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Solar - Geophysical Data

NO. 366 FEBRUARY 1975 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 Climatic Center, Federal Building, Asheville, NC 28801, Attn: Publications. 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 $23.00 for both parts or $11.50 for either part. Single issue price $1.40 for either part and $1.30 for this extra issue. Make checks and money orders payable to: Department of Commerce, NOAA.

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

Solar-Geophysical Data, 366 Part I (or Part II), pages, February 1975, 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 contained in the monthly publication *Solar-Geophysical Data*, issued by the Environmental Data Service of 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, NOAA, Boulder, Colorado 80302, or at a nominal cost through the National Climatic Center.* These data reports continue the series which were issued by the Central Radio Propagation Laboratory of the National Bureau of Standards, known since 1956 as the CRPL-F series Part B. The CRPL became the Institutes of Environmental Research in October 1965. The latter were reorganized as the ESSA Research Laboratories in November 1967. In October 1970 in a governmental reorganization ESSA was absorbed as part of the National Oceanic and Atmospheric Administration (NOAA). Since June 1965, the compilations and editing have been done by Miss Hope I. Leighton under the supervision of Mr. Dale B. Bucknam and Miss J. Virginia Lincoln.

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.

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 text.

In various places in this text, data types are identified both by name and by 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.)

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

> *Solar-Geophysical Data*, 336 Part I (or Part II), pages, February 1975, *U.S. Department of Commerce*, (Boulder Colorado, U.S.A. 80302).

TABLE OF CONTENTS

DATA FOR ONE MONTH BEFORE MONTH OF PUBLICATION

TABLE OF CONTENTS

A L E R T   P E R I O D S (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 Worldwide 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 revisions are available from the IUWDS Secretary for Ursigrams, Mr. R. B. Doeker, 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≥50)
WEAK MAGSTORM IN PROGRESS	JJHHmm	(30≤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

heliographic coordinates of flare

date and UT of Outstanding flare

key word

total number of flares, number > Imp I, number of M and X flares in active region

heliographic coordinates of active region

MAGSTORM JJHHmm 8HHJJ 7777C

key numbers and observations used for forecast

key numbers signify solar forecast to follow for day

date and UT of beginning of magnetic storm

key word

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

end of message

type of alert

active region description

heliographic coordinates of active region

3. Definition of symbols.

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: Definitions of class C, M or X flares follow:

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

PROTONFLARE - protons from this flare have been observed in the earth's vicinity

MAGFLARE - a geomagnetic and/or cosmic storm has been associated with this flare

MAJORFLARE - 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

Notes: 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	
2 = partial solar optical observations	4 = all including solar magnetic field measurements

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 ---- } includes day of week and
STRATWARM EXISTS ---- } 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) cycle. 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 -- A graph illustrates the recent trend of Cycle 20. As of this publication date, the end of Cycle 20, and thus the beginning of Cycle 21, has not been ascertained. The first new cycle spot was observed in November, 1974. When the beginning of the new cycle can be identified a new graph and table will be prepared for Cycle 21.

