0.045
4995 MHz	0.055 dB		
2695	0.051		

A very small error has been discovered in the computer program which generates the observed daily solar flux values. The error exists in all reported values through June 1974 and may be corrected by multiplying the values reported by 0.9975. Starting with July 1974, this correction factor was included in the computation of the observed daily solar fluxes.

SOLAR RADIO FLUX, 10.7 CM

ADJUSTED TO I.A.U.





VERTICAL BARS INDICATE HIGH AND LOW DAILY VALUES WITHIN EACH MONTH AND DEFINE THE SLOWLY VARYING COMPONENT OF FLUX; THE DASHED CURVE APPROXIMATELY SEPARATES THE FLUX ASSOCIATED WITH CENTERS OF ACTIVITY FROM A QUIET SUN DERIVED AS THE FLUX INTERCEPT FOR ZERO SUNSPOT NUMBER IN ANNUAL PLOTS OF DAILY FLUX VERSUS SUNSPOT NUMBER.

MAGNITUDE OF THE BASIC QUIET SUN OBTAINED AS THE LOWEST DAILY FLUX VALUE OBSERVED DURING MINIMUM SUNSPOT ACTIVITY AND INDICATED IN CARTOUCH AT TIME INDICATED. FIRST AND LAST APPEARANCE OF THIS BASIC EMISSION GIVEN BY HORIZONTAL LINE. RADIO MINIMUM IS DETERMINED BY SELECTING A MONTH WITH MINIMUM VALUES OF THE SLOWLY VARYING COMPONENT AS WELL AS THE BASIC FLUX.

SOLAR FLARES (C.1)

The Hα solar flare data in Part I (Prompt Reports) are presented as a preliminary record of those flares received on a rapid schedule. Definitive data are published later in Part II (Comprehensive Reports). After six months the flares have been grouped and an attempt made to verify that errors in reporting have been eliminated. The explanation of these definitive flare data begins on page 40 of this text. It includes an explanation of the column headings together with definition of the letters used in the Remarks Column. A table of solar flare patrol observatories is on page 42.

The solar flare reports are received from throughout the world at World Data Center A for Solar-Terrestrial Physics, NOAA, Boulder, Colorado 80302. Observations are made in the light of the center of Hα line unless noted otherwise. NOAA operates the flare patrol at Boulder, and

NOAA provides support and jointly operates with the Ionospheric Prediction Service of Australia the flare patrol at Culgoora. Tehran is operated by the USAF using NOAA equipment. The USAF operates Ramey, Palehua and Athens.

The no-flare patrol observations matching the solar flare table are given in graphical form. The observatories reporting the patrols are indicated. The dark areas at the bottom half of each day are times of no cinematographic patrol. The dark areas at the top half of the day are times of neither visual nor cinematographic patrol.

SOLAR RADIO WAVES (A.10, C.3)

Interferometric Observations -- The chart presents solar interferometric observations at 169 MHz as recorded around local noon at Nançay, France (47°23'N, 8'47"E) the field station of the Meudon Observatory.

The main lobes are parallel to the meridian plane: The half-power width is 3.8 minutes of arc in the East-West direction. The main lobes are about 1° apart [*Ann. Astroph.*, *20*, 155, 1957]. The records give the strip intensity distribution from the center of the disk to 30' to the West and East.

These daily distributions are plotted on the same chart giving diagrams of evolution. Points of equal intensity given in relative units are joined day after day in the form of isophotes. Four equal intensity levels have been chosen to draw the isophotes. These intensities are proportional to 0.6, 1, 1.5 and 2. The first level corresponds to the sun without any radio storm center.

In each noisy radio region the smoothed intensity around noon is given in $10^{-22}Wm^{-2}Hz^{-1}$.

East-West Solar Scans - Algonquin 10.7 cm -- East-West solar scans at 10.7 cm are taken daily at the Algonquin Radio Observatory of the National Research Council of Canada (N 45°56'43", W 78°3'33").

The antenna consists of an array of 32 3-meter paraboloids having interference fringes separated by approximately 1°. The zero order fringe on the meridian (where most of the published curves are taken) has an east-west width of 1.5', but the width increases to 1.7' for fringes 30° from the meridian. The antennas are kept fixed during each drift curve to avoid changes in sensitivity due to scanning and an effort is made to maintain a constant sensitivity from one day to another. When necessary, however, the receiver gain is adjusted to accommodate large fluxes. (Antenna specification can be found in *Solar Phys.*, *1*, 465-473, 1967 and details of the antennas' performance appear in *Astron. J.*, *73*, 749-755, 1968.)

The position of the limbs of the photosphere are indicated on each curve by the vertical bars at the ends of the horizontal line, which itself represents the cold-sky level. The estimated level of flux units (one solar flux unit = $10^{-22}Wm^{-2}Hz^{-1}$). This level is determined for each curve by comparing the area under the curve with the total solar flux at 10.7 cm. (Prior to December 1968 the quiet-sun level was estimated each day from a calibrating noise signal inserted between the antenna and receiver. The present method was begun in December 1968 when it was discovered that the quiet-sun levels shown for September and October 1968 were approximately 8% too low.)

East-West scans with 30 seconds of arc resolution (recorded simultaneously with the 1.5 minute scans) have been taken at selected intervals between 1969 and November 1971. Commencing November 1, 1971 they have been obtained on a routine basis along with circular polarization data. These data have not been included in the monthly summaries but can be made available on request.

East-West Solar Scans - Fleurs 21 cm and 43 cm -- East-West strip scans of the sun at 21 cm and 43 cm are made possible by the "Fleurs" Radio Astronomy Station of the University of Sydney, Sydney, Australia.

For the East-West solar scans from the 21 cm solar radio array the fan-beam has 2' of arc resolution. The two short horizontal lines drawn crossing the center line indicate the cold-sky level and the estimated quiet-sun level. The gain may differ from day-to-day. The curves have not been normalized to account for these gain variations other than by the indication of the estimated quiet-sun level.

For the East-West solar scans from the 43 cm solar radio array the fan beam has a resolution of 4' of arc. The estimated quiet sun is indicated on the published profiles in the same manner as for the 21 cm scans. The curves have not been normalized for variations in gain.

Outstanding Occurrences (SELECTED) -- A list of SELECTED centimeter and millimeter wavelength events at fixed frequencies is published one month following observations. Selections are made to provide 24-hour coverage as nearly as possible. See page 43, Outstanding Occurrences, for descriptions of the types of events and observatory characteristics.

S O L A R X - R A Y R A D I A T I O N (A.11, C.5)

The Space Environment Monitor (SEM) aboard the Synchronous Meteorological Satellites (SMS) and the Geostationary Operational Environmental Satellites (GOES) include a ½ to 4Å x-ray ion chamber and a 1-8Å chamber. SMS-1 was launched in May 1974; SMS-2 was launched in February 1975; and GOES-1 in October 1975. These geostationary satellites are located over the western hemisphere and provide nearly continuous solar x-ray data. The SEM's data from two satellites are recorded, processed and disseminated in real time by the Space Environment Services Center of the NOAA Space Environment Laboratory in Boulder, Colorado. Further details of the SEM system are given in *The SMS/GOES Space Environment Monitor Subsystem* by R. N. Grubb [NOAA SEL, Boulder, Colorado 80302] The x-ray ion chambers are described in *Calibration of X-ray Ion Chambers for the Space Environment Monitoring System* by A. Unzicker and R. F. Donnelly, NOAA Tech. Rept. ERL 310-SEL 31, 1974 [U.S. Government Printing Office, Washington, DC 20402].

The 1-8Å ion chamber has 300 mm Hg of Argon as a filler gas and a beryllium window that is 5×10^{-5} m thick with an x-ray viewing area of $1.9 \times 10^{-4} m^2$. The listed 1-8Å flux is based on a gray-body spectrum of $2\frac{1}{2} \times 10^6$°K, which gives an average transfer function in good agreement with gray-body or free-free thermal spectra with temperatures in the range 2 to 100 x 10^6°K. The ½ - 4Å ion chamber has 180 mm Hg of Xenon as a filler gas, with a beryllium window that is 5×10^{-4}m thick with an area of $5.8 \times 10^{-4} m^2$. The listed ½ - 4Å flux is based on a 10^7°K gray-body spectrum.

The average x-ray flux values include data obtained during solar flares. The time heading for each hourly average is the time at the end of the average. Low values of the x-ray flux are contaminated by a photoelectric effect on SMS-1, radio frequency interference within GOES-1, and by particle interference during solar proton events. Therefore, no flux values below $10^{-6} Wm^{-2}$ for the 1-8Å detector or 10^{-7} Wm^{-2} for the ½ - 4Å detector are reported. These cut-off levels also apply to data before August 1976, for which the published tables of hourly averages included incorrect units of 10^{-6} Wm^{-2} for ½ - 4Å and 10^{-5} Wm^{-2} for 1-8Å, when the units should have read 10^{-5} Wm^{-2} for ½ - 4Å and 10^{-4} Wm^{-2} for 1-8Å. A "B" in the hourly average table indicates the flux was below the cut-off levels. An "M" in these tables denotes periods of missing data. The hourly values are averages of the 1-hour averaged data. The list of events does not include events with a maximum flux less than 3×10^{-6} Wm^{-2} in the 1-8Å channel. The end of a flare is taken as that time when the 1-8Å flux enhancement above the preflare level has decreased to half its maximum value. Often an active region will remain bright after a flare or the x-ray flux will remain above the preflare value long after the half peak-enhancement end time. Copies of the detailed x-ray data measured every 3 sec may be obtained from World Data Center A for Solar-Terrestrial Physics, NOAA Environmental Data Service, Boulder, Colorado 80302.

C O R O N A L H O L E S (A.7f, A.7g)

The helium D3 chromosphere at the solar limb is observed on a routine daily basis at Big Bear Solar Observatory using the 26 inch vacuum telescope with a Zeiss Universal Birefringent Filter which gives 0.18Å bandpass. The observations are made visually by scanning the limb and recording the regions in which the double limb characteristic of the helium chromosphere are visible. This technique enables the positions of coronal holes to be determined at the limb to an accuracy of typically ±2° in position angle, except under bad seeing conditions in which case there is a serious danger of mistaking the edge of an isolated emission patch for the coronal hole boundary. Observations made under poor seeing conditions are indicated by dashed lines.

Observational and theoretical evidence that the gaps in the D3 chromosphere correspond to coronal holes has been presented by H. Zirin [*Ap. J., 199*, L63, 1975], who showed that the properties of the helium lines can be explained by a model in which the helium is photoionized by coronal back-radiation. The weakening of chromospheric D3 in coronal holes is then a consequence of the reduced back-radiation in these regions.

The results of the D3 limb scans are presented monthly and indicate the angular extent of the double limb versus time, where the position angle is measured from the sun's north pole (0°) to south pole (180°), with a positive sign for east limb and a negative sign for west. Days for which data are missing correspond to poor seeing conditions and/or equipment maintenance periods, and do not imply that the D3 double-limb was absent.

These observations are furnished by H. Zirin and K. A. Marsh of Big Bear Solar Observatory, California Institute of Technology.

Kitt Peak National Observatory -- Daily full disk spectroheliograms using the HeI 10830 Å line are obtained using the KPNO vacuum telescope (Livingston *et al.*, *Applied Optics 15*, 33, 1976). and 512-channel photodiode detector system (Livingston *et al.*, *Applied Optics 15*, 40, 1976). A significant amount of control of the strength of this line is due to short wavelength radiation originating in the corona and hence it is possible to infer the existence of features such as coronal holes and bright points (Harvey *et al.*, *Bull. A.A.S. 7*, 358, 1975). An example of an observation is published in the first cited reference above.

The inferred position of coronal holes is outlined on each day's photographic image and transferred by hand to an equal-area cylindrical projection of the sun's surface using the Carrington coordinate system shortly after the end of each solar rotation. Ideally, inferred coronal hole boundaries are sufficiently stable and well defined that the mapping process is now finished. In practice, boundaries are frequently not stable or well defined. What is drawn then is a weighted average of the inferred boundary where more weight is given to high quality observations and to those areas near the central meridian. Tick marks at the top of the maps represent the times of central meridian longitude of the spectroheliograms used to draw the maps. The longitude at 00UT at five day intervals are shown by longer tick marks.

A heavy solid line indicates a boundary which is fairly stable and well defined; a hole is almost certainly present. A dashed line means either an unstable boundary if it is connected to a solid line or that some question exists about the reality of the hole if the entire boundary is dashed. Faint lines may sometimes be visible on the reproduced maps and these are the individual day's observations. Solid black areas represent active regions or their remnants. Occasionally a filament will also be so indicated because they are sometimes hard to distinguish from active regions. The threshold for drawing active regions is variable and little significance can be placed in shape or other details.

Efforts to remove the subjectivity present in the preparation of these maps are underway but until these efforts are successful, users should be very careful. Further information can be obtained from J. Harvey or W. Livingston, Kitt Peak National Observatory, P. O. Box 26732, Tucson, Az. 85726. The 10830 observations would not be made without assistance from NOAA which is gratefully acknowledged.

SOLAR WIND MEASUREMENTS (A.13)

Pioneers 6, 7, 8 and 9 -- The NASA Ames Research Center plasma probe solar wind velocity data from Pioneers 6 through 9 are supplied by John H. Wolfe. These data include the date, the Deep Space Network (DSN) coverage period, the observation time in UT, the solar wind bulk velocity U_{H+} in kilometers/second, the density N_{H+} in particles/cubic centimeter, the temperature T_{H+} in millions of degrees Kelvin, the Earth-Sun-Probe (ESP) angle in degrees and the co-rotation delay time in days.

On Pioneers 8/9, the U_{H+}, the N_{H+} and the T_{H+} are derived by a least squares computer fit of the solar wind energy distribution to a Maxwell-Boltzmann distribution in a moving frame of reference. The velocity represents the bulk of convective velocity of the solar wind. On Pioneers 6/7, the peak velocities are reported because a least squares program was not developed for these data.

The co-rotation delay, τ, defined as the time in days required for a steady state solar corotating plasma beam to rotate from the spacecraft to earth. A diagram showing the angular positions of Pioneers 6 through 9 with respect to the earth is on page 13. Viewing from the North Ecliptic Pole onto the Ecliptic plane, note that Pioneers 6, 8, and 9 are lagging the earth and therefore the τ is positive. Pioneer 7 is leading the earth and therefore its τ is negative. The co-rotation delay depends on the heliocentric radial distance of the earth and the spacecraft, the angular separation between the earth and the spacecraft, the solar angular velocity and the solar wind bulk velocity which defines the degree of the hose angle of the co-rotating Interplanetary Magnetic Field.

The equation used to compute the co-rotation delay, τ, follows:

$$\tau(\text{in seconds}) = \phi/\omega - (r_p - r_e)/U_{H+}$$

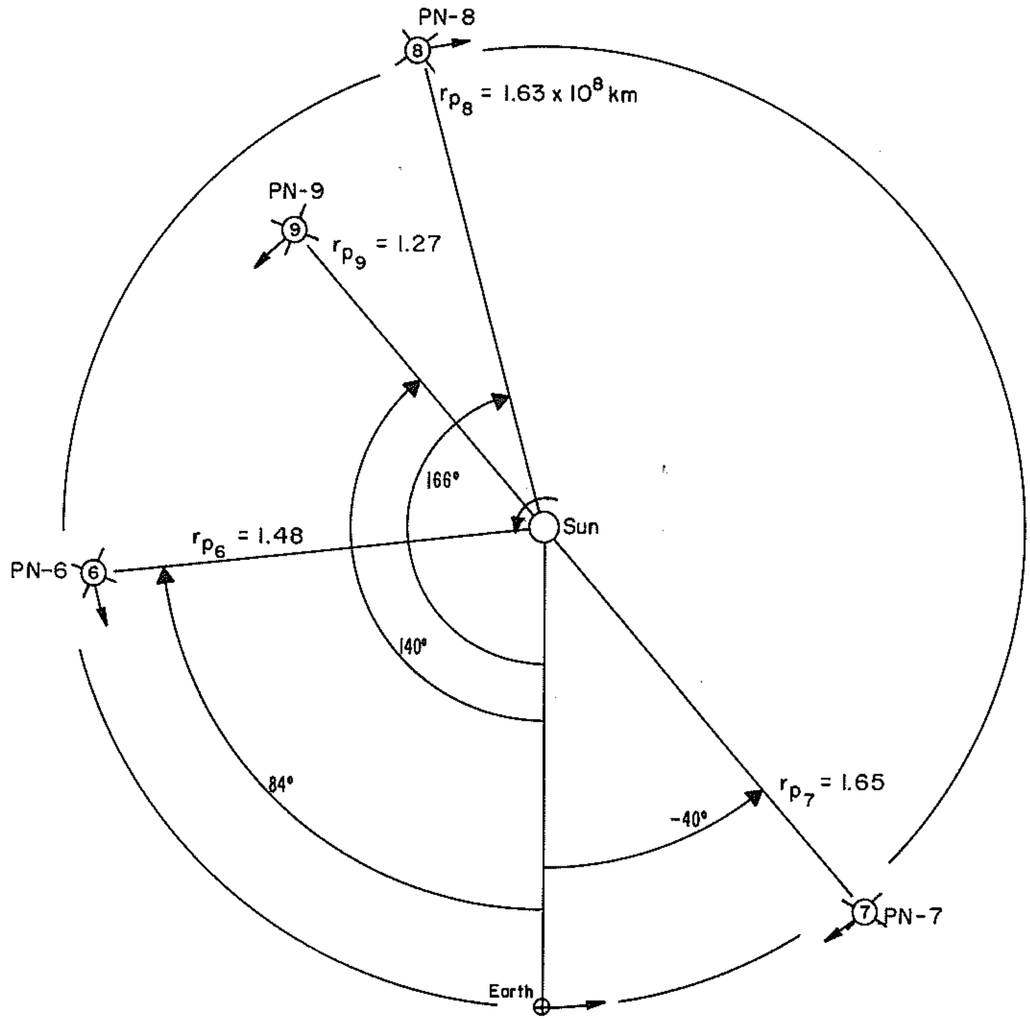
where ω is the angular velocity of the sun (in radians/second) corresponding to a 27-day solar synodical rotation period, and ϕ is the Earth-Sun-Probe angle (in radians).

Instead of using the solar equatorial projection of the Earth-Sun-Probe (ESP) angle ϕ', the ESP angle itself, ϕ, is used. The error caused by this substitution can be no more than approximately 0.008 radians (0.5°), as explained in the following paragraph.

Because the solar equatorial plane is inclined approximately 7.25° to the ecliptic plane, and also the ESP angles for the Pioneers are all very nearly in the ecliptic plane, the projection of the ESP angles in the solar equatorial plane, ϕ', can be related to the ESP angle, ϕ, as follows: Define ϕ as $\alpha_2-\alpha_1$. α_2 is the angle in the ecliptic plane of the Earth from the "northern crossing" side of the line defined by the intersection of the ecliptic plane and solar equatorial plane. The "northern crossing" side of this line is the side where the Earth crosses into the space to the north of the equatorial plane from the space to the south as it circles the Sun. α_1 is similarly defined for the pioneer spacecraft. Then ϕ' (the projection of the ESP angle, ϕ, in the solar equatorial plane) can be expressed:

$$\phi' = \tan^{-1}(\cos 7.25° \tan \alpha_2) - \tan^{-1}(\cos 7.25° \tan \alpha_1)$$

A difference of approximately 0.008 radians (0.5°) between ϕ' and ϕ occurs when α_2 = 45° and α_1 = 135° (or vice versa). The difference is less than 0.5° for other combinations of α_2 and α_1. Hence



Locations of Pioneers 6 through 9 on 1 Jan 76 in the Ecliptic Plane relative to the Earth (in a fixed Sun-Earth line plot) as viewed from the North Ecliptic Pole.

using ϕ rather than ϕ' is sufficiently accurate for the purposes of these calculations.

Solar Wind Speed from IPS Measurements at UC San Diego -- The solar wind speed is measured regularly with the three-station scintillation observatory at UCSD [Armstrong and Coles, *J. Geophys. Res.*, *77*, 4602, 1972]. The data are supplied by W. A. Coles and B. J. Rickett. The interplanetary scintillation (IPS) technique, pioneered by Dennison and Hewish [*Nature*, *213*, 343, 1967] yields an average velocity transverse to the line-of-sight to a distant radio source. Listed each month is the solar wind speed and an error from observations of eight radio sources each day (however, in a typical month only five or six sources are useful).

Each velocity is a weighted average from along the line-of-sight to the radio source, where the weighting factor decreases rapidly with distance from the sun. This spatial average is centered on an effective position (P), which is nominally at the point of closest approach of the line-of-sight to the sun, unless this point is closer to the earth than 0.3 A.U. In the latter case, P is taken to be at the point 0.3 A.U. from the earth along the line-of-sight. The heliographic coordinates of P vary slowly over the year as shown in Figure 1. Each month the solar distance (in A.U.), heliographic latitude and the difference in longitude between the point P and the earth are tabulated at 10-day intervals. Each source is observed for 1-2 hours per day and the observation time (in UT) is also tabulated. Details of the spatial weighting function can be computed and examples are shown in Figure 2 on the assumption of a power law shape for the density spectrum. The results are not very sensitive to the assumed density spectrum as can be seen by comparison with Readhead's [*MNRAS*, *155*, 185, 1971] calculations for a Gaussian spectrum, but they assume spherical symmetry. Close agreement is found between ecliptic IPS observation and IMP 7 observations of the solar wind speed, when the spacecraft data are smoothed by a weighting factor proportional to the expected turbulence level [Coles, Harmon, and Lazarus, *EOS*, *55*, 440, 1975].

Coles and Kaufman [*EOS*, *55*, 556, 1974] carefully analyzed the flow angle, as well as the speed, and found it to be very close to radial. Thus the regular data are analyzed under the assumption that the flow is indeed radial. This allows

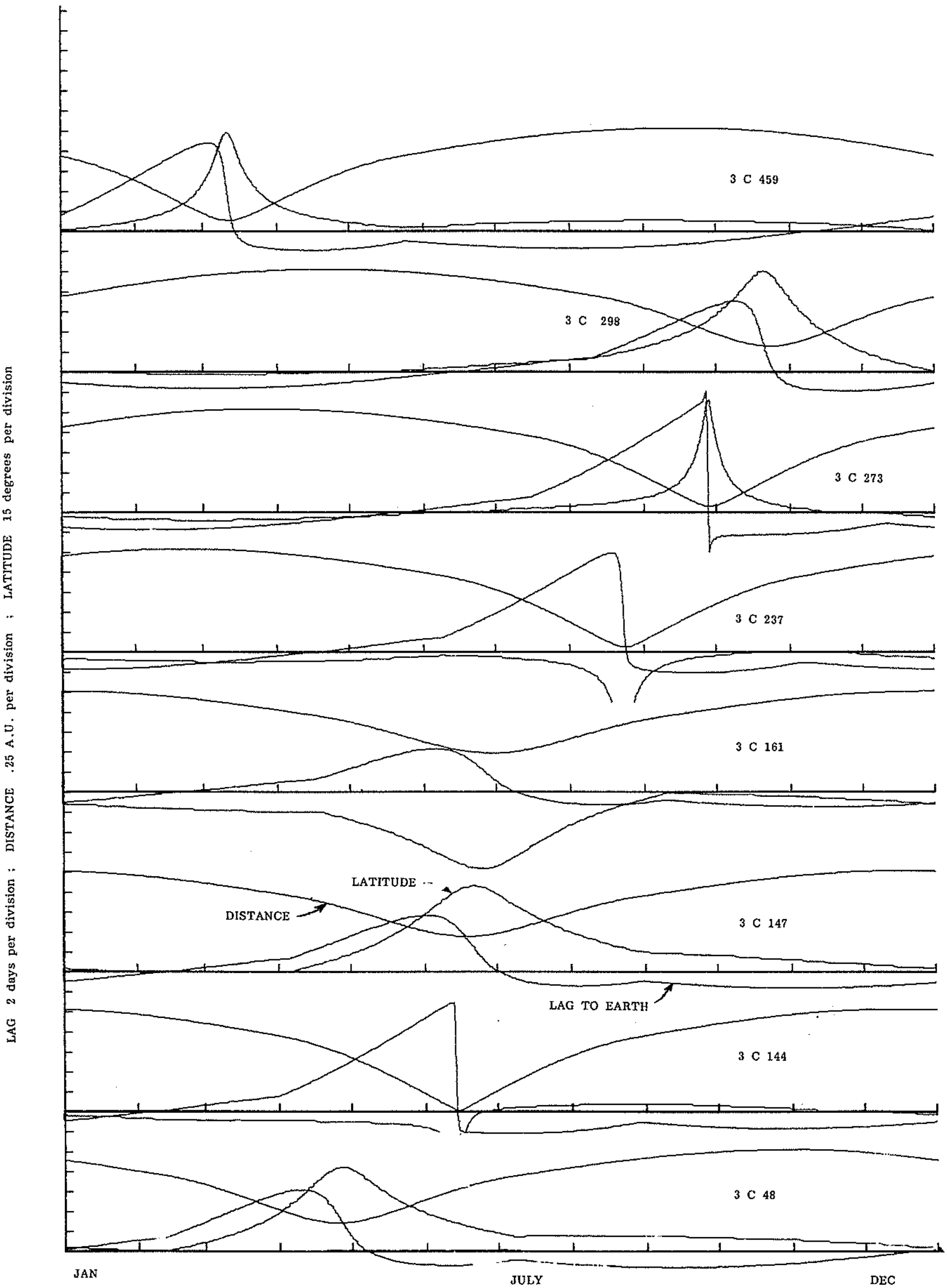

LAG 2 days per division ; DISTANCE .25 A.U. per division ; LATITUDE 15 degrees per division
3 C 459
3 C 298
3 C 273
3 C 237
3 C 161
LATITUDE
DISTANCE
3 C 147
LAG TO EARTH
3 C 144
3 C 48
JAN
JULY
DEC
DATE OF OBSERVATION

Figure 1

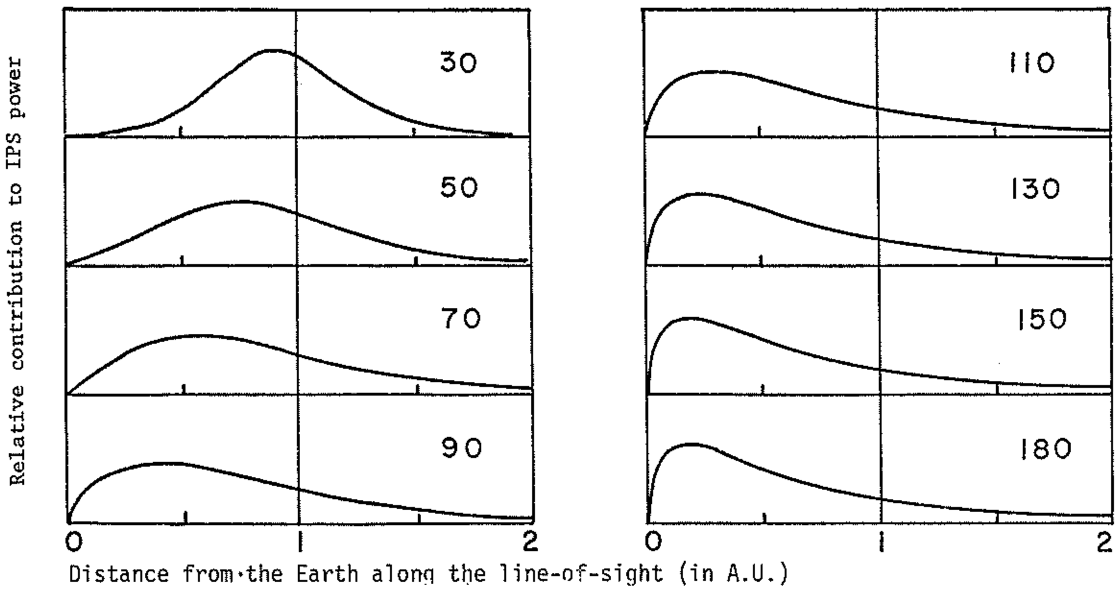


Figure 2. Computed IPS weighting functions along the line-of-sight, at the solar elongation angles indicated. The density spectrum was assumed to be power law $\propto q^{-3.3}r^{-4}$ (where q is wave number and r is solar distance); a source diameter of 0.25 sec of arc was also assumed.

a least-square estimate of the radial component of velocity and also an associated error estimate. When the solar elongation is greater than about 73°, the pattern velocity (at P) is less than the radial velocity (because the angle Earth-P-Sun is less than 90°); the tabulated velocities have been corrected for this projection effect. A further assumption is that the scintillation pattern is spatially isotropic; this introduces a second order error [Coles *et al.*, *EOS*, *56*, 1180, 1974] and in these preliminary data it has not been corrected. The flow angle is also estimated but is used only in editing data with poor signal-to-noise ratio. The data are not included in this table if the apparent flow angle is greater than 30° from the radial or if the speed error is greater than 33 percent of the speed estimate itself. Further analysis may yield speeds from data rejected by these criteria; those interested in particular periods should contact the authors directly.

The speed estimate is derived from the "midpoint" of the correlation functions. This is found to be a reliable estimator for the solar wind speed. [See Coles and Maagoe, *J. Geophys. Res.*, *77*, 5622, 1972; Coles, Rickett and Rumsey, a review of IPS in *"Solar Wind Three"*, published by UCLA, 1974]. The solar wind speeds derived from elongated radio sources [e.g., 3C273 and 3C298] are preliminary in that a bias of less than about 10% is sometimes present; corrected data are available to anyone interested. The "peak" velocity and other parameters of the scintillations are also computed, but are not included in the monthly reports.

The use of scintillation observations to obtain solar wind velocities represents part of the activity conducted by the SCOSTEP project, Study of Travelling Interplanetary Phenomena (STIP).

SOLAR PROTON MONITORING (A.12)

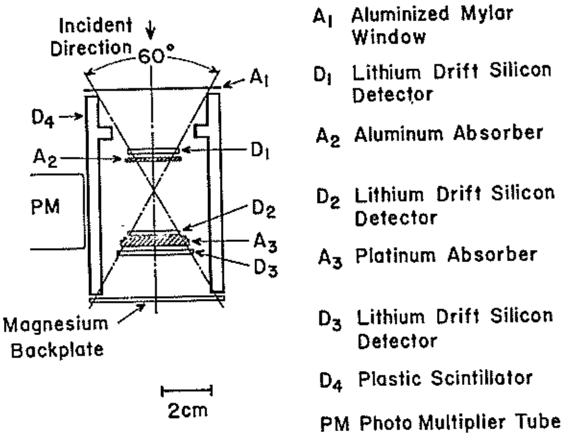
Pioneer 6 -- These data are provided by Professor J. A. Simpson and his co-workers at the University of Chicago. Cosmic-ray particle counting rates are provided for three ascending energy ranges, from 0.6 to >175 Mev/nucleon. Counting rate measurements are made by the University of Chicago cosmic-ray telescopes aboard Pioneer 6. These are supplied, when possible, hourly throughout the pass.

Both instruments consist of a stack of three solid-state detectors separated by absorbers, surrounded by an anti-coincidence cylinder. The Figure shows a cross-section view of the particle telescope.

Counting rates are provided for the coincidence modes $D_1 \overline{D}_2 \overline{D}_4$ (protons and helium nuclei 0.6-13 Mev/nucleon, electrons 400-700 kev),

$D_1 D_2 \overline{D}_4$ (protons 13-175 Mev helium nuclei >13 Mev/nucleon and $\overline{D}_1 \overline{D}_2 D_3 \overline{D}_4$ (proton >175 Mev). The geometrical factors for the three coincidence modes are 5.4, 0.92, and 0.5-1.65 (see below) cm^2-ster, respectively. At energies above ∿ 200 Mev, the last two coincidence modes become bidirectional. A detailed description of the telescope and the related electronics may be found in Fan *et al.* [*J. Geophys. Res.*, *73*, 1552-1582, 1968] and Retzler and Simpson [*J. Geophys, Res.*, *74*, 2149-2160, 1969].

The counting rates are prepared from quick-look data, and are subject to future revision when the final data tapes reach the University of Chicago. Times given are only approximate (time accurate to ± 15 minutes), and the counting rates are accurate to ∿ 10%. When one of the two high-energy counting rates is at the quiescent level, a symbol Q is used instead of the actual rate. For the 0.6-13 Mev proton counting rate, the quiescent level is approximately 0.08-0.15 c/s. The two highest ranges exhibit a pronounced variation of the quiescent level with the solar cycle.



Pioneer 6/7 Cosmic Ray Telescope

Pioneers 8 and 9 -- The cosmic-ray proton count rates as observed on Pioneers 8 and 9 are provided through the cooperation of Dr. W. R. Webber and Dr. J. Lezniak of the University of New Hampshire.

Quick look data from telescopes "5" and "1+2" are supplied.

Telescope 5 is a wide angle, two-element solid-state telescope with an energy threshold of 14 Mev for protons and 0.6 Mev for electrons. The geometric factor is approximately 8.3 cm^2-sterad during quiet times and 4.2 cm^2-sterad during solar flare times.

Telescope 1+2 is a narrow-angle, five-element, solid-state telescope with a proton energy threshold of 64 Mev on Pioneer 8 and 42 Mev on Pioneer 9. The geometric factor of this telescope is 2.35 cm^2-sterad.

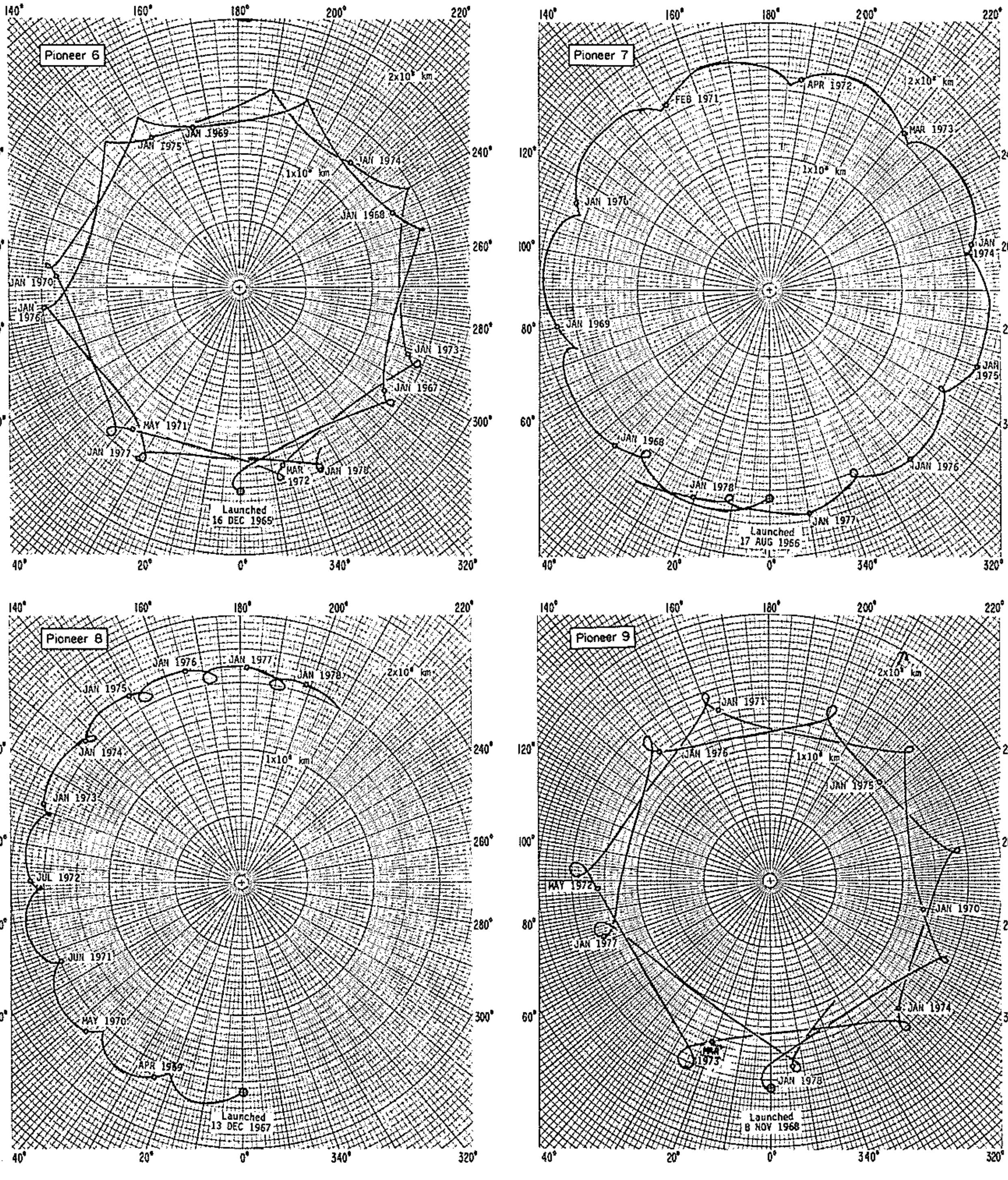
INTERPLANETARY MAGNETIC AND ELECTRIC FIELDS (A.17, A.17a, A.18)

Pioneer 8 -- The Interplanetary (IP) Magnetic Field data from the NASA-Goddard Space Flight Center magnetometer on Pioneer 8 are being supplied by Franco Mariani of the University of Roma and N. F. Ness of Goddard. The data supplied are the absolute magnitude, /B/, (in gammas, one gamma equals one nanotesla) and the solar ecliptic longitude, ϕ, (in degrees) of the field measured counterclockwise from the spacecraft-sun line, as viewed from the North Ecliptic Pole.

The instrument is a mono-axial fluxgate magnetometer. The sensor is mounted on one of three transverse booms 2.1 meters from the spin axis and at an angle of 54°45' to the spin axis.

Three samples are taken at equal intervals during one spacecraft rotation yielding three independent mutually orthogonal measurements defining the total vector magnetic field. The magnetometer incorporates an automatic inflight range

LOCATION OF PIONEER SPACECRAFTS



The above diagrams illustrate the position of Pioneers 6, 7, 8 and 9. Several types of observations are reported from these spacecraft as discussed in the accompanying descriptions.

switch between two dynamic range scales of ± 32 and ± 96 gammas for a resolution of ±0.125 and ± 0.375 gammas. The accuracy of the instrument is limited by spacecraft-associated magnetic fields and the sensor zero drift. A non-magnetic explosive-actuated indexing device is used to reorient the fluxgate by 180° to establish its zero level.

Five bit rates are possible: 512, 256, 64, 16 and 8 bits/second. At the three higher rates, the average time interval between successive determinations of the field vector is 1.3, 1.4 and 1.75 seconds, respectively. A special purpose digital computer is included in the instrument to compute time averages of the field components when the spacecraft is operating at the low bit rates of 16 and 8.

The data supplied include the date, the Deep Space Network (DSN) coverage period, the observation time in UT, the magnitude and solar ecliptic longitude of the field, as described above.

The magnetic field data are sampled approximately every hour. Each hourly sample is an average over three consecutive vectors which are separated by 14 seconds or less, depending on the spacecraft bit rate.

The IP sector structure at the Pioneer 8 position can be inferred from the longitudinal angle: angles between 45 and 225 degrees are associated with outward sectors, and the remaining angles with inward sectors. It is recognized, however, that the field direction, at the time of observation, may not adequately represent the direction over a period of hours.

Pioneer 9 -- The Interplanetary (IP) Magnetic Field data from the NASA Ames Research Center magnetometer on Pioneer 9 are being supplied by Chas. P. Sonett and David S. Colburn. The data supplied are in magnitude, /B/, of the field in gammas and the solar ecliptic longitude, ϕ, of the field in degrees, measured from the spacecraft-sun line in a counterclockwise direction, as viewed from the North Ecliptic Pole. The instrument is a triaxial fluxgate magnetometer with onboard spin demodulation and use of appropriate filters to avoid aliasing errors. The filter time constant is adjusted to be proportional to the sampling interval. The sampling interval is 0.292, 0.583, 2.33, 9.33 and 18.7 seconds for 512, 256, 64, 16 and 8 bps, respectively. The digitization uncertainty in each component of the field is ± 0.2 gammas. The quicklook data are not corrected for sensor offset in the component along the spin axis of the spacecraft. This, in general, gives an uncertainty in the field magnitude of less than one gamma and does not affect the determination of the longitude, ϕ.

The data supplied include the date, the Deep Space Network (DSN) coverage period, the observation time in UT, the field magnitude and its solar ecliptic longitude, as described above.

The magnetic field data are sampled approximately every hour. Each hourly sample is an average over three consecutive vectors which are separated by 18.7 second or less, depending on the spacecraft bit rate.

The IP sector structure at the Pioneer 9 spacecraft can be inferred from the longitudinal angle: angles between 45 and 225 degrees are associated with outward sectors, and the remaining angles with inward sectors. It is recognized, however, that the field direction at the time of observation may not adequately represent the direction over a period of hours.

Pioneers 8 and 9 -- The Interplanetary (IP) Electric Field data, as observed on Pioneers 8 and 9 on a real-time basis, are provided through the cooperation of Dr. F. L. Scarf from the Space Sciences Department of the TRW Group. These IP Very Low Frequency (VLF) wave data consist of a sequence of narrowband (400 Hz) signal amplitudes.

The table presents the date and Universal Time (UT) when the Electric Field Potential amplitudes (in millivolts) were read.

The real time 400 Hz data are selected to illustrate or characterize the activity during each pass and are being presented so that interested scientists can:

1. Attempt to correlate terrestrially-observed phenomena with variations noted in the IP Electric Field intensities at the spacecraft position.

2. Have access to simultaneous measurements of Plasma and E-field data on each spacecraft.

3. Study Solar Wind fluctuations and magnetic sectoring with the E- and B-field data on Pioneer 9.

Instrumental details of the Electric Field experiments are available in the following references: Pioneer 8: [*J. Geophys. Res.*, *73*, 6655, 1968] and Pioneer 9: [*Cosmic Electrodynamics*, *1*, 496, 1970].

INFERRED INTERPLANETARY MAGNETIC FIELD (A.17c)

The table shows daily inferences of the polarity of the interplanetary magnetic field. The first half of the day is based principally on magnetograms produced by the magnetometer at the Vostok Antarctic Station of the USSR. The magnetometer of the U.S. Air Weather Service operated at Thule by the Danish Meteorological Institute is used for the second half of the day. The inference relies on the studies of Mansurov [*Geomag. Aeron.*, *9*, 622-623, 1969] and Svalgaard [*Geophys. Pap. R-6*, 11 pp. Dan. Meteorol. Inst., Copenhagen, 1968] relating the variation of the polar cap magnetic field to the polarity of the interplanetary magnetic field. During 1972, the inferred polarity agreed with spacecraft observations on 83% of the days for which a definitive polarity was inferred. The rate of successful inferences for "toward" (interplanetary field directed toward the sun) day was somewhat greater than "away" days, 85% and 80%, respectively [Russell *et al.*, *J. Geophys, Res.*, *80*, 4747, 1975]. Forming a combined index from the two individual station inferences yields an overall success rate of 87% [Wilcox *et al.*, *J. Geophys. Res.*, *80*, 3685, 1975].

It appears that the sign of the east-west component of the interplanetary field is actually being inferred [Friis-Christensen *et al.*, *J. Geophys. Res.*, *77*, 3371, 1972], rather than the polarity toward or away from the sun. Russell and Rosenberg [*Solar Phys.*, *37*, 251, 1974] show that the east-west component is an accurate predictor of the magnetic polarity approximately 90% of the time. On "toward" days incorrectly inferred to have "away" polarity in 1972, the average Ap index was 20% less than the average Ap index on "toward" days. "Away" days incorrectly inferred to be "toward" days had no significant geomagnetic bias [Russell *et al.*, 1975]. This effect when combined with the success rate results in a slight (2.5%) bias of the average Ap index for all inferred "toward" days over inferred "away" days. The subject of inferring the polarity of the interplanetary magnetic field has been reviewed by Svalgaard [*Correlated Interplanetary and Magnetospheric Observations*, D. Reidel, 1974].

The effect is visible at Vostok in the first half of the Greenwich Universal Day and at Thule in the second half of the day. The inferences from Vostok and sometimes from Thule are made at the Institute for Terrestrial Magnetism, Ionosphere and Radiowave Propagation (IZMIRAN), Moscow, and are shown in the table as the first value (or set of values) each day. The inferences from Thule are made at the Space Environment Services Center, Boulder, Colorado, and are shown as the second value (or set of values) each day. If two values are shown for a half-day period, an apparent change of polarity occurred within that half day.

The notation adopted for the table is that T represents days of negative Y-solar magnetospheric interplanetary magnetic field which would be characteristic of a "toward" sector and A represents days of positive Y-solar magnetospheric field, i.e., "away" polarity. An asterisk along with an A or T indicates half days when the effect was somewhat doubtful, but one polarity seemed predominant. An asterisk alone indicates half days when no clear polarity effect could be discerned. A dash indicates half days when missing data prevented inference of the polarity.

MEAN SOLAR MAGNETIC FIELD (A.3d)

Sun-as-a-star integrated light measurements of the solar magnetic field are made daily at the Stanford Solar Observatory. The instrument is a Babcock-type magnetograph attached to a 23m vertical Littrow spectrograph. The mean field measurement represents a weighted average of the net magnetic field on the visible disk of the sun. The weighting arises from a variety of sources including limb darkening, solar rotation, and weakening of the line in magnetic regions. The difference in weighting between integrated light observations and averages of regular magnetograms is primarily due to limb darkening.

An individual mean field observation consists of a measurement of the mean magnetic field seen in the line Fe I 5250Å and a measurement of the instrumental zero offset in the magnetically insensitive line Fe I 5124Å. A complete observation, including several checks for instrumental errors, takes about 20 minutes. Several observations are made each day. The reported value is a weighted average of all observations for the particular local day. The daily observations are usually centered about local noon (20 UT). The uncertainty in each days mean field is about 2 micro-teslas (.02 gauss). The observations started on May 16, 1975. A more complete explanation of the observation program may be found in *Stanford University Institute for Plasma Research Report #682*, "The Mean Magnetic Field of the Sun: Observations at Stanford", 1977. The data is provided in two forms: a simple tabulation by date and a Bartels rotation type polarity diagram. In the Bartels diagram the data has been shifted five calendar days to allow for sun-earth transit time for easier comparison with at-earth observations. For further information contact P.H. Scherrer or J.M. Wilcox, Stanford Electronics Labs., Stanford University, Stanford, California 94305.

SOLAR PROTON EVENTS

An unnumbered page with a diagonal slash across it will be included whenever *provisional* outstanding solar proton events have been reported during the month before month of publication. This will be prepared by the Space Environment Services Center of the Space Environment Laboratory. These sheets will be self-explanatory and *are not to be used for research reference purposes*. They will merely provide some of the immediately available evidence when significant solar proton events have occurred in the previous month.

DATA FOR TWO MONTHS BEFORE MONTH OF PUBLICATION

TABLE OF CONTENTS

SOLAR ACTIVITY CENTERS

(A.1, A.3a, A.3c, A.4, A.5, A.5a, A.5b, A.6, A.7h, A.9cb, A.9d, A.11h)

H-alpha Synoptic Charts -- These charts of the entire solar surface show solar activity in terms of polarity of magnetic fields, filaments (cross-hatched), major sunspots (large dots), bright Hα plage (closely spaced lines), faint H-alpha plage (stipple), distinct neutral lines (solid lines), and estimated neutral lines (dashed lines).

Longitude is in terms of the mean rotation rate for sunspots as determined by Carrington. This is the heliographic longitude tabulated in the American Ephemeris and Nautical Almanac. The dates at the top of the synoptic chart correspond to these values, showing the time of central meridian passage for the corresponding heliographic longitudes.

The charts are labeled with the serial number of the solar rotation as counted by Carrington, with the first rotation commencing November 9, 1853.

The positions of magnetic polarity reversal are inferred according to the techniques described by McIntosh [*Rev. Geophys. and Space Phys., 11*, 837-846, 1972; also *Solar Activity Observations and Predictions*, McIntosh and Dryer, ed., MIT Press, 1972]. The H-alpha structures that reveal these "neutral" lines are: filaments, filament channels, plage corridors, "iron-filing" pattern of fibrils adjacent to active centers, and arch-filament systems. The patterns are mapped by accumulating the positions of features on H-alpha filtergrams from several consecutive days. Seldom does a single photograph show the patterns in their complete form, owing to the transient nature of the filaments and the variable observing conditions.

Magnetic polarities are inferred from Hale's law: leader sunspots in opposite solar hemispheres have opposite polarities. Northern leaders possess positive polarity during odd numbered solar cycles, while southern leaders are negative. Most sunspot groups are now members of cycle #21, with polarities reversed from the few cycle #20 groups still occurring near the solar equator. The polarities of all areas on the sun are inferred by beginning with a leader sunspot, or the leading portion of a bipolar plage, and alternating polarities with each successive neutral line.

The H-alpha patterns mapped are the forms seen when the particular features were near W40 on the visible solar hemisphere. This bias toward the west enables a more realistic comparison with solar wind, particle, and magnetic-field data measured near the earth. Whenever a pattern undergoes a conspicuous change from the time of first visibility to the time when at W40, the former neutral-line position is depicted as a line with dots superimposed.

The charts published here are preliminary versions constructed as part of the real-time solar monitoring at NOAA's Space Environment Services Center in Boulder. In most cases, there has been corroboration with solar magnetograms made with photospheric spectral lines (Kitt Peak, Mt. Wilson, and Sacramento Peak). Some changes and additions will be necessary when more careful study of the filtergrams and magnetic-field data can be made. The date in the lower right corner is the date of the last revision before the publication.

The mapping techniques include comparison with previous synoptic charts for maintenance of consistency and continuity. Daily use of inferred solar magnetic field data has demonstrated a 90% reliability within active regions and at least 75% reliability in the large-scale patterns in quiet regions. The reliability is degraded in regions where estimated neutral lines (dashed lines) are used extensively. Large portions of the charts for the period near solar minimum are so delineated. Charts beginning with Carrington Rotation 1648 are constructed with a computerized reader-plotter and have improved coordinate accuracy over previous preliminary charts.

Photographs or Charts -- On two pages per day are presented several photographs or charts of active solar centers recorded at optical and radio wavelengths. For each day the ephemeris heliographic longitude, Lo, at 0000 UT, position angle, P, and center of sun, Bo, are given. Transparent Stonyhurst disks (regular or modified) are provided with this text to fit the size of the charts. Regular Stonyhurst disks have the longitude lines spaced in intervals of 10° east and west of central meridian. Modified Stonyhurst disks have the longitude lines spaced at days east and west of central meridian. With the 1976 Explanation of Data Reports the small size transparencies were regular and the large size were modified. In this issue the small ones are modified and the large regular. Though a magnifying glass is needed to read detail, it is felt that the significant regions stand out on the scale used. *For those interested, larger sizes of these photographs or charts can be made available at cost through the World Data Center A for Solar-Terrestrial Physics.*

These data for each day are x-ray spectroheliograms, 8.6 mm and 2 cm spectroheliograms, solar magnetograms, λ5303 coronal intensities, calcium plage and sunspot tracings, and Hα filtergrams. The sunspot drawing also shows prominences.

Details of these individual observations follow:

X-ray Maps from OSO-8 -- The Lockheed Palo Alto Research Laboratory Mapping X-Ray Heliometer (MXRH) instrument on OSO-8 has been in operation since launch in June of 1975. The MXRH, which is in the wheel looking radially outward, consists of three one-dimensionally collimated (FWHM = 2.0 arcmin) systems, each tilted 120° from the other. Three one-dimensional distributions are obtained approximately every 20 seconds and can be unfolded to locate and isolate the emitting x-ray regions on the solar disk. The detection elements are proportional counters with three different detector types being employed in order to obtain a detectable, yet unsaturated, response over a dynamic range of 10^5. Fourteen channel pulse height analyzers provide the energy information. The MXRH spectral response is approximately 1.5-30 keV where the lower value is set by the 75 µm thick Be window of the most sensitive detectors. The actual upper value is spectrum and intensity dependent and for most cases will be substantially below 30 keV.

The maps presented here are prepared from quick-look data which are received daily over a phone line from GSFC to Lockheed. As such, they are based on a daily data sample which on average includes 200 minutes of solar coverage. A typical (neither the quietest nor the most active) thirty minute period is selected from these data to construct a map. The relative intensity of a region is indicated by differing dot sizes where "detectable" varies from system to system but nominally corresponds to a counting rate which is about 5 times the average background. The three dot sizes represent detectable (D) to 20D, 20D to 500D, and >500D. If a source has been highly variable in intensity (varying by more than an order-of-magnitude over a time period of less than two hours) no typical intensity is assigned, but rather a highly-variable indicator is used. The temperature assigned to each source is determined by fitting the observed data to that predicted by convolving the instrument response function with the spectra of an isothermal low density plasma as obtained from an updated Tucker Koren formulation [*Ap. J., 168,* 283, 1971]. The temperatures assigned should be considered preliminary pending final in-orbit instrument calibration. When this calibration is complete, the MXRH maps will include emission measure and absolute flux information.

Additional explanation or data may be obtained from L. W. Acton or C. J. Wolfson of Lockheed Palo Alto Research Laboratory, Dept. 52-12, Bldg. 202, Palo Alto, California 94304 (Telephone: (415) 493-4411, Ext. 45261). Workers needing historical or near-real-time solar x-ray information are invited to contact the Lockheed investigators.

Coronal Green-Line Intensity at 1.15$R_\odot$ -- Scans of the solar corona are made with the Sacramento Peak Observatory Green-Line Coronal Photometer, designed by R. R. Fisher (AFCRL-TR-73-0696 and *Solar Phys. 36,* 343, 1974). The intensity of the corona is recorded at 120 points around the limb with an aperture of 1.1 arc min by chopping between the corona and sky at a rate of 100kHz. The scans depicted here are made at 1.15$R_\odot$, although at least one other height is routinely recorded.

The display is in the form of a polar plot of the intensity around a circle with a radius of 10 millionths of the intensity of the center of the solar disk. The intensity at the edge of the circle is zero. Tick marks are separated by 10 millionths. Note that the horizontal and vertical scales on the graph may not be exactly the same. This is a property of the plotting unit that produced the graphs. There may also be slight changes in the scale from day to day. Models of the emissivity of the corona in the green line based on these data, useful for locating coronal holes, are available on a collaborative basis from R. C. Altrock, AFGL, Sacramento Peak Observatory, Sunspot, New Mexico 88349 USA.

Mount Wilson Observatory Solar Magnetograms -- The Mount Wilson Observatory solar magnetograms are computer-plotter iso-gauss drawings made with the magnetograph at the 150-foot tower telescope on Mount Wilson. The program is supported in part by the Office of Naval Research, the National Aeronautics and Space Administration, and the National Science Foundation. The polarities are indicated with "Plus" signifying the magnetic vector pointed toward the observer. The gauss levels are also indicated. This instrument measures the longitudinal component of the magnetic field using the line λ5250.216 Fe I. A solar magnetograph is basically a flux measuring instrument. It measures the total flux over the aperture which is being used. The magnetograph apertures are square (image slicer is used) and the raster scan lines are separated by the dimension of the aperture. This separation of the scan lines is given by the ΔY (DELTAY) printed on the magnetogram. The unit of ΔY are arc seconds. The DELTAX represents in the same units the distance along the scan line between points at which the data were digitized.

The scan is a boustrophedonic raster scan which extends for all scan lines beyond the disk. The data within about 12 arc seconds of the solar limb are not plotted. The scanning system is always oriented so that the scan lines are perpendicular to the central meridian of the sun. The cardinal points on the magnetogram refer to heliocentric coordinates so that the "N" and "S" define the rotation axis of the sun.

Because the magnetic field strength measured by the magnetograph is the product of the true field strength and the brightness of the image, the fields used to make the contours have been corrected for the brightness at each point. So effects of limb darkening and variable sky transparency have been corrected.

Effects due to weakening of the line profile in magnetic field regions have not been included. In general the magnetic field strengths on the map are low by about a factor of two because of these effects, but this varies somewhat with distances from the disk's center. For more details c.f. *Solar Physics, 22,* 402-417, 1972.

It is difficult to estimate precisely the errors in the magnetic data which goes into these magnetograms, and in any case, the errors vary from day-to-day. The zero level is probably accurate to a few tenths of a gauss, or better, on almost all magnetograms. The gauss scale is probably almost always accurate to 15% or better. The noise level is almost always well below the first isogauss level (5 gauss).

Sometimes, because of the small scale of the reproductions, it is difficult to make out the details of the field distribution in some regions.

Large scale copies of the particular magnetograms may be obtained by writing to:

> *World Data Center A for*
> *Solar-Terrestrial Physics*
> *NOAA*
> *Boulder, Colorado, U.S.A. 80302*

Kitt Peak Observatory Solar Magnetograms -- Full disk magnetograms are now made daily, weather permitting, at the vacuum telescope on Kitt Peak in Arizona. At the exit focus of the spectrograph is a Babcock type magnetograph which utilizes as detectors a pair of 512-element silicon-diode arrays. The diode spacing, referred to the entrance slit, is one arc-second. Resolution achieved depends in practice mainly on "seeing", but in any case falls to zero at this one arc-second limit. At present the magnetograms are taken in the wings of Fe I 8688.6 Å, a line selected to faithfully record network, plage and penumbral magnetic flux but which underestimates umbral flux by a factor of about two. A full disk recording is made up of four swaths and requires 37 minutes of scan time.

The display of magnetograph data is by a CRT generated picture where bright represents positive flux and dark negative flux. The display intensity is non-linear in an effort to compress the dynamic range so that weak fields can be seen along with the strong sunspot fields. The noise is about 10^{17} maxwells (i.e., 15 gauss over one arc-second). Blank areas indicate interfering clouds. These high resolution maps complement the Mt. Wilson iso-gauss charts. Detailed numeric listings exist and can be retrieved from the observatory archives. For further information contact: J. Harvey or W. Livingston, Kitt Peak National Observatory, P.O. Box 26732, Tucson, Arizona 85727.

H-alpha Spectroheliograms -- The H-alpha spectroheliograms are furnished by the solar observatory at Ramey Air Force Base, Puerto Rico, operated by the U. S. Air Force 12th Weather Squadron of the 3rd Weather Wing. The telescope is a 25 cm (10 inch) refractor of approximately 160 cm (63-inch) effective focal length, equipped with a half-Angstrom bandpass Halle birefringent filter. These photographs are supplemented by photographs provided by the NOAA Space Environment Services Center Observatory at Boulder, Colorado, using a 11 cm (4.5 inch) refractor.

Sunspot Drawings -- These drawings are simplified copies of originals made at the Boulder solar observatory operated by the NOAA Space Environment Services Center. Sunspot groups are boxed according to a judgement of bipolar pairs based on spot group evolution and the structure of associated H-alpha plage, following guidelines developed by P. S. McIntosh of the NOAA Space Environment Laboratory. Serial numbers appearing adjacent to some of the sunspot groups are the last three digits in the McMath-Hulbert plage number. It is not uncommon for more than one bipolar group to occur within the same large calcium plage. Drawings from the Sacramento Peak Observatory or photographs from the Culgoora Solar Observatory (C.S.I.R.O., Narrabri, N.S.W., Australia) may be used when Boulder data are missing.

H-α Prominences -- Drawings of prominences are added to the limb of the sunspot drawings by tracing detail from photographic prints made from the NOAA Boulder Hα patrol films.

Calcium Plage Reports -- The contours are based on estimates made and reported on the day of observation. These data on calcium plage regions are as reported by the McMath-Hulbert Observatory of The University of Michigan supported by NOAA contract. They are the same regions which are summarized in the following section. Listed beside the drawings in each case are the quality of the day's observations and the initials of the observer for the day followed by a table of the plages by region number, then area in millionths of the solar hemisphere and intensity, if area ≥3000 millionths or intensity ≥2.5. When McMath-Hulbert Observatory has been unable to observe, available drawings supplied by the Solar Observatory at Catania, Italy are used. The areas will differ from the McMath-Hulbert areas since there is considerable subjectivity in the grouping of the bright calcium areas into regions. Each series should be homogeneous in itself.

2.0 cm and 8.6 mm Spectroheliograms -- The 2.0 cm wavelength (15.3 GHz) and 8.6 mm wavelength (35.0 GHz) solar radio maps are made at the La Posta Astrogeophysical Observatory of the Naval Electronics Laboratory Center, San Diego, Calif. (NELC La Posta). The program is funded in part by the Air Force Geophysics Laboratory. The geographic coordinates of the observatory are: Long. 116°26'6.43"W, Lat. 32°40'39.33"N; elevation 1188m above mean sea level.

The antenna used for the observations is a 18.3 m (60 ft) diameter circular paraboloid with a Cassegrain feed system, on a computer controlled altitude-azimuth mount. The half power beam width of the antenna is approximately 4.0' at 2.0 cm and 2.8' at 8.6 mm. The observations are made with Dicke switch radiometers, the antenna being switched against a noise tube. The central disk quiet area solar antenna temperature is ∿ 7000°K at 2.0 cm and ∿ 3800°K at 8.6 mm. The measured rms noise of both radiometer systems when looking at the sun is ∿ 2°K for a 1.0 second time constant.

The data for the maps are collected by automatically directing the telescope to perform a square boustrophedonic raster with lines perpendicular to heliographic north-south, filling a 19 by 19 grid of points spaced 2.0' apart at 2.0 cm wavelength, and a 35 by 35 grid of points spaced 1.0' apart at 8.6 mm wavelength. The corners of the resulting grid are indicated on the maps. Note that at 2.0 cm the grid is 36' square while at 8.6 mm the grid is 34' square. The scale of the map is shown at the lower left corner of the grid by short axes with 1.0' tic marks. The Universal Time at which the map was begun is shown below the map. Approximately 25 minutes are required to fill the 2.0 cm wavelength grid, while approximately 65 minutes are required at 8.6 mm wavelength. The quantity being contoured is antenna temperature; all contours are labeled in units of 100°K. The contour interval is not necessarily constant on a map, and may be changed from map to map in order to provide a clearer picture of the radio emission.

On days for which no map is presented the words NO DATA appear near the center of the grid. Below this appears a one word indicator of why no map has been provided. These words have the following specific meanings:

CLOUDY ------- A map was made for the day beginning at the time shown; however, the data were so seriously affected by clouds that it was deemed unwise to publish it. Such maps will be provided to individual researchers upon request.

WEATHER ------ The weather at the observatory was so inclement that no observations were made. No time is given in the format.

CALIBRATION -- A map was made for the day beginning at the time shown; however, the operation of the equipment was such that the reliability of the antenna temperature is in doubt. Such maps will be provided to individual researchers upon request.

EQUIPMENT ---- The situation and condition of the equipment were such that no map was made. This includes such causes as receiver malfunction, mechanical and computer problems, and preventive maintenance. No start time is given in the format.

Further information and requests for extra data as stated above should be addressed to : Max P. Bleiweiss, NELC La Posta, Rt. 1 Box 591, Campo, California 92006.

Individual Regions of Solar Activity -- The table provides a history of each active center visible on the solar disk using data from McMath-Hulbert Observatory (calcium plages under NOAA contract) Mt. Wilson Observatory (magnetic classification of sunspots) and NOAA, Boulder (area, count and Brunner Classification of sunspots). The Greenwich date of central meridian passage of each region is given in the lead line for each region as well as prior rotation number.

After the year, month, and day the McMath-Hulbert calcium plage region number is repeated followed by the latitude, central meridian distance, and heliographic longitude of the center of the region on that day. The next two columns give the corrected area in millionths of a solar hemisphere, and the intensity of the region at time of measurement on that day, on a scale of 1 = faint to 5 = very bright, referring to the brightest part of the plage.

These data are based upon estimates made and reported on the day of observation, However, they have been compared with the re-evaluated data and all significant discrepancies have been corrected, either directly in the data or by means of footnotes. These data are from observations obtained and reduced by different observers on days of widely different observing quality. For the quality of the observation on each day and the identification of the observer see daily calcium maps. The McMath-Hulbert Observatory requests that special attention be paid to the quality of observation for the days in question and to the possible personal equation of the respective observers.

The sunspot data lists the Mt. Wilson* group number, the latitude, central meridian distance and heliographic longitude of each spot group and the magnetic classification and largest magnetic field strength measured in each group. The magnetic classifications are defined as follows:

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

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

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

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

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

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

Y = γ A group in which the polarities are completely mixed.

Statements will be added to the above classifications if the group is also of the "D = δ-configuration": spots of opposite polarity within 2° of one another and in the same penumbra.

The Mt. Wilson magnetic sunspot classifications are given for spot groups observed at Mt. Wilson. If a magnetic classification is based on magnetic measurements, that classification is enclosed in parentheses. When only half of the sunspot group is measured, a half parenthesis indicates which half was measured - either the leader or the follower. A magnetic classification not enclosed in parentheses is determined from the appearance of the spot groups and the plage. A blank in the classification column indicates sufficient information was not available to make an intelligent determination of the magnetic classification. Prior to July 1966 the only magnetic

*The Mt. Wilson daily observations in monthly summary form may be obtained upon request from World Data Center A for Solar-Terrestrial Physics.

classifications included in the lists were those for which there were magnetic measurements.

The largest magnetic field strength measured in each group is given. The number which appears under the column headed "H" is a coded representation of the largest magnetic field strength measured in the group. The field strength is only given to the nearest 500 gauss because it is felt that the uncertainties of measurement do not permit greater accuracy. These measurements are made with the line λ5250.216 Å(Fe I). No correction is made for blending the Zeeman components. The code is as follows:

Code	Maximum Field Strength in Gauss
1	100- 500
2	600-1000
3	1100-1500
4	1600-2000
5	2100-2500
6	2600-3000
7	3100-3500
8	3600-4000
9	4100-4500
10	>4500

The area in millionths of a solar hemisphere, sunspot count and classification as observed at NOAA-Boulder are used to complete the sunspot information. Telegraphic Ramey or Manila sunspot data are substituted when available to fill gaps in Boulder data. The initial letter is used in the table to indicate the source of sunspot information.

The sunspot classification in column marked "Class" is represented by three consecutive uppercase letters. It is the revised classification devised by P. S. McIntosh of NOAA. It consists of a modified Zürich Brunner class, the type of largest spot within the group, and the relative spot distribution or compactness of the group. This classification is included in the USSPS code, *I.U.W.D.S. "Synoptic Codes for Solar and Geophysical Data, Third Revised Edition 1973"*, p. 108. The definitions of the classification and an illustration of the types of sunspots follow.

When possible separate bipolar sets of spots are identified by measured magnetic polarities, by the positions of spots relative to lines of polarity reversal inferred from structures on H-alpha filtergrams, and by the record of birth and evolution of spots. If these observations are not available, the following definitions identify most unipolar and bipolar spot groups: (see Figure and definitions to follow).

<u>Unipolar Group</u>: A single spot or a single compact cluster of spots with the greatest distance between two spots of the cluster not exceeding three heliographic degrees. In modified Zürich H-class groups, this distance is measured from the outer penumbral border of the largest spot to the center of the most distant spot in the group. Strong new spots which are clearly younger than a nearby h-type spot (see Penumbra: Largest Spot) are usually members of a new emerging bipolar group and should be called a separate group.

<u>Bipolar (Elongated) Group</u>: Two spots of a cluster of many spots extending roughly east-west with the major axis exceeding a length of three heliographic degrees. An h-type major spot can have a diameter of three degrees, so a bipolar group with an h-type spot must exceed five degrees in length.

<u>Modified Zürich Class</u> (first upper case letter)

A — A unipolar group with no penumbra.

B — A bipolar group with no penumbra.

C — A bipolar group with penumbra on spots of one polarity, usually on spots at only one end of an elongated group. Class C groups become compact class D when the penumbra exceeds five degrees in longitudinal extent.

D — A bipolar group with penumbra on spots of both polarities, usually on spots at both ends of an elongated group. The length does not exceed 10 degrees of heliographic longitude.

E — A bipolar group with penumbra on spots of both polarities and with a length between 10 and 15 heliographic degrees.

F — A bipolar group with penumbra on spots of both polarities and with a length exceeding 15 heliographic degrees.

H — A unipolar group with penumbra. The principal spots are nearly always the leader spots remaining from an old bipolar group. Class H groups become compact class D when the penumbra exceeds five degrees in longitudinal extent.

Note that Zürich classes G and J are missing in this revision. Class G groups are included in the definition of classes E and F, and class J groups are included in class H.

<u>Penumbra: Largest Spot</u> (second upper case letter)

"x" — No penumbra. The width of the gray area bordering spots must exceed three arc seconds in order to classify as penumbra.

"r" — The penumbra is rudimentary. It is usually incomplete, irregular in outline, as narrow as three arc seconds, brighter intensity than normal penumbra and has a mottled, or granular, fine structure. Rudimentary penumbra represents the transition between photospheric granulation and filamentary penumbra. Recognition of rudimentary penumbra will ordinarily require photographs of direct observation at the telescope.

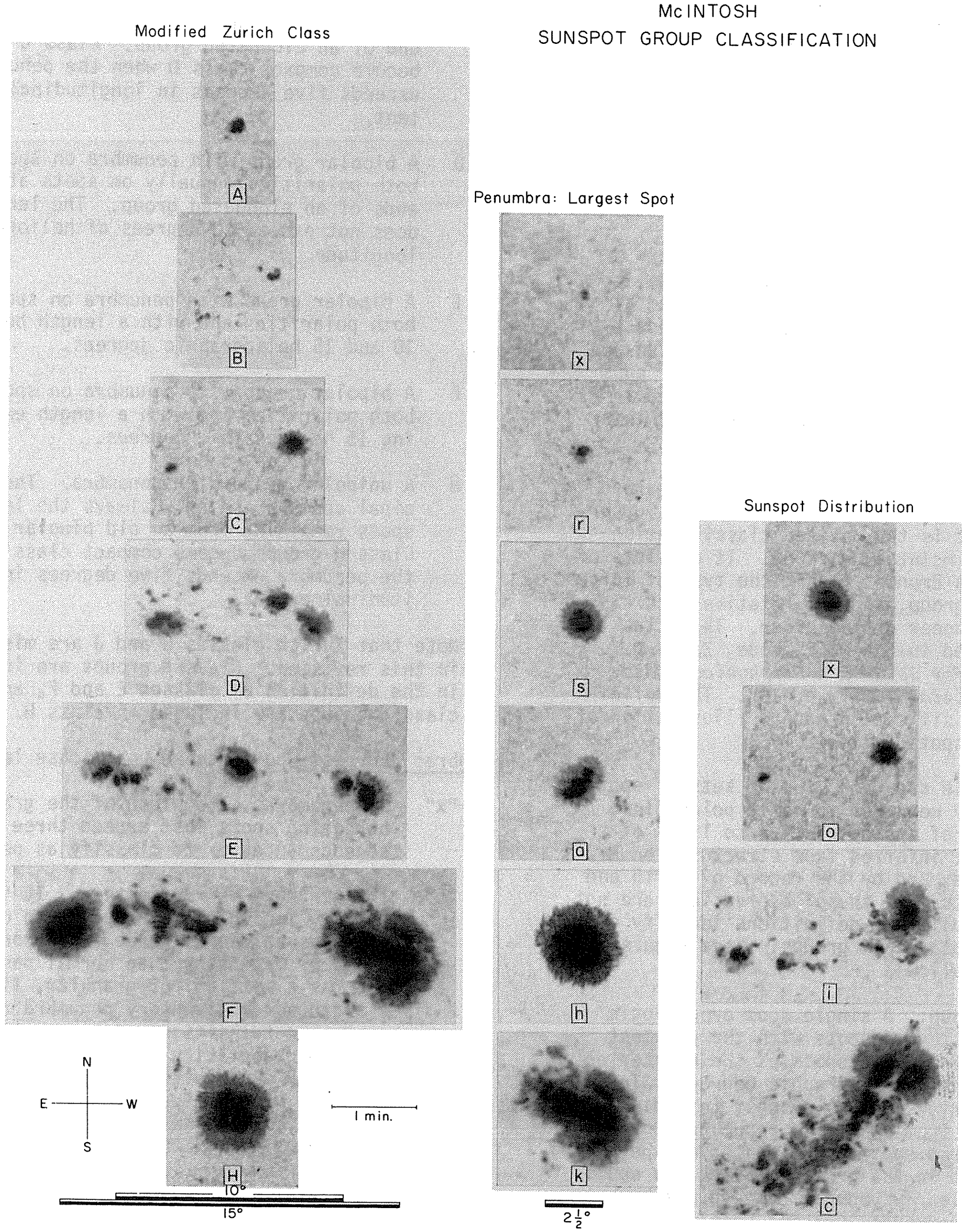
"s" — Symmetric, nearly circular penumbra with filamentary fine structure and a spot diameter not exceeding 2½ heliographic degrees. The umbrae form a compact cluster near the center of the penumbra. Also, elliptical penumbra are symmetric about a single umbra. Spots with symmetric penumbra change very slowly.

"a" Asymmetric, or complex penumbra with filamentary fine structure and a spot diameter along a solar meridian not exceeding 2½ heliographic degrees. Asymmetric penumbra is irregular in outline or clearly elongated (not circular) with two or more umbrae scattered within it. The example in the figure is transitional between "s" and "a". Asymmetric spots typically change form from day-to-day.

"h" A large symmetric penumbra with diameter greater than 2½ heliographic degrees. Other than size, it has characteristics the same as "s" penumbra.

"k" A large asymmetric penumbra with dia- than 2½ heliographic degrees. Other than size, its characteristics are the same as "a" penumbra. When the longitudinal extent of the penumbra exceeds five heliographic degrees, it is almost

McINTOSH
SUNSPOT GROUP CLASSIFICATION



certain that both magnetic polarities are present within the penumbra and the classification of the group becomes Dkc or Ekc or Fkc.

Sunspot Distribution (third upper case letter)

"x" Single spot.

"o" An open spot distribution. The area between leading and following ends of the group is free of spots so that the group appears to divide clearly into two areas of opposite magnetic polarity. An open distribution implies a relatively low magnetic field gradient across the line of polarity reversal.

"i" An intermediate spot distribution. Some spots lie between the leading and following ends of the group, but none of them possesses penumbra.

"c" A compact spot distribution. The area between the leading and following ends of the spot group is populated with many strong spots, with at least one interior spot possessing penumbra. The extreme case of compact distribution has the entire spot group enveloped in one continuous penumbral area. A compact spot distribution implies a relatively steep magnetic field gradient across the line of polarity reversal.

The first letter of the McIntosh classification is essentially the Brunner classification with the following exceptions:

McIntosh types:	Ero	and	Fro	=	Brunner class G
	Eso		Fso		
	Eao		Fao		
	Eho		Fho		
	Eko		Fko		

McIntosh types:	Hrx	=	Brunner class J
	Hsx		
	Hax		

N.B. For detailed research analyses these region tabulations should be used with caution.

Calcium Plage Index -- This table provides the daily calcium plage index based on the formula by Wesley R. Swartz, Ionosphere Research Laboratory, Pennsylvania State University as published in February 1971 text. The formula is re-expressed below:

$$\text{Ca II}_{\text{index}} = \left[\sum_i I_i A_i \cos\theta_i \cos\phi_i\right] / 1000$$

where the summation includes all the plages visable on the day.

I_i = intensity of plage i

A_i = corrected area of plage i in millionths of a solar hemisphere (McMath-Hulbert Observatory data)

Θ_i = central meridian distance of plage i in degrees

ϕ_i = latitude of plage i.

Values of this index for the period January 1, 1958 through January 31, 1971 appear in the Pennsylvania State University Ionosphere Research Laboratory Report 373(E), *The Solar Ca II Plage Index*, Wesley E. Swartz and Regan Overbeck, October 8, 1971.

SUDDEN IONOSPHERIC DISTURBANCES (C.6)

Sudden ionospheric distrubances (SID) are presented in a table as one line per SID event. This table gives the date, beginning, ending and maximum time in UT of each event; an importance rating; types of SID observations; and flare, if known. The selected times of beginning, ending and maximum are usually those of a sudden phase anomaly (SPA). The time that is chosen from the SPA reporting stations is selected by taking into consideration the amplitude of the event and the time of the associated flare, if known. In the table D = greater than, E = less than and U = approximate time indicated. The importance rating is obtained by subjective averaging of the importances reported by all stations for all the different types of SID. The importance rating is based on a scale of 1, the least, to 3+, the most important. If SPA events are not available, shortwave fade out (SWF) events are used to determine the times. The degree of confidence of identifying the event is reported by the stations as a subjective estimate. This is then evaluated to decide whether the reported event is an SID or not. From the reports believed to be SID, a wide spread index is prepared signifying that the SID is geographically widespread. The index ranges from 1 (possible-single station) to 5 (definite-many stations). Some phenomena are listed if noted at only one location, if there has been a flare or other type of flare-associated effect reported for that time. In the flare column an * represents no flare patrol as yet available for time of event, and NF means no flare observed though there was a flare patrol at that time. Consideration is also given as to whether other reports are available from that longitude on that date. Below the table are listed the stations together with the type of SID reported which were analyzed to prepare the SID event table. A second table lists the number of SID for each day by the McMath region of the associated flare, if known.

The table on page 29 of this text gives the two-letter station code, the geographic location of the station and the type or types of SID information submitted. These data are made possible through the auspices of the International Ursigram and World Days Service, the U.S. Coast Guard, and private interested individual observers (AAVSO). Greater detail concerning the reporting stations can be found in "The Listing of Sudden Ionospheric Disturbances" by J. Virginia Lincoln [*Planet. Space Sci.*, *12*, 419-434, 1964] and in earlier versions of this text.

The SID stations presently active are shown on the chart on page 30 by their longitude and by the type of SID recorded. The numbers across the top at 30° intervals indicate the earliest sunrise (top) and the latest sunset (bottom) times in UT for the stations within ± 15° longitude. The times are based on the summer solstice (June 22). The small triangles throughout the chart indicate the midpoint of transmitting paths for SWF, SPA, SES, and SFD for only those stations that are underlined. (Many of the non-underlined SWF stations are commercial terminals, and the location of the transmitters being recorded are not always known.) The world-wide coverage of SID effects is indicated by the density of the triangles, and will show in which parts of the world the ionosphere is studied for SID effects. The boxes around the three SCNA stations note that those stations record cosmic noise absorption with the same equipment; i.e., recorders designed by Robert Lee of the High Altitude Observatory, Boulder, Colorado.

N.B. The detailed data as formerly published are available at cost of reproduction from World Data Center A for Solar-Terrestrial Physics, NOAA, Boulder, Colorado 80302.

SID, sudden ionospheric disturbances (and GID, gradual ionospheric disturbances) may be detected in a number of ways: shortwave fadeouts (SWF), increases in cosmic noise absorption (SCNA), enhancement or decrease of low frequency atmospherics (SEA or SDA), sudden phase anomalies at VLF (SPA), sudden enhancements at VLF (SES), sudden phase anomalies at LF (SPA and SFA), and sudden frequency deviations (SFD).

SWF -- SWF events are recognized on field-strength recording of distant high-frequency radio transmissions.

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

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

SCNA-SEA -- Sudden ionospheric disturbances recognized on recorders for detecting cosmic noise absorption at about 18 or 25 MHz are known as SCNA, or recognized on records for detecting enhancements of low frequency atmospherics at about 27 kHz are known as SEA.

SPA and SES -- Sudden phase anomalies (SPA) are observed as a phase shift of the downcoming skywave on VLF recordings or on pulse measurements on LF recordings. An estimate of the intensity can be obtained in terms of the degree of phase shift [see Chilton, C. J., *et al.*, *J. Geophys, Res.*, *68*, 5421-5435, 1963]. The length of path and amount of sunlight on the path must of course be considered.

Sudden enhancements of signal strength (SES) are observed on field-strength recordings of extremely stable VLF transmissions.

SPA recorded by LF pulse observations over a one-hop propagation path yield information more indicative of the ionospheric changes occurring at the mid-point of the path, rather than over the entire path. LF phase observations, reported in degrees, represent an increase in sensitivity over VLF observations. The phase sensitivity is directly proportional to the ratio of the frequencies for identical paths. However, since the height of energy deposition is related to the type of flare x-rays emitted, the LF measurements in conjunction with the VLF measurements will tend to indicate the x-ray intensity range. Since the LF signal can apparently be reflected from either of two layers within the D-region [Doherty, R. H., *Radio Science*, *2*, 645-651, 1967] phase retardations as well as phase advances may occur during an SID at LF.

The amplitude of the low frequency pulse observations made at Loran stations normally changes during an SID. This change is usually, but not always, in the direction of a signal enhancement (SES). The height of signal absorption is below the height of signal reflection. LF amplitude observations along with the LF and VLF phase observations for any one event tend to indicate the x-ray intensities associated with that event. Amplitude changes are reported in dB to the nearest dB of voltage change. Since 6 dB represents doubling of the received signal and 20 dB represents a ten fold change in amplitude, it is obvious that many SIDs produce large effects in LF propagation.

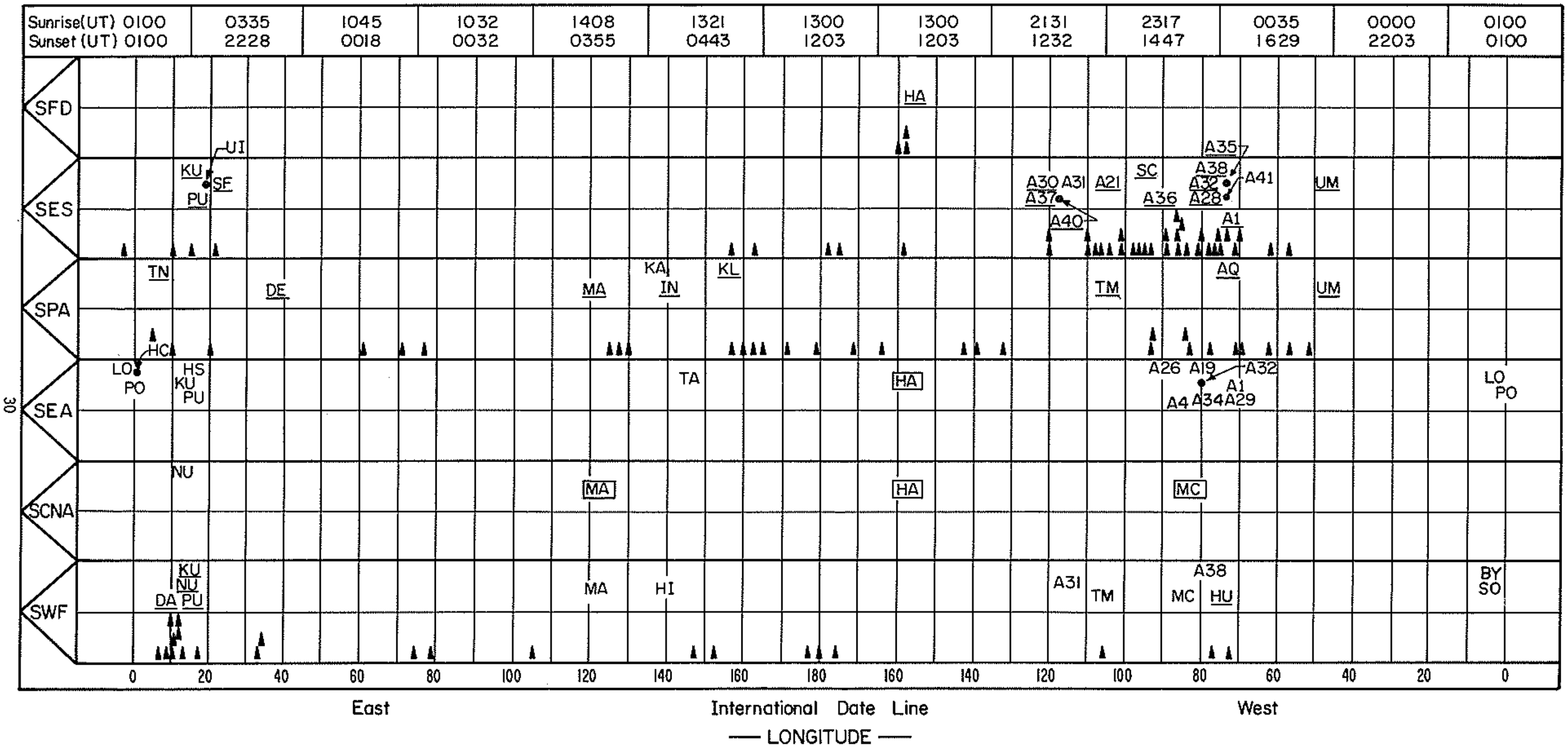
SFA -- On LF amplitude recordings on paths about 1000 km long, sudden phase anomalies of the type known as SFA can be detected. These are events recognized by indirect phase measurements made evident by the one-hop sky wave interfering with the ground wave.

SFD -- A sudden frequency deviation (SFD) is an event where the received frequency of an HF radio wave reflected from the ionosphere increases suddenly, peaks, and then decays back to the transmitted frequency. Sometimes several peaks occur and usually the frequency deviation takes on negative values during the decaying portion of an SFD. The peak frequency deviation for most SFDs is less than 0.5 Hz. The start-to-maximum time is typically about 1 minute. SFDs are caused by sudden enhancements of ionization at E and F1 region heights produced by impulsive flare radiation at wavelengths from 10 - 1030Å. A more complete discussion of SFDs can be found in Report UAG-36, *An Atlas of Extreme Ultraviolet Flashes of Solar Flares Observed via Sudden Frequency Deviations During the ATM-SKYLAB Missions,* 1974.