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

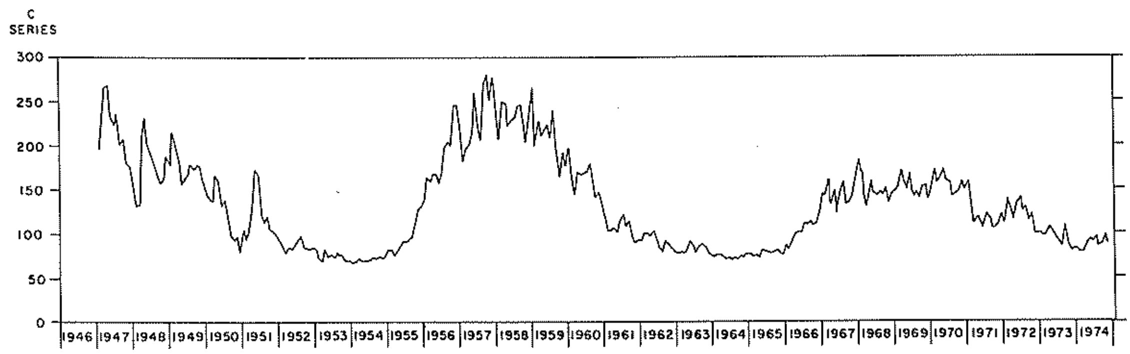
in which R_k is the mean value of R for a single month k and R_{12} is the smoothed index for the month represented by k = n. Predictions shown are those made for one year after the latest available datum by the method of A. G. McNish and J. V. Lincoln [*Trans. Am. Geophys. Union*, 30, 673-685, 1949] modified by the use of regression coefficients and mean cycle values recomputed for Cycles 8 through 19. The last prediction made also shows the 90% prediction interval, an indication of the uncertainty above and below the predicted number. Cycle 20 began October 1964, when the minimum $\bar{R}$ of 9.6 was reached. The values of observed and predicted Zürich smoothed relative sunspot numbers are given for cycle 20 in the table. The predicted values again 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.

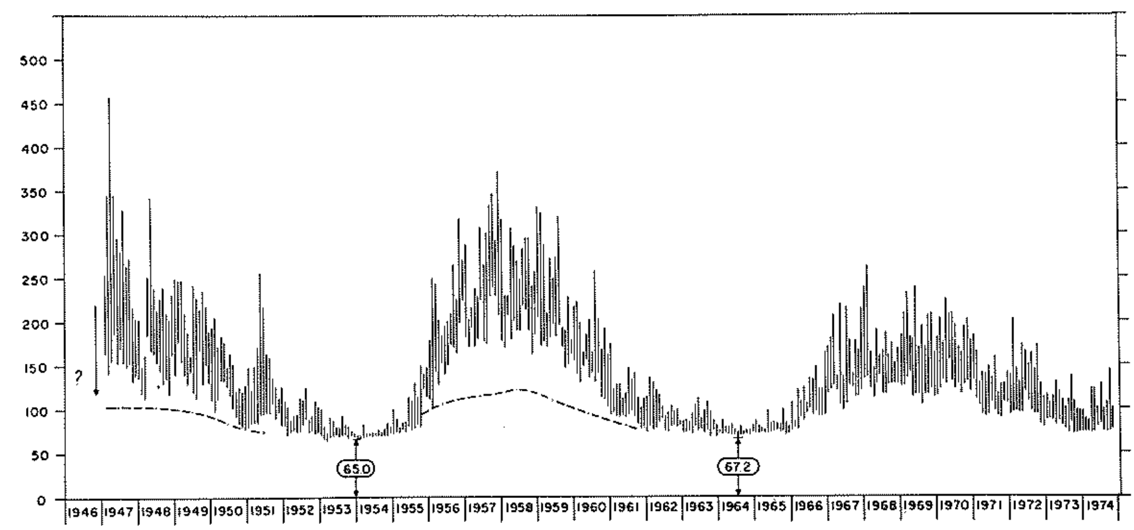
Relative Sunspot Numbers -- The relative sunspot number is an index of the activity of the entire visible disk of the sun. It is determined each day without reference to preceding days. Each isolated cluster of sunspots is termed a sunspot group and it may consist of one or a large number of distinct 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 numbers, 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 originate 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 1.8 meters diameter. These are a continuation of observations which commenced in Ottawa in 1947. Numerical values of flux in the tables 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

SOLAR RADIO FLUX, 10.7 CM
ADJUSTED TO I.A.U.





UPPER CURVE - MONTHLY MEANS OF RADIO FLUX
LOWER CURVE - MONTHLY HIGH & LOW VALUE OF SLOWLY VARYING COMPONENTS
CURVE (-- --) APPROXIMATELY SEPARATES SUNSPOT COMPONENT FROM BASIC COMPONENT
MAGNITUDE OF THE RADIO QUIET SUN AT SUNSPOT MINIMUM SHOWN

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 in this text. 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]. Experiments conducted during the past few years indicate that a multiplying factor of 0.90 should be applied to the reported flux values in order to derive the absolute flux value. 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 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 previously 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. 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 radar 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 value of solar radio-noise flux".