STATION LIST FOR SUDDEN IONOSPHERIC DISTURBANCES TABLE

CODE STATION LOCATION	SWF	SCNA	SEA	SES	SFD	SPA
AQ = AREQUIPA, PERU						X
BY = BEARLEY, ENGLAND	X					
DA = DARMSTADT, GFR	X					
DE = DEBRE ZEIT, ETHIOPIA						X
HA = HAWAII, USA		X	X		X	
HC = HERSTMONCEAUX, ENGLAND			X			
HI = HIRAISO, JAPAN	X					
HS = HERMANUS, SOUTH AFRICA			X			
HU = HUANCAYO, PERU	X					
IN = INUBO, JAPAN						X
KA = KASUAGI, JAPAN						X
KU = KUHLUNGSBORN, GDR			X			X
LO = PRESTON, ENGLAND			X			
MA = MANILA, PHILIPPINE ISLANDS	X	X				X
MC = MCMATH-HULBERT OBS., MICHIGAN, USA	X	X				
MN = MAYNOOTH, COUNTY KILDARE, IRELAND				X		
NU = NEUSTRELITZ, GDR	X	X				
PO = POITIERS, FRANCE			X			
PU = PRAGUE, CZECHOSLOVAKIA	X		X	X		
SC = ST. CLOUD, MINNESOTA, USA				X		
SF = SOFIA, BULGARIA				X		
SO = SOMERTON, ENGLAND	X					
TA = HOBART, TASMANIA			X			
TM = TABLE MOUNTAIN (BOULDER, COLO, USA)	X					X
TN = TORINO, ITALY						X
UI = UPICE, CZECHOSLOVAKIA			X			
UM = SAO PAULO, BRAZIL				X		X
AMERICAN ASSOCIATION OF VARIABLE STAR OBSERVERS (AAVSO)						
A1 = VALLEY COTTAGE, NEW YORK, USA			X	X		
A4 = COLUMBUS, OHIO, USA			X			
A19 = LATROBE, PENNSYLVANIA, USA			X			
A21 = LITTLETON, COLORADO, USA				X		
A26 = LOUISVILLE, KENTUCKY, USA			X			
A28 = MAYFIELD VILLAGE, OHIO, USA				X		
A29 = LEXINGTON, MASSACHUSETTS, USA			X			
A30 = SUNNYVALE, CALIFORNIA, USA				X		
A31 = MISSOULA, MONTANA, USA	X			X		
A32 = POMPTON PLAINS, NEW JERSEY, USA			X			
A34 = PAEONIAN SPRINGS, VIRGINIA, USA			X			
A35 = BROOKLYN PARK, MINNESOTA, USA				X		
A36 = WORTHINGTON, OHIO, USA				X		
A37 = YAKIMA, WASHINGTON, USA				X		
A38 = ORMOND BEACH, FLORIDA, USA	X			X		
A39 = MANGROVE BAY, SOMERSET, BERMUDA			X			
A40 = LA CRESCENTA, CALIFORNIA, USA				X		
A41 = HAMILTON, NEW YORK, USA				X		

MERIDIONAL POSITION OF SID STATIONS, BY TYPE



Presently active SID stations are shown above. The numbers across the top at 30° intervals indicate the earliest sunrise (top) and latest sunset (bottom) times in UT for the stations within ± 15° longitude. The times are based on the summer solstice (June 22). The small triangles throughout the chart indicate the midpoint of transmitting paths for SWF, SPA, SES, and SFD for only those stations that are underlined. The boxes around the 4 SCNA-SEA stations indicate similar equipment.

S O L A R R A D I O W A V E S

S P E C T R A L O B S E R V A T I O N S (C.4)

Solar spectral events from Fort Davis (Texas), Culgoora (Australia), Sagamore Hill (Massachusetts), Manila Observatory (Philippines), Weissenau (GFR), Dürnten (Switzerland) and Dwingeloo (Netherlands) are presented in a combined table. The contents of the table are described below:

Universal (Greenwich) date

Observing periods during day (UT) -- aligned with first burst from observatory

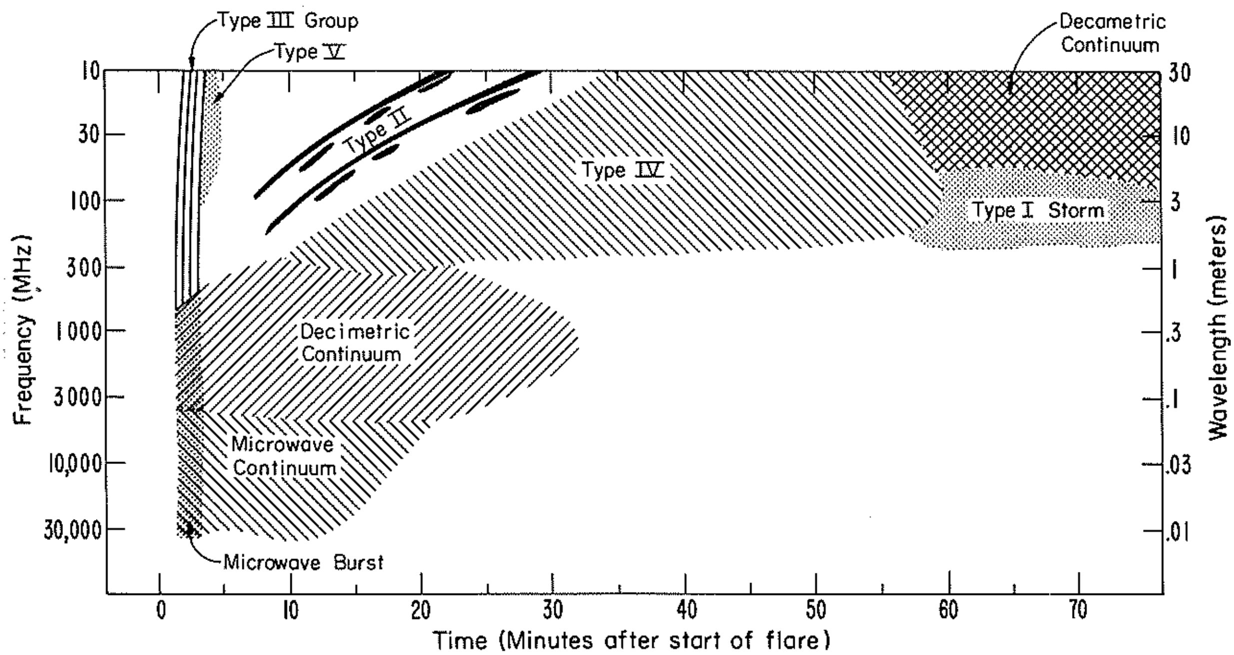
Station -- HARV = Fort Davis, CULG = Culgoora, MANI = Manila, SGMR = Sagamore Hill, WEIS = Weissenau, DURN = Dürnten and DWIN = Dwingeloo.

Burst indicated in wavelength band by beginning and ending times in UT together with an indication of intensity on a 1 to 3 scale, 3 the most important. Symbol "E" is used for an event in progress before the time given and "D" for one that ends after the given time.

Spectral type --

I = storm bursts
II = slow drift bursts
III = fast drift bursts
IV = prolonged continuum
V = brief continuum (normally following type III bursts)
CONT = continuum in close association with type III burst storms, often with reverse drift bursts and often, but not always, associated with noise storms on metric wavelengths (used by SGMR)
DCIM = decimetric burst defined by very fast drift spike or group of spikes with very high degree of polarization extending usually less than one octave in or close to decimeter range
UNCLF = unclassified activity

See J. P. Wild, S. F. Smerd and A. A. Weiss, *Annual Review of Astronomy and Astrophysics, 1,* 291, 1963 for description of types I through V.



The schematic diagram above illustrates a typical dynamic spectrum which might be produced by a large flare (Importance 2B and larger). Various flares produce many variations to this "typical spectrum". Microwave continuum will no longer be listed here except as special comments in the Remarks column.

Symbols appended to spectral type:

- B = Single burst
- G = Small group (<10) of bursts
- GG = Large group (>10) of bursts
- C = Underlying continuum (particularly with type I)
- S = Storm in the sense of intermittent but apparently connected activity
- N = Intermittent activity in this period
- U = U-shaped burst of Type III
- RS = Reverse slope burst
- DP = Drifting pairs
- DC = Drifting chains
- H = Herringbone
- W = Weak activity
- P = Pulsations
- MOV = Moving (Type IV)
- STA = Stationary (Type IV)
- Z = Zebra patterns (parallel drifting bands)
- F = Fiber bursts (intermediate drift bursts)

The bursts are divided into dekameter, meter, and decimeter wavelength ranges. For the reporting stations listed below, these ranges cover approximately the frequency bands 10-30, 30-300, and 300-3000 MHz. There has been little uniformity among observatories in interpreting the intensity levels. The reason for this stems from the fact that equipment and antenna systems at different stations are different, having different gains, different dynamic ranges and saturate at different levels.

The Instruction Manual for reporting solar radio emission prepared by World Data Center-C2, Toyokawa Observatory, 1975, recommends that spectral observations be given a uniform intensity classification by all observatories. These are:

Intensity Classes	Flux Density in $10^{-22}Wm^{-2}Hz^{-1}$
1	<50
2	50-500
3	>500

Because of equipment and antenna differences this recommendation has not been followed at most observatories as is seen in the following observatory discussions:

Weissenau Radio Astronomy Observatory, Astronomical Institute of Tübingen University -- This research work is supported by the University of Tübingen, Baden-Wurttemberg, GFR. Instrumental descriptions are given by Urbarz [*Solar Phys., 7*, 147-152, 1969], Urbarz [*Information Bulletin of Solar Radio Observations, No. 25*, 8-10, 1969], Kraemer [*Kleinheubacher Berichte, 13*, FTZ Darmstadt, 165-168], Urbarz [*Z. Astrophys., 67*, 321-338, 1967].

A 35 mm film is used with a 0.2 mm/s feed, the sweep rate is 4 per sec. The number of resolution elements of recorded events is about 100 per octave on film.

Since May 27, 1970, the attenuation on channels 3, 4, and 5 is considerably lower than before, due to feeder replacement. The minimum detectable flux has decreased on channels 1, 3, 4, 5, and 6 from about 100 to 50 flux units ($10^{-22}Wm^{-2}Hz^{-1}$) and on channel 2 from 600 to 200 flux units. The saturation flux is also greater on channel 2 than on the other channels.

In 1971 the ratios of the numbers of type III bursts reported at Weissenau to those reported at Ft. Davis and Culgoora, respectively, were 1:2.5 and 1:3.5. It was concluded that the same ratios hold for the average minimum detectable flux on the film recordings.

Harvard Radio Astronomy Station, Fort Davis, Texas -- Summaries are presented of solar radio bursts recorded in the frequency range 25-320 MHz.) (During periods of considerable solar activity the range is increased to 25-2000 MHz.) The equipment used at the Station has been described by Thompson [*Astrophys. J., 133*, 643, 1961] and by Maxwell [*Solar Physics, 16*, 224, 1971]. At 100 MHz the intensity ranges listed as 1, 2, and 3 correspond approximately to 5-50, 50-500, and >500 x $10^{-22}Wm^{-2}Hz^{-1}$.

Culgoora Solar Observatory, Australia -- The observations at C.S.I.R.O. Solar Observatory, Culgoora, N.S.W., Australia are made by the C.S.I.R.O. Division of Radiophysics, Epping, N.S.W. Summaries are presented of solar radio bursts in the frequency range 8-8000 MHz. For a description of the equipment see K. V. Sheridan [*Proc. Astron. Soc. Australia, 1*, 58, 1967]. The intensity scale is qualitative.

Sagamore Hill Radio Observatory -- Spectral measurements of dekameter wavelength Type II, III, IV and V radio emission are made at Sagamore Hill on a patrol basis. A special purpose radiometer sweeps the 25-75 MHz frequency range at a rate of 1 sweep per second. Two semi-bicone stationary antennas, spaced 300 meters apart on an E-W line to form the interferometer, are used with the spectral receiver.

With this array, positive identification of any solar event is enhanced by the resultant fringe pattern on the spectrogram. (The bicone antennas are a D. Gaunt design.)

All raw data are recorded on a Varian Statos-V x, y, z Electrostatic Recorder (Model 500) for real time readout. An improved solid state sweep frequency radiometer whose basic component is a H.P. Spectrum Analyzer provides up to 10 dB greater sensitivity than the original instrument and is now in routine operation at Sagamore Hill. On 12 July 1970 the frequency interval of the dekameter spectral observations was changed from 19-41 MHz to 24-48 MHz. This observed frequency interval was changed to 25-75 MHz on 12 August 1975 to provide a better representation of the burst phenomena observed at these wavelengths. Sagamore Hill now uses the recommended intensity classification listed above from the 1975 Instruction Manual.

Manila Observatory -- The Manila Observatory observes in the spectral range 24-48 MHz and coordinates its observations with the observers at Sagamore Hill.

Dürnten Spectrograph, Switzerland -- The Dürnten spectrograph was constructed under support of the Swiss National Science Foundation. It is located at Dürnten near Zürich, Switzerland. The film registration now covers a frequency range from 100-1000 MHz in one continuous sweep. The sweep rate is normally set at 4 Hz. The treshold intensity I_{th} amounts to about 110±30 flux units between 140 and 200 MHz and 70±30 flux units between 200 and 1000 MHz. Saturation occurs roughly at $I = 3\ I_{th}$. Intensities are indicated according to the following intensity levels:

Intensity 1 = not saturated
Intensity 2 = nearly saturated
Intensity 3 = clearly saturated

For more detailed description of the instrument see: Tarnstrom, G. L., *Astr. Mitt. Eidgen. Sternwarte Zürich, No. 317,* 1973.

Dwingeloo Radio Spectrograph, Netherlands -- The radiospectrograph at Dwingeloo is operated by the Netherlands Foundation for Radio Astronomy, which is financed by the Netherlands Organization for the Advancement of Pure Research (Z.W.O.). It is a 60-channel receiver measuring intensity and circular polarization. The intensity is displayed in two ways: one sensitive for fluctuations, which has a dynamical range of ± 1.7 dB, and one with a logarithmic measuring range of about 15 dB over quiet sun level (q.s.l.). Saturation occurs about 20 dB over q.s.l. The threshold sensitivity is 0.2 dB. The time resolution is 0.01 sec. The bandwidth of the channels is 0.9 MHz. The outputs are routinely recorded on 35 mm cinefilm. In addition, for particularly interesting events, they are recorded on digital magnetic tape. The receiver is regularly calibrated against Cassiopeia-A.

Intensities of bursts are reported as estimated from the film in ranges approximately as:

1: 1 - 50 flux units ($10^{-22}Wm^{-2}Hz^{-1}$)

2: 50 - 200 flux units.

3: > 200 flux units.

From September 1975 to July 1976 the spectrograph was tuned between 260-227 MHz and 177-160 MHz. Bursts observed between 160 and 177 MHz are reported as metric, those between 227 and 260 MHz as decimetric. Since July 1976 the resolution and tuning of the channels have been changed. A block of 20 channels of 0.9 MHz width, is tuned as before between 160 and 177 MHz. A block of 40 channels of 0.17 MHz width, spaced at 0.34 MHz with a total coverage of 13.3 MHz, is tunable in steps of 13.3 MHz between 200 and 320 MHz. Generally the option 240-213.3 MHz is used, but retuning is easy and is done according to the prevailing activity.

A number of single frequency recordings are derived from the spectrograph channels. These recordings are reported as "Distinctive Events".

For detailed descriptions of the spectrograph see: [De Groot, T. and J. Van Nieuwkoop, *Solar Phys., 4,* 332, 1968] and [Van Nieuwkoop, J., A Multi-channel Solar Radio-Spectrograph, *Thesis, Utrecht,* 1971].

Culgoora Radioheliograph at 43.25, 80 or 160 MHz -- The radioheliograph at the CSIRO Solar Observatiory, Culgoora (Australia) is a circular array of 96 paraboloid reflector antennas equally spaced around a circle of 3 km diameter. It records 2 two-dimensional pictures of the Sun each second: one in the left-handed, the other in the right-handed sense of circular polarization [J. P. Wild, editor, *Proc. IREE (Aust.), 28,* 277, 1967]. Originally the heliograph operated at 80 MHz; it has been converted to time-sharing operation at 43.25, 80 and 160 MHz covering fields of view of 2° x 1.6°, 2° x 1.6° and 1° x 0.8° with half-power beamwidths at zenith of 7.4', 3.7' and 1.9', respectively [K. V. Sheridan, N. R. Labrum and W. J. Payten, *Proc. IEEE, 61,* 1312, 1973]. For the 43.25 MHz frequency an array of 48 corner reflector antennas set on a circle of 2.77 km diameter has been built just inside the main radioheliograph array. At this frequency only one sense of linear polarization is received.

The heliograph pencil beam can track the Sun for 6 hours and 40 minutes centered on local noon. The mechanical movement of the antennas is limited to 4 hours and 48 minutes (slightly less near the summer and winter solstices) so that the Sun drifts into and out of the broad antenna beams during the first and the last hour of observation. The normal observing hours are approximately 2300 to 0500 UT. The necessity to provide time for maintenance and development has limited observations to about 2/3 of all days since the end of 1967.

The events selected for listing in the Table may be: small, isolated events during periods of little activity; daily samples during prolonged storms; or outstanding events during active periods. Source postions are given by their central distance in units of the Sun's optical radius, $R_\odot$ and their position angle; the latter is the angle of 0° to 360° measured eastward from the north point of the solar disk (i.e., from celestial north). The apparent projected positions and the polarization listed here are taken from the visual analog display of the taped, digital heliograph data; the expected relative accuracy is about 0.1 $R_\odot$ in distance and 10° in PA. The polarization is described qualitatively as weak [ℓ or r] or strong [L or R] circular polarization. The intensity is given on a scale 1 to 3, with the corresponding flux densities, S, very approximately in the range:

1 : $S < 2 \times 10^{-21}Wm^{-2}Hz^{-1}$

2 : $2 \times 10^{-21} < S < 2 \times 10^{-20}Wm^{-2}Hz^{-1}$

3 : $S > 2 \times 10^{-20}Wm^{-2}Hz^{-1}$

Storms which are mostly of intensity 1 will not normally be listed. The positions may be affected by unknown amounts of ionospheric refraction; this effect is more pronounced the lower the frequency. If refraction errors are suspected this will be noted in the "remarks" column of the Table.

C O S M I C R A Y S (F.1)

Tabulated Observations -- The table presents the daily (UT) average counting rates per hour (scaled) for eight high counting rate neutron monitors: Thule, Alert, Deep River, Calgary, Sulphur Mountain, Kiel, Climax, and Tokyo.

The characteristics of the eight stations are given below; the data have been corrected applying the barometric coefficients to the listed mean station pressures.

Station	Thule	Alert	Deep River	Calgary	Sulphur Mt.	Kiel	Climax	Tokyo
Geog. Lat., N.	76°35'	82°31'	46°06'	51°05'	51°12'	54°18'	39°22'	35°45'
Geog. Long., E.	291°35'	297°40'	282°30'	245°52	244°24	10°06'	253°49	139°43'
Cutoff, GV	0.00	0.00	1.02	1.09	1.14	2.28	3.03	11.61
Altitude, m	260	66	145	1128	2283	54	3400	20
Detector type	NM 64	NM 64	NM 64	NM 64	NM 64	NM 64	IGY	NM 64
Scaling factor	100	100	300	100	100	100	100*	128
Baro. coeff., % mm Hg	1.00	.987	.987	1.0155	1.0085	.961	.943	.844
Mean press. mm Hg	730	752	747	671	582	755	504	760.5

* From January 1, 1966.

The Climax, Colorado, U.S.A., neutron monitor data are communicated by J. A. Simpson and G. Lentz of the Enrico Fermi Institute for Nuclear Studies, University of Chicago. The instrument is a standard Chicago type neutron monitor, utilizing 12 BF_3 counter tubes. The station has a mean barometric pressure of 504.0 mm Hg. For a more detailed description of the neutron intensity monitor and its associated electronics see J. A. Simpson, *Annals of the IGY, Vol. IV*, Part VII, 351-373, 1957. The publication on these data in this monthly series began September 1960. *Earlier data, beginning January 1953, are available in hourly form at the World Data Center A for Solar-Terrestrial Physics.*

The Deep River, Ontario, Canada, neutron monitor, follows the IQSY design [*IQSY Instruction Manual No. 7*]. Publication of the daily rates in this series began in January 1966 but a chart of hourly values from Deep River, described below has been published herein since January 1959. Until December 31, 1972 the station was operated and maintained by Atomic Energy of Canada Ltd., but on January 1, 1973 the National Research Council of Canada took over the responsibility for maintenance of the station. The data are now provided by Margaret D. Wilson of the National Research Council of Canada. *The original data can be obtained from National Research Council of Canada, Ontario, Canada, K1A 0R6, or from any of the World Data Centers.*

The 18-NM-64 neutron monitor located at Alert, North West Territories, Canada, is unique because its asymptotic cone of acceptance in space is less than 10° wide and is aligned within 7° of the spin axis of the earth. Hence, unlike the stations whose cones of acceptance rotate with the earth approximately in the plane of the ecliptic, Alert always "looks" into a fixed cone directed northwards. It experiences negligible periodic diurnal intensity variation. The monitor at Alert was provided by Atomic Energy of Canada, Ltd., and housed in a building provided by National Research Council of Canada. It is the responsibility of the National Research Council, and day-to-day operation is by courtesy of the Canadian Meteorological Service.

The two high counting rate neutron monitors at Sulphur Mountain and Calgary have values for magnetic cutoff rigidity comparable to the Deep River monitor. Their asymptotic cones of acceptance "look" approximately in the equatorial plane in essentially the same direction in space. The data, beginning January 1971, from Sulphur Mountain and Calgary super neutron monitors are communicated by D. Venkatesan and T. Mathews of the Department of Physics, University of Calgary, Calgary 44, Alberta, Canada. The stations have mean barometric pressures of 766 mb, and 883 mb., respectively. The barometric coefficients used to correct the data are 0.7665%/mb and 0.7718%/mb, respectively. *Hourly mean data from both installations are routinely distributed to the scientific community and the World Data Center A for Solar-Terrestrial Physics, Boulder, Colorado.* The data began March 1963 for Sulphur Mountain and January 1964 for Calgary, and are available at the World

Data Center as stated. The stations were set up by B. G. Wilson (now at Simon Fraser University, Burnaby, British Columbia).

The Thule nucleonic intensity detector, of standard IQSY design, was originally located at the Geopole Station Greenland: latitute 76°36'N, longitude 68°48'W, altitude 260m, geomagnetic threshold rigidity essentially zero. At the end of 1976, it was moved to a new site on Thule Air Base. The coordinates are essentially unchanged except that the altitude is now close to sea level. The data are communicated by Martin A. Pomerantz, Bartol Research Foundation, Swarthmore, Pa. 19081. Any changes in either the atmospheric attenuation length or in the sensitivity arising from long term drifts are applied retrospectively before the final hourly mean data are routinely distributed to the World Data Centers and to the scientific community.

Two other monitors, at Kiel and Tokyo, have asymptotic cones of acceptance much different from those given above. Therefore, they can be used to distinguish between UT-dependent and LT-dependent time variations. Higher cutoff rigidities also aid further estimation of rigidity dependence. The publication of these data began with the December 1973 data. The data from both 18-NM-64 neutron monitors are routinely submitted to the World Data Centers A, B, C1 and C2 for Cosmic Rays as well as to listed researchers. Kiel data has been available since September 1964 and Tokyo (or Tokyo-Itabashi) data since January 1970. The data are communicated to *Solar-Geophysical Data* by M. Wada after receiving the Kiel data from O. Binder.

Charts -- Variations of cosmic ray intensity are depicted in chart form for the above stations. The vertical scale lines mark the days of the month in Universal Time. The horizontal scale lines are in intervals of 5% deviation from an arbitrarily chosen 100% reference level for each station. The 100% reference levels are based upon (after barometric correction) 1.846×10^6 counts per hours for Deep River; 0.6678×10^6 for Alert; 0.8827×10^6 for Sulphur Mountain; and 1.1767×10^6 for Calgary. For Thule, Kiel, Climax, and Tokyo, the plots represent percentage deviation from the monthly mean intensity which is taken to be the 100% level.

GEOMAGNETIC ACTIVITY (D.1)

Kp, Kn, Ks, Km, Cp, Ap, aa, and Selected Quiet and Disturbed Days -- The data in the table are: ten quietest days (Q), and five most disturbed days of the month (D); three-hourly indices Kp, Kn, Ks, Km; character figure, Cp; daily "equivalent amplitude", Ap; and aa indices with quiet day figures K and C.

The data are made available by the International Service of Geomagnetic Indices under the auspices of the International Association of Geomagnetism and Aeronomy through Division V: Observatories, Instruments, Indices and Data. The Institute für Geophysik, Göttingen University, computes the planetary and equivalent amplitude indices and determines the "international quiet and disturbed days", Q and D. The aa-indices and Kn, Ks, Km are provided by the Institut de Physique du Globe, Paris, France. Many of the activity indices are described by J. Bartels in *Annals of the IGY, Vol IV*, 227-236, London, Pergamon Press, 1957.

Kp is the mean standardized K-index from 13 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 and 2/3, 5o is 5 and 0/3, and 5+ is 5 and 1/3. This planetary index is designed to measure solar particle-radiation by its magnetic effects, specifically to meet the needs of research workers in the other geophysical fields.

A full description of the indices Kn, Ks, Km is given in a monograph, *Indices Kn, Ks et Km, 1964-1967*, edited in 1968 by the Centre National de la Recherche Scientifique, 15 quai Anatole, France, 75007 PARIS, which contains these indices for 1964-1967. Yearly compilations of these data are published in the series of *IAGA Bulletins No. 32*. Indices for 1959-1963 will be published in a special number of the IAGA Bulletin. All of them are available at the appropriate World Data Centers.

Briefly, the three-hourly indices Kn and Ks for the Northern and Southern hemispheres respectively are derived from the K indices of observatories approximately well distributed in latitude and in longitude. The indices are standardized according to the distances of the stations to the auroral zones. The stations are arranged in groups representing a longitude sector in one of the hemispheres (5 in the Northern hemisphere, 3 in the Southern). The observatories currently in use are:

Magadan	Newport
Petropavlovsk	Tucson
Memambetsu	Amberley
Sverdlovsk	Toolangi
Tunguska	Gnangara
Niemegk	Kerguelen
Witteveen	Hermanus
Hartland	Port Alfred
Ottawa	Argentine Island
Fredericksburg	South Georgia
Victoria	Trelew

The mean standardized K of each sector is converted into an equivalent amplitude and the weighted (in longitude) averages an and as of these amplitudes are converted back into Kn and Ks, Km is derived in the same way from am, the average of an and as. Indices an, as, and am are expressed in gammas (one gamma equals one nano-tesla) and correspond to the magnetic activity level (as it can be inferred from K indices) at an invariant magnetic latitude of

50°. Indices Kn, Ks, and Km are expressed in the same units as Kp. Values published in these reports are only provisional because in some months all observatories used in each longitude sector have not sent K indices at the right time and because K indices of Antarctic stations have to be rescaled at the end of each wintering.

The Cp-figure is a standardized version of the Ci-figure formerly published and is derived from the indices Kp by converting the daily sum of ap into the range 0.0 to 2.5.

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 approximately 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. Values of Ap (like Kp and Cp) have been published for 1932 to 1961 in *IAGA-Bulletin No. 18* by J. Bartels. Yearly compilations of these data, as well as the selected days, are published in the series of *IAGA-Bulletin No. 32 (the continuation of IAGA Bulletin No. 12). These Bulletins are available from the IUGG Publications Office 39, Rue Gay Lussac, Paris (V). These indices are also available at the appropriate World Data Centers.*

The aa indices are the continuation of the series beginning in the year 1868. A full description of these indices is given in the *IAGA Bulletin 33*, which contains them for the years 1868-1967. Descriptions are also given (especially comparisons with am, ap, or Ci indices) in two short papers [*Ann. Geoph. 27*, 62-70, 1971, and *J. Geophys. Res., 77, 6870-6874, 1972*]. aa values for 1968-1974 will soon be published in IAGA Bulletin 32 series. A graph of these values through 1976 is published in the February 1977 issue of *Solar-Geophysical Data.* Briefly, such three-hourly indices, computed from K indices of two antipodal observatories (invariant magnetic latitude 50°), provide a quantitative characterization of the magnetic activity, which is homogeneous through the whole series. Half-daily and daily values give an estimation of the activity level very close to that obtained with am indices. Values are in gammas and correspond to the activity level at an invariant magnetic latitude of 50°. The aa indices are computed for:

N = daily values for the Northern hemisphere,

S = daily values for the Southern hemisphere,

M = half-daily values of aa indices for the Greenwich day.

Letters C and K refer to a classification of the quiet days of the month (C = really quiet, K = quiet but with slightly disturbed three-hourly intervals). The letters on the left refer to the 24 hour Greenwich day, on the right to a period of 48 hours centered on the Greenwich noon. The three-hourly indices aa are available from the appropriate World Data Centers on magnetic tape using the format described in IAGA Bulletin 33.

The magnetically quiet and disturbed days (D & Q) are selected in accordance with the general outline in *Terr. Mag.* (Predecessor to *J. Geophys. Res.) 48*, 219-227, 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.

Beginning with the data for December 1976 numbers appear with the Qs and Ds to rank them in order from the most quiet or most disturbed, respectively. Day number 10 is given as "0". Also a selected "quiet day" considered "not really quiet" is marked by the letter A if Ap > 6 for that day, or marked by the letter K if Ap ≤ 6 but one Kp ≥ 3o or two Kp values are ≥ 3-. A selected "disturbed day" considered "not really disturbed" is marked by an asterisk (*) if Ap < 20. This ranking method has been used since the responsibility for issuing these selected days was transferred from De Bilt to Göttingen in July 1976. The rankings may be obtained for the months of July - November 1976 by request to WDC-A for Solar-Terrestrial Physics.

A table of Ap indices for the last 12 months is presented so that trends in magnetic activity can be easily followed.

Chart of Kp by Solar Rotations -- Monthly a graph of Kp is given for several solar rotations, furnished through the courtesy of the Geophysikalisches Institut of the University of Göttingen. Annually a graph of the whole year by solar rotations is included. From time to time another 27-day rotation chart depicting the daily geomagnetic character figure, C9, is presented. C9 is obtained from Cp by reducing the Cp-values to integers between 0 and 9 according to the key given in the charts.

Chart of Dst by Solar Rotations -- A plot of Dst values which has been given regularly following the table of Dst, described below, will also be presented on a Bartels Rotation basis corresponding to the Kp presentation. The purpose in making this presentation is to enable conformity with recommendations concerning scale lengths made for the years of International Magnetospheric Study (IMS). Since the vertical scale varies with each month the 100γ interval is illustrated at the end of each month.

Provisional Hourly Values of the Equatorial Dst Index -- The equatorial Dst index at given UT represents magnetic field variations at the dipole equator on the earth's surface, averaged over local time, that are caused mainly by the magnetospheric equatorial currents including the cross-tail current. The reference level of Dst is such that Dst is statistically zero on the days internationally designated as quiet days.

Provisional hourly Dst data are based on hourly values of the horizontal component from four magnetic observatories: San Juan, Honolulu, Kakioka, and Hermanus. These provisional hourly values are replaced by a more definitive annual set of the Dst index at the end of each year. The provisional hourly values are calculated and forwarded for publication by M. Sugiura, NASA-Goddard Space Flight Center, Greenbelt, Maryland 20771 and D. J. Poros, Computer Sciences Corporation, Silver Spring, Maryland.

Principal Magnetic Storms -- Finally a table presents the principal magnetic storms for the month as reported by several observatories through cooperation with the International Association of Geomagnetism and Aeronomy. These are the data formerly published in the Journal of Geophysical Research. They are now, however, grouped by the storm rather than by station. The geomagnetic latitude of the station is indicated. The beginning time is given to the hour and minute in UT.

The type of sudden commencement, if any, together with its magnitude in each element D, H or Z is next in the table: sc = sudden commencement; sc* = small initial impluse followed by main impulse (in this case the amplitude is that of the main pulse only, neglecting the initial brief pulse); dots in these columns represent a storm with gradual commencement; dashes indicate no data entries. Signs of amplitudes of D and Z are taken algebraically; D reckoned positive if toward the east and Z reckoned positive if vertically downward. In the next columns the day and the three-hour periods on that day when the K index reached its maximum are given followed by the K-index value. In the next three columns the maximum ranges in D, H and Z during the storm are given. The ending time is given only to the nearest hour. This is the time of cessation of reasonably marked disturbance movements in the trace. More specifically, it is the time when the K-index measure has diminished to 2 or less for a reasonable period. For each date the data are listed in north-to-south geomagnetic latitude order. The observatories reporting are listed below the table each month. The abbreviations used for the observatory names are as follows:

GEOMAGNETIC OBSERVATORIES

Code	Station	Geomag. Latitude
AA	Addis Ababa	5.3N
AL	Alibag	9.5N
AM	Amberley	47.7S
AN	Annamalainagar	1.5N
AP	Apia	16.0S
BD	Boulder	48.9N
CO	College	64.6N
EB	Ebro	43.9N
FR	Fredericksburg	49.6N
GN	Gnangara	43.2S
GU	Guam	4.0N
HR	Hermanus	33.7S
HO	Honolulu	21.1N
HU	Huancayo	0.6S
HD	Hyderabad	7.6N
IR	Irkutsk	41.0N
JP	Jaipur	17.3N
KG	Kerguelen	56.5S
MB	M'Bour	21.3N
NE	Newport	55.1N
PM	Port Moresby	18.6S
SH	Shillong	14.7N
SJ	San Juan	29.9N
SI	Sitka	60.0N
TO	Toolangi	46.7S
TV	Trivandrum	1.1S
TU	Tucson	40.4N
UJ	Ujjain	13.5N
WI	Witteveen	54.2N

Sudden Commencements and Solar Flare Effects -- These reports are provided by A. Romaña for the International Service of Geomagnetic Indices, International Association of Geomagnetism and Aeronomy, Division V: Observatories, Instruments, Indices and Data. The sudden commencements (s.s.c.) and solar flare effects (s.f.e.) are from magnetograms of the world-wide network of magnetic observatories. The stations, together with their abbreviations, are given in *IAGA Bulletin No. 20* of the International Union of Geodesy and Geophysics as well as the series *IAGA Bulletin No. 32* which contain the yearly compilations of these data. Before January 1966 these reports were published periodically in *Journal of Geophysical Research.* From then until December 1970 they were published quarterly in *Solar-Geophysical Data.*

Beginning with December 1970 these data are published monthly and, thus, are based on fewer reports and differ slightly in detail from the similar data published previously. The decision to publish this less complete report was made in order to make the data available more rapidly. The table gives date and UT time of event with stations by two letter abbreviations grouped by quality A, B or C.

RADIO PROPAGATION QUALITY INDICES (B.52,B.53)

Transmission Frequency Ranges -- The North Atlantic path (Lüchow (53.0°N, 11.2°E) - Norfolk) is represented by six frequencies, 3.357, 4.975, 8.080, 10.865, 16.410, and 20.015 Mhz, recorded continuously. They are shown in a series of diagrams one for each day. The heavy solid lines represent field strength $\geq$ -12 dB above 1 μV/m (transmitter power reduced to 1 kW). Observed field strengths between -12 dB and -40 dB above 1 μV/m are shown by the fine line. These diagrams are based on data reported by the German Post Office through the Fernmeldetechnisches Zentralamt, Darmstadt, Federal Republic of Germany.

Radio Propagation Quality Indices are calculated from the records on five circuits received at Lüchow Federal Republic of Germany, with highly directive rhombic antennas (except the short-haul paths Bracknell-Lüchow and Moscow-Lüchow which are received with non-directional vertical antennas). The quality figures are calculated for a twenty-four hour period (0600 - 0600 UT) using transmissions from Tokyo, Japan; Norfolk, USA; Moscow, USSR; Canberra, Australia; and Bracknell, England. The following frequencies are currently in use:

Tokyo	Norfolk	Moscow
22.770 MHz	20.015 MHz	15.9 MHz
18.220	16.410	11.0
13.597	10.865	7.7
9.970	8.080	5.4
3.622	4.975	3.9
	3.357	

Canberra	Bracknell
19.690 MHz	22.384 MHz
13.920	16.938
11.030	12.844
5.100	9.203
	6.435
	3.289

The index 0.0 corresponds to a median field strength of -30 dB above 1 μV/m (converted to 1 kW and referred to an omnidirectional antenna). The figures are in steps of 5 dB (index 10.0 = +20 dB above 1 μV/m). The field strength of the frequency with the highest value for each hour is used in place of a mean of all recorded frequencies. This is done on the assumption that the optimum frequency would be used for communication.

DATA FOR SIX MONTHS BEFORE MONTH OF PUBLICATION

TABLE OF CONTENTS

ACTIVE REGION SUMMARY (A.6b)

These documents are a preliminary version of the maps of filaments and active regions published biennially by the Paris Observatory. They are prepared from the daily spectroheliograms of the Meudon Observatory (Hα, K_{1V} and K_3) and from filtergrams of the Haute Provence Observatory (Hα). When there are gaps in these observations, they are filled by the complementary Hα and K_{2-3} images from the Kodaikanal (India), Athens (Greece) and Madrid (Spain) Observatories.

I. Map. -- On the map solar meridian and parallels appear as a rectangular grid so that a phenomenon appearing at latitude ϕ has its longitudinal size enlarged proportional to sec ϕ. Choice of the 0° meridian and numbering follows Carrington. A rotation begins at the moment when the 0° meridian coincides with the central meridian.

The longitude of the central meridian of the visible hemisphere at 0h is shown for every day of the rotation by short heavy bars. Some dates are shown for convenience. The longer bars show the longitude of the central meridian at the time of the observations used.

The map presents a synopsis of chromospheric filaments and of active regions with or without sunspots. The schematic line which locates the filaments is obtained by superposition of daily observations. The solid areas inside the double lines correspond to the part of the filament which was observed on more than eight days whether successive days or not. The hatched parts were observed between 4 and 8 days and the parts left blank correspond to a visibility of less than four days. Small size filaments visible only by a single observation are not shown.

Sunspots are shown by small circles with diameters proportional to their size. The adopted diameter corresponds approximately to a maximum diameter observed while the sunspot crosses the visible hemisphere of the sun, measured on the Meudon plates K_{1V} and reduced to the scale of the maps. Facular plages are shown at the moment of the maximum development of the sunspots that they contain, or on the day when the brightness was maximum. This brightness is indicated by four kinds of hatching, the darkest corresponds to the most intense plages, the clearest to highly scattered faculae.

II. Table of Active Regions -- The columns of the table are explained as follows:

1) Identification numbers by rotation. This identification has been used in *IAU Quarterly Bulletin* since 1959 with the lists of published flares to indicate the responsible active regions.

2) Mean co-ordinates for each active region.

3) Age, given in days in relation to central meridian passage. Example: A center is >6 days old when it was born before appearing at East limb. The number of days is preceded by + if it was born before passage at central meridian, by - if it was born between the central meridian and the West limb.

4) Importance on a scale of 1 to 10. The value given takes into account the persistence, the number and the size of sunspots and the size of the facular plage. Ephemeral plages or the very scattered ones are outlines on the maps but are not mentioned in the table.

5) Indication (x) that no visible sunspots on K_{1V} Spectroheliograms have been observed in this center during the passage.

6) Identification of the center in the preceding rotation if the active region is a return one.

7) State of activity in the center during the passage at the West limb.

Hα SOLAR FLARES
(C.1ba, C.1e, C.1d)

From January 1968 the flare reports published six months after observation were divided into two tables labeled "confirmed" and "unconfirmed". This separation was felt desirable in 1968 to present the most homogeneous and reliable flare data for use by the scientific community. However, it has become apparent that for small events, which currently constitute the majority of reports, such discrimination is questionable. Therefore, beginning with the January 1975 data, all reported Hα flares are published in one chronological list.

The listing is prepared in cooperation with DASOP (Department d'Astronomie Solaire et Planetaire), Observatoire de Paris, 92190 Meudon, France. For each event there is a "group report" line more closely resembling the presentation of the flares as they will be published in the *IAU Quarterly Bulletin on Solar Activity (QBSA)*. In *Solar-Geophysical Data* the flares as reported by the individual observatories follow the "group report" line. In *QBSA* only the summary of the observatory contributions is included.

The "group report" line is intended as a summary of all individual reports. The principal criteria for grouping reports together are flare position and times. The following new rules have been adopted to determine times, areas and importances of grouped events:

-- The beginning time is the time of first observation of an event by an observatory. If there is uncertainty in the beginning time, it is indicated by a "+" sign followed by the difference in minutes between the time of the first observation and the time of the latest observed beginning. More than 9 minutes difference appears as >9. The same applies for times of maximum. When only one observatory has reported the flare the uncertainty in time cannot be determined. When two or more maxima are identified, their times are reported with the same group line. The ending time is an average time of the reported ends.

-- With near agreement among observatories an average of the areas is used in determining importance.

-- With widely varying area measurements reported by several observatories the average area is not computed. The importance is estimated from the reported importances. An importance 1 or more is assigned only when reported by several observers or when only a single observatory is operating at the time of observing such a flare.

-- When only one observatory has reported a flare the measured and corrected areas must be considered somewhat questionable. There is no way to confirm their accuracy and it has been noted that measurements vary considerably from one observatory to another.

-- A question mark (?) as a flare importance may result from a questionable report of importance 1 or more when one of the following conditions exists.

  (1) The reported importances show too much scatter.
  (2) Disagreement exists on the classification of the event. An event reported as a flare by one observer may be identified by another observer as a different type of event (e.g. Bright Surge at Limb)
  (3) Only one observatory reports the event even though several are observing at that time. No confirmation of the event was obtained from queries sent to those with cinematographic patrols. These observatories are listed followed by "2" when a second look at their film was made or by "1" when there was no second evaluation.

The individual flare reports serve to show the detail of the times, areas, and importances as summarized in the grouped events.

The columns in the table are as follows:

-- Group Number and Reporting Observatories using IAU abbreviation (see p.42).
-- The Universal date.
-- Beginning time in UT.
-- Time of maximum phase in UT. (more than one maxima may be listed)
-- Ending time in UT.
-- The heliographic coordinates in degrees for the "center of gravity" of the emission region, corresponding to the time of maximum intensity.
-- The distance from the center of disk in units of disk radius.
-- McMath serial number of the associated plage region.
-- The time of central meridian passage of the position of the flare in tenths of the Universal date.
-- Duration in minutes.
-- The flare importance on the IAU scale of Sf* to 4b. (In summary line for the group a "?" will be used when there has been too much discrepancy among individual reports to determine accurately the probable importance of the event).
-- Observing conditions where 1 means poor, 2 fair, and 3 good. (Observatories at Ramey, Palehua, Athenes and Tehran use a scale of 1-5).
-- Nature and completeness of available observations where

  C = a complete, or quasi-complete sequence of photographs was obtained,
  P = one or a few photographs of the event were obtained resulting in incomplete time coverage,
  V = all (or most of) the development of the flare was visually observed or,
  S = flare was seen visually for a small part of its probable duration.

-- Time of measurement for tabulated areas.
-- Apparent (i.e., projected area at time of maximum brightness in millionths of solar disk -- this is not necessarily the maximum area. (Prior to January 1975 this measured area in millionths was divided by 97 and was indicated as heliographic square degrees, hence the tabular heading was incorrect and should have been millionths/97).
-- Corrected area in square degrees.
-- Remarks in the IAU system of notes where

  A = Eruptive prominence whose base is less than 90° from central meridian.
  B = Probably the end of a more important flare.
  C = Invisible 10 minutes before.
  D = Brilliant Point.
  E = Two or more brilliant points.

* For easier visual selection of the more important flares a minus sign, "-", is used to indicate subflares instead of "S".

F = Several eruptive centers.
G = No visible spots in the neighborhood.
H = Flare accompanied by a high speed dark filament.
I = Active region very extended.
J = Distinct variations of plage intensity before or after the flare.
K = Several intensity maxima.
L = Existing filaments show signs of sudden activity.
M = White-light flare.
N = Continuous spectrum shows effects of polarization.
O = Observations have been made in the calcium II lines H or K.
P = Flare shows helium D_3 in emission.
Q = Flare shows the Balmer continuum in emission.
R = Marked asymmetry in Hα line suggests ejection of high velocity material.
S = Brightness follows disappearance of filament (same position).
T = Region active all day.
U = Two bright branches, parallel (11) or converging (Y).
V = Occurrence of an explosive phase: important and abrupt expansion in about a minute with or without important intensity increase.
W = Great increase in area after time of maximum intensity.
X = Unusually wide Hα line.
Y = System of loop-type prominences.
Z = Major sunspot umbra covered by flare.

Intervals when no observatory reported times of patrol observation are listed chronologically in the table.

The dual importance scheme used, which was adopted January 1, 1966 by IAU Commission 10, is summarized in the following table:

"Corrected" area in square degrees	Relative Intensity Evaluation Faint(f)	Normal(n)	Brilliant(b)
≤2.0	Sf	Sn	Sb
2.1 - 5.1	1f	1n	1b
5.2 - 12.4	2f	2n	2b
12.5 - 24.7	3f	3n	3b
>24.7	4f	4n	4b

The area to be used in assigning the first figure of the dual importance is the area of the flaring region at the time of maximum brightness. The observatory measures apparent area in millionths of the solar disk. For flares less than 65° from the center of the solar disk, the formula relating apparent and corrected area is

$$\text{"corrected" area} = \frac{\text{apparent area}}{97} \times \sec \Theta$$

where apparent area is in millionths of the disk and corrected area is in heliographic square degrees. For flares more than 65° from the center, the "sec Θ law" becomes unsatisfactory. The first importance figure can be estimated from the table below where areas are given in millionths of the disk.

Angle	Limit S-1	Limit 1-2	Limit 2-3
0°	200	500	1200
---	sec Θ law	sec Θ law	sec Θ law
65°	90	280	600
70°	75	240	500
80°	50	180	350
90°	45	170	300

The intensity scale shown as the second importance figure is only a qualitative one where each observatory uses its experience to decide if a flare is rather faint (f), normal (n), or rather bright (b).

SOLAR FLARE OBSERVATORIES

COMPUTER CODE NO.	OBS. TYPE	I.A.U. ABBREV.	NAME, PLACE AND COUNTRY
824	C	ABST	ABASTUMANI,GEORGIAN SSR
512	VP	ARCE	ARCETRI,FLORENCE,ITALY
508	VC	ATHN	NATL OBS.,ATHENS,GREECE(USAF)
560	VC	BUCA	NATL OBS.,BUCHAREST,ROMANIA
570	VC	CATA	CATANIA,ITALY
402	C	CULG	CULGOORA,AUSTRALIA
478	C	HALE	HALEAKALA,MAUI,HAWAII,USA
537	VP	HERS	R.GREENWICH OBS.,HERSTMONCEUX,ENGLAND
563	C	HTPR	HAUTE-PROVENCE,FRANCE
718	C	HUAN	GEOPHYSICAL INST.,HUANCAYO,PERU
517	V	HURB	HURBANOVO,CZECHOSLOVAKIA
358	V	ISTA	UNIV.OBS.,ISTANBOUL,TURKEY
627	VP	KHAR	KHARKOV,UKRANIAN SSR
828	C	KIEV	KIEV,GAO,UKRANIAN SSR
309	V	KODA	KODAIKANAL,INDIA
522	VP	LOCA	LOCARNO,SWITZERLAND
876	C	LVOV	LVOV,UKRANIAN SSR
468	VC	MANI	MANILA,PHILIPPINES
642	C	MCMA	MCMATH-HULBERT,PONTIAC,MICHIGAN,USA
505	C	MEUD	MEUDON,FRANCE
314	C	MITK	MITAKA,TOKYO,JAPAN
555	C	MONT	MONTE MARIO OBS.,ROME,ITALY
476	VC	PALE	PALEHUA,HAWAII,USA
648	VC	RAMY	RAMEY SOLAR OBSERVATORY,RAMEY AFB,PUERTO RICO
833	VC	TACH	TACHKENT,UZBECK SSR
341	VP	TEHR	TEHRAN,IRAN
514	C	UPIC	UPICE,CZECHOSLAVAKIA
834	VC	VORO	VOROSHILOV,USSR
546	VP	WEND	WENDELSTEIN,GFR
523	PC	ZURI	EIDGENOSSISCHE STERNWARTE,ZURICH,SWITZERLAND

The above table gives the solar flare observatories presently cooperating in international data interchange through the World Data Centers as originally established during the International Geophysical Year. For each observatory are given the code numbers used on the punched cards at NOAA; the four letter IAU abbreviations; name, place and country; and type of patrol where C, V and P have the meanings explained above.

Note: *All the flare data are recorded on punched cards. Copies of tabulations from them or magnetic tapes of the data are available at cost through the World Data Center A for Solar-Terrestrial Physics, NOAA, Boulder, Colorado U.S.A. 80302.*

Flare Index -- The daily flare index is defined as

$$I_f = \frac{.76}{T^*} \sum A_d^2$$

where individual flare areas A_d are measured in millionths of solar disk. T^* is the effective observing time in minutes. I_f corresponds closely to the flare index developed at the High Altitude Observatory to measure the integrated intensity of flare radiation. The flare areas are not corrected for geometric foreshortening, so the definition of I_f places great weight on large flares located near the center of the sun's disk. Characteristics of the index I_f are discussed in more detail in the paper by C. Sawyer "Daily Index of Solar Flare Activity" [*J. Geophys. Res.*, *72*, 385, 1967].

The table lists the date, index and actual hours of observation included in the calculation and follows the table of Solar Flares. Beginning with the January 1975 data, this index is calculated using all flares. Previously it had been calculated using only those confirmed flares of greater than 1 square degree in area, as then included in the *IAU Quarterly Bulletin on Solar Activity*.

A regional flare index is described in the text for the data for seven months before month of publication on page 57.

Patrols -- Following the tables a graph of the intervals of no flare patrol observation for all the observatories included in the total patrol is given. The graph is divided into visual and cinematographic patrols. (See page 10 for more detail.)

SOLAR RADIO WAVES (C.3)

Outstanding Occurrences -- Solar radio emission bursts at fixed frequencies are reported by the worldwide network of observing stations. By the sixth month following observation, it is expected that all reports have been received and the data are published in table form in *Solar-Geophysical Data*. From time to time selected solar bursts are illustrated.

The code name used in this publication to identify the station, its alternate station names, if appropriate, the geographic coordinates, and frequencies in MHz on which the station reports are presented in the table on page 49.

In the data presentation, bursts reported from different observing stations are joined by brackets when they occur near the same time. Each set of brackets may not always include all of the solar event. The frequency in MHz precedes the abbreviated station name. Following the name is given the type of event. The Type consists of two columns. The first column is the morphological *SGD* numerical code which has been used in *Solar-Geophysical Data*, and the second column is the letter symbol for easier recognition of type. The use of the letter symbol began with the January 1975 data. In the case of OTTA and PENT observations, letters are sometimes appended to the *SGD* numerical code. See page 47 for explanations. For each event start and maximum phase in UT, duration in minutes, and peak and mean flux densities in $10^{-22}Wm^{-2}Hz^{-1}$ are listed. Information on polarization, positions and other remarks are included in the final column.

Both the tables and illustrations prepared by H. Tanaka, as a part of the *Instruction Manual for Monthly Report*, and a table of definitions with a page of illustrations prepared by A. Covington are included here. It is felt that though the meanings are essentially the same, the two viewpoints may aid experimenters in interpreting how the symbols are assigned to bursts by the various observatories. Two possibly confusing items seem to remain. Covington feels those GRF bursts with obvious flat tops are a new type of burst best listed under 27(RF) rather than with the GRF symbol since it is also defined as more or less regular rise and fall of continuum with long duration. The illustration of the 10 cm wavelength "Group" with the letter code "SER" may also prove confusing as Covington feels it should rightfully be listed with the *SGD* number code 41 rather than 42(SER).

The modifications appended to the *SGD* numerical code for Ottawa and Penticton observations are given here as explained by A. E. Covington, National Research Council, Canada. The letter A added to a Simple event recognizes the longest duration event superimposed upon a long duration event. The use of A enables a marginal line to be placed against the entry for the start and extended to include the superimposed events. The presence of unlisted fluctuations or variations which slightly modify the basic form are denoted by the letter F added to the *SGD* numerical code for the event so modified. Records observed simultaneously at widely separated stations have led to the recognition of unique variations of small intensity such as the Rise Only event (which can sometimes be regarded as a discontinuity in the daily level), the absorption only event, the GRF of great duration, isolated events of short duration or spikes, and the single cycle of a sinusoid. Clarification of some of the profiles follows. To identify Rise Only encode as 240, and to identify the Post Rise enhanced level following the rise encode as either 24P or 25P. Typical profiles based upon the new IAU letter symbols and the modifications suggested are shown in idealized form in the Figure on page 48, identified by the *SGD* numerical code and underlined letters. The various systems are related as indicated by the key to the figures.

At Sagamore Hill an automated data correction and handling system was integrated into the patrol operation in June 1974. After being subjected to an extended period of evaluation, it is currently functioning as a regular part of the patrol operation. This automated data system provides real time burst integrated flux densities, a quantity which has been found to be of great value in predicting the occurrence and magnitude of PCA phenomena.

In the Descriptive Texts published before 1975 details were given concerning equipment used at Western Hemisphere Observatories. Although these are no longer included in the text, information concerning equipment and data reduction may be obtained from the World Data Center A for Solar-Terrestrial Physics or from the observatories.

Event Types According to the *Instruction Manual for Monthly Report*
(prepared by H. Tanaka for ICSU-STP-IAU)

The key for identifying types of event by numerical SGD code and letter symbol.

SGD Code	New Letter Symbol	Morphological Classification	URANO Code	Remarks
1	S	Simple 1	1	
2	S/F	Simple 1F	1	S + F
3	S	Simple 2	1	
4	S/F	Simple 2F	1	S + F
5	S	Simple	1	
6	S	Minor	0	Defined as simple rise and fall of minor burst with duration 1 or 2 min.
7	C	Minor+	0	Defined as minor burst with second part.
8	S	Spike	1	Self-evident by duration.
20	GRF	Simple 3	1	
21	GRF	Simple 3A	1	A means underlying. Clearly superposed burst is to be listed separately, but separation is sometimes difficult and arbitrary. In such cases list as C.
22	GRF	Simple 3F		Fluctuations of short periods be listed separately.
23	GRF	Simple 3AF	1	
24	R	Rise	8	
25	R	Rise A	8	
26	FAL	Fall		
27	RF			
28	PRE	Precursor		
29	PBI	Post Burst Increase	2	
30	PBI	Post Burst Increase A	2	
31	ABS	Post Burst Decrease		
32	ABS	Absorption		
40	F	Fluctuations	4	
41	F	Group of Bursts	4	A group of minor bursts close to each other.
42	SER	Series of Bursts	4	A series of bursts occur intermittently from base level with considerable time intervals between bursts.
43	NS	Onset of Noise Storm	7	To be listed with starting time, and duration with symbol D.
44	NS	Noise Storm in Progress	7	Starting time with symbol E, and duration with symbol D.
45	C	Complex	3	
46	C	Complex F	3	
47	GB	Great Burst	3	
48	C	Major	5	Defined as complex variation of intensity with large amplitude
49	GB	Major+	6	Major increase of flux with duration greater than 10 min.

Explanation of letter symbols.
Basically, microwave bursts can be classified into the following types:

- S = Simple : Mostly nonthermal 'microwave impulsive burst' or 'decimetric burst' (see p. 31).
- C = Complex : Combination of a few or many simple bursts.
- F = Fluctuation : Minor C sometimes superposed in the main burst.
- GB = Great Burst : Major C of special importance.
- PRE = Precursor : Preburst activity connected to the main burst.
- PBI = Post Burst Increase : Tail of the main burst which may be regarded as enhancement of S-component.
- GRF = Gradual Rise and Fall : Temporal enhancement of S-component or similar activation in the flaring region. It may sometimes start with relatively sharp rise like a simple burst. If this sharp rise can be clearly recognized as simple burst, GRF becomes PBI. Note that both have similar characteristics.
- ABS = Absorption : Absorption due to surge-like material mainly appears after the burst and is sometimes called post-burst decrease. This phenomenon may occur frequently, but it can only be recognized when the flux comes down to preburst level. Temporal fall of flux which is sometimes called negative burst may be listed as ABS, but it may simply be the temporal fall of emission.

The following three symbols are simply morphological, which may be necessary due to limited observation time, or for the simplicity of tabulation:

- R = Rise : This may also occur as the onset of long-enduring enhancement of S-component associated with other solar events.
- FAL = Fall
- SER = Series of Bursts

On dm-m-Dm wavelength range, most of the events may be C with F, GB, and PRE as more specific descriptions. The following two symbols were prepared for this range:

- NS = Noise Storm
- RF = Rise and Fall : Defined as more or less irregular rise and fall of continuum with duration of the order of minutes to an hour.

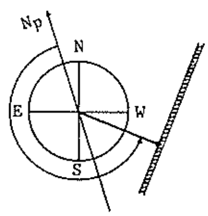
S, FAL and SER may also be used.

These types are illustrated in tables beginning on the following page in which samples from different sources are compared.

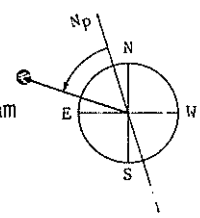
Polarization information is denoted by the letters R (right-handed) or L (left-handed). The degree of polarization in percent is shown in two digits. When precise values are not available, the degree of polarization is expressed in symbols, W = weak, M = moderate or S = strong. For example, 83R means 83% right-hand polarization, and SL means strong left-hand polarization.

Positional information is indicated by the letters F (fan-beam) or P(pencil-beam). Position angle is shown in the first three digits, and radial distance is shown by the following three digits. For example, 135120F means -- position angle = 135°, radial distance = 120% of solar radius observed by fan beam.

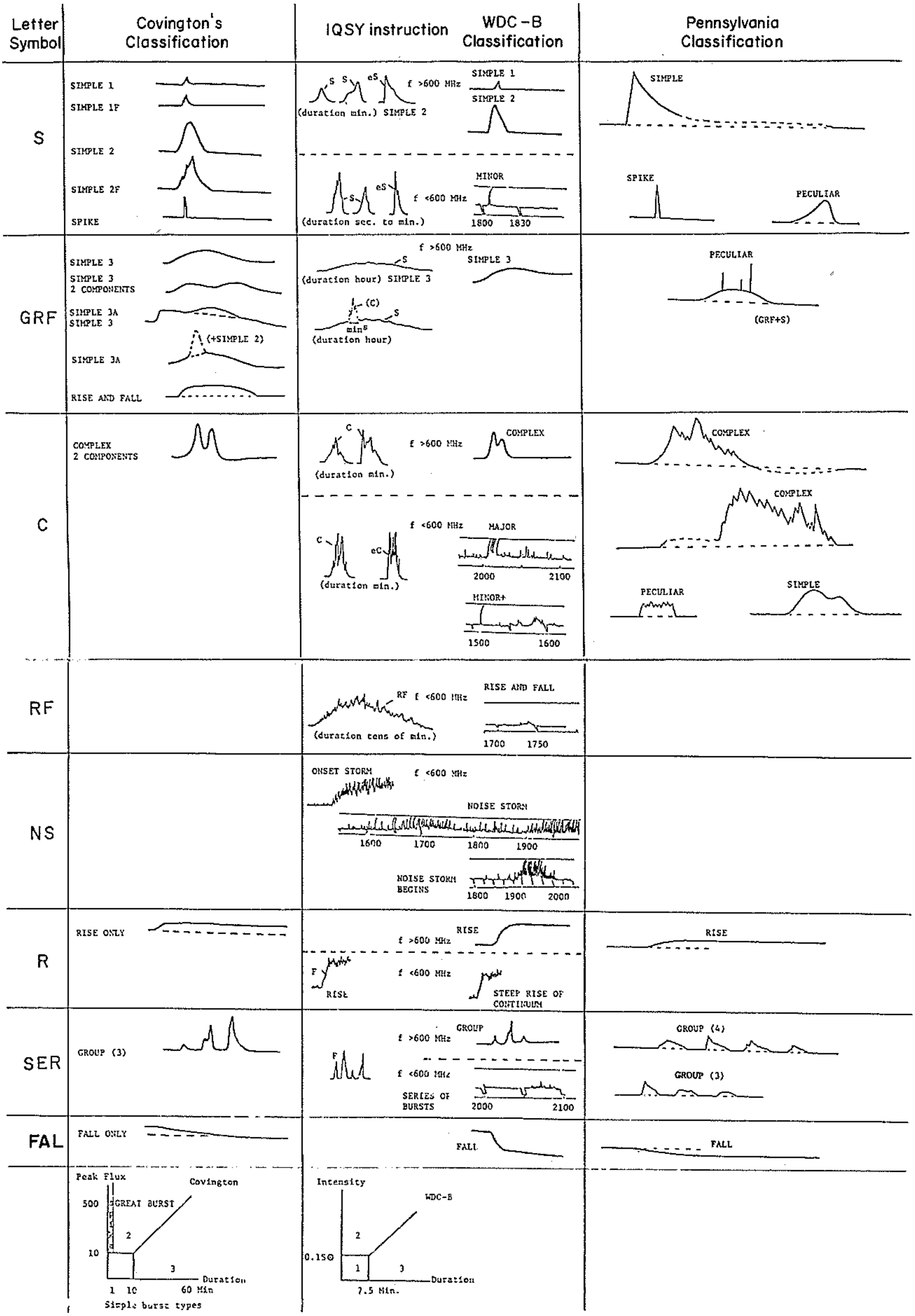
Fan Beam

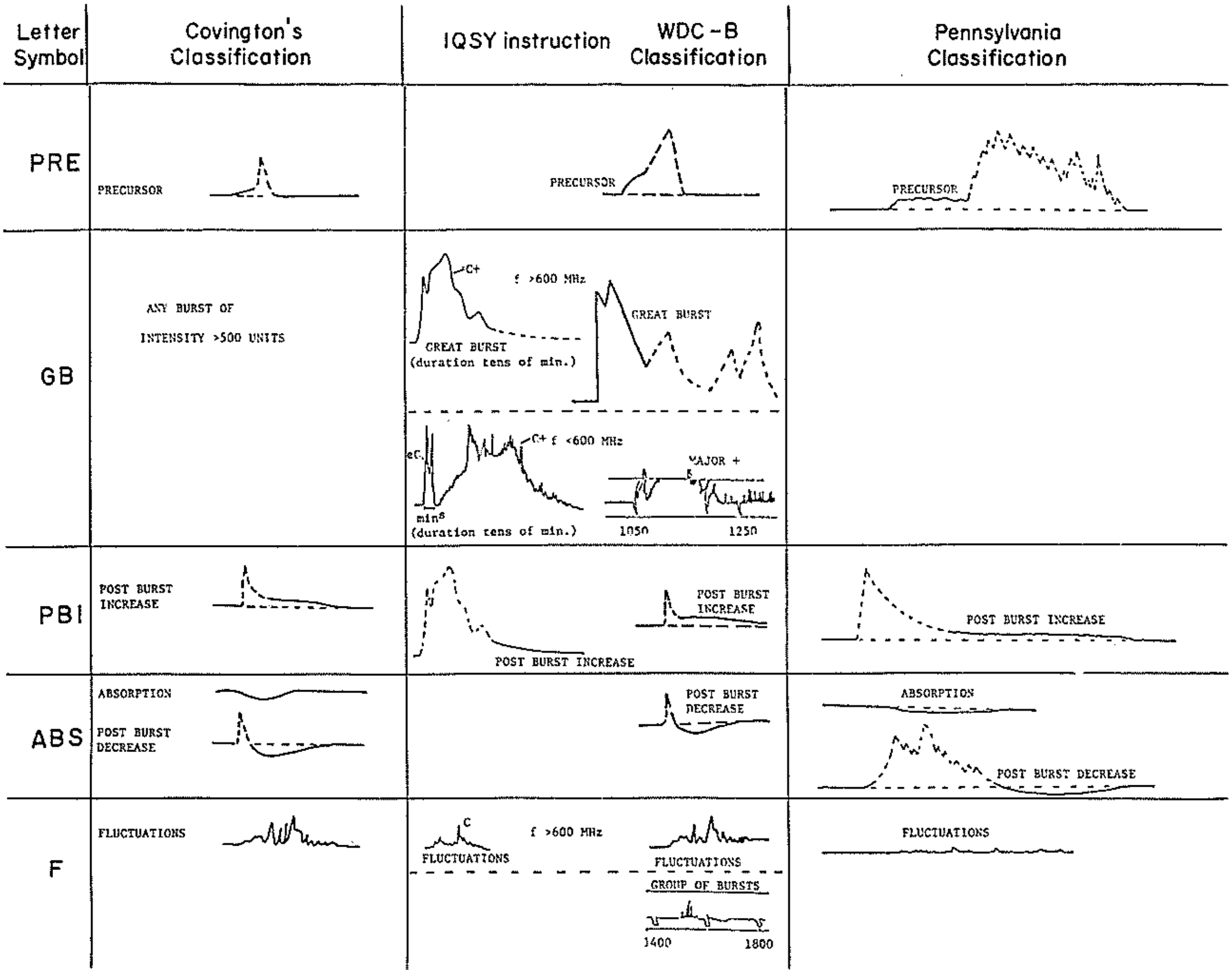


Pencil Beam



A *Selected Bibliography with Comments Related to Evolution of Burst Profiles at 2700-2800 MHz* has been compiled by A. E. Covington. A copy can be made available, on request, from the World Data Center A for Solar-Terrestrial Physics.

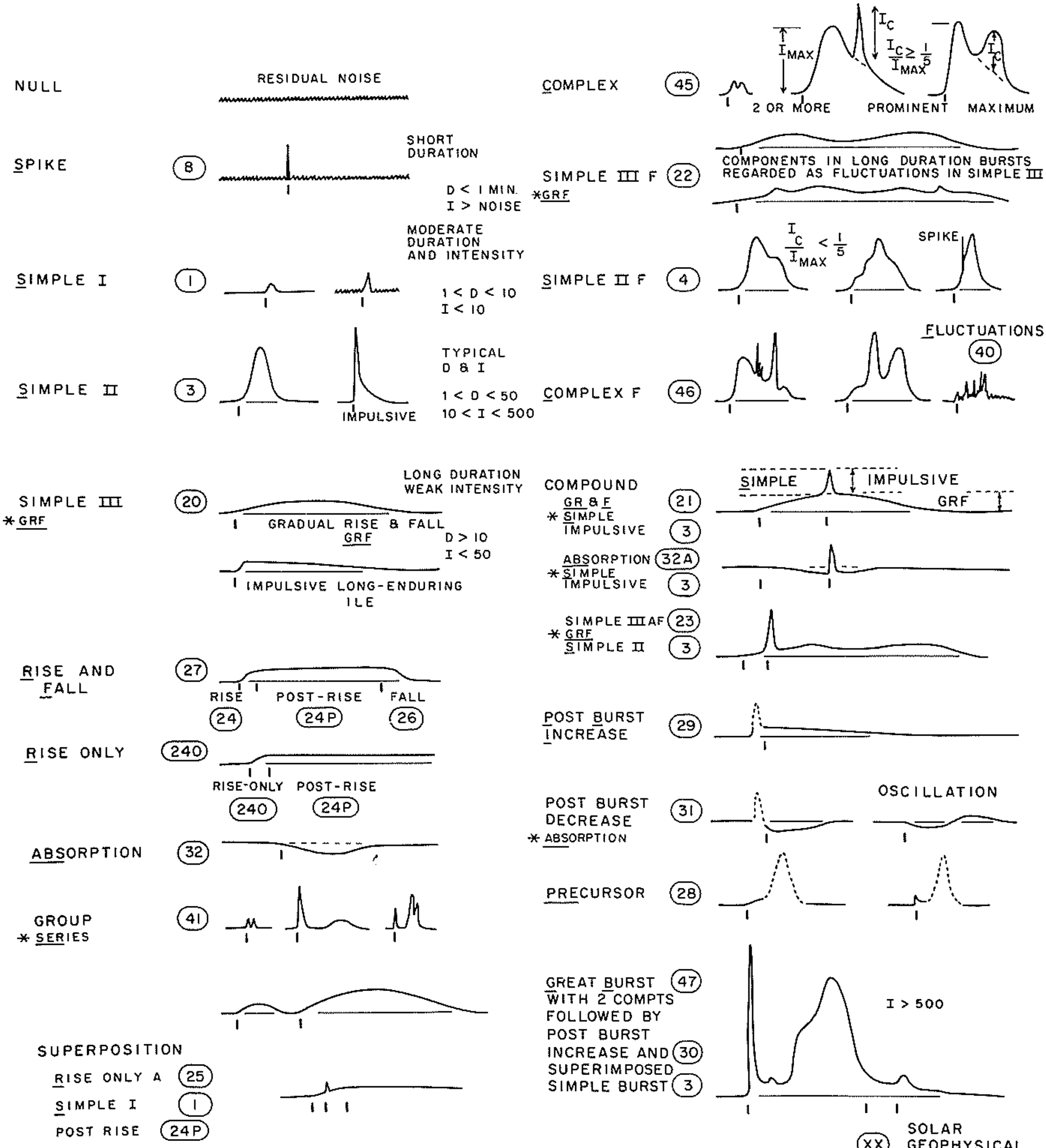

Letter Symbol
Covington's Classification
IQSY instruction
WDC-B Classification
Pennsylvania Classification
S
SIMPLE 1
SIMPLE 1F
SIMPLE 2
SIMPLE 2F
SPIKE
f >600 MHz
(duration min.) SIMPLE 2
f <600 MHz
(duration sec. to min.)
MINOR
1800 1830
SIMPLE
PECULIAR
GRF
SIMPLE 3
SIMPLE 3 2 COMPONENTS
SIMPLE 3A SIMPLE 3
(+SIMPLE 2)
SIMPLE 3A
RISE AND FALL
(duration hour) SIMPLE 3
(duration hour)
(GRF+S)
C
COMPLEX 2 COMPONENTS
COMPLEX
(duration min.)
MAJOR
2000 2100
MINOR+
1500 1600
RF
RISE AND FALL
(duration tens of min.)
1700 1750
NS
ONSET STORM
NOISE STORM
1600 1700 1800 1900
NOISE STORM BEGINS
1800 1900 2000
R
RISE ONLY
RISE
STEEP RISE OF CONTINUUM
SER
GROUP (3)
GROUP
SERIES OF BURSTS
2000 2100
GROUP (4)
FAL
FALL ONLY
FALL
Peak Flux
Covington
500
GREAT BURST
10
Duration
1 10 60 Min
Simple burst types
Intensity
WDC-B
0.15Q
Duration
7.5 Min.



Covington Additions to Tanaka's Proposed IAU Key

SGD Code	New Letter Symbol	Morphological Classification	Remarks
1A	S	Simple 1A	Single simple burst any duration and intensity. Event separable from other superimposed bursts.
3A	S	Simple 2A	
21A	GRF	Simple 3A GRF	
2A	S/F	Simple 1AF	Single simple burst any duration and intensity. Event separable from other superimposed bursts. Unlisted minor departures and fluctuations.
4A	S/F	Simple 2AF	
240	R	Rise only	Discontinuity in daily level without observed restoration, any cause.
240F	R	Rise only F	With unlisted fluctuations.
24P	R	Post Rise	Post Rise enhanced level.
24PF	R	Post Rise F	Post Rise enhanced level with unlisted fluctuations.
26A	FAL	Fall A	Fall with listed superimposed event.
260	FAL	Fall Only	Fall only as discontinuity in daily level.
26F	FAL	Fall F	Fall with unlisted minor fluctuations.
27F	RF	Rise and Fall F	Rise and Fall with unlisted minor variations and fluctuations.
27AF	RF	Rise and Fall AF	Rise and Fall with listed superimposed events and unlisted minor variations and fluctuations.
31A	ABS	P.B. Decrease A	Post Burst Decrease with listed superimposed event.
32A	ABS	Absorption A	Absorption with listed superimposed emissive event.
46F	C	Complex F	Complex event with fluctuations.

2800-2700 MHz
SOLAR BURST PROFILES



(2) - SIMPLE IF-EVENT DIFFICULT TO OBSERVE - NOT ILLUSTRATED

(40) - FLUCTUATIONS - ORIGINALLY PERIOD OF IRREGULAR ACTIVITY

X - I. A. U. LETTER SYMBOL SELECTED FROM EXISTING OR ADDITIONAL WORD INDICATED BY *

(XX) SOLAR GEOPHYSICAL DATA CODE

(XXα) MODIFIED CODE

I START

AEC
1974-5-6

Solar Radio Observatories
(Fixed Frequency Observations)

CODE NAME	STATION	ALTERNATE NAME	GEOGRAPHIC LAT	GEOGRAPHIC LONG	FREQUENCIES REPORTED (MHz)
ABST	Abastumani		42N	43E	221
ARCE	Arcetri		44N	11E	9240, 2830, 1420
ATHN	Athens		38N	24E	8800, 4995, 2695, 1415
BERN	Berne		47N	07E	10500
BORD	Bordeaux	Floriac	44N	01W	930
BOUL	Boulder		40N	105W	4995, 2695, 1420
CRIM	Simferopol	Crimea	44N	34E	3100
DWIN	Dwingeloo		53N	06E	250, 160
GORK	Gorky	Zimenki	56N	44E	9100, 2950, 950, 650, 200, 100
HARS	Harestua	Blindern	60N	10E	228
HIRA	Hiraiso		36N	140E	500, 200, 100
HUAN	Huancayo		12S	75W	9400
IRKU	Irkutsk	Siberian IZMIR	52N	104E	9650
IZMI	Moscow IZMIRAN	Krasnaja Pakhra	55N	37E	207
KIEL	Kiel		54N	10E	1420, 1030, 800, 602, 405, 240
KIEV	Kiev		50N	30E	550, 188
KISV	Kislovodsk		43N	42E	15000, 6100
MANI	Manila		14N	121E	8800, 4995, 2695, 1415, 606,
MCMA	McMath-Hulbert		42N	83W	18
ONDR	Ondrejov		49N	14E	808, 536, 260
OTTA	Ottawa ARO	Algonquin	45N	78W	2800
PALE	Palehua		21N	158W	8800, 1415
PENN	Penn. State Univ.		41N	78W	10700, 2700, 960
PENT	Penticton		49N	119W	2695
POTS	Potsdam	Tremsdorf	52N	13E	510, 234, 113, 1470, 3000, 9500
SAOP	Sao Paulo		22S	46W	7000
SGMR	Sagamore Hill		42N	71W	35000, 15400, 8800, 4995, 2695, 1415, 606, 410, 245
SLOU	Slough		51N	00E	71000, 37000, 19000, 9400, 2800
SYDN	Sydney		34S	151E	1420, 720
TORN	Torun		53N	19E	127
TRST	Trieste		46N	14E	408, 237
TYKW	Toyokawa		34N	137E	9400, 3750, 2000, 1000
UCCL	Uccle	Humain	50N	04E	600
UPIC	Upice		50N	16E	29, 33
VORO	Voroshilov	Ussurisk	43N	132E	2930, 207

ENERGETIC SOLAR PARTICLES AND PLASMA
(A.12e, A.13e)

A series of data plots are presented using data obtained on the NASA spacecraft IMP 7 and IMP 8. The purpose of the plots is to convey on as near continuous a basis as possible the state of the interplanetary particle environment. The plots consist of hourly averaged solar wind plasma parameters and representative fluxes of energetic electrons, protons, and alpha particles.

Plasma plots are generated at MIT. Energetic particle flux plots are generated at the National Space Science Data Center (Code 601, Goddard Space Flight Center, Greenbelt, Maryland 20772) from machine sensible hourly averaged fluxes given in $(cm^2 \text{ ster sec MeV/n})^{-1}$ provided by several experimental groups. Updated composite magnetic tapes are available at NSSDC, as are 35 mm microfilm flux plots with standard International Magnetospheric Study scalings.

IMP 7 (Explorer 47, IMP H) was launched into a near-circular geocentric, ∿ 12 day, orbit at

30-40 R_E on September 23, 1972. IMP 8 (Explorer 50, IMP J) was launched on October 26, 1973 into a similar orbit. The two spacecraft were instrumented to measure the plasmas, fields, and energetic particle fluxes found in the interplanetary medium and in the distant magnetosheath and magnetotail. The relative orbital phase of the two spacecraft evolved such that the percent of each 12-day period during which at least one spacecraft was in the interplanetary medium was 100% until mid-1975, decreased to a minimum of about 65% near January 1976, and returned to 100% in late 1976.

Due to the relatively large number of flux plots, multiple traces are graphed on individual frames. Accordingly, the statistical error bar associated with each data point is omitted in order to maximize cleanliness of plot. To compensate for this, only data points with statistical uncertainties of about 20% or less are plotted. As this corresponds to 25 counts ($1/\sqrt{25} = 20\%$), averages of hourly fluxes are taken over a sufficient number of hours to assure that the longer term averaged flux corresponds to at least 25 incident particles. In this process it is assumed that during each hour for which a flux is given, the instrument was counting for a full 60 minutes. This assumption is rarely significantly in error, and, after the first two months of data submission, only data for hours during which at least 30 minutes of counting occurred were provided to NSSDC. Such >1-hour - averaged fluxes are plotted as a series of apparent hourly fluxes of the common value. The reader is cautioned against interpreting such a series of apparently constant flux values as representing a physically real time-independence in the flux level.

In order to preserve particle event onset-time information low flux averages are terminated whenever the flux for a single hour exceeds that associated with 50 counts.

Data gaps in the data are distinguished by the lack of connecting lines between data points.

The purpose of the IMP data plots is to convey on as near continuous a basis as possible the state of the interplanetary particle environment. As such, IMP 7 and IMP 8 data have been interspersed for the Caltech and JHU/APL modes. Such an interspersal is not feasible for the U. of Maryland mode due to a disparity in energy windows, and is not required for the U. of Chicago and GSFC modes due to the negligible magnetotail modulation of the high rigidity particles involved in these modes.

Plasma plots contain data only for hours during which the appropriate spacecraft was beyond the earth's bow shock. These interplanetary identifications are made by a visual inspection of preliminary data plots at MIT. On the two lowest energy proton plots, fluxes obtained in the magnetotail during hours when no interplanetary values are available are distinguishable. For only the 0.16 - 0.22 MeV protons is there a significant probability that the fluxes so plotted will be significantly different than the interplanetary fluxes. Predicted times of model bow shock crossings are used for these energetic proton plots.

Plasma Data -- Hourly averaged plasma parameters (bulk speed, proton number density, most probable thermal speed), determined from the MIT plasma experiments on IMP's 7 and 8, are provided by H. Bridge, A. Lazarus and J. Sullivan of the Massachusetts Institute of Technology. The instrument is a split-collector, modulated-grid Faraday cup designed to measure the positive ion component of the solar wind. Particle fluxes in 24 contiguous energy channels and in 14 angular sectors are measured every 15 seconds (IMP 7) or 30 seconds (IMP 8). The hourly averages are based on preliminary plasma parameters computed by fitting the observations to a convected, isotropic Maxwellian distribution function. The error bars on each plotted data point indicate the standard deviation of the data contributing to the hourly average. Note that the thermal speed plot has scales for both thermal speed (left side) and temperature (right side).

Energetic Particle Data -- The sources and some characteristics of the energetic particle data are summarized in Table 1. The geometric factors are in some cases average values over the indicated energy ranges. Neglect of energy dependence in geometric factors leads to an error whose magnitude depends on sensor geometry and ambient particle spectrum. Thus for the highest energy proton mode which uses a non-curved, relatively thick sensor, a flux ∿5% too high is found for an E^{-4} spectrum. Typically, smaller errors are made for other modes.

TABLE 1

SPECIES	ENERGY (Mev/n)	GEOMETRIC FACTOR (cm^2 ster)	MULTI-PARAMETER ANALYSIS?	SOURCE
Electrons	1-5	0.07 to 1.6 (see text)	yes	Caltech.
Protons	0.16-0.22	0.03	no	U. of Md.
Protons	0.97-1.85	1.51	no	JHU/APL
Protons	4.0-12.5	0.07 or 0.23 (see text)	yes	Caltech.
Protons	13.7-25.2	0.32	yes	JHU/APL
Protons	19.8-40.1	3.13	yes	GSFC
Protons	40.1-81.8	2.68	yes	GSFC
Alphas	11-20	2.05	yes	U. Chicago
Alphas	20-25	2.05	yes	U. Chicago
Alphas	25-90	2.05	yes	U. Chicago

The "Multi-Parameter Analysis?" column indicates whether multi-parameter analysis (typically dE/dx vs. E) is used in flux determination. Such analysis permits unambiguous identification of particle species [see, for example, discussion in Garcia-Munoz *et al.*, *Astrophys. J.*, *184*, 967, 1973] but is generally not feasible for particles which have insufficient energy to penetrate one sensor and reach a second sensor. As discussed below, however, an attempt has been made to remove the non-proton component from the 0.97 - 1.85 MeV proton fluxes.

Fluxes in units of $(cm^2 \text{ ster sec})^{-1}$ have been obtained by folding together count rates, geometric factors, and, where appropriate, pulse height analysis data. These fluxes are then divided by the width of the energy window to yield the differential fluxes plotted. The ratio of these average differential fluxes, to the "true" differential flux at the midpoint of the energy range E_1 to E_2, is indicated in Table 2 for E^{-n} spectra and for $R = E_2/E_1$. Alternatively, one can ask at what energy within the E_1 to E_2 interval is the true differential flux equal to the average differential flux. The ratio of this energy $[(n-1)\ (E_2-E_1)/(E_1^{1-n} - E_2^{1-n})]$ to the midpoint energy $(\frac{1}{2}\ (E_1 + E_2))$ is given in Table 3. It is clear from these tables that great care must be used when obtaining spectral parameters from fluxes resulting from wide energy windows at times of steep spectra.

TABLE 2

RATIO OF AVERAGE TO TRUE DIFFERENTIAL FLUX AT MIDPOINT OF ENERGY INTERVAL

n \ R	1.3	1.6	2	3
0.5	1.0021	1.0068	1.0146	1.0353
2	1.0173	1.0563	1.1250	1.3333
5	1.0893	1.3110	1.7798	3.9506

TABLE 3

RATIO OF ENERGY AT WHICH TRUE FLUX = AVERAGE FLUX TO MIDPOINT ENERGY

n \ R	1.3	1.6	2	3
0.5	.9957	.9865	.9714	.9330
2	.9914	.9730	.9428	.8660
5	.9830	.9473	.8912	.7598

The 1-5 MeV electron data and 4.0-12.5 MeV proton data are obtained from telescopes consisting of eleven fully depleted silicon detectors surrounded by a plastic scintillator anti-coinci dence cup. These data are provided by E. C. Stone, R. E. Vogt, R. A. Mewaldt, and co-workers at the California Institute of Technology. During most times, the electron fluxes result from a "wide geometry" mode (effective geometric factor = 1.6 cm^2 ster for IMP 7, 1.5 cm^2 ster for IMP 8), although for times of large solar particle fluxes, a "narrow geometry" mode is used (effective geometric factor = 0.07 cm^2 ster for IMP 7, 0.23 cm^2 ster for IMP 8). Electron fluxes have been corrected for secondary electrons produced by the interaction of gamma rays in the detector stack. (This background flux is separately monitored by the instrument.) Periods during which magnetospheric electrons seriously contaminate the observed 1-5 MeV electron fluxes have been identified and eliminated by analysis of 0.2-1.0 MeV electron fluxes and by a comparison of the IMP 7 and IMP 8 counting rates. Plotted proton fluxes result from a mode having geometric factors of 0.07 cm^2 ster on IMP 7 and 0.23 cm^2 ster on IMP 8. Illustrations and further descriptions of the instruments can be found in Hurford *et al.*, [*Ap. J.*, *192*, 541, 1974], and in Mewaldt *et al.*, [*Ap. J.*, *205*, 931, 1976].

The 0.16-0.22 MeV proton fluxes are provided from a University of Maryland experiment flown on IMP 8. They are obtained from an electrostatic analyzer in which incident particles are deflected by an applied electric field by an amount dependent on their energy/charge ratio. The deflected particles are then counted by a series of surface-barrier detectors positioned to measure particles having experienced various amount of deflection. The flux as plotted results from the counting rate of one of these sensors and consists of:

(1) 0.16-0.22 MeV ambient protons,
(2) ambient Helium and heavier ions which generally do not exceed 10% of the proton component.
(3) a background flux level of ~90 particles per cm^2 ster sec MeV caused by interactions of galactic cosmic rays in the spacecraft, and
(4) during times of intense fluxes of high energy particles, a complicated time-variable background.

This last component may be particularly important in the onset phase of solar flare particle events. For further details on the instrument, see Tums *et al.*, [*IEEE Trans. Nuc. Sci.*, *NS-21*, *1*, 210, 1974].

The University of Maryland data are provided by G. Gloeckler, C. Y. Fan (University of Arizona), D. Hovestadt (Max-Planck Institute), F. Ipavich and co-workers.

The 0.97-1.85 MeV and 13.7-25.2 MeV proton fluxes are provided from an experiment of the Johns Hopkins University/Applied Physics Laboratory. They are obtained from a telescope consisting of three colinear sensors (two surface-barrier totally depleted detectors followed by a lithium-drifted detector) surrounded by a plastic scintillator anti-coincidence cup. The 0.97-1.85 MeV proton fluxes correspond to particles stopping in the first sensor; hence standard dE/dx - E analysis is not possible. However, ratios of proton to alpha particle fluxes and alpha particle to medium nuclei fluxes measured at slightly higher energies have been used to estimate the magnitude of, and to eliminate, the non-proton component of this 0.97-1.85 MeV proton mode. In the 13.7-25.2 MeV channels, background effects are significant for ambient fluxes below 10^{-3} $(cm^2 \text{ ster sec MeV})^{-1}$. As such, only fluxes above this amplitude are plotted. These data are provided by S. M. Krimigis and T. P. Armstrong (University of Kansas). Further details on the instrument and on data analysis techniques may be found in Sarris *et al.*, ["Observations of Magnetospheric Bursts of High Energy Protons and Electrons at ∿35 R_E with IMP 7", *J. Geophys, Res.*, *81*, 2341, 1976].

The 19.8 - 40.1 MeV and 40.1 - 81.8 MeV proton fluxes are obtained from a telescope consisting of two CsI (Na) scintillators viewed by phototubes and surrounded by an active anti-coincidence detector. These fluxes are obtained on IMP 8 only and are provided by F. B. McDonald and T. T. von Rosenvinge of NASA, Goddard Space Flight Center. The dE/dx element is 1 mm x 5 cm diameter whereas the E element is 2.01 cm x 5 cm diameter. The finite thickness of the E element yields a geometric factor which decreases nearly linearly with increasing energy, being 3.25 cm^2 ster at 19.8 MeV and 2.35 cm^2 ster at 81.8 MeV. In computing fluxes, the average geometric factors in each of the two energy intervals is used. No correction is made for the resultant error which ranges from zero for a flat spectrum to 5% (computed flux too high) for an E^{-4} spectrum Corrections for slow gain shifts in the scintillator/phototube output are made.

The three alpha particle fluxes are provided by J. A. Simpson and G. M. Mason of the University of Chicago. They are obtained from a telescope consisting of three lithium-drifter silicon detectors, a CsI (Tℓ) scintillator viewed by four photodiodes and a sapphire scintillator/Cerenkov radiator, all surrounded by a plastic anti-coincidence scintillator. The three fluxes correspond to alpha particles stopping in the second, third, and fourth sensors of the telescope. Background contamination of these fluxes is less than 10%. Care should be taken when proton and electron fluxes above 0.5 MeV are $\geq 3 \times 10^3$ particles/cm^2 ster sec, since these high rates may interfere with the proper operation of the instrument logic and analysis. The quoted fluxes include He^3 and He^4. During quiet periods, He^3 may contribute up to 10% of the total 25-90 MeV/n flux, and considerable less for the two lower energy fluxes. The instrument is further described in Garcia-Munoz *et al.*, [*Astrophys. J. Lett.*, *201*, 145, 1975].

SOLAR X-RAY RADIATION (A.11i, C.5f)

The Columbia University solar x-ray spectrometer, mounted in the wheel section of the OSO-8 satellite, makes use of Bragg reflection to obtain high resolution solar x-ray spectra in the 1.5 - 6.7 Å range. A complete spectrum is obtained every ten seconds, and the data are superposed to yield time averaged fluxes. Particularly prominent emission lines found in these spectra include Si XII (5.82Å), Si XIV (6.18 Å) and Si XIII (6.64Å). Corrections for satellite orientation, instrument sensitivity, and exposure time are applied to the ray data to obtain absolute line fluxes in ergs $(cm^2\text{-sec})^{-1}$. The results for these selected lines are reported as hourly averages in the tables. The statistical accuracy of the measurements is generally very good as the background rate is low. At limiting sensitivity (10^{-8}ergs $(cm^2\text{-sec})^{-1}$), the statistical accuracy is 5%, comparable to uncertainties in the instrument parameters.

The spectrometer utilizes Bragg reflection from mosiac graphite crystals to disperse the incident x-ray flux and proportional counters to detect the photons which satisfy the Bragg condition and are reflected from the crystal panel. The properties of the crystals, the detectors, and other relevant parameters are listed in the table. Since the 0.8° rocking curve width of the crystal is greater than the solar angular diameter, specific regions of the sun cannot be resolved. The spectra obtained are an average of the total solar emission. (In practice, one or two active regions on the disk usually dominate the x-ray emission in the wavelength range of the spectrometer). The spectral scan of the instrument is accomplished by utilizing rotation of the spacecraft. The spectrometer entrance aperture is located in the perimeter of the satellite wheel, which rotates uniformly at 6 RPM. The rotation axis is orthogonal to the Earth-Sun line, so that each rotation yields a complete x-ray spectrum. The spectrometer itself contains no moving parts. Masking collimators are included to avoid direct illumination of the detectors by the solar x-ray flux.

Parameter	Description
Field of view	Whole sun,±3° perpendicular to dispersion plane
Time resolution	One spectrum in 10s
Crystal material	Pyrolytic graphite, grade ZYC, - Union Carbide Corp.
Crystal area	1221 cm^2
2d	6.7Å
Rocking curve width	0.8°
Wavelength range	1.5 - 6.7Å
Resolving power, $\frac{\lambda}{\Delta\lambda}$	
1.5Å	17
6.7Å	2500
Detectors	Proportional counters
Windows	Be, 0.002 inches
Gas filling	Ar(90%), CO_2 (10%)

The raw data for each revolution is encoded in azimuth bins, recorded, and telemetered each orbit. The ten second time resolution is maintained, but to improve statistical precision the data are superposed, and for the purposes of this report, ultimately presented as hourly averages. Conversion of the raw data as azimuth counts per revolution to line fluxes is accomplished by utilizing the spacecraft aspect solution and the spectrometer response function. The azimuth code is translated to Bragg angle and the data is binned in 0.16° intervals between 10° and 90°. The results for each revolution are then corrected for instrument response and combined to obtain the time averaged spectrum. The fluxes in the particular lines are obtained by integrating to obtain the total intensity: line emission, continuum, and non-x-ray background. The continuum and non-x-ray contribution is determined from adjacent regions of the spectrum where no known lines are found, and the net flux obtained by subtraction. The estimated systematic uncertainty in this procedure, combined with uncertainties in the instrumental calibration, is 5%.

When the solar x-ray emission is weak, the statistical error in an hourly average of data becomes comparable to the systematic error at an equivalent line intensity of 10^{-6} ergs $(cm^2\text{-sec})^{-1}$. This is taken as the limiting sensitivity, and flux measurements falling below this level are reported as "B" in the table. Missing data, corresponding to hour long intervals when no relevant solar observations were made, are indicated by "M". The reported times are in UT, and the interval corresponding to a particular hour "H" extends from H - 30^m to H + 30^m. The dynamic range of the spectrometer is approximately 10^5, and dead time corrections at peak intensity can be reliably made for line fluxes equivalent to 10^{-3}ergs $(cm^2\text{- sec})^{-1}$. Saturated data are not included in the hourly averages, and are indicated by "X". Such events are rare, and the temporal evolution of x-ray bursts will be presented separately. Data have been obtained continuously since June 30, 1975.

MAGNETOGRAMS OF GEOMAGNETIC STORMS (D.1e)

In the past the Kp and other indices have provided some information on geomagnetic disturbances. However, during the last few years there has been an increasing demand for more quantitative indices with finer time resolution and based upon records from a more suitable distribution of observatories. The indices Kn, Ks, and Km have been developed and continue to satisfy the requirement for 3-hourly indices of activity as observed at mid-latitude locations. Both the Dst and AE indices have been devised to fulfill the need for quantitative indices having finer time resolution. Dst provides an estimate of the field of the ring current although ignoring its asymmetry. AE provides an estimate of the field of the auroral electrojets.

Recent progress in magnetospheric physics has made it clear that a comprehensive study of the asymmetric growth of the ring current belt is essential in understanding the mechanism of its formation and generating mechanism of magnetospheric storms as well. For this purpose, Dst is not necessarily the most suitable index. Auroral electrojets have a lifetime of order one to three hours and the increasing availability of 2.5-min AE(11)* provides indices having excellent time resolution for the study of these high-latitude magnetic variations. However, the delay inherent in acquisition and processing of all magnetograms used in deriving AE(11) and the desirability of including a record of magnetic variations at mid-latitude and equatorial locations suggest that no combination of indices is completely self-sufficient.

For these reasons, actual records of magnetic variations at a number of observatories are still very useful. In this publication, one or two interesting geomagnetic events may be chosen for each month and are illustrated by reconstructed H-component magnetograms. The magnetograms are reduced from the original records to display the same amplitude scale and time base. Such common scale magnetograms are included from about 10 of the 16 observatories listed in the table page 54 although delays in receipt of some magnetograms may necessitate using records from substitute stations. If an adequate coverage of auroral zone observatories is available, preliminary AU and AL graphs are also prepared for each event No reduced magnetograms are prepared for months having activity of only minimal interest.

These common scale magnetograms and index graphs are now produced under the direction of J. H. Allen and W. Paulishak of the National Geophysical and Solar-Terrestrial Data Center from magnetograms furnished by the World Data Center A for Solar-Terrestrial Physics. For the interval January 1967 through September 1973, the common scale magnetograms were provided by Dr. S. -I. Akasofu.

*The AE indices have been published as UAG reports. A list is given on the following page.

Table of Observatories

	Geog. Coord. Lat.	Geog. Coord. Long.	Geomag. Coord. Lat.	Geomag. Coord. Long.
Narssarssuaq	61.20	314.60E	71.14	37.42E
Leirvogur	64.18	338.30	70.12	71.51
Fort Churchill	58.80	265.90	68.74	323.46
Barrow	71.30	203.25	68.64	241.55
Great Whale River	55.27	282.22	66.57	348.05
Cape Chelyuskin	77.72	104.28	66.28	176.70
Abisko	68.36	18.82	65.94	115.28
College	64.87	212.17	64.73	256.99
Dixon Island	73.55	80.57	63.01	161.84
Tixie Bay	71.58	129.00	60.48	191.72
Tashkent	41.33	69.62	32.30	144.43
San Juan	18.12	293.85	29.57	3.63
Kakioka	36.23	140.18	26.09	106.38
Honolulu	21.32	202.00	21.17	266.99
Davao	07.08	125.58	-4.00	194.97
Tangerang	-06.17	106.63	-17.62	175.93

UAG-37 "Auroral Electrojet Magnetic Activity Indices AE(10) for 1966", by Joe Haskell Allen, Carl C. Abston and Leslie D. Morris, National Geophysical and Solar-Terrestrial Data Center, Environmental Data Service, December 1974, 142 pages, price 75 cents.

UAG-33 "Auroral Electrojet Magnetic Activity Indices AE(10) for 1967", by Joe Haskell Allen, Carl C. Abston and Leslie D. Morris, National Geophysical and Solar-Terrestrial Data Center, Environmental Data Service, May 1974, 142 pages, price 75 cents.

UAG-29 "Auroral Electrojet Magnetic Activity Indices AE(11) for 1968", by Joe Haskell Allen, Carl C. Abston and Leslie D. Morris, National Geophysical and Solar-Terrestrial Data Center, Environmental Data Service, October 1973, 148 pages, price 75 cents.

UAG-31 "Auroral Electrojet Magnetic Activity Indices AE(11) for 1969", by Joe Haskell Allen, Carl C. Abston and Leslie D. Morris, National Geophysical and Solar-Terrestrial Data Center, Environmental Data Service, February 1974, 142 pages, price 75 cents.

UAG-22 "Auroral Electrojet Magnetic Activity Indices (AE) for 1970", by Joe Haskell Allen, National Geophysical and Solar-Terrestrial Data Center, Environmental Data Service, November 1972, 146 pages, price 75 cents.

UAG-39 "Auroral Electrojet Magnetic Activity Indices AE(11) for 1971", by Joe Haskell Allen, Carl C. Abston and Leslie D. Morris, National Geophysical and Solar-Terrestrial Data Center, Environmental Data Service, February 1975, 144 pages, price $2.05.

UAG-45 "Auroral Electrojet Magnetic Activity Indices AE(11) for 1972", by Joe Haskell Allen, Carl C. Abston and Leslie D. Morris, National Geophysical and Solar-Terrestrial Data Center, Environmental Data Service, May 1975, 144 pages, price $2.10.

UAG-47 "Auroral Electrojet Magnetic Activity Indices AE(11) for 1973", by Joe Haskell Allen, Carl C. Abston and Leslie D. Morris, National Geophysical and Solar-Terrestrial Data Center, Environmental Data Service, June 1975, 144 pages, price $2.10.

UAG-59 "Auroral Electrojet Magnetic Activity Indices AE(11) for 1974", by Joe Haskell Allen, Carl C. Abston and Leslie D. Morris, National Geophysical and Solar-Terrestrial Data Center, Environmental Data Service, December 1976, 144 pages, price $2.16.

DATA FOR SEVEN MONTHS BEFORE MONTH OF PUBLICATION

TABLE OF CONTENTS

A B B R E V I A T E D C A L E N D A R R E C O R D (H.62)

The Abbreviated Calendar Record is a monthly summary chronological account of solar and geophysical activity and events published in the seventh month after observation. It is intended to give a background for the early interpretation of solar-geophysical results. It continues the series published in *IQSY NOTES* beginning with data for January 1964 in No. 7, through data for December 1966 in No. 21, and for January 1967 through November 1968 in *STP NOTES* No. 1-3, 5, and 7. A Condensed Calendar Record has continued in *STP NOTES*. Data for December 1968 through March 1975 are published in Nos. 7-14.) It is similar to the Calendar Record compiled for the IGY and IGC-1959 [*Annals of the IGY,* Vol. 16] and compiled for 1960-1965 [*Annals of the IQSY,* Vol.2]. It is prepared from data reports available at the World Data Center A for Solar-Terrestrial Physics. However, it is compiled rapidly, including some provisional data, and should not be relied on for details of solar and geophysical events in preference to standard publications.

The format is as follows:

The period covered on each date is 0000 to 2400 UT (Universal Time). At the beginning of each month a chart of the sun for the month locates the calcium plages, as reported by the McMath-Hulbert Observatory, at the latitude and longitude of their Central Meridian passage by the last two digits of the plage serial number. The general activity of the region is approximately evaluated, mainly from area and intensity of plage and associated sunspots, by use of the symbols: G = great activity, M = moderate activity and S = small activity. This chart is superimposed on the most recent revision of the Hα synoptic chart for the same month which was originally published at the beginning of the second section of Part I (Prompt Reports). See page 21.

For each date a series of time lines are presented. In the first block the duration of flares of importance ≥ 1f is shown by a horizontal line, followed by the importance with a slant line separating the last two digits of the serial number of the calcium plage region in which the flare occurred. These are selected from the grouped flare reports as published in these *Solar-Geophysical Data* reports. Fixed frequency solar noise bursts are indicated by vertical tick marks by wavelength range at the time of beginning of the burst. The ranges are defined as dekameter = <40 MHz, meter = 40-400 MHz, decimeter = 400-1500 MHz, and centimeter = >1500 MHz. Spectral events of types II and IV are shown at the time of beginning by the appropriate Roman numeral. Noise storms at meter wavelength are indicated by horizontal lines. On the next two lines are vertical tick marks at the time of beginning to show sudden ionospheric disturbances and solar x-ray bursts from SMS/GOES (.5-4Å; 1-8Å).

The Ap for the day is given in the left-hand portion of the next two lines which give the eight Kp centered in the appropriate three-hour time blocks, and the time of storm sudden commencements, if any, by a triangle. The daily planetary Ap index is derived from the 3-hourly Kp indices, which are based on reports from a selected standard group of geomagnetic observatories. The Ap index increases with increasing magnetic activity to a maximum of 400. The data are provided by the International Service of Geomagnetic Indices (Göttingen) of IAGA [*Annals of the IGY,* Vol. 4, pp. 227-236]. Beside the Ap value appears, when appropriate, D1 to D5 or Q1 to Q10 for disturbed or quiet days respectively. The numbers indicate order from most disturbed or quietest. See page 36 for interpretation of attached letters or symbol (A, K, *). Adjacent to the sc triangle the exact time of the sc is given with the number of observatories reporting it in the parentheses.

Auroral displays are usually mentioned only if the southern limit reached ϕ (geomagnetic latitude) less than 60°. The ϕ given is that of overhead occurrence in the USSR. The time and type of auroral follows this. N. V. Pushkov provides descriptions of aurora summarizing reports from a network of about 130 stations between 30° and 140° E longitude. After December 1975 the Western Europe sector data are no longer available.

The following Codes to describe the aurora, as defined by F. Jacka and J. Paton in the *IQSY Instruction Manual No. 3 Aurora,* are used:

1. Auroral Forms: A (arc); B (band); P (patch); V (veil); R (rays); G (glow); N (not identifiable).
2. Structure: H (homogeneous); S (striated); R (rayed); $_1$ - short rays; $_2$ - medium length rays; $_3$ - long rays.
3. Qualifying Symbols: m (multiple); f (fragmentary); c (coronal).
4. Condition: q (quiet); a (active); p (pulsing); p_2 (flaming); p_3 (flickering); p_4 (streaming).
5. Brightness:
   1. weak, comparable with the Milky Way.
   2. comparable with moonlit cirrus clouds.
   3. comparable with moonlit cumulus clouds.
   4. much brighter than 3; if extensive, aurora may cast discernible shadows.

On the next line is given the Forbush cosmic ray decreases from the Deep River or Sulphur Mountain charts limited to those of 3% or greater.

Outstanding green corona as published in *Solar-Geophysical Data* Part I are mentioned by limb quadrant on date the peak would be at CMP.

The indices on the next line are as follows:

-- The provisional daily Zürich relative sunspot number, R_Z, as communicated by Prof. M. Waldmeier of the Swiss Federal Observatory. It is based on observations at Zürich, Arosa and Locarno only. Final values of R_Z, issued after the end of each calendar year, usually differ slightly from the provisional ones. If available at time of publication these final values are used.

-- The 10 cm solar radio flux at 2800 MHz is observed at the Algonquin Radio Observatory by the National Research Council, Canada, at about 1700 UT daily. It is expressed in units of $10^{-22}Wm^{-2}Hz^{-1}$. The observed flux should be used for most solar-terrestrial studies. The values adjusted for the varying Sun-Earth distance are published elsewhere in *Solar-Geophysical Data*.

-- The flare index gives the daily flare index with the hours of flare patrol on which the index was based (see p. 42 of this text).

-- The daily Ca plage index is given next (see p. 27 of this text).

-- The ionospheric indices, I_p and I_a, are computed by the method of Y. Hakura, Y. Takenoshita, and K. Matsuoka in "Influence of Solar Activity on the Ionosphere Blackout Index", [*J. Radio Res. Labs., Japan, 14,* No. 73, 1967]. If "-" is entered, it signifies less than 12 hours of data, so no value has been computed. The index I_p is for polar cap blackout, and the index I_a is for auroral zone blackout. The indices are on a scale from "0" representing 0.4 hours or less of blackout per day increasing to "9" representing 20.1 to 24 hours of blackout per day. Ionospheric f-min data from selected stations are used. The indices differ from Hakura *et al.* in that Kiruna and Fort Churchill data have been substituted for Point Barrow for I_a, and only Resolute Bay data is usually available for I_p.

Next are given the McMath calcium plage region numbers on their date of CMP together with their latitude and number of rotations, if more than one, in the parentheses. The Mt. Wilson sunspot region numbers, together with their latitude, magnetic classification by α, β, γ or δ and largest spot (preceding "p" or following "f") and a digit encoding field strength are listed under the calcium plage region in which they appeared.

The digits used to encode field strength are as follows:

1 = 100 - 500 gauss	6 = 2600 - 3000 gauss
2 = 600 - 1000	7 = 3100 - 3500
3 = 1100 - 1500	8 = 3600 - 4000
4 = 1600 - 2000	9 = 4100 - 4500
5 = 2100 - 2500	10 = >4500

If the Mt. Wilson sunspot is at CMP on a different date than the center of the calcium plage was, this date is given in parentheses following the sunspot information. If the calcium or sunspot region numbers are in parentheses, this signifies the regions were never actually at the Central Meridian; these had either died while on the Eastern Hemisphere or were born on the Western Hemisphere.

When necessary, written remarks may appear at the end of the day.

FLARE INDEX BY REGION (C.1f)

An index that characterized the flare productivity of McMath calcium plage regions integrated over a disk passage has been developed by Constance Sawyer and Catherine Candelaria. The scale is consistent with the HAO flare index, and with the NOAA whole-disk index which is briefly described on page 42. The same formula,

$$I_f = \frac{.76}{T^*} \sum A_d^2 \quad ,$$

is used where A_d is the measured (apparent) area in millionths of solar disk, but the sum is taken for each region separately over all the days of its disk passage.

The total number of flares is also given and the dates on which the first and last flares were observed in the region. The "flare-index mean" is the flare-index sum divided by the interval in days from the first flare to the last flare.

DATA FOR

MISCELLANEOUS TIME PERIODS

RETROSPECTIVE WORLD INTERVALS (H.63)

Retrospective World Intervals selected by the Monitoring of Sun Earth Environment (MONSEE) program of the ICSU Special Committee on Solar-Terrestrial Physics will be presented as appropriate.

OTHER DATA

Information available either annually or on a non-routine publication basis will be given. The descriptive material necessary to understand the data will be included in the issue presenting the data. Data received too late for publication in the normal section may also appear here.

PARTIAL LIST OF CONTRIBUTORS

These monthly reports would not be possible without the continuing support and cooperation of scientists throughout the world. Much of the data included have been obtained through either the International Ursigram and World Days Service program or the international exchange of geophysical observations between World Data Centers in accordance with the principles set forth in recommendations of relevant organizations of the International Council of Scientific Unions. (See *Guide to International Data Exchange,* issued in 1973 by the ICSU Panel on World Data Centres).

Special thanks are due to many individuals including the following:

Name	Organization	Data Type
C. H. Hossfield	American Association of Variable Star Observers Solar Division 540 N. Central Avenue Ramsey, New Jersey 07446	Sunspots
P. S. McIntosh	Space Environment Laboratory NOAA Boulder, Colorado 80302	Sunspots, Hα photographs, Hα synoptic charts
M. J. Martres	Section de Physique Observatoire de Paris 92190 Meudon, France	Active regions
M. Waldmeier	Eidgen. Sternwarte Schmelzbergstrasse 25 8006 Zürich, Switzerland	Sunspots
Helen W. Dodson	McMath-Hulbert Observatory University of Michigan 895 Lake Angeles Rd. North Pontiac, Michigan 48055	Calcium plages, flares, SID
	Osservatorio Astrofisico Citta Universitaria Viale A. Doria 95123 Catania, Italy	Calcium plages, flares
R. Howard J. M. Adkins	Mount Wilson Observatory 813 Santa Barbara Street Pasadena, California 91101	Magnetic classifications of sunspots, solar magnetograms
J. W. Harvey W. Livingstone F. Receley	Kitt Peak National Observatory P. O. Box 26732 Tucson, Arizona 85726	Solar magnetograms Helium 10830 Å synoptic chart
R. C. Altrock	Sacramento Peak Observatory Sunspot, New Mexico 88349	Corona
A. A. Giesecke M. Ishitsuka	Observatorio de Huancayo Instituto Geofisico del Peru Apartado 46 Huancayo, Peru	SID, solar radio emission flares
V. Badillo F. J. Heyden	Manila Observatory P.O. Box 1231 Manila, Philippines	Flares, SID, solar radio emission, sunspots
M. Bernot P. Simon	Observatoire de Meudon 92190 Meudon, France	Flares
H. Tanaka S. Enome	Toyokawa Observatory The Research Institute of Atmospherics Nagoya University Toyokawa, 442 Japan	Solar radio emission

Name	Organization	Data Type
J. P. Castelli Wm. R. Barron	Air Force Geophysics Laboratory L. G. Hanscom Field Code LIR Bedford, Massachusetts 01730	Solar radio emission
W. N. Christiansen Arthur Watkinson	School of Electrical Engineering University of Sydney Sydney, N.S.W. 2006, Australia	Solar radio emission
A. E. Covington M. B. Bell	Astrophysics Branch National Research Council Ottawa, Ontario, Canada K1A OR6	Solar radio emission
A. Maxwell	Harvard Radio Astronomy Station Fort Davis, Texas 79734	Solar radio emission
H. Urbarz	Aussenstelle Astronomie Institut der Universitaet Tübingen 7981 Weissenau Federal Republic of Germany	Solar radio emission
A. O. Benz H. K. Asper	Microwave Laboratory Gloriastrasse 35 CH-8006 Zürich, Switzerland	Solar radio emission
C. Slottje	Solar Radio Observatory Netherlands Foundation for Radio Astronomy Dwingeloo, Netherlands 7514	Solar radio emission
M. Pick	Observatoire de Meudon 92190 Meudon, France	Solar radio emission
J. P. Wild S. F. Smerd	CSIRO Division of Radio Physics P.O. Box 76 Epping N.S.W. 2121 Australia	Solar radio emission
M. P. Bleiweiss	NELC La Posta Rt. 1, Box 591 Campo, California 92006	Solar radio maps
H. Zirin K. A. Marsh	Big Bear Solar Observatory California Institute of Technology North Shore Drive Big Bear City, California 92314	Coronal holes
B. J. Rickett	University of California, San Diego Dept. of Applied Physics and Information Science La Jolla, California 92037	Solar wind
J. H. Wolfe	NASA Mail Code 245-11 Electrodynamics Branch Ames Research Center Moffett Field, California 94035	Solar wind
D. S. Colburn C. P. Sonett	NASA/ARC Moffett Field, California 94035	IP Electric Field
F. L. Scarf	Space Science Department TRW Systems One Space Park Bldg. R-5, Rm. 1280 Redondo Beach, California 90278	IP Electric Field
N. F. Ness	Laboratory for Extraterrestrial Physics NASA/GSFC, Code 690 Greenbelt, Maryland 20771	IP Magnetic Field

Name	Organization	Data Type
F. Mariani	Instituto Fisica Universita Piazza Annunziata 67100 L'Aquila, Italy	IP Magnetic Field
J. H. King	NSSDC NASA/GSFC Code 601 Greenbelt, MD 20771	Solar particles, plasmas
W. R. Webber J. A. Lezniak	Physics Department University of New Hampshire Demerritt Hall Durham, New Hampshire 03824	Solar cosmic ray protons
A. Frosolone	Space Weather Consultants P.O. Box 213 Moffett Field, California 94035	Pioneer spacecraft
G. Heckman	Space Environment Services Center NOAA Boulder, Colorado 80302	Solar proton events Inferred IP Magnetic Fields
S. Mansurov	IZMIRAN P.O. Akademogorodok Moscow Region, 142092, USSR	Inferred IP Magnetic Fields
J. M. Wilcox P. H. Sherrer	Institute for Plasma Research Stanford University Via Crespi, Stanford, Calif. 94305	Solar Mean Magnetic Fields
R. B. Ammons (AAVSO)	P.O. Box 1441 Missoula, Montana 59801	SES, SWF
C. Hornback	Table Mountain Geophysical Monitoring Station Space Environment Laboratory NOAA Boulder, Colorado 80302	SID, Solar radio emission
S. Katahara	Ionospheric Sounding Station P.O. Box 578 Puunene, Maui, Hawaii 96784	SPA
P. C. Yuen Kazutoshi Najitu	Department of Electrical Engineering University of Hawaii Honolulu, Hawaii 96822	SFD
R. F. Donnelly	Space Environment Laboratory NOAA Boulder, Colorado 80302	Solar x-rays
L. W. Acton C. J. Wolfson	Lockheed Research Laboratory Div. 52/10, Bldg. 202 3251 Hanover Street Palo Alto, California 94304	X-ray maps
R. S. Wolf	Columbia Astrophysics Laboratory Columbia University 538 West 120th St. New York, N.Y. 10027	Solar x-ray
J. P. Delaboudiniere	Centre National de la Recherche Scientifique Laboratoire de Physique Stellaire et Planetaire Boite Postale No. 10 91 Verrieres-le-Buisson, France	XUV
M. Bercovitch Margaret D. Wilson	National Research Council of Canada Division of Physics Ottawa, Ontario, Canada K1A OR6	Cosmic rays

Name	Organization	Data Type
D. Venkatesan M. Tjoei	Department of Physics University of Calgary Calgary, Alberta, Canada T2N, 1N4	Cosmic rays
J. A. Simpson G. Lentz	LASR Enrico Fermi Institute University of Chicago 933 E. 56th Street Chicago, Illinois 60637	Cosmic rays Solar cosmic ray protons
M. A. Pomerantz	Bartol Research Foundation Swarthmore, Pennsylvania 19081	Cosmic rays
M. Wada	Institute of Physical and Chemical Research 7-13 Kaga-1, Itabashi Tokyo, Japan 173	Cosmic rays
O. Binder	Institut für Reine und Angewandte Kernphysik Olshausenstr. 40/60, Gebäude N20a 23 Kiel, German Federal Republic	Cosmic rays
M. Siebert	Institut für Geophysik Herzberger Landstrasse 180 34 Göttingen, G.F.R.	Magnetic indices
D. Van Sabben	Kon. Nederlands Meteorlogisch Instituut DeBilt, The Netherlands	Magnetic indices
M. Sugiura	Magnetic and Electric Fields Branch NASA/GSFC, Code 625 Greenbelt, Maryland 20771	Magnetic indices
D. J. Poros	Computer Sciences Corporation Silver Spring, Maryland 20910	Magnetic indices
P. N. Mayaud	Institut de Physique du Globe 4, Place Jussieu - Tour 14 75230 Paris, France	Magnetic indices
A. Romaña	Observatorio del Ebro Roqueta (Tarragona) Spain	ssc, sfe
W. Paulishak	NGSDC/EDS/NOAA Boulder, Colorado 80302	Magnetograms
T. Damboldt	Forschungsinstitut der Deutschen Bundespost 61 Darmstadt, Postfach 800 German Federal Republic	Radio quality figures

INDEX FOR SOLAR-GEOPHYSICAL DATA

An index to *Solar-Geophysical Data* beginning with the data for the year 1957 can be found on pages 64-81. The serial number of the report in which data for a given year and month were published is listed in the index according to type of data. The types are keyed according to ICSU recommendations; and this key, expanded for the data published in *Solar-Geophysical Data,* precedes the index. Listed with the kinds of data received are the periods during which they were available for publication.

Beginning with 1969, when *Solar-Geophysical Data* was divided into Part I and Part II, the index gives pages on which the data appear in addition to the serial number. A "B" appears between the serial number and the page number when the data were published in Part II.

STONYHURST DISKS

Two transparencies provide Stonyhurst disks in days from CMP in the size of most of the maps or drawings presented in the second section of these monthly reports. A second set of transparencies with meridian calibrated in degrees from CMP are included to fit the Mount Wilson and Kitt Peak magnetograms. The two sizes as calibrated in degrees or days from CMP are reversed from those published in the last Explanatory Text which may also be used with these maps.

The dates shown were for 1969 but are within 1 day of appropriate date for 1977. See any Ephemeris.

KEY TO INDEX OF SOLAR GEOPHYSICAL DATA

A. Solar and Interplanetary Phenomena

		Mo/Yr		Mo/Yr
A.1	Sunspot Drawings	1/67	-	present
A.1a	Sunspot Data (see A.5a)	7/57	-	present
A.2a	Zürich Provisional Relative Sunspot numbers, R_Z	7/57	-	present
A.2b	Zürich Final Sunspot numbers, R_Z	7/57	-	present
A.2c	American Relative Sunspot numbers, R_A'	7/57	-	present
A.2d	27-day Plot of Relative Sunspot numbers (see D.1c)	7/57	-	present
A.2e	Sunspot Cycle (Smoothed numbers) Graphs - in each issue	7/57	-	present
A.2f	Table of Observed and Predicted Smoothed Sunspot numbers	10/64	-	present
A.3a	Mt. Wilson Magnetograms	9/66	-	present
A.3b	Mt. Wilson Sunspot Magnetic Field Classifications	1/62	-	present
A.3c	Kitt Peak Magnetograms	7/74	-	present
A.3d	Mean Solar Magnetic Field (Stanford)	1/77	-	present
A.4	Hα Spectroheliograms	1/67	-	present
A.5	Calcium Plage Drawings - McMath (or Catania)	1/67	-	present
A.5a	Calcium Plage (McMath) and Sunspot Regions	7/57	-	present
A.5b	Daily Calcium Plage Index	12/70	-	present
A.6	Hα Synotic Charts	6/73	-	present
A.6b	Synoptic Chart and Active Regions	4/76	-	present
A.7a	Coronal Line Emission Indices (Provisional)	7/57	-	5/66
A.7b	Coronal Line Emission Indices (Final)	1/60	-	present
A.7c	White-Light Corona (NRL OSO-7, 1971-083A)	2/72	-	6/74
A.11ja	Solar EUV Spectroheliograms FeXV 284 Å (GSFC OSO-7, 1971-083A)	5/72	-	3/74
A.7e	Solar XUV Coronagrams (NRL OSO-7, 1971-083A)	10/72	-	12/73
A.7f	Coronal Holes (Helium D3)	1/76	-	present
A.7g	Helium Synoptic Maps (Kitt Peak)	1/77	-	present
A.7h	Coronal Intensities (Sacramento Peak)	1/77	-	present
A.8aa	2800 MHz (ARO-Ottawa) Daily Observed Values of Solar Flux	7/57	-	present
A.8ab	2800 MHz (Ottawa) Final - Daily Observed Values of Solar Flux	1/62	-	12/66
A.8ac	2800 MHz (ARO-Ottawa) Daily Values Solar Flux Adjusted to 1 A.U.	1/64	-	present
A.8ad	2800 MHz (Ottawa) Final - Daily Values of Solar Flux Adjusted to A.U.	1/64	-	12/66
A.8b	470 MHz (Boulder) Daily 3-hourly Averages	7/57	-	3/58
A.8c	167 MHz (Boulder) Daily 3-hourly Averages	7/57	-	12/58
A.8d	200 MHz (Cornell) Daily 3-hourly Averages	7/57	-	12/58
A.8e	9530 MHz (USNRL) Daily Averages	2/58	-	4/59
A.8f	3200 MHz (USNRL) Daily Averages	2/58	-	4/59
A.8g	15400, 8800, 4995, 2695, 1415, 606, 410, 245 MHz (AFCRL) Solar Flux Adjusted to 1 A.U. (15400 MHz began 6/69 and 245 MHz began 1/70)	1/67	-	present
A.9a	9.1 cm (Stanford) Radio Maps of the Sun	4/60	-	8/73
A.9aa	9.1 cm Spectroheliogram tabulated Data (Stanford)	1/69	-	8/73
A.9b	21 cm (Fleurs) Radio Maps of the Sun	12/64	-	12/73
A.9c	8.6 mm (Prospect Hill) Radio Maps of the Sun	4/70	-	2/74
A.9cb	8.6 mm (NELC) Radio Maps of the Sun	11/74	-	present
A.9d	2 cm (NELC) Radio Maps of the Sun	6/74	-	present
A.10a	169 MHz (Nançay) Interferometric Observations	7/57	-	present
A.10b	408 MHz (Nançay) Interferometric Observations	11/65	-	8/71
A.10c	21 cm (Fleurs) East-West Solar Scans	10/65	-	present
A.10d	43 cm (Fleurs) East-West Solar Scans	4/66	-	present
A.10e	10.7 cm (Ottawa-ARO) East-West Solar Scans	6/68	-	present
A.11aa	Solar X-ray Background Levels (NRL) satellites, see below	1/64	-	4/74
A.11ab	Solar X-ray Background Levels (NRL Graphs) " " "	3/65	-	4/74
A.11ac	Solar X-ray Background Levels (Boulder) " " "	12/65	-	11/68
A.11ad	Solar X-ray Background Levels (France) " " "	4/66	-	5/66
A.11ae	Solar X-ray Background Levels (Aberdeen, S. D.) " "	1/66	-	11/68

Popular Name	Satellite Designation			
SOLRAD 7A	1964-1D	1/64	-	10/64
SOLRAD 7B	1965-16D	3/65	-	12/65
SOLRAD 8 (Explorer 30)	1965-93A	1/66	-	12/67
OGO-4	1967-73A	1/68	-	3/68
OSO-4	1967-100A			
SOLRAD 9 (Explorer 37) (Beginning 12/68 daily/hourly averages presented)	1968-17A	3/68	-	7/72
		6/73	-	4/74
SOLRAD-10 (Explorer 44)	1971-58A	8/72	-	6/73

A. Solar and Interplanetary Phenomena (continued)

A.11b	Solar X-ray Background Levels, 0-20Å	6/61 - 12/61
	Injun 1/SOLRAD-3, 1961-02	
A.11c	Solar X-ray Background Levels (Vela 1,2; 1963-39A,C)	(10/63)
A.11d	Solar X-ray Background Levels (McMath)	3/67 - 8/67
	(OSO-3; 1967-20A), 8-12Å	
A.11e	Solar X-ray (OSO-5; 1969-6A) Spectroheliograms	7/69 - 11/72
	(University College London, Leicester Univ.)	7/74 - 6/75
A.11f	Solar X-ray (GSFC OSO-7, 1971-083A) Spectroheliograms	12/72 - 7/74
A.11g	Solar X-ray Background Levels (SMS-1/GOES, 1974-033A;	
	SMS-2/GOES, 1975-011A)	1/74 - present
A.11h	Solar X-ray (OSO-8, 1975-057A) 2-14 keV (Lockheed)	8/75 - present
A.11i	Solar X-ray (OSO-8, 1975-057A) (Columbia University)	
A.11jb	FeXV - 284Å Spectroheliograms	2/76 - 12/76
A.12aa	Solar Protons, Daily-hourly Values, JPL/GSFC (satellites, see below)	5/67 - 5/73
A.12ab	Solar Protons, Graphs, JPL/GSFC " " "	5/67 - 5/73

Popular Name	Satellite Designation	
Explorer 34	1967-51A, Ep >10, >30, >60 Mev	5/67 - 5/69
Explorer 41	1969-53A, Ep >10, >30, >60 Mev	6/69 - 12/72
Explorer 43	1971-19A, Ep >10, >30, >60 Mev	11/71 - 5/73

A.12ba	Cosmic Ray Protons, Ep 0.6-13, 13-175, >175 Mev, Univ. of Chicago	
	(Pioneer 6; 1965-105A and Pioneer 7; 1966-75A)	3/69 - present
A.12bb	Cosmic Ray Protons, Ep >13.9, >64 or >40 Mev, Univ.of New Hampshire	
	(Pioneer 8; 1967-123A and Pioneer 9; 1968-100A)	12/69 - present
A.12c	Cosmic Ray Protons, Ep 5-21, 21-70 Mev, Aerospace	
	(ATS-1; 1966-110A)	1/70 - 8/72
A.12d	Low Energy Protons (NOAA satellites 1972-082A, 1973-086A,	7/74 - 11/74
	1974-089A)	
A.12e	Energetic Solar Particles (IMP H, 1972-073A and IMP J, 1973-078A)	8/75 - present
A.13a	Solar Wind (Pioneer 6, 1965-105A; and Pioneer 7, 1966-75A)	
	NASA Ames	12/65 - present
A.13ab	Solar Wind (Pioneer 8, 1967-123A; Pioneer 9, 1968-100A) NASA Ames	4/72 - present
A.13b	Solar Wind, M.I.T.	
	Pioneer 6, 1965-105A	3/69 - 2/70
		12/73 - present
	Pioneer 7, 1966-75A	6/69 - 12/69
A.13c	Solar Wind (Vela 3, 1964-40A; Vela 5, 1965-58A)	1/69 - 6/72
A.13d	Solar Wind from IPS Measurements (UCSD)	1/75 - present
A.13e	Solar Plasma Data (IMP H, 1972-073A and IMP J, 1973-078A)	8/75 - present
A.17	Interplanetary Magnetic Field	
	Pioneer 8, 1967-123A	10/72 - present
	Pioneer 9, 1968-100A	4/72 - present
A.17c	Inferred Interplanetary Magnetic Field	12/71 - present
A.18	Interplanetary Electric Field	
	Pioneer 8, 1967-123A	5/72 - present
	Pioneer 9, 1968-100A	4/72 - present

B. Ionospheric (and Radio Wave Propagation) Phenomena

B.10	Radar Meteor Indices, perpetual, based upon 1958-1962	
	data for N45 latitude -- see issues 246, 251	
B.51aa	NARWS Quality Figures and Forecasts (NBS/ESSA)	7/57 - 12/65
B.51ab	NARWS Comparison Graphs (NBS/ESSA)	7/57 - 12/65
B.51ba	NPRWS Quality Figures and Forecasts (NBS)	7/57 - 12/65
B.51bb	NPRWS Comparison Graphs (NBS)	7/57 - 10/64
B.51ca	High Latitude Quality Figures and Forecasts (ESSA/OT)	11/64 - 9/76
B.51cb	High Latitude Comparison Graphs (ESSA/OT)	11/64 - 11/73
B.52	North Atlantic Graphs of Useful Frequency Ranges (German PTT)	7/57 - present
B.53	Quality Figures Based Upon Frequency Ranges (German PTT)	1/70 - present

C. Flare-Associated Events

C.1a	H-α Solar Flares (Preliminary)	7/57 - present
C.1ba	H-α Solar Flares (including Standardized Data)	9/66 - present
	(Divided into Confirmed and Unconfirmed Flares from 1/68-12/74)	
C.1c	H-α Subflares (included in C.1a and C.1b after 1/62)	7/57 - present
C.1d	H-α Flare Patrol (The most recent issue listed for a month	7/57 - present
	contains the comprehensive flare patrol.)	
C.1e	H-α Flare Index (Daily)	9/69 - present
C.1f	H-α Flare Index (by Region)	9/70 - present
C.1g	Frequency of Occurrence of Confirmed Solar Flares	1/68 - 6/68

C. <u>Flare-Associated Events</u> (continued)

C.3a	2800 MHz (Ottawa) Outstanding Occurrences	7/57 - present
C.3aa	2800 MHz (Ottawa) Hours of Observation	7/57 - 12/65
C.3b	470 MHz (Boulder) Outstanding Occurrences	7/57 - 3/58
C.3c	167 MHz (Boulder) Outstanding Occurrences	7/57 - 10/60
C.3ca	167 MHz (Boulder) Hours of Observation	1/59 - 12/59
C.3d	200 MHz (Cornell) Outstanding Occurrences	7/57 - 12/58
C.3e	9530 MHz (USNRL) Outstanding Occurrences	2/58 - 4/59
C.3f	3200 MHz (USNRL) Outstanding Occurrences	2/58 - 4/59
C.3g	200 MHz (Hawaii) Outstanding Occurrences	6/59 - 8/59
C.3h	108 MHz (Boulder) Outstanding Occurrences	1/60 - 6/66
C.3ha	108 MHz (Boulder) Hours of Observation	1/60 - 12/65
C.3i	221 MHz (Boeing-Seattle) Outstanding Occurrences (Interferometric) - Changed to 223 MHz in May 1963	4/62 - 7/63 5/65 - 11/65
C.3j	107 MHz (Haleakala) Outstanding Occurrences	6/65 - 3/66
C.3k	10700, 2700, 960 MHz (Pennsylvania State Univ.) Outstanding Occurrences	7/64 - 5/75
C.3l	486 MHz (Washington State Univ.) Outstanding Occurrences	7/66 - 4/69
C.3m	18 MHz Bursts (Boulder) (reported with C.6 1/63 - 11/66, C.6ab prior to 1/63)	11/67 - present
C.3n	35000, 15400, 8800, 4995, 2695, 1415, 606, 410, 245 MHz (AFCRL - Sagamore Hill) Outstanding Occurrences (15400 MHz began 11/67, 35000 and 245 MHz began early 1969, 410 MHz began 1971)	1/66 - present
C.3p	184 MHz (Boulder) Outstanding Occurrences	3/67 - 7/72
C.3q	7000 MHz (Sao Paulo) Outstanding Occurrences	11/67 - present
C.3r	408 MHz (San Miquel) Outstanding Occurrences	10/67 - 4/72
C.3s	18 MHz (McMath-Hulbert) Bursts	1/68 - present
C.3t	43.25, 80 and 160 MHz (Culgoora) Selected Bursts	12/72 - present

Note: Beginning with the data for April 1966, in CRPL-FB-261, the C.3 entries on Solar Radio Outstanding Occurrences for the western hemisphere observatories and frequencies were combined into a single table "Solar Radio Emission Outstanding Occurrences, C.3." Beginning with June 1969 data, the table was expanded to worldwide coverage, and the various observatories are no longer indexed separately.

C.4aa	Solar Radio Spectrograms of Events (Fort Davis)	7/57 - 12/58
	100 - 580 MHz	7/57 - 12/58
	25 - 580 MHz	1/59 - 12/62
	50 - 320 MHz	1/63 - 3/65
	25 - 320 MHz	4/65 - 12/66
	10 - 580 MHz	1/67 - 2/70
	10 - 1000 MHz	3/70 - 4/70
	10 - 2000 MHz	5/70 - 5/73
	10 - 4000 MHz	5/73 - 3/74
	25 - 320 MHz	4/74 - present
C.4ab	2100-3900 MHz Solar Radio Spectrograms of Events (Fort Davis)	1/60 - 12/61
C.4b	Solar Radio Spectrograms of Events (Boulder)	
	7.6 - 41 MHz	3/61 - 8/68
	7.6 - 80 MHz	9/68 - 6/76
C.4c	450-1000 MHz Solar Radio Spectrograms of Events (Owens Valley)	11/60 - 10/61
C.4d	Solar Radio Spectrograms of Events (Culgoora)	
	10 - 210 MHz	1/67 - 7/69
	8 - 2000 MHz	8/69 - 2/70
	8 - 4000 MHz	3/70 - 10/70
	8 - 8000 MHz	11/70 - present
C.4e	30-1000 MHz Solar Radio Spectrograms of Events (Weissenau, GFR)	3/68 - present
C.4f	Solar Radio Spectrograms of Events (AFCRL - Sagamore Hill)	
	19 - 41 MHz	1/68 - 7/70
	24 - 48 MHz	7/70 - 7/75
	25 - 75 MHz	8/75 - present
C.4g	20-60 MHz Solar Radio Spectrograms of Events (Clark Lake)	4/70 - 9/70
C.4h	160-320 MHz Solar Radio Spectrograms of Events (Dwingeloo)	1/74 - present
C.4i	100-1000 MHz Solar Radio Spectrograms of Events (Dürnten)	1/74 - present
C.4j	24-48 MHz Solar Radio Spectrogram of Events (Manila)	4/74 - present

C. Flare-Associated Events (continued)

C.5a	Solar X-ray Events (Vela 1,2; 1963-39A,C)	(10/63)
C.5b	Solar X-ray Events (Univ. of Iowa)	
	Explorer 33; 1966-58A (2-12Å)	7/66 - 10/71
	Explorer 35; 1967-70A (2-12Å)	12/67 - 7/72
C.5c	Solar X-ray Events (NRL Tabulation)	1/64 - 10/64
	(See A.11ab for NRL Graphs and list of Satellites)	and 3/65 - present
C.5d	Solar X-ray Events (McMath-Hulbert) OSO-3; 1967-20A (8-12Å)	3/67 - 8/67
C.5e	Solar X-ray Events (SMS-1/GOES, 1974-033A; SMS-2/GOES, 1975-011A)	11/74 - present
C.5f	Solar X-ray Events (OSO-8, 1975-057A) (Columbia University)	
C.6	Sudden Ionospheric Disturbances (SID)	1/63 - present
C.6aa	Sudden Ionospheric Disturbances (SWF) (included with C.6 after 12/62)	7/57 - present
C.6ab	Sudden Ionospheric Disturbances (SCNA, SEA, bursts) "	1/58 - present
C.6ac	Sudden Ionospheric Disturbances (SPA) "	6/61 - present
C.7	Solar Proton Events - Direct Measurement - same as A.12	5/67 - present
C.8	Solar Proton Events - Riometer	1/67 - 6/67
	Confirmed Polar Cap Absorption Events (ESSA)	
C.8ba	Solar Protons, 26 MHz Riometer Events (South Pole) Provisional	9/63 - 11/67
C.8bc	Solar Protons, 30 MHz Riometer Events (Frobisher Bay)	1/65 - 5/65
C.8be	Solar Protons, 30 MHz Riometer Events (Great Whale River)	6/65 - 2/67

D. Geomagnetic and Magnetospheric Phenomena

D.1a	Geomagnetic Indices Ci, Ks, Kn, Km, Cp, Kp, Ap, aa, Selected Days (aa first published 1/74; Ks, Kn, Km first published 12/75; Ci discontinued 8/75)	7/57 - present
D.1b	27-day Chart of Kp for Year	7/57 - present
D.1ba	27-day Chart of Kp Indices	7/57 - present
D.1c	27-day Chart of C9 for Year	7/57 - present
D.1d	Principal Magnetic Storms	7/66 - present
D.1e	Reduced Magnetograms	1/67 - present
D.1f	Sudden Commencements and Solar Flare Effects	1/66 - present
D.1g	Equatorial Indices Dst	5/73 - present

F. Cosmic Rays

F.1a	Cosmic Ray Daily Averages Neutron Monitors (Deep River - graph of hourly values, daily averages begin 11/65)	1/59 - present
F.1b	Cosmic Ray Daily Averages Neutron Monitors (Climax)	9/60 - 3/72
	Daily Averages and Graph of hourly values	12/74 - present
F.1c	Cosmic Ray Daily Averages Neutron Monitors (Dallas)	1/64 - 3/74
F.1d	Cosmic Ray Daily Averages Neutron Monitors (Churchill)	5/64 - 6/72
F.1e	Cosmic Ray Daily Averages Neutron Monitors (Alert)	3/74 - present
	Graph of hourly values (Alert)	7/66 - present
F.1f	Cosmic Ray Daily Averages Neutron Monitors (Calgary - also graph of hourly values)	1/71 - present
F.1g	Cosmic Ray Daily Averages Neutron Monitors (Sulphur Mountain - also graph of hourly values)	1/71 - present
F.1h	Cosmic Ray Daily Averages Neutron Monitors (Thule - also graph of hourly values)	4/73 - present
F.1i	Cosmic Ray Daily Averages Neutron Monitors (Tokyo - also graph of hourly values)	12/73 - present
F.1j	Cosmic Ray Daily Averages Neutron Monitors (Kiel - also graph of hourly values)	12/73 - present

H. Miscellaneous

H.60	Alert and Special World Interval Decisions (IUWDS Geophysical Alerts)	7/57 - present
H.61	International Geophysical Calendar	1/62 - 12/62
H.62	Abbreviated Calendar Record	12/68 - present
H.63	Retrospective World Intervals	1/66 - 12/67

INDEX TO "SOLAR-GEOPHYSICAL DATA"

Key *	1957 Jul	Aug	Sep	Oct	Nov	Dec	1958 Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
A.2a	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173
A.2b	166	166	166	166	166	166	175	175	175	175	175	175	175	175	175	175	175	175
A.2c	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174
A.5a	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173
A.7	156	157	158	159	160	161	162	163	164	166	166	167	168	169	170	171	172	173
			165	165	165	165	165	171	171	171	171	171	171					
							171											
A.8aa	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173
A.8b	156	157	158	159	161	162	163	164	165									
A.8c	156	157	158	159	162	162	163	164	165	167	168	169	170	172	173	174	175	176
A.8d	156	157	158	159	160	161	163	163	164	165	167	167	168	169	170	171	172	173
A.8e								176	175	174	172	170	170	170	170	171	172	173
A.8f								176	175	174	172	170	170	170	170	171	172	173
A.10a	171	171	171	171	171	171	171	171	171	171	171	171	171	171	171	171	172	173
B.51aa	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174
B.51ab	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174
B.51ba	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174
B.51bb	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174
B.52	157	159	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174
C.1a	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173
	166	167	168	168	169	169	170	170	171	171	172	172	173	173	174	174	175	175
	169	174	174	174	161	174	174		174	174	174					176		
	174		175		174													
C.1c	156	157	158	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174
C.1d	158	158	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173
	166	167	168	168	169	169	170	170	171	171	172	172	173	173	174	174	175	175
	176	176	176	176	176	176	176	176	176	176								
C.3a	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173
C.3aa	158	158	158	161	161	161	164	164	164	167	167	167	170	170	170	173	173	173
C.3b	156	157	159	159	161	162	163	164	165									
C.3c	156	157	159	159	162	162	163	164	165	168	169	169	170	172	173	174	175	176
C.3d	156	157	158	159	160	161	163	163	164	165	167	167	168	169	170	171	172	173
C.3e								176	175	174	172	170	170	170	170	171	172	173
C.3f								176	175	174	172	170	170	170	170	171	172	173
C.4aa												174	168	169	170	171	172	174
C.6aa	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174
C.6ab									171	172	173	174	175	176	177	178	178	179
D.1a	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174
D.1b	174	174	174	174	174	174	174	174	174	174	174	174	174	174	174	174	174	174
D.1c	190	190	190	190	190	190	190	190	190	190	190	190	190	190	190	190	190	190
H.60	158	158	158	159	160	161	162	163	164	165	165	167	168	168	170	171	172	173
										166	166			169				

* See "Key" on pages 64 and following.

INDEX TO "SOLAR-GEOPHYSICAL DATA"

	1959												1960											
Key *	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug.	Sep	Oct	Nov	Dec
A.2a	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197
A.2b	187	187	187	187	187	187	187	187	187	187	187	187	199	199	199	199	199	199	199	199	199	199	199	199
A.2c	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198
A.5a	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197
A.7a	174	175	176	177	178	179	180	181	183	183 185	184 185	185	186	187	188	189	190	191	192	193	195	196	196	197
A.7b													189	189	189	193	193	193	196	196	196	199	199	199
A.8aa	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197
A.8e	174	175	176	177																				
A.8f	174	175	176	177																				
A.9a																196	197	199	210	211	212	212	212	
A.10a	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197
B.51aa	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198
B.51ab	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198
B.51ba	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198
B.51bb	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198
B.52	175	176	177	178	179	180	181	182	183	184	185	186	187	188	190	190	191	192	193	194	195	196	197	198
C.1a	174 176 178 185	175 178 185	176 179 185	177 180 185	178 181 185	179 182 185	180 183 185	181 184 185	182 185	183 186	184 187 191	185 188 189 191	186 189 191 194	187 190 191 194 196	188 191 194	189 192 194	190 193 201	191 194 195 201	192 195 201	193 196 201	194 197 201	195 198 199 201	196 199 201	197 200 201
C.1c	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198
C.1d	174 176 178 185	175 178 185	176 179 185	177 180 185	178 181 185	179 182 185 200	180 183 185	181 184 185	182 185	183 186	184 187 191	185 188 191	186 189 191	187 190 191	188 191	189 192	190 193 202	191 194 202	192 195 202	193 196 202	194 197 202	195 198 202	196 199 202	197 200 202
C.3a	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197
C.3aa	176	176	176	179	179	179	182	182	182	185	185	185	188	188	188	191	191	191	194	194	194	197	197	197
C.3c	176	177	178	178	179	180	180	181	182	183	184	185	195	195	195	195	195	195	195	195	195	195		
C.3ca	182	182	182	182	182	182	182	182	182	183	184	185												
C.3e	174	175	176	177																				
C.3f	174	175	176	177																				
C.3g						180	182	185																
C.3h													186	187	188	189	190	191	192	193	194	195	196	197
C.4aa	182	182	182	184	184	184	188	188	188	192	192	192	197	197	197	198	198	198	199	199	199	200	200	200
C.4ab													197	197	197	198	198	198	199	199	199	200	200	200
C.4c																							197	197
C.6aa	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198
C.6ab	180	181	182	183	184	184	184	185	186	187	187	188	188	189	189	190	191	192	193	194	195	196	197	198
D.1a	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190+	191	192	193	194	195	196	197	198
D.1b	186	186	186	186	186	186	186	186	186	186	186	186	198	198	198	198	198	198	198	198	198	198	198	198
D.1c	190	190	190	190	190	190	190	190	190	190	190	190	190	190	190	190	226	226	226	226	226	226	226	226
F.1a	195	195	195	195	195	195	195	195	195	195	195	195	195	195	195	195	195 205	195	195	195	195	196	197	198
F.1b																					195	196	197	198
H.60	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197

* See "Key" on pages 64 and following.

INDEX TO "SOLAR-GEOPHYSICAL DATA"

Key *	1961 Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	1962 Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
A.2a	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221
A.2b	211	211	211	211	211	211	211	211	211	211	211	211	223	223	223	223	223	223	223	223	223	223	223	223
A.2c	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222
A.3b													210	211	212	213	214	215	216	217	218	219	220	221
A.5a	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221
A.7a	198	199	200	201	202	203	205	205	207	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221
A.7b	204	204	204	205	205	205	208	208	208	212	212	212	213	213	213	216	216	216	220	220	220	226	226	226
A.8aa	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221
A.8ab													223	223	223	223	223	223	223	223	223	223	223	223
A.9a		213	213													213	214	215	216	217	218	219	220	221
A.10a	198	200	201	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	219	219	220	221
A.11b						249	249	249	249	249	249	249												
B.51aa	199	200	201	202	203	204	205	206	207	208	209	210	222	212	213	214	215	216	217	218	219	220	221	222
B.51ab	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222
B.51ba	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222
B.51bb	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222
B.52	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222
C.1a	198 201 208	199 202 208	200 203 208	201 204 208	202 205 208	203 206	204 207 208	205 208	206 210-	207 210	208 211	209 212	210 213	211 214	212 215	213 216	214 217	215 218	216 219	217 220	218 221	219 222	220 223	221 224
C.1c	199	200	201	202	203	204	205	206	207	208	209	210	211	included in C.1a after Jan. 1962										
C.1d	198 201 208	199 202 208	200 203 208	201 204 208	202 205 208	203 206	204 207 208	205 208	206 210	207 210	208 211	209 212	210 213	211 214	212 215	213 216	214 217	215 218	216 219	217 220	218 221	219 222	220 223	221 224
C.3a	198	199	200	201	202	203	204 206	205	206 209	207	208 209	209	210	211	212	213	214	215	216	217	218	219	220	221
C.3aa	200	200	200	203	203	203	206	206	206	209	209	209	212	212	212	215	215	215	218	218	218	221	221	221
C.3h	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221
C.3ha													210	211	212	213	214	215	216	217	218	219	220	221
C.3i													-	-	-	221	221	221	221	221	221	221	221	221
C.4aa	203	203	203	204	204	204	208	208	208	209	209	209	213	213	213	216	216	216	219	219	219	222	222	222
C.4ab	203	203	203	204	204	204	208	208	208	209	209	209												
C.4b			207	207	207	207	207	207	207	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221
C.4c	198	201	202	202	202	203	207	207	207	207	207													
C.6aa	199	200	201	202	203	204	207	206	207	208	209	210	211	212	213	214	215	216	219	219	219	220	221	222
C.6ab	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	219	219	219	220	221	222
C.6ac						204	205	206	207	208	209	210	211	212	213	214	215	216	219	219	219	220	221	222
D.1a	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222
D.1b	208	208	208	208	208	208	208	208	208	208	208	208	221	221	221	221	221	221	221	221	221	221	221	221
D.1c	226	226	226	226	226	226	226	226	226	226	226	226	226	233	233	233	233	233	233	233	233	233	233	233
F.1a	199	200	201	202	203	204	204 205	206	207	208	209	210	211	212	213	214	223	223	223	223	223	223	233	222
F.1b	199	200	201	202	203	204	205	206	207	208	210	210	211	212	213	214	215	216	217	218	219	220	221	222
H.60	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221
H.61													207	207	207	207	207	207	207	207	207	207	207	207

* See "Key" on pages 64 and following.

INDEX TO "SOLAR-GEOPHYSICAL DATA"

Key	1963 Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	1964 Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
A.2a	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245
A.2b	235	235	235	235	235	235	235	235	235	235	235	235	247	247	247	247	247	247	247	247	247	247	247	247
A.2c	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246
A.3b	222	223	224	225	none	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245
A.5a	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245
A.7a	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245
A.7b	226	226	226	228	228	228	231	231	231	234	234	234	237	237	237	240	240	240	243	243	243	248	248	248
A.8aa	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245
A.8ab	233	233	233	233	233	233	233	233	233	233	233	233	245	245	245	245	245	245	245	245	245	245	245	245
A.8ac													240	240	240	240	240	240	240	241	242	243	244	245
A.8ad													245	245	245	245	245	245	245	245	245	245	245	245
A.9a	222	-	-	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245
A.9b																								250
A.10a	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245
A.11aa													243	247	247	241	241	241	244	244	245	245		
																249	255	264	266	266				
A.11c										249														
B.51aa	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246
B.51ab	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246
B.51ba	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244		
B.51bb	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244		
B.51ca																							245	246
B.51cb																							245	246
B.52	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246
C.1a	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245
	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	248	248
													240	240	240									
C.1d	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245
	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	248	248
C.3a	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245
C.3aa	224	224	224	227	227	227	230	230	230	233	233	233	236	236	236	239	239	239	242	242	242	245	245	245
C.3h	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245
C.3ha	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245
C.3i	222	223	224	225	229	229	229																	
C.3k																			252	252	252	252	252	252
C.4aa	225	225	225	228	228	228	230	230	230	234	234	234	237	237	237	240	240	240	243	243	243	246	246	246
C.4b	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245
C.5a										249														
C.6	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246
							230																	
	231	231	231	231	231	231	231	231																
C.8ba									231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246
D.1a	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246
D.1b	233	233	233	233	233	233	233	233	233	233	233	233	245	245	245	245	245	245	245	245	245	245	245	245
D.1c	233	233	233	233	233	233	233	233	233	233	233	233	245	245	245	245	245	245	245	245	245	245	245	245
F.1a	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246
F.1b	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246
									234															
F.1c													243	243	243	243	243	243	243	243	243	244	245	246
F.1d																	243	243	243	243	243	244	245	246
H.60	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245

* See "Key" on pages 64 and following.

INDEX TO "SOLAR-GEOPHYSICAL DATA"

Key *	1965 Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	1966 Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
A.2a	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269
A.2b	258	258	258	258	258	258	258	258	258	258	258	258	271	271	271	271	271	271	271	271	271	271	271	271
A.2c	247	248	249	250	251	252	253	254	255	256	257	257	258	259	260	261	262	263	264	265	266	267	268	269
A.3a																					269	269	269	270
A.3b	246	247	248	249	---	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269
A.5a	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269
A.7a	247	248	248	249	250	251	252	253	---	256	257	257	258	259	260	261	262							
A.7b	249	249	249	252	252	252	256	256	256	258	258	258	261	261	261	264	264	264	267	267	267	270	270	270
A.8aa	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269
A.8ab	257	257	257	257	257	257	257	257	257	257	257	257	269	269	269	269	269	269	269	269	269	269	269	269
A.8ac	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269
A.8ad	257	257	257	257	257	257	257	257	257	257	257	257	269	269	269	269	269	269	269	269	269	269	269	269
A.9a	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269
A.9b	250	250	254	254	257	257	257	259	260	263	263	263	263	263	263	266	266	266	267	267	267	268	---	269
A.10a	246	---	---	---	---	---	---	253	254	255	257	257	258	259	260	261	262	264	264	265	266	267	268	269
A.10b											257	257	258	259	260	261	262	264	264	265	266	267	268	269
A.10c										255	256	257	258	259	260	261	262	263	264	265	266	267	268	269
A.10d																261	262	263	264	265	266	267	268	269
A.11aa			279	279	279	279	279	279	279	279	276	276	276	276	264	276	276	264	265	267	267	269	269	269
A.11ab			286	286	286	286	286	286	286	286										279		272	273	274
A.11ac												270	270	270	270	270	271	271	271	271	271	271	271	271
A.11ad																267	267							
A.11ae													261	261	261	261	262	263	264	265	266	---	272	---
A.13a												306	306	306	306	306	306	306	306	306	306	306	306	306
B.51aa	247	248	249	250	251	252	253	254	255	256	257	258												
B.51ab	247	248	249	250	251	252	253	254	255	256	257	258												
B.51ba	247	248	249	250	251	252	253	254	255	256	257	258												
B.51ca	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270
B.51cb	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270
B.52	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270
C.1a	246 249	247 250	248 251	249 252	250 253	251 255	252 255	253 256	254 257	255 258	256 259	257 260	258 261	259 262 266	260 263	261 264 266 268	262 265 266	263 266	264 267	265 268 270	266	267	268	269
C.1ba																					269 271	272	273	274
C.1d	246 249	247 250	248 251	249 252	250 253	251 255	252 255	253 256	254 257	255 258	256 259	257 260	258 261	259 262	260 263	261 264	262 265	263 266	264 267	265 268 270	266 269 271	267 272	268 273	269 274
C.3a	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269
C.3aa	248	248	248	251	251	251	254	254	254	257	257	257												
C.3h	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	---	---	---	---	---	---
C.3ha	246	247	248	249	250	251	252	253	254	255	256	257												
C.3i					251	252	253	253	254	255	256													
C.3j						252	253	253	254	255	256	257	258	---	261	---	---	---	---	---	---	---	---	---
C.3k	252	252	252	256	256	256	263	263	263	263	263	263	258	259	260	261	262	263	264	265	266	267	268	269
C.3l																			264	265	266	267	268	269
C.3n													260	260	260	261	262	263	264	265	266	267	268	269
C.4aa	249	249	249	252	252	252	255	255	255	258	258	258	261	261	261	264	264	264	267	267	267	270	270	270
C.4b	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269
C.5b																			275	275	275	275	275	277
C.5c			279	279	279	279	279	279	279	279	276	276	276	276	264	276	276	264	265	267	267	269	269	269
C.6	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270
C.8bc	247	248	249	250	251																			
C.8be						252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270
D.1a	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270
D.1b	258	258	258	258	258	258	258	258	258	258	258	258	270	270	270	270	270	270	270	270	270	270	270	270
D.1c	258	258	258	258	258	258	258	258	258	258	258	258	270	270	270	270	270	270	270	270	270	270	270	270
D.1d																			270	270	270	270	270	270
D.1f													270	270	270	270	270	270	270	270	270	273	273	273
F.1a	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270
F.1b	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270
F.1c	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	275	275	275	275	275	275			
F.1d	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	274	274	274	274	274	274	274	274	274
F.1e																			265	266	267	268	269	270
H.60	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269
H.63													282	282	282	282	282	282	282	282	282	282	282	282

* See "Key" on pages 64 and following.

INDEX TO "SOLAR-GEOPHYSICAL DATA"

Key *	1967 Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	1968 Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
A.1	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294
A.2a	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293
A.2b	282	282	282	282	282	282	282	282	282	282	282	282	295	295	295	295	295	295	295	295	295	295	295	295
A.2c	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293
A.3a	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294
A.3b	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293
A.4	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294
A.5	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294
A.5a	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293
A.7b	271	272	273	275	275	276	277	278	279	280	282	282	283	284	285	286	287	288	289	290	291	292	293	294
A.8aa	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293
A.8ac	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293
A.8g	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293
A.9a	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294
A.9b	271	272	273	274	275	276	277	278	---	280	281	282	283	284	285	286	---	288	289	290	291	292	293	294
A.10a	270	271	272	273	---	---	277	277	279	279	280	---	---	---	284	285	287	287	288	289	290	291	292	293
A.10b	270	271	272	273	275	275	276	277	279	279	280	281	282	283	284	285	287	287	288	289	290	291	292	293
A.10c	270	271	272	273	274	275	276	277	278	280	280	281	282	283	284	285	286	287	288	289	290	291	292	293
A.10d	270	271	272	273	274	275	276	277	278	280	280	281	282	283	284	285	286	287	288	289	290	291	292	293
A.10e													---	---	---	---	---	287	288	289	290	291	292	293
A.11aa	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294
A.11ab	275	276	277	278	279	280	281	---	---	---	---	---												
A.11ac	271	272	273	274	275	---	---	278	279	280	281	---	---	---	---	---	---	288	289	290	291	292	293	---
A.11ae	---	272	273	274	---	276	277	---	279	280	---	---	---	---	---	---	---	288	289	290	291	292	293	---
A.11d	---	---	278	279	279	280	281	282	---	---	---	---												
A.12aa					282	282	282	282	283	284	285	286	287	288	289	290	291	292	293	298	298	298	300	301
A.12ab					282	282	282	282	283	284	285	286	287	288	289	290	291	292	293	298	298	298	300	301
A.13a	305	305	305	305	305	305	305	305	305	305	281	281	282	283	284	285	286	287	288	289	290	291	292	293
B.51ca	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294
B.51cb	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294
B.52	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294
C.1a	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293
C.1ba	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298
			278																					
C.1d	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293
	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298
C.1g													295	295	295	295	295	295						
C.3a	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293
C.3k	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293
C.3l	270	271	272	273	274	275	276	277	278	279	280	281	---	283	284	---	---	---	---	---	290	291	---	293
C.3m											280	281	282	283	284	285	286	287	288	289	290	291	292	293
C.3n	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293
C.3p	---	---	272	273	274	275	276	277	278	279	280	281	282	---	---	---	---	---	288	289	290	291	292	293
C.3q											280	281	282	283	284	285	286	287	288	289	290	291	292	293
C.3r										279	280	281	282	283	284	285	286	287	288	289	290	291	292	293
C.3s													282	---	284	285	286	287	288	289	290	291	292	293
C.4aa	277	277	277	277	277	277	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294
C.4b	270	271	272	273	274	275	276	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294
C.4d	277	277	277	277	277	277	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294
C.4e													---	---	285	286	287	288	289	290	292	292	293	294
C.4f													283	284	285	286	287	288	289	290	291	292	293	294
C.5b	278	278	278	280	280	281	281	283	283	284	285	287	287	288	289	290	291	292	293	294	295	296	297	299
C.5c	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294
C.5d	---	---	278	279	279	280	281	282	---	---	---	---												
C.6	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	287	288	289	290	291	292	293
													287	288	289	290	291	292	293	294	295	296	297	298
C.8	284	284	284	284	284	284	---	---	---	---	---	---												
C.8ba	---	---	273	274	275	276	277	278	279	280	281	---												
C.8be	271	272	---	---	---	---	---	---	---	---	---	---												
D.1a	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294
D.1b	282	282	282	282	282	282	282	282	282	282	282	282	294	294	294	294	294	294	294	294	294	294	294	294
D.1c	282	282	282	282	282	282	282	282	282	282	282	282	294	294	294	294	294	294	294	294	294	294	294	294
D.1d	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294
D.1e	297																					298	298	
D.1f	277	277	277	280	280	280	283	283	283	285	285	285	290	290	290	291	291	291	295	295	295	296	296	296
F.1a	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294
F.1b	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294
F.1c	288	288	288	288	288	288	288	288	288	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294
F.1d	288	288	288	288	288	288	288	288	288	288	288	282	288	284	285	286	287	288	289	290	291	292	293	294
F.1e	271	272	273	274	275	276	277	278	279	280	281	282	---	284	285	286	287	288	289	290	291	292	293	294
H.60	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293
H.62	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	299
H.63	282	282	282	282	282	282	282	282	282	282	282	282												

* See "Key" on pages 64 and following.

INDEX TO "SOLAR-GEOPHYSICAL DATA"

Key*	1969 Jan Serial #	page	Feb #	page	Mar #	page	Apr #	page	May #	page	June #	page	July #	page	Aug #	page	Sep #	page	Oct #	page	Nov #	page	Dec #	page
A.1	295		296		297		298		299	41	300	31	301	32	302	34	303	34	304	36	305	28	306	28
A.2a	294		295		296		297		298		299	7	300	7	301	7	302	7	303	7	304	7	305	7
A.2b	307	6	307	6	307	6	307	6	307	6	307	6	307	6	307	6	307	6	307	6	307	6	307	6
A.2c	294		295		296		297		298		299	7	300	7	301	7	302	7	303	7	304	7	305	7
A.3a	295		296		297		298		299	41	300	31	301	32	302	34	303	34	304	36	305	28	306	28
A.3b	295		296		297		298		299	72	300	61	301	69	302	71	303	69	304	73	305	63	306	65
A.4	295		296		297		298		299	41	300	31	301	32	302	65	303	64	304	67	305	58	306	59
A.5	295		296		297		298		299	41	300	31	301	32	302	34	303	34	304	36	305	28	306	28
A.5a	295		296		297		298		299	72	300	61	301	69	302	71	303	69	304	73	305	63	306	65
A.7b	295		296		297		298		299	41	300	31	301	32	302	34	303	34	304	36	305	28	306	28
A.8aa	294		295		296		297		298		299	7	300	7	301	7	302	7	303	7	304	7	305	7
A.8ac	294		295		296		297		298		299	7	300	7	301	7	302	7	303	7	304	7	305	7
A.8g	294		295		296		297		298		299	7	300	7	301	7	302	7	303	7	304	7	305	7
A.9a	295		296		297		298		299	41	300	31	301	32	302	34	303	34	304	36	305	28	306	28
A.9b	295		296		297		298		299	41	300	31	301	32	302	34	303	34	304	36	305	28	306	28
A.10a	294		295		296		297		298		299	29	300	20	301	22	302	21	303	23	304	25	305	19
A.10b	294		295		296		297		298		299	28	300	19	301	21	302	20	303	22	304	24	305	18
A.10c	294		295		296		297		298		299	31	300	22	301	24	302	23	303	25	304	27	305	21
A.10d	294		295		296		297		298		299	32	300	23	301	25	302	24	303	26	304	28	305	22
A.10e	294		295		296		297		298		299	30	300	21	301	23	302	22	303	24	304	26	305	20
A.11aa	295		296		297		298		299	84	300	71	301	78	302	81	303	79	304	83	305	73	306	74
A.11ab	299B	58	300B	60	301B	86	302B	64	303B	80	304B	77	305B	46	306B	52	307B	55	308B	65	309B	63	310B	36
A.11e	---		---		---		---		---		---		301	64	302	34	303	34	304	36	305	28	306	28
A.12aa	301B	120	301B	126	303B	112	303B	118	303B	96	304B	92	305B	62	306B	68	307B	70	308B	81	309B	78	310B	52
A.12ab	301B	121	301B	127	303B	113	303B	119	303B	97	304B	93	305B	63	306B	69	307B	70	308B	82	309B	79	310B	53
A.12ba	---		---		296		297		298		299	37	300	27	301	29	302	29	303	31	304	31	305	25
A.12bb	---		---		---		---		---		---		---		---		---		---		---		305	26
A.13a	294		295		296		297		298		299	33	300	24	301	26	302	25	303	27	304	29	305	23
A.13b	---		---		296		297		298		299	34	300	25	301	27	302	26	303	28	306B	99	306B	100
A.13c	294		295		296		297		298		299	36	300	26	301	28	302	28	303	30	304	30	305	24
B.51ca	295		296		297		298		299	104	300	88	301	94	302	95	303	95	304	100	305	92	306	92
B.51cb	295		296		297		298		299	105	300	89	301	95	302	96	303	96	304	101	305	93	306	93
B.52	295		296		297		298		299	106	300	90	301	96	302	97	303	97	304	102	305	94	306	94
B.53	---		---		---		---		---		---		---		---		---		---		---		306	96
C.1a	294		295		296		297		298		299	10	300	10	301	10	302	10	303	10	304	10	305	10
C.1ba	299B	10	300B1	4	301B	4	302B	4	303B	4	304B	5	305B	4	306B	4	307B	4	308B	4	309B	4	310B	4
C.1d	294		295		296		297		298		299	18	300	15	301	14	302	14	303	15	304	13	305	12
	299B	35	300B	29	301B	35	302B	37	303B	48	304B	43	305B	30	306B	34	307B	34	308B	38	309B	33	310B	23
C.1e	---		---		---		---		---		---		---		---		307B	24	308B	27	309B	23	310B	17
C.3	299B	41	300B	38	301B	51	302B	45	303B	57	304B	51	305B	34	306B	35	307B	35	308B	39	309B	34	310B	24
C.3a	294		295		296		297		298		(-- See C.3 --)													
C.3k	294		295		296		297		298		(-- See C.3 --)													
C.3l	---		---		---		297		---		---		---		---		---		---		---		---	
C.3m	294		295		296		296		298		(-- See C.3 --)													
C.3n	294		295		296		297		298		(-- See C.3 --)													
C.3p	294		295		296		297		298		(-- See C.3 --)													
C.3q	294		300B	38	296		297		298		(-- See C.3 --)													
C.3r	294		295		296		297		298		(-- See C.3 --)													
C.3s	294		295		296		297		298		(-- See C.3 --)													
C.4aa	295		296		297		298		299	87	300	74	301	81	302	84	303	82	304	86	305	77	306	79
C.4b	295		296		297		298		299	87	300	74	301	81	302	84	303	82	304	86	305	77	306	79
C.4d	295		296		297		298		299	87	300	74	301	81	302	84	303	82	304	86	305	77	306	79
C.4e	295		296		297		298		299	87	300	74	301	81	302	84	303	82	304	86	306	77	306	79
C.4f	295		296		297		298		299	87	300	74	301	81	302	84	303	82	304	86	305	77	306	79
C.5b	299B	57	300B	58	302B	89	303B	108	304B	104	304B	76	305B	45	306B	51	311B	53	311B	71	312B	86	312B	88
C.5c	295		296		297		298		299	86	300	73	301	80	302	83	303	81	304	85	305	75	306	76
C.6	294		295		296		297		298		299	19	300	16	301	15	302	15	303	16	304	14	305	13
	299B	36	300B	30	301B	36	302B	38	303B	49	304B	44	305B	31	306B	74	---		---		---		306	77
D.1a	295		296		297		298		299	100	300	84	301	90	302	92	303	92	304	97	305	89	306	87
D.1b	306	89	306	89	306	89	306	89	306	89	306	89	306	89	306	89	306	89	306	89	306	89	306	89
D.1c	306	90	306	90	306	90	306	90	306	90	306	90	306	90	306	90	306	90	306	90	306	90	306	90
D.1d	295		296		297		298		299	102	300	86	301	92	302	94	303	94	304	99	305	91	306	91
D.1e	---		300B	74	301B	102	302B	79	303B	98	304B	94	305B	68	306B	74	307B	76	---		309B	84	310B	58
D.1f	300B	84	300B	84	300B	84	303B	110	303B	110	303B	110	304B	107	304B	107	304B	107	307B	88	307B	88	307B	88
F.1a	295		296		297		298		299	98	300	82	301	88	302	90	303	90	304	95	305	87	306	85
F.1b	295		296		297		298		299	98	300	82	301	88	302	90	303	90	304	95	305	87	306	85
F.1c	295		296		297		298		299	98	300	82	301	88	301	90	---		---		---		---	
F.1d	295		296		297		298		299	98	300	82	301	88	302	90	---		---		---		---	
F.1e	295		296		297		298		299	99	300	83	301	89	302	91	303	91	304	96	305	88	306	86
H.60	294		295		296		297		298		299	5	300	5	301	5	302	5	303	5	304	4	305	5
H.62	300B	76	301B	107	302B	82	303B	101	304B	97	305B	70	306B	78	307B	80	308B	88	309B	88	310B	60	311B	62

* See "Key" on pages 64 and following.

INDEX TO "SOLAR-GEOPHYSICAL DATA"

Key*	1970 Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
A.												
A.1	307 30	308 30	309 31	310 63	311 63	312 62	313 62	314 63	315 60	316 63	317 58	318 59
A.2a	306 7	307 7	308 7	309 7	310 7	311 7	312 7	313 7	314 7	315 73	316 7	317 7
A.2b	319 6	319 6	319 6	319 6	319 6	319 6	319 6	319 6	319 6	319 6	319 6	319 6
A.2c	306 7	307 7	308 7	309 7	310 7	311 7	312 7	313 7	314 7	315 7	316 7	317 7
A.3a	307 30	308 30	309 31	310 31	311 32	312 32	313 31	314 31	315 30	316 32	317 28	318 28
A.3b	307 67	308 63	309 68	310 73	311 74	312 72	313 73	314 74	315 70	316 74	317 68	318 70
A.4	307 61	308 58	309 62	310 63	311 63	312 62	313 62	314 63	315 60	316 63	317 58	318 59
A.5	307 30	308 30	309 31	310 33	311 32	312 32	313 31	314 31	315 30	316 32	317 28	318 28
A.5a	307 67	308 63	309 68	310 73	311 74	312 72	313 73	314 74	315 70	316 74	317 68	318 70
A.5b	---	---	---	---	---	---	---	---	---	---	---	318 77
A.7b	307 30	308 30	309 31	310 63	311 63	312 62	313 62	314 63	315 60	316 63	317 58	318 59
A.8aa	306 7	307 7	308 7	309 7	310 7	311 7	312 7	313 7	314 7	315 7	316 7	317 7
A.8ac	306 7	307 7	308 7	309 7	310 7	311 7	312 7	313 7	314 7	315 7	316 7	317 7
A.8g	306 7	307 7	308 7	309 7	310 7	311 7	312 7	313 7	314 7	315 7	316 7	317 7
A.9a	307 30	308 30	309 31	310 33	311 32	312 32	313 31	314 31	315 30	316 32	317 28	318 28
A.9b	307 30	308 30	309 31	310 33	311 32	312 32	313 31	314 31	315 30	316 32	317 28	318 28
A.9c	---	---	---	310 33	311 32	312 32	313 31	314 31	315 30	316 32	317 28	318 28
A.10a	306 14	307 17	308 17	309 18	310 18	311 21	---	---	314 18	315 17	316 17	318 97
A.10b	306 13	307 16	308 16	309 17	310 17	311 20	312 19	313 15	314 17	315 16	316 16	318 96
A.10c	306 16	307 19	308 19	309 20	310 20	311 23	312 21	313 17	314 20	315 19	316 19	317 18
A.10d	306 17	307 20	308 20	309 21	310 21	311 24	312 22	313 18	314 21	316 20	316 20	317 19
A.10e	306 15	307 18	308 18	309 19	310 19	311 22	312 20	313 16	314 19	315 18	316 18	317 17
A.11aa	307 77	308 73	309 78	310 84	311 84	312 83	313 83	314 85	315 81	316 82	317 77	318 78
A.11ab	311B 38	312B 56	313B 72	314B 61	315B 72	316B 99	317B 90	318B 68	319B 61	320B 65	321B 65	322B 66
A.11e	307 30	308 30	309 31	310 33	311 32	312 32	313 31	314 31	316B130	316 32	317 28	318 28
A.12aa	311B 54	312B 70	313B 88	314B 76	315B 88	316B114	317B106	323B 86	323B 92	323B 98	326B 74	326B 80
A.12ab	311B 55	312B 70	313B 89	314B 77	315B 89	316B115	317B107	323B 87	323B 93	323B 99	326B 75	326B 81
A.12ba	306 21	307 24	308 23	309 24	310 25	311 27	312 25	313 21	314 25	315 23	316 23	317 23
A.12bb	306 22	307 25	308 24	309 25	310 26	311 28	312 26	313 22	314 26	315 24	316 24	317 24
A.12c	306 24	307 27	308 26	309 27	310 28	311 30	312 28	313 24	314 28	315 26	316 26	317 25
A.13a	306 18	307 21	308 21	309 22	310 22	311 25	312 23	313 19	314 22	315 21	317 21	318 20
A.13b	306 19	307 22	---	---	---	---	---	---	---	---	---	---
A.13c	306 20	307 23	308 22	309 23	310 23	311 26	312 24	313 20	314 23	315 22	316 22	317 21
B.												
B.51ca	307 96	308 98	309 106	310 107	311 106	312 106	313 112	314 112	315 104	316 104	317 100	318 106
B.51cb	307 97	308 99	309 107	310 108	311 107	312 107	313 113	314 113	315 105	316 105	317 101	318 107
B.52	307 98	308 100	309 108	310 109	311 108	312 108	313 114	314 114	315 106	316 106	317 102	318 108
B.53	307 100	308 102	309 110	310 111	311 110	312 110	313 116	314 115	315 108	316 108	317 104	318 110
C.												
C.1a	306 10	307 10	308 10	309 10	310 10	311 10	312 10	313. 10	314 10	315 10	316 10	317 10
C.1ba	311B 5	312B 4	313B 5	314B 5	315B 4	316B 5	317B 5	318B 4	319B 4	320B 4	321B 4	322B 4
C.1d	306 12	307 15	308 15	309 16	310 16	311 19	312 18	313 14	314 16	315 15	316 15	317 14
	311B 26	312B 34	313B 34	314B 38	315B 41	316B 52	317B 56	318B 44	319B 45	320B 47	321B 40	322B 38
C.1e	311B 19	312B 24	313B 25	314B 26	315B 29	316B 38	317B 40	318B 30	319B 32	320B 36	321B 32	322B 30
C.1f	---	---	---	---	---	---	---	319B 85	320B 91	321B 89	322B 91	323B 79
C.3	311B 27	312B 35	313B 35	314B 39	315B 42	316B 53	317B 57	318B 45	319B 46	320B 48	321B 41	322B 39
C.4aa	307 84	308 82	309 87	310 93	311 92	312 92	313 91	314 93	315 87	316 89	317 86	318 84
C.4b	307 84	308 82	309 87	310 93	311 92	312 92	---	---	---	---	317 86	318 84
C.4d	307 84	308 82	309 87	310 93	311 92	313B108	313 91	314 93	315 87	316 89	317 86	318 84
C.4e	307 84	308 82	309 87	311B 72	311 92	312 92	313 91	314 93	315 87	316 89	318B 96	318 84
C.4f	307 84	308 82	309 87	310 93	311 92	312 92	313 91	314 93	315 87	316 89	317 86	318 84
C.4g	---	308 82	309 87	310 93	312B 89	312 92	313 91	314 93	315 87	323B 83	---	---
C.5b	313B106	313B107	313B 70	314B 60	315B 71	316B 97	317B 88	318B 66	319B 60	320B 64	321B 64	323B 85
C.5c	307 79	308 76	309 80	310 86	311 86	312 85	313 85	314 87	315 83	316 84	317 79	318 80
C.6	307 80	308 77	309 82	310 88	311 87	312 87	313 87	314 89	315 84	316 85	317 81	318 81
D.												
D.1a	307 93	308 94	309 102	310 104	311 103	312 103	313 108	314 109	315 100	316 100	317 96	318 100
D.1b	318 102	318 102	318 102	318 102	318 102	318 102	318 102	318 102	318 102	318 102	318 102	318 102
D.1c	318 103	318 103	318 103	318 103	318 103	318 103	318 103	318 103	318 103	318 103	318 103	318 103
D.1d	307 95	308 96	309 104	310 106	311 105	312 105	313 110	314 111	315 102	316 102	317 98	318 104
D.1e	311B 60	---	313B 94	314B 82	315B 94	316B120	317B112	318B 84	---	320B 81	321B 80	322B 82
D.1f	310B 68	310B 68	310B 68	313B104	313B104	313B104	317B122	317B122	317B122	318B 94	318B 94	318B 94
F.												
F.1a	307 91	308 92	309 100	310 102	311 101	312 101	313 106	314 107	315 98	316 98	317 94	318 98
F.1b	307 91	308 92	309 100	310 102	311 101	312 101	313 106	314 107	315 98	316 98	317 94	318 98
F.1c	---	---	---	---	311 101	312 101	313 106	314 107	315 98	316 98	317 94	318 98
F.1d	---	---	---	---	311 101	312 101	313 106	314 107	315 98	316 98	317 94	318 98
F.1e	307 92	308 93	309 101	310 103	311 102	312 102	313 107	314 108	315 99	316 99	317 95	318 99
H.												
H.60	306 5	307 5	308 4	309 5	310 5	311 5	312 4	313 5	314 5	315 5	316 4	317 5
H.62	312B 78	313B 97	314B 85	315B 97	316B122	317B114	318B 86	319B 78	320B 84	321B 82	322B 84	323B 72

* See "Key" on pages 64 and following.

INDEX TO "SOLAR-GEOPHYSICAL DATA"

Key*	1971 Jan		Feb		Mar		Apr		May		June		July		Aug		Sep		Oct		Nov		Dec	
A.																								
A.1	319	62	320	59	321	64	322	61	323	60	324	62	325	63	326	61	327	58	328	60	329	58	330	58
A.2a	318	7	319	7	320	7	321	7	322	7	323	7	324	7	325	7	326	7	327	7	328	7	329	7
A.2b	331	6	331	6	331	6	331	6	331	6	331	6	331	6	331	6	331	6	331	6	331	6	331	6
A.2c	318	7	319	7	320	7	321	7	322	7	323	7	324	7	325	7	326	7	327	7	328	7	329	7
A.3a	319	31	320	31	321	33	322	31	323	29	324	32	325	32	326	30	327	28	328	29	329	28	330	27
A.3b	319	73	320	69	321	75	322	71	323	71	324	72	325	74	326	72	327	68	328	71	329	68	330	69
A.4	319	62	320	59	321	64	322	61	323	60	324	62	325	63	326	61	327	58	328	60	329	58	330	58
A.5	319	31	320	31	321	33	322	31	323	29	324	32	325	32	326	30	327	28	328	29	329	28	330	27
A.5a	319	73	320	69	321	75	322	71	323	71	324	72	325	74	326	72	327	68	328	71	329	68	330	69
A.5b	319	80	320	75	321	83	322	79	323	80	324	80	325	82	326	79	327	76	328	78	329	76	330	76
A.7b	319	62	320	59	321	64	322	61	323	60	324	62	325	63	326	61	327	58	328	60	329	58	330	58
A.8aa	318	7	319	7	320	7	321	7	322	7	323	7	324	7	325	7	326	7	327	7	328	7	329	7
A.8ac	318	7	319	7	320	7	321	7	322	7	323	7	324	7	325	7	326	7	327	7	328	7	329	7
A.8g	318	7	319	7	320	7	321	7	322	7	323	7	324	7	325	7	326	7	327	7	328	7	329	7
A.9a	319	31	320	31	321	33	322	31	323	29	324	32	325	32	326	30	327	28	328	29	329	28	330	27
A.9b	319	31	320	31	321	33	322	31	323	29	324	32	325	32	326	30	327	28	328	29	329	28	330	27
A.9c	319	31	320	31	321	33	322	31	325B	61	324	32	325	32	326	30	327	28	328	29	329	28	330	27
A.10a	318	15	319	15	320	16	321	16	322	15	323	15	324	18	325	18	---		---		333B	66	333B	67
A.10b	318	14	319	14	320	15	321	15	322	14	323	14	324	17	325	17	---		---		---		---	
A.10c	318	17	319	17	320	18	321	18	322	17	323	17	324	20	325	20	326	15	327	16	328	15	329	16
A.10d	318	18	319	18	320	19	321	19	322	18	323	18	324	21	325	21	326	16	327	17	328	16	329	17
A.10e	318	16	319	16	320	17	321	17	322	16	323	16	324	19	325	19	326	14	327	15	328	14	329	15
A.11aa	319	81	320	76	321	84	322	80	323	81	324	81	325	83	326	80	327	77	328	79	329	77	330	77
A.11ab	323B	53	324B	44	325B	33	326B	47	327B	44	328B	36	329B	60	330B	64	331B	42	332B	34	333B	39	334B	38
A.11e	319	31	322B	94	321	33	322	31	323	29	324	32	325	32	326	30	327	28	328	29	329	28	330	27
A.12aa	328B	68	328B	74	328B	80	328B	86	328B	92	330B	92	330B	98	336B	98	336B	104	336B	110	338B	64	338B	70
A.12ab	328B	69	328B	75	328B	81	328B	87	328B	93	330B	93	330B	99	336B	99	366B	105	336B	111	338B	65	338B	71
A.12ba	318	21	319	24	320	25	321	24	322	24	323	22	324	27	325	27	326	22	327	23	328	23	329	23
A.12bb	318	22	319	25	320	26	321	25	322	25	323	23	324	28	325	28	326	23	329B	89	329B	89	---	
A.12c	318	23	319	26	320	27	321	26	322	26	323	24	324	29	325	29	326	24	327	24	328	24	329	24
A.13a	318	19	319	22	320	23	321	22	322	22	323	20	324	25	325	25	326	20	327	21	328	21	329	21
A.13c	318	20	319	23	320	24	321	23	322	23	323	21	324	26	325	26	326	21	327	22	328	22	329	22
B.																								
B.51ca	319	104	320	96	321	104	322	100	323	102	324	100	325	104	326	100	327	96	328	98	329	96	330	98
B.51cb	319	105	320	97	321	105	322	101	323	103	324	101	325	105	326	101	327	97	328	99	329	97	330	99
B.52	319	106	320	98	321	106	322	102	323	104	324	102	325	106	326	102	327	98	328	100	329	98	330	100
B.53	319	108	320	100	321	108	324B	70	324B	70	324	104	325	108	326	104	327	100	328	102	330B	104	330	102
C.																								
C.1a	318	10	319	10	320	10	321	10	322	10	323	10	324	10	325	10	326	10	327	10	328	10	329	10
C.1ba	323B	4	324B	5	325B	5	326B	4	327B	4	328B	4	329B	4	330B	4	331B	4	332B	4	333B	4	334B	5
C.1d	323B	33	324B	29	325B	23	326B	32	327B	28	328B	26	329B	44	330B	45	331B	30	332B	23	333B	25	334B	24
C.1e	323B	25	324B	21	325B	16	326B	22	327B	19	328B	17	329B	30	330B	33	331B	29	332B	15	333B	19	334B	18
C.1f	324B	67	325B	58	326B	71	327B	69	328B	62	329B	85	330B	89	331B	65	332B	59	333B	63	334B	65	335B	63
C.3	323B	34	324B	30	325B	24	326B	33	327B	29	328B	27	329B	45	330B	46	331B	31	332B	24	333B	26	334B	25
C.3	---		319	19	320	20	321	20	322	19	323	19	324	22	325	22	326	17	327	18	328	17	329	18
C.4aa	319	88	320	81	321	89	322	86	323	87	324	87	325	89	326	86	327	82	328	84	329	82	330	82
C.4b	319	88	320	81	321	89	322	86	323	87	324	87	325	89	326	86	327	82	328	84	329	82	330	82
C.4d	319	88	320	81	321	89	322	86	323	87	324	87	325	89	326	86	327	82	328	84	329	82	330	82
C.4e	319	88	320	81	321	89	322	86	323	87	327B	73	325	89	327B	71	327	82	328	84	329	82	330	82
C.4f	319	88	320	81	321	89	322	86	323	87	324	87	325	89	326	86	327	82	328	84	329	82	330	82
C.4g	---		---		321	89	322	86	323	87	324	87	328B	64	328B	65	---		---		333B	70	333B	71
C.5b	323B	52	324B	43	325B	32	326B	46	327B	43	328B	35	329B	59	330B	63	331B	41	332B	33	333B	38	334B	37
C.5c	319	83	320	78	321	86	322	82	323	83	324	83	325	85	326	82	327	79	328	81	329	79	330	79
C.6	319	84	320	79	321	87	322	83	323	84	324	84	325	86	326	83	327	80	328	82	329	80	330	80
D.																								
D.1a	319	100	320	92	321	100	322	96	323	98	324	96	325	100	326	96	327	92	328	94	329	92	330	92
D.1b	330	94	330	94	330	94	330	94	330	94	330	94	330	94	330	94	330	94	330	94	330	94	330	94
D.1c	330	95	330	95	330	95	330	95	330	95	330	95	330	95	330	95	330	95	330	95	330	95	330	95
D.1d	319	102	320	94	321	102	322	98	323	100	324	98	325	102	326	98	327	94	328	96	329	94	330	96
D.1e	323B	69	324B	58	325B	49	326B	62	327B	60	328B	51	329B	76	---		---		---		---		334B	54
D.1f	319	103	320	95	321	103	322	99	323	101	324	99	325	103	326	99	327	95	328	97	329	95	330	97
F.																								
F.1a	319	96	320	90	321	98	322	94	323	96	324	94	325	98	326	94	327	90	328	92	329	90	330	90
F.1b	319	96	310	90	321	98	322	94	323	96	324	94	328B	67	328B	67	328B	67	328	92	329	90	330	90
F.1c	319	96	320	90	321	98	322	94	323	96	324	94	325	98	326	94	327	90	328	92	333B	76	333B	76
F.1d	319	96	320	90	321	98	322	94	323	96	324	94	325	98	326	94	327	90	328	92	333B	76	333B	76
F.1e	319	98	320	91	321	99	322	95	323	97	324	95	325	99	326	95	327	91	328	93	329	91	330	91
F.1f	319	96	320	90	321	98	322	94	323	96	324	94	325	98	326	94	327	90	328	92	329	90	330	90
F.1g	319	96	320	90	321	98	322	94	323	96	324	94	325	98	326	94	327	90	328	92	329	90	330	90
H.																								
H.60	318	4	319	5	320	5	321	5	322	5	323	5	324	5	325	5	326	5	327	5	328	5	329	5
H.62	324B	60	325B	52	326B	64	327B	62	328B	55	329B	78	330B	82	331B	58	332B	52	333B	56	334B	58	335B	56

* See "Key" on pages 64 and following.

INDEX TO "SOLAR-GEOPHYSICAL DATA"

Key*	1972 Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
A.												
A.1	331 64	332 59	333 56	334 66	335 34	336 30	337 40	338 24	339 28	340 26	341 22	342 22
A.2a	330 7	331 7	332 7	333 7	334 7	335 7	336 7	337 7	338 7	339 6	340 7	341 7
A.2b	343 6	343 6	343 6	343 6	343 6	343 6	343 6	343 6	343 6	343 6	343 6	343 6
A.2c	330 7	331 7	332 7	333 7	334 7	335 7	336 7	337 7	338 7	339 6	340 7	341 7
A.3a	331 33	332 30	333 25	334 36	335 34	336 30	337 40	338 24	339 28	340 26	341 22	342 22
A.3b	331 75	332 74	333 72	334 81	335 96	336 90	337 102	338 86	339 88	340 89	341 82	342 84
A.4	331 64	332 59	333 56	334 66	335 34	336 30	337 40	338 24	339 28	340 26	341 22	342 22
A.5	331 33	332 30	333 25	334 36	335 34	336 30	337 40	338 24	339 28	340 26	341 22	342 22
A.5a	331 75	332 74	333 72	334 81	335 96	336 90	337 102	338 86	339 88	340 89	341 82	342 84
A.5b	331 82	332 81	333 79	334 88	335 104	336 97	337 109	338 93	339 95	340 98	341 87	342 89
A.7b	331 64	332 59	333 56	334 66	335 34	336 30	337 40	338 24	339 28	340 26	341 22	342 22
A.7c	---	332 59	333 56	334 66	335 34	336 30	337 40	338 24	339 28	340 26	341 22	342 22
A.11ja	---	---	---	---	335 34	336 30	337 40	338 24	339 28	340 26	341 22	342 22
A.8aa	330 7	331 7	332 7	333 7	334 7	335 7	336 7	337 7	338 7	339 6	340 7	341 7
A.8ac	330 7	331 7	332 7	333 7	334 7	335 7	336 7	337 7	338 7	339 6	340 7	341 7
A.8g	330 7	331 7	332 7	333 7	334 7	335 7	336 7	337 7	338 7	339 6	340 7	341 7
A.9a	331 33	332 30	333 25	334 36	335 34	336 30	337 40	338 24	339 28	340 26	341 22	342 22
A.9b	331 33	332 30	333 25	334 36	335 34	336 30	337 40	338 24	339 28	340 26	341 22	342 22
A.9c	331 33	332 30	333 25	334 36	335 34	336 30	338B 83	339B 96	339 28	340 26	341 22	342 22
A.10a	333B 68	333B 69	334B 69	334B 70	334 17	335 15	336 15	337 15	338 15	340 117	340 13	341 13
A.10c	330 14	331 18	332 16	333 14	334 19	335 17	336 17	337 18	338 17	339 15	340 15	341 15
A.10d	330 15	331 19	332 17	333 15	334 20	335 18	336 18	337 19	338 18	339 16	340 16	341 16
A.10e	330 13	331 16	332 15	333 13	334 18	335 16	336 16	337 16	338 16	339 13	340 14	341 14
A.11aa	331 83	332 82	333 80	334 89	335 105	336 98	337 110	338 94	339 96	340 99	341 88	342 90
A.11ab	335B 39	336B 68	337B 66	338B 32	339B 62	340B 59	341B 44	342B 70	343B 34	344B 54	345B 23	346B 24
A.11e	331 33	332 30	333 25	334 36	335 34	336 30	337 40	338 24	339 28	340 26	342B109	---
A.12aa	338B 78	337B 98	337B 82	338B 47	339B 78	340B 74	341B 60	342B 86	343B 49	345B 56	345B 38	346B 40& 353B 58
A.12ab	338B 79	337B 99	337B 83	338B 48	339B 79	340B 75	341B 61	342B 87	343B 50	345B 57	345B 39	346B 41& 353B 59
A.12ba	330 22	331 28	332 26	333 19	334 28	335 26	336 24	337 28	---	339 22	340 20	---
A.12bb	---	---	---	333 20	334 29	335 27	336 26	337 29	338 21	339 23	340 22	341 19
A.12c	330 23	331 29	332 27	333 21	334 31	335 28	336 27	337 31	---	---	---	---
A.13a	330 20	331 26	332 24	333 19	334 28	335 26	336 24	337 28	---	339 22	340 20	341 19
A.13ab	---	---	---	333 20	334 30	335 27	336 26	337 29	338 21	339 24	340 23	341 19
A.13c	330 20	331 27	332 25	333 18	334 27	335 25	---	---	---	---	---	---
A.17	---	---	---	333 20	334 30	335 27	336 26	337 29	338 21	339 24	340 23	341 19
A.18	---	---	---	333 20	334 29	335 27	336 26	337 29	338 21	339 23	340 22	341 19
B.												
B.51ca	331 106	332 106	333 104	334 108	335 130	336 122	337 132	338 122	339 116	340 124	341 104	342 110
B.51cb	331 107	332 107	333 105	334 109	335 131	336 123	337 133	338 123	339 117	340 125	341 105	342 111
B.52	331 108	332 108	333 106	334 110	335 132	336 124	337 134	338 124	339 118	340 126	341 106	342 112
B.53	331 110	332 110	333 108	334 112	335 134	336 126	337 136	338 126	339 120	340 128	341 108	342 114
C.												
C.1a	330 10	331 10	332 10	333 10	334 10	335 10	336 10	337 10	338 10	339 9	340 10	341 10
C.1ba	335B 5	336B 5	337B 5	338B 5	339B 5	340B 5	341B 5	342B 4	343B 4	344B 4	345B 4	346B 4
C.1d	335B 23	336B 38	337B 37	338B 22	339B 38	340B 35	341B 28	342B 34	343B 22	344B 25	345B 14	346B 14
C.1e	335B 18	336B 30	337B 28	338B 15	339B 28	340B 24	341B 21	342B 25	343B 16	344B 19	345B 11	346B 11
C.1f	336B 92	337B 96	338B 62	339B 94	340B 90	341B 76	342B105	343B 65	344B 79	345B 55	346B 55	347B 51
C.3	335B 24	336B 39	337B 38	338B 23	339B 39	340B 36	341B 29	342B 35	343B 23	344B 26	345B 15	346B 15
C.3	330 16	331 20	332 18	333 16	334 21	335 19	336 19	337 20	338 19	339 18	340 17	341 17
C.3t	---	---	---	---	---	---	---	---	---	---	---	342 101
C.4aa	331 88	332 88	333 86	334 94	335 111	336 104	337 115	338 100	339 101	340 105	341 93	342 95
C.4b	331 88	332 88	333 86	334 94	335 111	336 104	337 115	338 100	339 101	340 105	341 93	342 95
C.4d	331 88	332 88	333 86	334 94	335 111	336 104	337 115	338 100	339 101	340 105	341 93	342 95
C.4e	331 88	332 88	336B 95	334 94	335 111	336 104	337 115	338 100	339 101	340 105	341 93	342 95
C.4f	331 88	332 88	333 86	334 94	335 111	336 104	337 115	338 100	339 101	340 105	341 93	342 95
C.4g	---	333B 72	---	334 94	335 111	---	---	---	---	---	---	---
C.5b	335B 38	337B104	338B 82	338B 31	341B 78	341B 79	341B 43	---	---	---	---	---
C.5c	331 85	332 84	333 82	334 91	335 107	336 100	337 112	338 96	339 98	340 101	341 90	342 92
C.6	331 86	332 85	333 83	334 92	335 108	336 101	337 113	338 97	339 99	340 102	341 91	342 93
D.												
D.1a	331 102	332 102	333 100	334 104	335 126	336 118	337 128	338 118	339 112	340 120	341 100	342 104
D.1b	342 106	342 106	342 106	342 106	342 106	342 106	342 106	342 106	342 106	342 106	342 106	342 106
D.1c	342 107	342 107	342 107	342 107	342 107	342 107	342 107	342 107	342 107	342 107	342 107	342 107
D.1d	331 104	332 104	333 102	334 106	335 128	336 120	337 130	338 120	339 114	340 122	341 102	342 108
D.1e	---	---	---	---	339B 84	340B 80	---	342B 92	343B 55	---	345B 44	---
D.1f	331 105	332 105	333 103	334 107	335 129	336 121	337 131	338 121	339 115	340 123	341 103	342 109
F.												
F.1a	331 100	332 100	333B 71	334 102	335 124	336 116	337 126	350B 98	350B 98	350B 98	350B 98	350B 98
F.1b	331 100	332 100	333 98									
F.1c	331 100	342B111	333 98	334 102	335 124	336 116	337 126	338 116	339 110	340 118	341 98	342 102
F.1d	331 100	342B111	342B111	342B111	342B111	336 116	348B 49	348B 49	348B 49	348B 49	348B 49	348B 49
F.1e	331 101	332 101	334B 71	334 103	335 125	336 117	337 127	350B 99	350B100	350B100	350B101	350B101
F.1f	331 100	332 100	333 98	334 102	335 124	336 116	337 126	338 116	339 110	340 118	341 98	342 102
F.1g	331 100	332 100	333 98	334 102	335 124	336 116	337 126	338 116	339 110	340 118	341 98	341 102
H.												
H.60	330 5	331 5	332 5	333 5	334 5	335 5	336 5	337 4	338 5	339 4	340 5	341 5
H.62	336B 85	337B 90	338B 55	339B 87	340B 83	341B 69	342B 98	343B 58	344B 72	345B 48	346B 48	347B 44

* See "Key" on pages 64 and following.

INDEX TO "SOLAR-GEOPHYSICAL DATA"

Key*	1973 Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
A.												
A.1	343 22	344 26	345 30	346 30	347 24	348 24	349 26	350 28	351 26	352 24	353 26	354 24
A.2a	342 7	343 7	344 7	345 7	346 7	347 7	348 7	349 7	350 7	351 7	352 7	353 7
A.2b	355 6	355 6	355 6	355 6	355 6	355 6	355 6	355 6	355 6	355 6	355 6	355 6
A.2c	342 7	343 7	344 7	345 7	346 7	347 7	348 7	349 7	350 7	351 7	352 7	353 7
A.3a	343 22	344 26	345 30	346 30	347 24	348 24	349 26	350 28	351 26	352 24	353 26	354 24
A.3b	343 84	344 82	345 92	346 90	347 86	348 84	349 88	350 90	351 86	352 86	353 86	354 86
A.4	343 22	344 26	345 30	346 30	347 24	348 24	349 26	350 28	351 26	352 24	353 26	354 24
A.5	343 22	344 26	345 30	346 30	347 24	348 24	349 26	350 28	351 26	352 24	353 26	354 24
A.5a	343 84	344 82	345 92	346 90	347 86	348 84	349 88	350 90	351 86	352 86	353 86	354 86
A.5b	343 91	344 88	345 99	346 96	347 92	348 90	349 95	350 95	351 91	352 93	353 92	354 91
A.6	---	---	---	---	---	348 22	349 25	350 27	351 25	352 23	353 25	354 23
A.7b	343 22	344 26	345 30	346 30	347 24	348 24	349 26	350 28	351 26	352 24	353 26	354 24
A.7c	343 22	344 26	345 30	346 30	347 24	348 24	349 26	350 28	351 26	352 24	353 26	354 24
A.11ja	343 22	344 26	345 30	346 30	347 24	348 24	349 26	350 28	351 26	352 24	353 26	354 24
A.7e	343 22	344 26	345 30	346 30	347 24	348 24	349 26	350 28	351 26	352 24	353 26	354 24
A.8aa	342 7	343 7	344 7	345 7	346 7	347 7	348 7	349 7	350 7	351 7	352 7	353 7
A.8ac	342 7	343 7	344 7	345 7	346 7	347 7	348 7	349 7	350 7	351 7	352 7	353 7
A.8g	342 7	343 7	344 7	345 7	346 7	347 7	348 7	349 7	350 7	351 7	352 7	353 7
A.9a	343 22	344 26	345 30	346 30	347 24	348 24	349 26	350 28	---	---	---	---
A.9b	343 22	344 26	345 30	346 30	347 24	348 24	349 26	350 28	351 26	352 24	353 26	354 24
A.9c	---	---	---	---	---	---	---	350 28	351 26	353B 54	353 6	354 24
A.10a	342 13	343 13	344 15	345 15	346 15	347 13	348 13	349 13	350 14	351 13	352 13	353 13
A.10c	342 15	343 15	344 17	345 17	346 17	347 15	348 15	349 15	351 107	351 15	353 104	353 15
A.10d	342 16	343 16	344 18	345 18	346 18	347 16	348 16	349 16	351 108	351 16	353 105	353 16
A.10e	342 14	343 14	344 16	345 16	346 16	347 14	348 14	349 14	350 15	351 14	352 14	353 14
A.11aa	343 92	344 89	345 100	346 97	347 93	348 91	349 96	350 96	351 92	352 94	353 93	354 92
A.11ab	347B 26	348B 21	349B 50	350B 67	351B 61	352B 30	353B 26	354B 21	355B 37	356B 24	357B 21	358B 20
A.11f	343 22	344 26	345 30	346 30	347 24	348 24	349 26	350 28	351 26	352 24	353 26	354 24
A.12aa	350B102	353B 64	353B 70	353B 76	353B 82	---	---	---	---	---	---	---
A.12ab	350B102	353B 64	353B 70	353B 76	353B 82	---	---	---	---	---	---	---
A.12ba	342 19	---	---	---	346 26	347 20	---	349 20	350 20	---	352 17	353 20
A.12bb	342 20	343 19	344 24	345 27	346 27	347 21	348 19	349 21	350 21	351 20	352 18	353 21
A.13a	342 19	---	---	---	346 26	347 20	---	349 20	350 20	---	352 17	353 20
A.13ab	342 20	343 19	344 24	345 27	346 27	347 21	348 19	349 21	350 21	351 20	352 18	353 21
A.17	342 19	---	---	---	346 27	347 21	---	349 21	350 21	---	---	353 21
A.17	342 20	343 19	344 24	345 27	346 27	347 21	348 19	349 21	350 21	351 20	352 18	353 21
A.17c	348 20	348 20	348 20	348 20	348 20	348 20	348 20	349 22	350 22	351 21	352 19	353 22
A.18	342 19	---	---	---	346 27	347 21	---	349 21	350 21	---	---	353 21
A.18	342 20	343 19	344 24	345 27	346 27	347 21	348 19	349 21	350 21	351 20	352 18	353 21
B.												
B.51ca	343 110	344 108	345 126	346 128	347 120	348 114	349 118	350 114	351 116	352 114	353 114	354 111
B.51cb	343 111	344 109	345 127	346 129	347 121	348 115	349 119	350 115	351 117	352 115	353 115	---
B.52	343 112	344 110	345 128	346 130	347 122	348 116	349 120	350 116	351 118	352 116	353 116	354 112
B.53	343 114	344 112	345 130	346 132	347 124	348 118	349 122	350 118	351 120	352 118	353 118	354 114
C.												
C.1a	342 10	343 6	344 10	345 10	346 10	347 10	348 10	349 10	350 10	351 10	352 10	353 10
C.1ba	347B 4	348B 4	349B 4	350B 4	351B 4	352B 4	353B 4	354B 4	355B 4	356B 4	357B 4	358B 4
C.1d	347B 15	348B 14	349B 26	350B 29	351B 27	352B 19	353B 16	354B 14	355B 22	356B 15	357B 12	358B 13
C.1e	347B 14	348B 12	349B 20	350B 28	351B 21	352B 14	353B 11	354B 10	355B 16	356B 12	357B 9	358B 10
C.1f	348B 45	349B 78	350B 95	351B 82	352B 63	353B 51	354B 45	355B 61	356B 51	357B 45	358B 45	359B 45
C.3	347B 16	348B 15	349B 27	350B 30	351B 28	352B 20	353B 17	354B 15	355B 23	356B 16	357B 13	358B 14
C.3	342 17	343 17	344 19	345 19	346 19	347 17	348 17	349 17	350 16	351 17	352 15	353 17
C.3t	344B 83	344 101	345 117	346 119	347 111	348 105	349 109	350 106	351 106	352 105	353 102	354 101
C.4aa	343 97	344 95	345 106	346 104	347 100	348 97	349 101	350 100	351 97	352 99	353 97	354 96
C.4b	343 97	344 95	345 106	346 104	347 100	348 97	349 101	350 100	351 97	352 99	353 97	354 96
C.4d	343 97	344 95	345 106	346 104	347 100	348 97	349 101	350 100	351 97	352 99	353 97	354 96
C.4e	343 97	344 95	345 106	346 104	347 100	348 97	349 101	350 100	351 97	352 99	353 97	354 96
C.4f	343 97	344 95	345 106	346 104	347 100	348 97	349 101	350 100	351 97	352 99	353 97	354 96
C.5c	343 94	344 91	345 102	346 99	347 95	348 93	349 98	350 98	351 94	352 96	353 95	354 94
C.6	343 95	344 93	345 103	346 100	347 97	348 94	349 99	350 99	351 95	352 97	353 96	354 95
D.												
D.1a	343 106	344 104	345 120	346 123	347 114	348 108	349 112	350 109	351 111	352 108	353 108	354 104
D.1b	354 106	354 106	354 106	354 106	354 106	354 106	354 106	354 106	354 106	354 106	354 106	354 106
D.1c	354 107	354 107	354 107	354 107	354 107	354 107	354 107	354 107	354 107	354 107	354 107	354 107
D.1d	343 108	344 106	345 122	346 125	347 118	348 111	349 115	350 112	351 114	352 111	353 111	354 109
D.1e	---	348B 35	349B 66	350B 82	351B 77	352B 51	---	---	---	356B 40	---	---
D.1f	343 109	344 107	345 124	346 127	347 119	348 113	349 116	350 113	351 115	352 113	353 112	354 110
D.1g	---	---	---	---	347 116	348 110	349 114	350 111	351 113	352 110	353 110	354 108
F.												
F.1a	346B 58	346B 58	346B 58	347B 55	348B 48	349B 81	349 110	350 107	351 109	352 106	353 106	355B 64
F.1c	343 104	344 102	345 118	346 121	347 112	348 106	349 110	350 107	352B 66	352 106	353 106	354 102
F.1e	346B 59	346B 60	346B 61	347B 55	348B 48	349B 81	349 111	350 108	351 110	352 107	353 107	355B 64
F.1f	343 104	344 102	345 118	346 121	347 112	348 106	349 110	350 107	351 109	352 106	353 106	354 102
F.1g	343 104	344 102	345 118	346 121	347 112	348 106	349 110	350 107	351 109	352 106	353 106	354 102
F.1h	---	---	---	346 121	347 112	348 106	349 110	350 107	351 109	352 106	353 106	354 102
F.1i	---	---	---	---	---	---	---	---	---	---	---	354 102
F.1j	---	---	---	---	---	---	---	---	---	---	---	354 102
H.												
H.60	342 5	343 5	344 5	345 5	346 5	347 5	348 5	349 5	350 5	351 5	352 5	353 5
H.62	348B 38	349B 72	350B 88	351B 82	352B 56	353B 44	354B 38	355B 54	356B 44	357B 38	358B 38	359B 38

*See "Key" on page 64 and following.

INDEX TO "SOLAR-GEOPHYSICAL DATA"

Key*	1974 Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
A.												
A.1	355 24	356 24	357 26	358 30	359 22	360 42	361 30	362 32	363 28	364 32	365 26	366 24
A.2a	354 7	355 7	356 7	357 7	358 7	359 7	360 7	361 7	362 7	363 7	364 7	365 7
A.2b	367A 6	367A 6	367A 6	367A 6	367A 6	367A 6	367A 6	367A 6	367A 6	367A 6	367A 6	367A 6
A.2c	354 7	355 7	356 7	357 7	358 7	359 7	360 7	361 7	362 7	363 7	364 7	365 7
A.3a	355 24	356 24	357 26	358 30	359 22	360 42	361 30	362 32	363 28	364 32	365 26	366 24
A.3b	355 86	356 80	357 88	358 90	359 84	360 102	361 92	362 94	363 88	364 94	365 86	366 86
A.3c	---	---	---	---	---	---	361 27	362 32	363 28	364 32	365 26	366 24
A.4	355 24	356 24	357 26	358 30	359 22	360 42	361 30	362 32	363 28	364 32	365 26	366 24
A.5	355 24	356 24	357 26	358 30	359 22	360 42	361 30	362 32	363 28	364 32	365 26	366 24
A.5a	355 86	356 80	357 88	358 90	359 84	360 102	361 92	362 94	363 88	364 94	365 86	366 86
A.5b	355 92	356 86	357 96	358 97	359 94	360 110	361 102	362 102	363 97	364 101	365 92	366 92
A.6	355 23	356 23	357 25	358 29	359 21	360 40	361 26	362 31	363 27	364 31	365 24	366 23
A.7b	355 24	356 24	357 26	358 30	359 22	360 42	361 30	362 32	363 28	364 32	365 26	366 24
A.7c	355 24	356 24	357 26	358 30	359 22	360 42	---	---	---	---	---	---
A.11ja	355 24	356 24	357 26	---	---	---	---	---	---	---	---	----
A.8aa	354 7	355 7	356 7	357 7	358 7	359 7	360 7	361 7	362 7	363 7	364 7	365 7
A.8ac	354 7	355 7	356 7	357 7	358 7	359 7	360 7	361 7	362 7	363 7	364 7	365 7
A.8g	354 7	355 7	356 7	357 7	358 7	359 7	360 7	361 7	362 7	363 7	364 7	365 7
A.9c	356B 56	356 24	---	---	---	---	---	---	---	---	---	---
A.9cb	---	---	---	---	---	---	---	---	---	---	365 26	366 24
A.9d	---	---	---	---	---	360 42	361 30	362 32	363 28	364 32	365 26	366 24
A.10a	354 13	355 13	356 12	357 14	358 14	359 13	360 16	361 13	362 14	364 110	364 13	365 12
A.10c	354 15	355 15	356 14	357 16	358 16	360B 32	360 18	361 15	362 16	363 15	364 15	365 14
A.10d	354 16	355 16	356 15	357 17	358 17	360B 33	360 19	361 16	362 17	363 16	364 16	365 15
A.10e	354 14	355 14	356 13	357 15	358 15	359 14	360 17	361 14	362 15	363 14	364 14	365 13
A.11aa	355 93	356 87	364B 57	364B 59	---	---	---	---	---	---	---	---
A.11ab	359B 18	364B 44	365B 84	365B 92	---	---	---	---	---	---	---	---
A.11e	---	---	---	---	---	---	365B 98	362 32	363 28	364 32	365 26	366 24
A.11f	355 24	356 24	357 26	358 30	359 22	360 42	361 30	---	---	---	---	---
A.11g	---	---	---	---	---	---	---	---	---	---	364 21	365 18
A.12ba	--- ---	---	356 17	---	---	---	---	361 18	---	---	---	365 17
A.12bb	354 19	355 19	356 18	---	358 23	---	360 31	361 19	362 22	---	364 19	---
A.12d	---	---	---	---	---	---	360 33	361 20	362 23	363 22	364 24	---
A.13a	---	---	356 17	---	---	---	---	361 18	---	---	---	365 17
A.13ab	354 19	355 19	356 18	---	358 23	---	360 31	361 19	---	363 21	364 19	---
A.17	354 19	---	---	---	---	---	360 31	361 19	362 22	---	---	---
A.17	354 19	355 19	356 18	---	358 23	---	360 31	361 19	---	363 21	364 19	---
A.17c	354 20	355 20	356 19	357 22	358 25	359 18	360 32	361 23	362 26	363 24	364 27	365 21
A.18	354 19	---	---	---	---	---	360 31	361 19	362 22	---	---	---
A.18	354 19	355 19	356 18	---	358 23	---	360 31	361 19	---	363 21	364 19	---
B.												
B.51ca	355 111	356 107	357 111	358 117	359 119	360 131	361 131	362 119	363 123	364 119	365 109	366 111
B.52	355 112	356 108	357 112	358 118	359 120	360 132	361 132	362 120	363 124	364 120	365 110	366 112
B.53	355 114	356 110	357 114	358 120	359 122	360 134	361 134	362 122	363 126	364 122	365 112	366 114
C.												
C.1a	354 10	355 10	356 10	357 10	358 10	359 10	360 10	361 10	362 10	363 10	364 10	365 10
C.1ba	359B 4	360B 4	361B 4	362B 4	363B 4	364B 4	365B 4	366B 4	367B 4	368B 4	369B 4	370B 4
C.1d	359B 12	360B 12	361B 10	362B 23	363B 18	364B 17	365B 26	366B 14	367B 20	368B 24	369B 14	370B 11
C.1e	359B 9	360B 10	361B 8	362B 18	363B 14	364B 13	365B 20	366B 13	367B 16	368B 20	369B 11	370B 8
C.1f	360B 29	361B 22	362B 47	363B 41	364B 39	365B 81	366B 29	367B 52	368B 56	369B 34	370B 26	371B 22
C.3	359B 13	360B 13	361B 11	362B 24	363B 19	364B 18	365B 27	366B 15	367B 21	368B 25	369B 15	370B 12
C.3	354 17	355 17	356 16	357 18	358 18	359 15	360 20	361 17	362 18	363 17	364 17	365 16
C.3t	355 103	356 98	357 103	359B 51	359 110	360 122	361 122	362 111	263 115	365B106	365 101	366 100
C.4aa	355 98	356 91	357 99	358 102	359 98	361B 24	361 106	362 104	363 101	364 104	365 94	366 94
C.4b	355 98	356 91	357 99	358 102	359 98	360 113	361 106	362 104	363 101	364 104	365 94	366 94
C.4d	355 98	356 91	357 99	359B 48	359 98	360 113	361 106	362 104	363 101	365B103	365 94	366 94
C.4e	355 98	356 91	357 99	358 102	359 98	360 113	361 106	362 104	363 101	364 104	365 94	366 94
C.4f	355 98	356 91	357 99	358 102	359 98	360 113	361 106	362 104	363 101	364 104	365 94	366 94
C.4h	---	356 91	357 99	358 102	---	360 113	361 106	362 104	---	---	365 94	366 94
C.4i	---	---	357 99	---	359 98	360 113	361 106	362 104	363 101	364 104	365 94	366 94
C.4j	---	---	---	358 102	359 98	360 113	261 106	362 104	363 101	364 104	265 94	366 94
C.5c	355 95	356 89	---	364B 61	---	---	---	---	---	---	---	---
C.5e	---	---	---	---	---	---	---	---	---	---	---	---
C.6	355 96	356 90	357 97	358 98	359 95	360 111	361 103	362 103	363 99	364 102	364 23 365 93	365 18 366 93
D.												
D.1a	355 106	356 102	357 106	358 112	359 114	360 126	361 126	362 114	363 118	364 113	365 104	366 103
D.1ba	355 107	356 103	357 107	358 113	359 115	360 127	361 127	362 115	363 119	364 114	365 104	366 105
D.1c	366 107	366 107	366 107	366 107	366 107	366 107	366 107	366 107	366 107	366 107	366 107	366 107
D.1d	355 109	356 105	357 109	358 115	359 117	360 129	361 129	362 117	363 121	364 116	365 107	366 109
D.1e	359B 34	---	362B 48	363B 42	---	---	365B 70	---	367B 40	367B 44	---	---
D.1f	355 110	356 106	357 110	358 116	359 118	360 130	361 130	362 118	363 122	364 118	365 108	366 110
D.1g	355 108	356 104	357 108	358 114	359 116	360 128	361 128	362 116	363 120	364 115	365 106	366 108
F.												
F.1a	356B 54	357B 48	357 104	358 110	359 112	360 124	361 124	362 112	364B 42	364 111	365 102	366 101
F.1b	---	---	---	---	---	---	---	---	---	---	---	366 101
F.1c	355 104	356 100	357 104	---	---	---	---	---	---	---	---	---
F.1e	356B 54	357B 48	357 104	358 110	359 112	360 124	361 124	362 112	364B 42	364 111	365 102	365 101
F.1f	355 104	356 100	357 104	358 110	359 112	360 124	361 124	362 112	363 116	364 111	366B 32	366 101
F.1g	355 104	356 100	357 104	358 110	359 112	360 124	361 124	362 112	363 116	364 111	366B 32	366 101
F.1h	355 104	356 100	357 104	358 110	359 112	360 124	361 124	363B 47	363 116	364 111	365 102	366 101
F.1i	355 104	356 100	357 104	358 110	359 112	360 124	361 124	362 112	363 116	364 111	365 102	366 101
F.1j	355 104	356 100	357 104	358 110	359 112	360 124	361 124	362 112	363 116	364 111	365 102	366 101
H.												
H.60	354 4	355 4	356 4	357 4	358 4	359 4	360 4	361 4	362 4	363 4	364 4	365 4
H.62	360B 22	361B 16	362B 40	363B 34	364B 32	365B 74	366B 22	367B 44	368B 48	369B 25	370B 17	371B 13

* See "Key" on pages 64 and following.

INDEX TO "SOLAR-GEOPHYSICAL DATA"

Key*	1975 Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
A.												
A.1	367A 24	368A 26	369A 26	370A 24	371A 24	372A 28	373A 34	374A 28	375A 24	376A 28	377A 26	378A 28
A.2a	366A 7	367A 7	368A 7	369A 7	370A 7	371A 7	372A 7	373A 7	374A 7	375A 7	376A 7	377A 7
A.2b	378A 6	378A 6	378A 6	378A 6	378A 6	378A 6	378A 6	378A 6	378A 6	378A 6	378A 6	378A 6
A.2c	366A 7	367A 7	368A 7	369A 7	370A 7	371A 7	372A 7	373A 7	374A 7	375A 7	376A 7	377A 7
A.3a	367A 24	368A 26	369A 26	370A 24	371A 24	372A 28	374A 34	374A 28	375A 24	376A 28	377A 26	378A 28
A.3b	367A 86	368A 82	369A 88	370A 84	371A 86	372A 88	373A 96	374A 90	375A 84	376A 90	377A 86	378A 90
A.3c	367A 24	368A 26	369A 26	370A 24	371A 24	372A 28	373A 34	374A 28	375A 24	376A 28	377A 26	378A 28
A.4	367A 24	368A 26	369A 26	370A 24	371A 24	372A 28	373A 34	374A 28	375A 24	376A 28	377A 26	378A 28
A.5	367A 24	368A 26	369A 26	370A 24	371A 24	372A 28	373A 34	374A 28	375A 24	376A 28	377A 26	378A 28
A.5a	367A 86	368A 82	369A 88	370A 84	371A 86	372A 88	373A 96	374A 90	375A 84	376A 90	377A 86	378A 90
A.5b	367A 93	368A 89	369A 93	370A 91	371A 92	372A 93	373A101	374A 95	375A 90	376A 96	377A 92	378A 94
A.6	367A 23	368A 25	369A 25	370A 23	371A 23	372A 27	373A 33	374A 26	375A 23	376A 27	377A 25	378A 27
A.7b	367A 24	368A 26	369A 26	370A 24	371A 24	372A 28	373A 34	374A 28	375A 24	376A 28	377A 26	378A 28
A.8aa	366A 7	367A 7	368A 7	369A 7	370A 7	371A 7	372A 7	373A 7	374A 7	375A 7	376A 7	377A 7
A.8ac	366A 7	367A 7	368A 7	369A 7	370A 7	371A 7	372A 7	373A 7	374A 7	375A 7	376A 7	377A 7
A.8g	366A 7	367A 7	368A 7	369A 7	370A 7	371A 7	372A 7	373A 7	374A 7	375A 7	376A 7	377A 7
A.9cb	367A 24	368A 26	369A 26	370A 24	371A 24	372A 28	373A 34	374A 28	375A 24	376A 28	377A 26	378A 28
A.9d	367A 24	368A 26	369A 26	370A 24	371A 24	372A 28	373A 34	374A 28	375A 24	376A 28	377A 26	378A 28
A.10a	366A 12	367A 12	369A101	369A 12	370A 12	371A 12	372A 15	373A 15	374A 12	375A 12	376A 14	377A 12
A.10c	366A 14	367A 14	368A 14	369A 14	371A100	371A 14	372A 17	373A 17	374A 14	375A 14	376A 16	378B 57
A.10d	366A 15	367A 15	368A 15	369A 15	371A101	371A 15	372A 18	373A 18	374A 15	375A 15	376A 17	378B 58
A.10e	366A 13	367A 13	368A 13	369A 13	370A 13	371A 13	372A 16	373A 16	374A 13	375A 13	376A 15	377A 13
A.11e	368B 58	369B 36	369A 26	371B 24	371A 24	373A 34	---	---	---	---	---	---
A.11g	366A 18	367A 18	368A 18	369A 20	370A 18	---	---	373A 25	374A 20	375A 18	376A 21	377A 19
A.11h	---	---	---	---	---	---	---	374A 28	375A 24	376A 28	377A 26	378A 28
A.12a	---	---	---	369A 18	370A 16	371A 18	---	---	374A 18	---	---	377A 18
A.12bb	---	---	---	369A 19	370A 17	371A 19	---	---	374A 19	---	---	---
A.13a	---	---	---	369A 18	370A 16	371A 18	---	---	374A 18	---	---	377A 18
A.13ab	---	---	---	369A 19	370A 17	371A 19	372A 22	---	374A 19	---	---	---
A.13d	366A 17	367A 17	368A 17	369A 17	370A 15	371A 17	372A 21	373A 24	374A 17	375A 17	376A 20	377A 17
A.17	---	---	---	369A 19	370A 17	371A 19	---	---	374A 19	---	---	---
A.17	---	---	---	369A 19	---	371A 19	372A 22	---	374A 19	---	---	---
A.17c	366A 20	367A 20	368A 21	369A 22	370A 20	371A 20	372A 24	373A 29	374A 23	375A 20	376A 24	377A 21
A.18	---	---	---	369A 19	370A 17	371A 19	---	---	374A 19	---	---	---
A.18	---	---	---	369A 19	---	371A 19	372A 24	---	374A 19	---	---	---
B.												
B.51ca	367A111	368A103	369A109	370A105	371A108	372A109	373A119	374A115	375A103	376A113	377A111	378A114
B.52	367A112	368A104	369A110	370A106	371A109	372A110	373A120	374A116	375A104	376A114	377A112	378A115
B.53	367A114	368A106	369A112	370A108	371A111	372A112	373A122	374A118	375A106	376A116	377A114	378A117
C.												
C.1a	366A 10	367A 10	368A 10	369A 10	370A 10	371A 10	372A 10	373A 10	374A 10	375A 10	376A 10	377A 10
C.1ba	375B 26	375B 30	375B 35	375B 39	375B 6	376B 4	377B 4	378B 4	379B 4	380B 4	381B 4	382B 4
C.1d	366A 11	367A 11	368A 11	369A 11	370A 11	371A 11	372A 14	373A 14	374A 11	375A 11	376A 13	377A 11
C.1d	371B 6	372B 6	373B 6	374B 5	375B 10	376B 9	377B 15	378B 25	379B 8	380B 7	381B 13	382B 8
C.1e	371B 5	372B 5	375B 41	375B 41	375B 9	376B 8	377B 14	378B 24	379B 7	380B 6	381B 12	382B 7
C.1f	372B 20	375B 41	375B 41	375B 24	376B 22	377B 32	378B 52	379B 22	380B 20	381B 36	382B 26	383B 32
C.3	371B 7	372B 7	373B 7	374B 6	375B 11	376B 10	377B 16	378B 26	379B 9	380B 8	381B 14	382B 9
C.3	366A 16	367A 16	368A 16	369A 16	370A 14	371A 16	372A 19	373A 19	374A 16	375A 16	376A 18	377A 16
C.3t	367A103	368A 95	369A100	370A 97	371A 99	372A101	363A111	374A107	376B 26	376A105	377A102	378A101
C.4a	367A 96	368A 91	369A 95	370A 93	371A 94	372A 95	373A103	374A 99	375A 92	376A 98	377A 94	378A 96
C.4b	367A 96	368A 91	369A 95	370A 93	371A 94	372A 95	373A103	374A 99	375A 92	376A 98	377A 94	378A 96
C.4d	367A 96	368A 91	369A 95	370A 93	371A 94	372A 95	374B 19	378B 54	376B 24	376A 98	377A 94	378A 96
C.4e	367A 96	368A 91	369A 95	370A 93	371A 94	372A 95	373A103	374A 99	375A 92	376A 98	377A 94	378A 96
C.4f	367A 96	368A 91	369A 95	370A 93	371A 94	372A 95	373A103	374A 99	375A 92	376A 98	377A 94	378A 96
C.4h	367A 96	368A 91	369A 95	---	---	372A 95	373A103	---	---	376A 98	---	---
C.4i	367A 96	368A 91	369A 95	370A 93	371A 94	372A 95	373A103	374A 99	375A 92	376A 98	377A 94	378A 96
C.4j	367A 96	368A 91	369A 95	370A 93	371A 94	372A 95	373A103	374A 99	375A 92	376A 98	377A 94	378A 96
C.5e	366A 18	367A 18	368A 18	369A 20	370A 18	---	372A 23	373A 27	374A 22	375A 18	376A 23	377A 23
C.6	367A 95	368A 90	369A 94	370A 92	371A 93	372A 94	373A102	374A 96	375A 91	376A 97	377A 93	378A 95
D.												
D.1a	367A106	368A 98	369A104	370A100	371A104	372A104	373A114	374A110	374A 98	376A108	377A105	378A105
D.1ba	367A107	368A 99	369A105	370A101	371A105	372A105	373A115	374A111	374A 99	376A109	377A106	378A107
D.1c	378A108	378A108	378A108	378A108	378A108	378A108	378A108	378A108	378A108	378A108	378A108	378A108
D.1d	367A109	368A101	369A107	370A103	371A106	372A107	373A117	374A113	374A101	376A111	377A108	378A112
D.1e	---	---	373B 10	---	---	---	---	---	---	381B 47	382B 40	---
D.1f	367A110	368A102	369A108	370A104	371A107	372A108	373A118	374A114	374A102	376A112	377A110	378A113
D.1g	367A108	368A100	369A106	370A102	372B 24	372A106	373A116	374A112	374A100	376A110	377A107	378A111
F.												
F.1a	367A104	368A 96	369A102	370A 98	371A102	372A102	373A112	374A108	375A 96	377B 34	377A103	378A104
F.1b	367A104	368A 96	369A102	370A 98	371A102	372A102	373A112	374A108	375A 96	376A106	377A103	378A104
F.1e	367A104	368A 96	369A102	370A 98	371A102	372A102	373A112	374A108	375A 96	377B 34	377A103	378A104
F.1f	367A104	368A 96	369A102	370A 98	371A102	372A102	374B 22	374A108	375A 96	376A106	377A103	378A104
F.1g	367A104	368A 96	369A102	370A 98	371A102	372A102	374B 22	374A108	375A 96	376A106	377A103	378A104
F.1h	367A104	368A 96	369A102	370A 98	371A102	372A102	373A112	374A108	375A 96	376A106	377A103	378A104
F.1i	367A104	368A 96	370A102	370A 98	371A102	372A102	373A112	374A108	375A 96	376A106	377A103	378A104
F.1j	367A104	368A 96	369A102	370A 98	371A102	372A102	373A112	374A108	375A 96	376A106	377A103	378A104
H.												
H.60	366A 4	367A 5	368A 4	369A 5	370A 5	371A 5	372A 4	373A 4	374A 4	375A 5	376A 5	377A 5
H.62	372B 11	373B 15	374B 8	375B 16	376B 14	377B 24	378B 44	379B 15	380B 13	381B 29	382B 19	383B 25

* See "Key" on pages 64 and following.

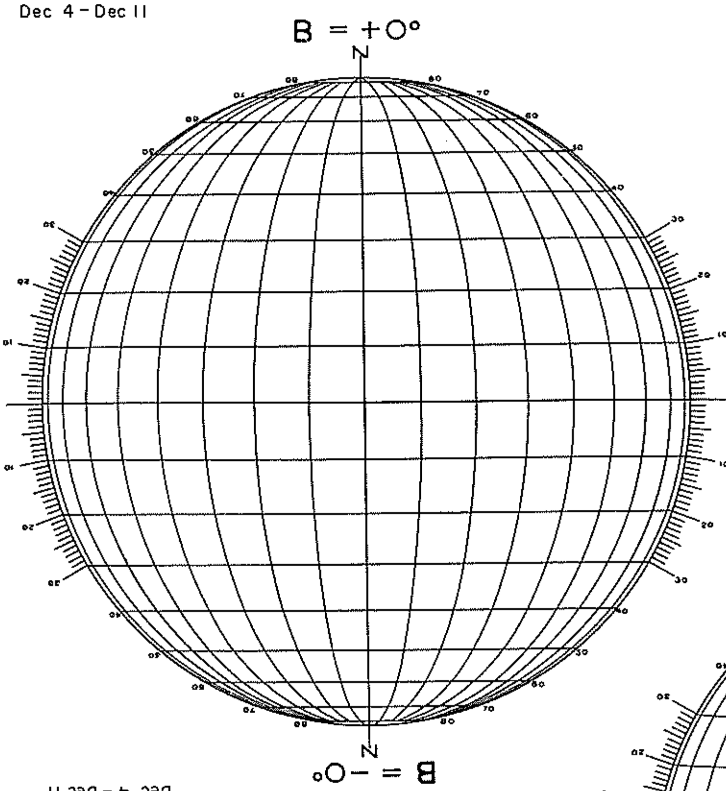
Key*	1976 Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
A.												
A.1	379A 26	380A 36	381A 30	382A 26	383A 26	384A 24	385A 26	386A 22	387A 26	388A 26	389A 26	390A 28
A.2a	378A 7	379A 7	380A 7	381A 7	382A 7	383A 7	384A 7	385A 7	386A 7	387A 7	388A 7	389A 7
A.2b												
A.2c	378A 7	379A 7	380A 7	381A 7	382A 7	383A 7	384A 7	385A 7	386A 7	387A 7	388A 7	389A 7
A.3a	379A 26	380A 36	381A 30	382A 26	383A 26	383A 24	385A 26	386A 22	387A 26	388A 26	389A 26	390A 28
A.3b	379A 88	380A 94	381A 92	382A 86	383A 88	384A 84	385A 88	386A 84	387A 86	388A 88	389A 86	390A 90
A.3c	379A 26	380A 36	381A 30	---	---	---	---	386A 22	387A 26	388A 26	389A 26	390A 28
A.4	379A 26	380A 36	381A 30	382A 26	383A 26	384A 24	385A 26	386A 22	387A 26	388A 26	389A 26	390A 28
A.5	379A 26	380A 36	381A 30	382A 26	383A 26	384A 24	385A 26	386A 22	387A 26	388A 26	389A 26	390A 28
A.5a	379A 88	380A 94	381A 92	382A 86	383A 88	384A 84	385A 88	386A 84	387A 86	388A 88	389A 86	390A 90
A.5b	379A 93	380A100	381A 97	382A 91	383A 94	384A 90	385A 93	386A 89	387A 93	388A 94	389A 90	390A 95
A.6	379A 25	380A 33	381A 29	382A 25	383A 25	384A 23	385A 24	386A 20	387A 26	388A 26	389A 26	390A 26
A.6b	---	---	---	386B 4	387B 4	388B 4	389B 4	390B 4				
A.7b	379A 26	380A 36	381A 30	382A 26	383A 26	384A 24	385A 26	386A 22	387A 26	388A 26	389A 26	390A 28
A.7f	378A 23	379A 21	380A 30	381A 24	382A 21	383A 21	384A 19	385A 21	---	387A 20	388A 21	389A 21
A.8aa	378A 7	379A 7	380A 7	381A 7	382A 7	383A 7	384A 7	385A 7	386A 7	387A 7	388A 7	389A 7
A.8ac	378A 7	379A 7	380A 7	381A 7	382A 7	383A 7	384A 7	385A 7	386A 7	387A 7	388A 7	389A 7
A.8g	378A 7	379A 7	380A 7	381A 7	382A 7	383A 7	384A 7	385A 7	386A 7	387A 7	388A 7	389A 7
A.9cb	379A 26	380A 36	381A 30	382A 26	383A 26	384A 24	385A 26	386A 22	387A 26	388A 26	389A 26	390A 28
A.9d	379A 26	380A 36	381A 30	382A 26	383A 26	384A 24	385A 26	386A 22	387A 26	388A 26	389A 26	390A 28
A.10a	378A 13	379A 12	380A 15	381A 13	382A 12	383A 13	384A 12	---	386A 12	387A 12	388A 12	389A 12
A.10c	378A 15	379A 14	380A 17	381A 15	382A 14	383A 15	384A 14	385A 14	387A101	388A101	388A 14	389A 14
A.10d	378A 16	379A 15	380A 18	381A 16	382A 15	383A 16	384A 15	385A 15	387A102	388A102	388A 15	389A 15
A.10e	378A 14	379A 13	380A 16	381A 14	382A 13	383A 14	384A 13	385A 13	386A 13	387A 13	388A 13	389A 13
A.11g	378A 20	379A 19	380A 26	381A 21	382A 18	383A 19	384A 17	385A 18	386A 16	387A 18	388A 19	389A 18
A.11h	379A 26	380A 36	381A 30	382A 26	383A 26	384A 24	385A 26	386A 22	387A 26	388A 26	389A 26	390A 28
A.11ib	---	380A 36	381A 30	382A 26	383A 26	384A 24	385A 26	386A 22	387A 26	388A 26	389A 26	390A 28
A.12ba	---	---	---	---	---	---	---	---	386A 15	387A 16	388A 18	---
A.12bb	---	---	---	---	---	---	---	---	---	387A 17	---	---
A.12e	383B 17	384B 10	385B 16	386B 20	387B 16	388B 15	389B 12	390B 23				
A.13a	378A 19	379A 18	---	---	---	---	---	---	386A 15	387A 16	388A 18	---
A.13ab	---	---	---	---	---	---	---	---	---	387A 17	---	---
A.13d	378A 18	380A123	380A 25	381A 20	382A 17	383A 18				387A 15	388A 17	389A 17
A.13e	383B 16	384B 9	385B 15	387B 36	387B 15	388B 14	389B 11	390B 22				
A.17	---	---	---	---	---	---	---	---	---	---	---	---
A.17	---	---	---	---	---	---	---	---	---	387A 17	---	---
A.17c	378A 24	379A 22	380A 31	381A 25	382A 22	383A 22	384A 20	385A 22	386A 18	387A 21	388A 22	389A 22
A.18	---	---	---	---	---	---	---	---	---	---	---	---
A.18	---	---	---	---	---	---	---	---	---	387A 17	---	---
B.												
B.51ca	379A115	380A119	381A126	382A113	383A118	384A108	385A113	386A111	387A115	---	---	---
B.52	379A116	380A120	381A127	382A114	383A120	384A110	385A114	386A112	387A116	388A116	389A110	390A116
B.53	379A118	380A122	381A129	382A116	383A119	384A109	385A116	386A114	387A118	388A118	389A109	390A118
C.												
C.1a	378A 10	379A 10	380A 10	381A 10	382A 10	383A 10	384A 10	385A 10	386A 10	387A 10	388A 10	389A 10
C.1ba	383B 4	384B 4	385B 4	386B 7	387B 6	388B 6	389B 6	390B 6				
C.1d	378A 12	379A 11	380A 14	381A 12	382A 11	383A 12	384A 11	385A 11	386A 11	387A 11	388A 11	389A 11
C.1d	383B 10	384B 7	385B 14	386B 12	387B 10	388B 11	389B 9	390B 11				
C.1e	383B 9	384B 6	385B 13	386B 11	387B 9	388B 10	389B 8	390B 10				
C.1f	384B 24	385B 56	386B 34	387B 30	388B 30	389B 26	390B 39					
C.3	383B 11	384B 8	385B 15	386B 13	387B 11	388B 12	389B 10	390B 12				
	378A 17	379A 16	380A 19	381A 17	382A 16	383A 17	384A 16	385A 16	386A 14	387A 14	388A 16	389A 16
C.3t	379A102	380A106	381A114	383B 37	383A103	385B 60	385A100	390B 42	390B 43	390B 44		
C.4a	379A 95	380A102	381A100	382A 93	383A 96	384A 92	385A 95	386A 91	387A 95	388A 96	389A 92	390A 97
C.4b	379A 95	380A102	381A100	382A 93	383A 96	384A 92	---	---	---	---	---	---
C.4d	379A 95	380A102	381A100	383B 34	383A 96	385B 58	385A 95	387B 32	389B 29	389B 32	389A 92	
C.4e	379A 95	380A102	381A100	382A 93	383A 96	384A 92	385A 95	386A 91	387A 95	388A 96	389A 92	390A 97
C.4f	379A 95	381B 45	381A100	382A 93	383A 96	384A 92	385A 95	386A 91	387A 95	388A 96	389A 92	390A 97
C.4h	379A 95	---	381A100	382A 93	383A 96	384A 92	---	386A 91	387A 95	388A 96	389A 92	390A 97
C.4i	379A 95	380A102	381A100	382A 93	383A 96	384A 92	385A 95	386A 91	387A 95	388A 96	389A 92	390A 97
C.4j	379A 95	381B 45	381A100	382A 93	383A 96	384A 92	385A 95	386A 91	387A 95	388A 96	389A 92	390A 97
C.5e	378A 22	---	380A 28	381A 23	382A 20	---	---	385A 20	---	---	---	389A 20
C.6	379A 94	380A101	381A 98	382A 92	383A 95	394A 91	385A 94	386A 90	387A 94	388A 95	389A 91	390A 96
D.												
D.1a	379A108	380A112	381A119	382A106	383A111	385B 61	385A106	386A104	387A108	388A108	389A102	390A107
D.1ba	379A109	380A114	381A121	382A108	383A113	384A103	385A108	386A106	387A110	388A110	389A104	390A109
D.1c	390A110	390A110	390A110	390A110	390A110	390A110	390A110	390A110	390A110	390A110	390A110	390A110
D.1d	379A113	380A117	381A124	382A111	383A116	384A106	385A111	386A109	387A113	388A113	389A107	390A114
D.1e		---				---	---	---			---	---
D.1f	379A114	380A118	381A125	382A112	383A117	384A107	385A112	386A110	387A114	388A114	389A108	390A115
D.1g	379A112	380A116	381A123	382A110	383A115	384A105	385A110	386A108	387A112	388A112	389A106	390A113
F.												
F.1a	379A103	380A107	381A118	382A101	383A104	384A 96	385A101	386A 99	387A103	388A103	389A 97	390A106
F.1b	379A103	380A107	381A118	382A101	383A104	384A 96	385A101	386A 99	387A103	388A103	389A 97	390A106
F.1e	379A103	380A107	381A118	382A101	383A104	384A 96	385A101	386A 99	387A103	388A103	389A 97	390A106
F.1f	380B 28	381B 44	381A118	382A101	383A104	384A 96	385A101	386A 99	387A103	388A103	389A 97	390A106
F.1g	380B 28	381B 44	381A118	382A101	383A104	384A 96	385A101	386A 99	387A103	388A103	389A 97	390A106
F.1h	379A103	380A107	381A118	383B 38	383A104	---	---	---	---	---	---	
F.1i	379A103	380A107	381A118	382A101	383A104	384A 96	385A101	386A 99	387A103	388A103	389A 97	390A106
F.1j	379A103	380A107	381A118	382A101	383A104	384A 96	385A101	386A 99	387A103	388A103	389A 97	390A106
H.												
H.60	378A 5	379A 5	380A 4	381A 4	382A 4	383A 5	384A 5	385A 5	386A 5	387A 4	388A 5	389A 4
H.62	384B 17	385B 49	386B 27	387B 23	388B 23	389B 19	390B 32					

* See "Key" on pages 64 and following.

USCOMM-NOAA-ASHEVILLE--3-77--1050

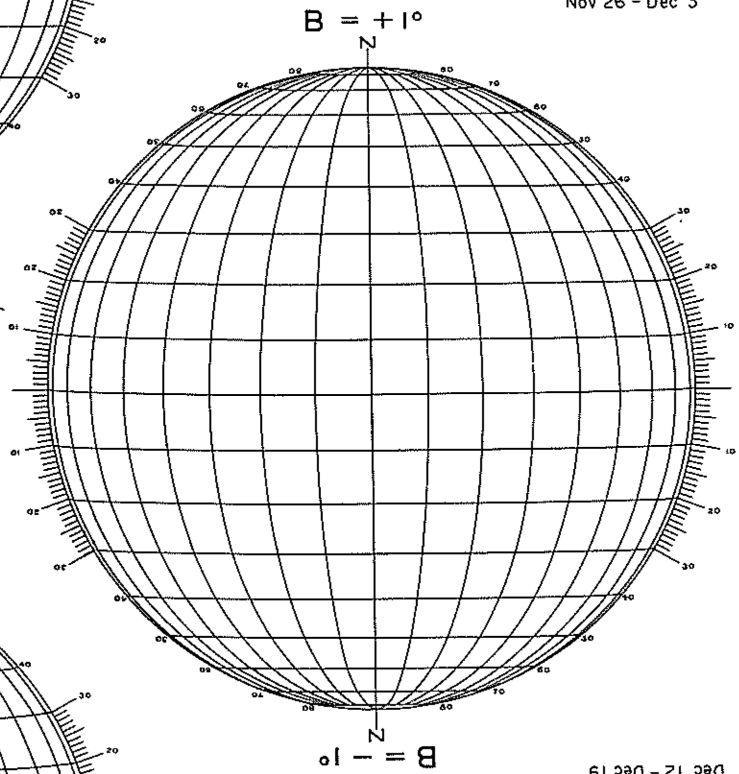
DEGREES FROM CENTRAL MERIDIAN

June 3 - June 10
Dec 4 - Dec 11



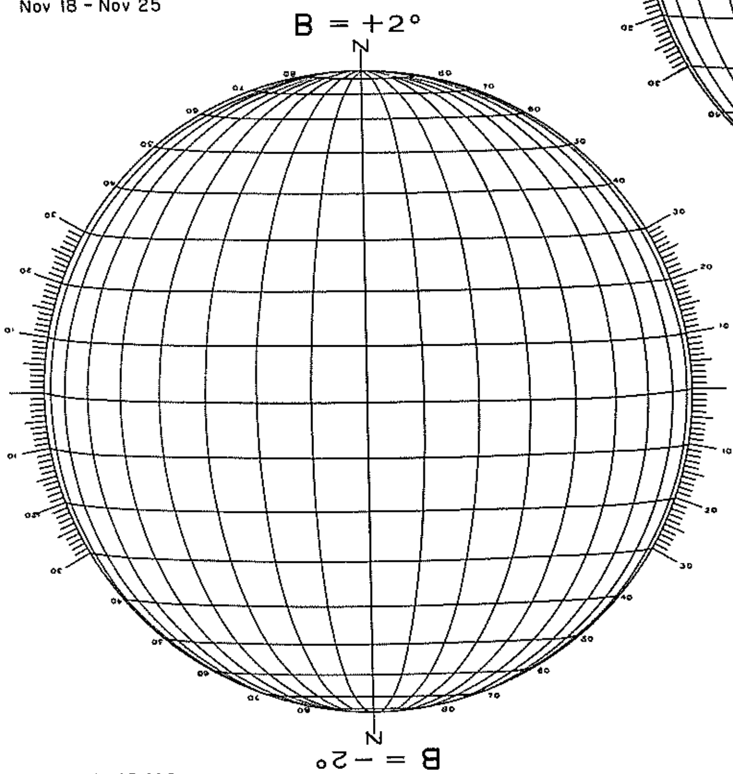
June 3 - June 10
Dec 4 - Dec 11

June 11 - June 18
Nov 26 - Dec 3



May 25 - June 2
Dec 12 - Dec 19

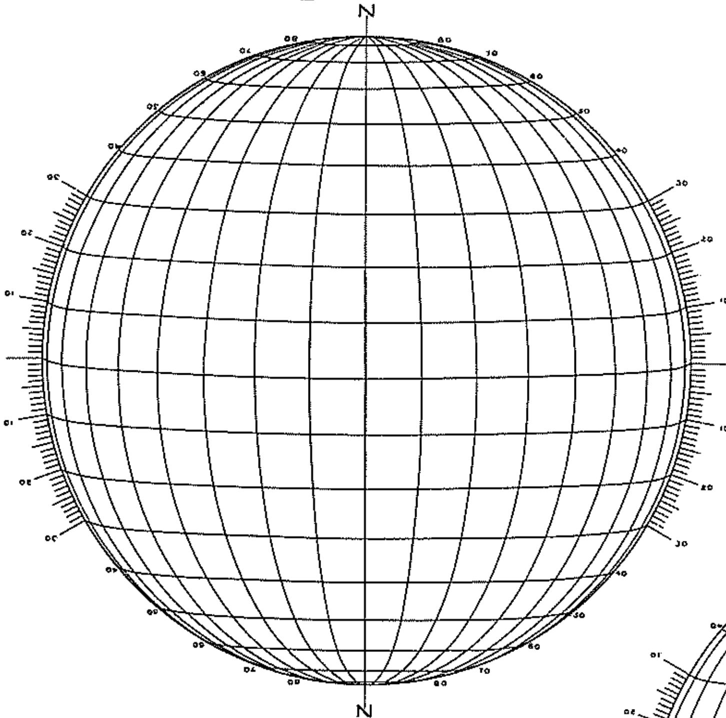
June 19-June 27
Nov 18 - Nov 25



May 17 - May 24
Dec 20-Dec 27

June 28 – July 6
Nov 10 – Nov 17

B = +3°

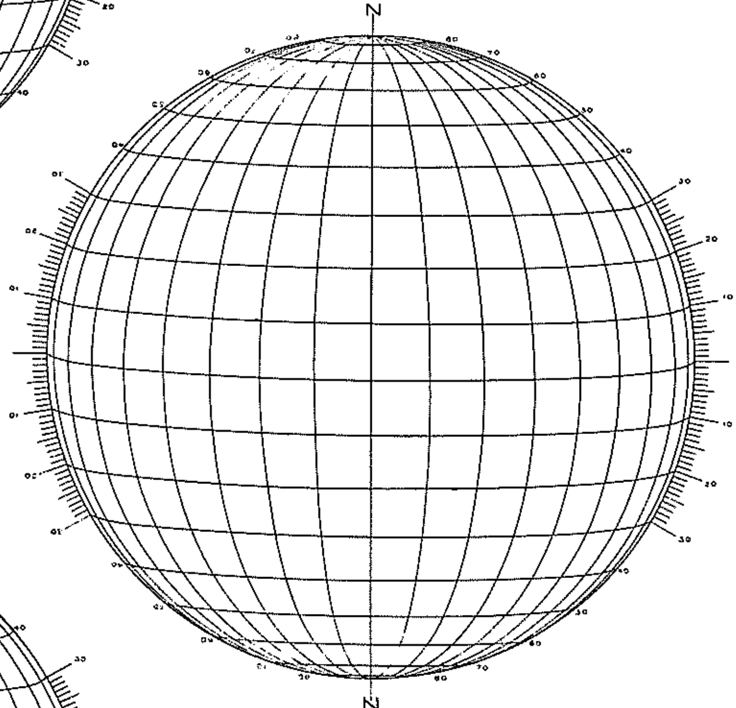


B = −3°

May 8 – May 16
Dec 28 – Jan 4

July 7 – July 16
Oct 31 – Nov 9

B = +4°

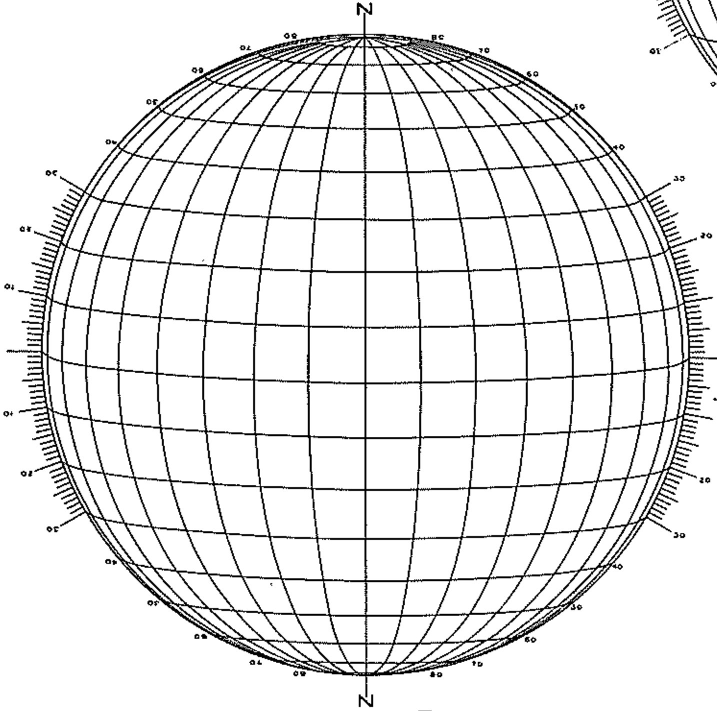


B = −4°

Apr 28 – May 7
Jan 5 – Jan 14

July 17 – July 27
Oct 20 – Oct 30

B = +5°

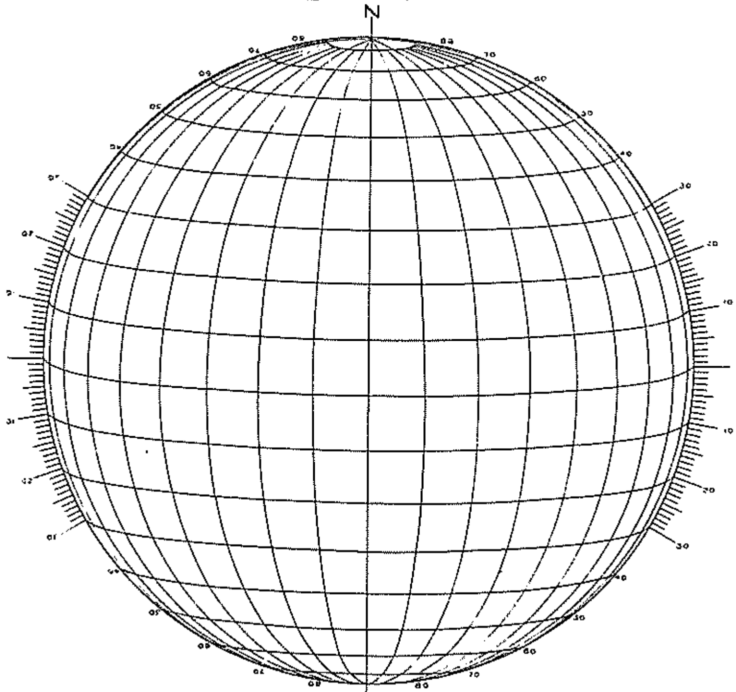


B = −5°

Apr 17 – Apr 27
Jan 15 – Jan 24

July 28 - Aug 12
Oct 5 - Oct 19

B = +6°

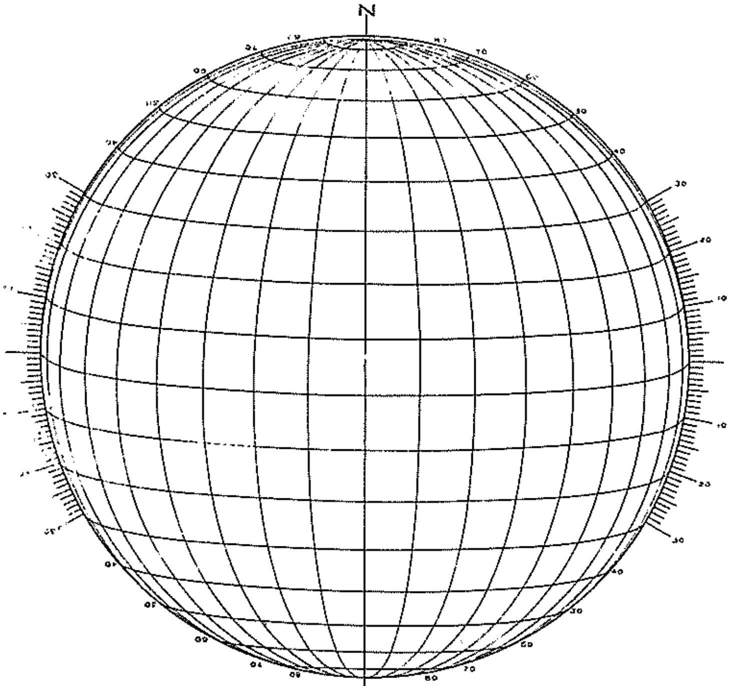


B = −6°

Jan 25 - Feb 8
Apr 2 - Apr 16

Aug 13 - Oct 4

B = +7°

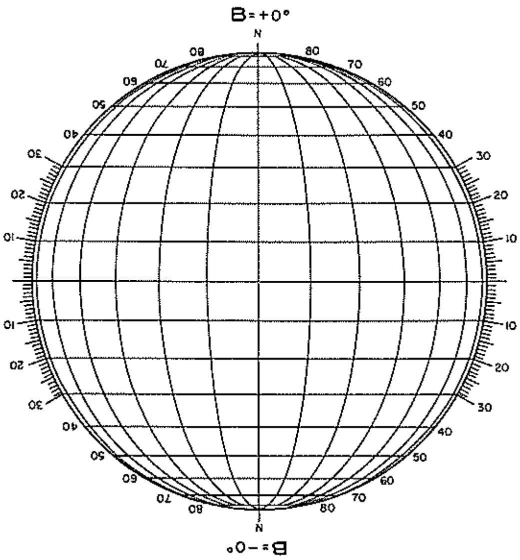


B = −7°

Feb 9 - Apr 1

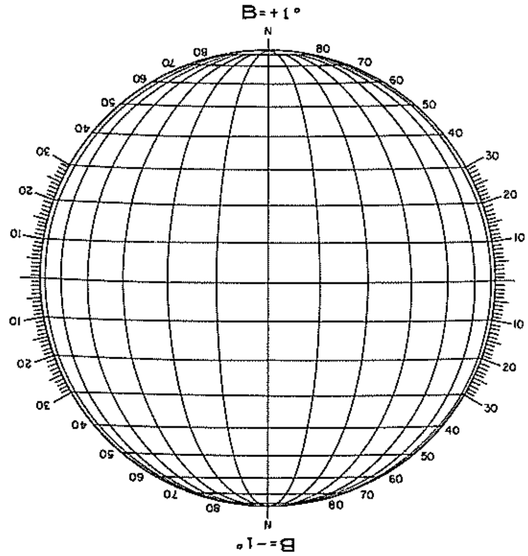
DAYS FROM CENTRAL MERIDIAN

June 3 - June 10
Dec 4 - Dec 11



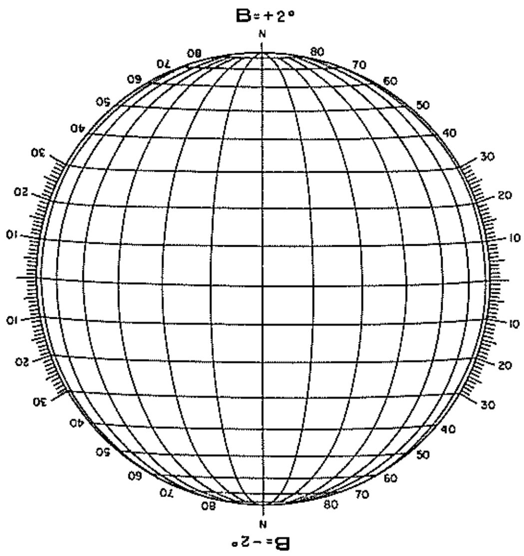
June 3 - June 10
Dec 4 - Dec 11

June 11 - June 18
Nov 26 - Dec 3



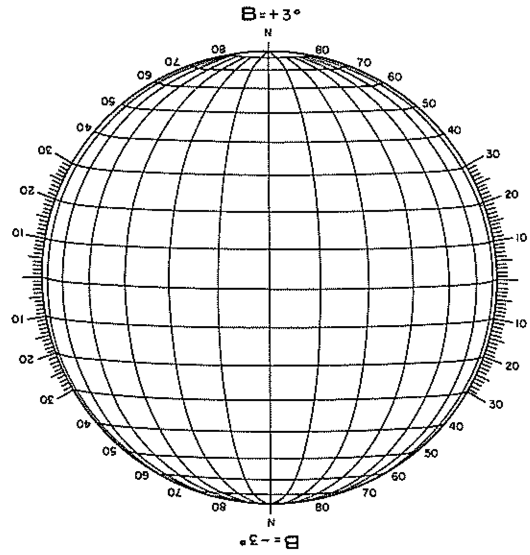
May 25 - June 2
Dec 12 - Dec 19

June 19 - June 27
Nov 18 - Nov 25



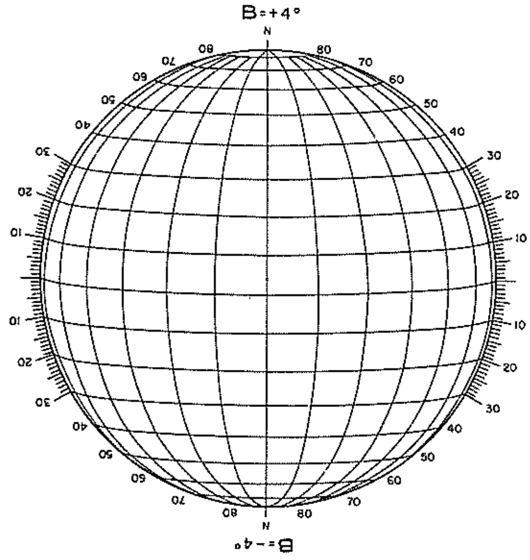
May 17 - May 24
Dec 20 - Dec 27

June 28 - July 6
Nov 10 - Nov 17



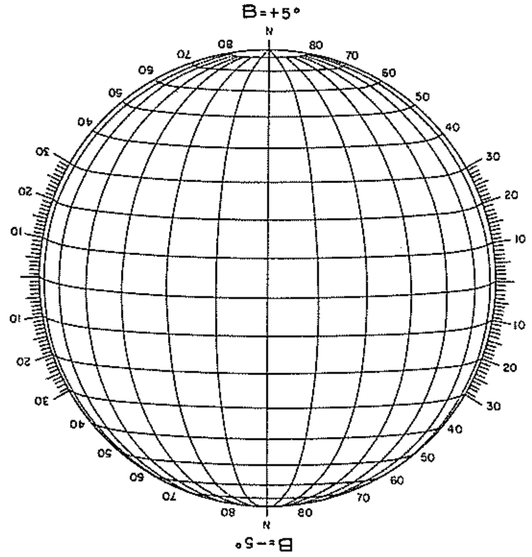
May 8 - May 16
Dec 28 - Jan 4

July 7 – July 16
Oct 31 – Nov 9



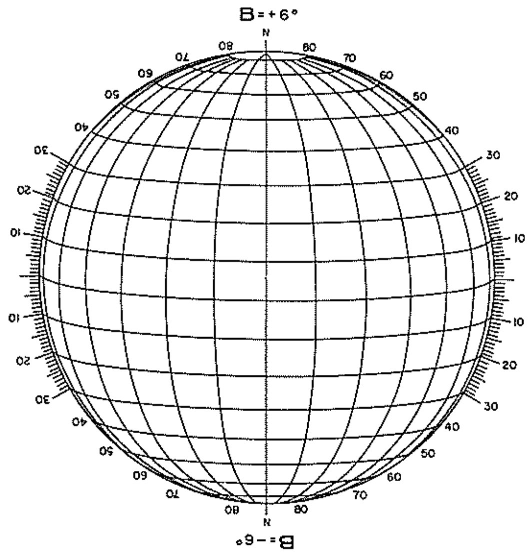
Jan 5 – Jan 14
Apr 28 – May 7

July 17 – July 27
Oct 20 – Oct 30



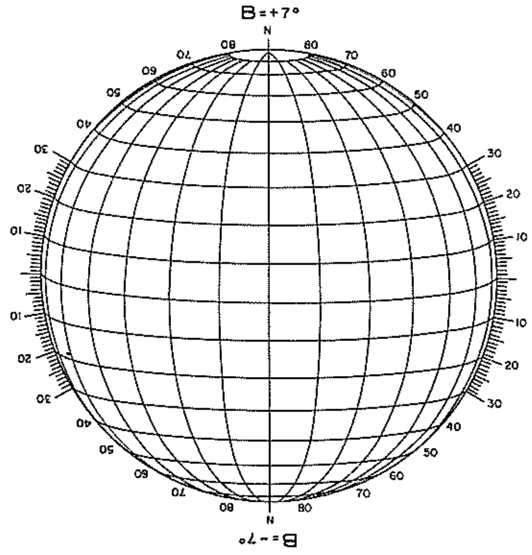
Jan 15 – Jan 24
Apr 17 – Apr 27

July 28 – Aug 12
Oct 5 – Oct 19



Jan 25 – Feb 8
Apr 2 – Apr 16

Aug 13 – Oct 4



Feb 9 – Apr 1

WORLD DATA CENTER A

FOR

SOLAR-TERRESTRIAL PHYSICS

The ICSU Panel on WDCs has recommended that it would be appropriate courtesy to acknowledge in publications that data were obtained from the originating station or investigator through the intermediary of the WDCs. The following statement is suggested:

"Data used in this study were provided by WDC-A for Solar-Terrestrial Physics, NOAA E/GC2, 325 Broadway, Boulder Colorado 80303, USA."