Daily Solar Flux Values - AFCRL Sagamore Hill -- The Sagamore Hill Solar Radio Observatory of the Air Force Cambridge Research 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 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	4995 MHz	0.055 dB	1415 MHz	0.05 dB
8800	0.070	2695	0.051	606	0.045

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 FLARES (C.1)

The solar flare data from the month before that of publication are divided into two tables. The first table is restricted to the record of solar flares for which one or more observatories assigned a numerical importance of "1" or greater.* The heading is marked PARTIAL LISTING to emphasize these reports are those received at NOAA on a rapid schedule. To make the report of occurrence of flares more comprehensive, the flares reported only as subflares are listed in the second table by time of beginning in UT and coordinates only. In the section of these bulletins presenting data for the sixth month before that of publication, verification of questionable values has been attempted and in addition a separation is made between Confirmed and Unconfirmed flares.

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 and Palehua are operated by the USAF using NOAA equipment. The USAF operates Ramey and Athens.

* The complete provisional listings can be made available at cost through the World Data Center A for Solar-Terrestrial Physics, NOAA, Boulder, Colorado U.S.A. 80302.

The columns in the table are as follows:

- -reporting observatory using *IAU Quarterly Bulletin on Solar Activity* designations;
- -the Universal date;
- -beginning and ending times in UT;
- -time of maximum phase 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 center of disk in units of the 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 (see below);
- -observing conditions where 1 means poor, 2 fair and 3 good;
- -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 either tabulated width of Hα to nearest 1/10Å or for tabulated area;
- -measured (i.e. projected) area at maximum intensity in heliographic square degrees (reported originally in millionths of disk by observatory) -- this is not necessarily the maximum area;
- -corrected area in square degrees (see below);
- -maximum effective line-width in Hα to nearest 1/10Å;
- -maximum intensity expressed in percent of the local continuum;††
- -and 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.
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.

The following symbols are used in the table to explain accuracy of the times reported:

D = greater than
E = less than
U = approximate

All times are Universal Time (UT or GCT).

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.

** For easier visual selection of the more important flares a minus sign, "-", is used to indicate subflares instead of "S". "--" signifies the subflare has been confirmed by the NOAA grouping program but is not included in the IAU Quarterly Bulletin on Solar Activity, nor is it used in deriving the Flare index for the day.

† Circumstances C and P can occur with any type of photographic patrol, whether automatic or not. Combinations of two symbols can be used for intermediate circumstances, example: VP = continuous visual watch plus a few photographs.

†† Catania and Anacapri-S report their intensity as referred to the local undisturbed chromosphere.

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

"Corrected" area in square degrees	Relative Intensity Evaluation Faint (f)	Normal (n)	Brilliant (b)
$\leq$ 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	0°	----	65°	70°	80°	90°
Limit S-1	200	sec θ law	90	75	50	45
Limit 1-2	500	sec θ law	280	240	180	170
Limit 2-3	1200	sec θ law	600	500	350	300

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
521	VP	AROS	AROSA,SWITZERLAND
508	VC	ATHN	NATL OBS.,ATHENS,GREECE
647	VC	BOUL	BOULDER,COLORADO,USA
560	VC	BUCA	NATL OBS.,BUCHAREST,ROMANIA
570	VC	CATA	CATANIA,ITALY
826	C	CRIM	SIMEIS,CRIMEA,USSR
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
827	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
504	V	ONDR	ONDREJOV,PRAGUE,CZECHOSLOVAKIA
476	VC	PALE	PALEHUA,HAWAII,USA
648	VC	RAMY	RAMEY SOLAR OBSERVATORY,RAMEY AFB,PUERTO RICO
862	VP	SIBE	SIBERIE(SIBERIAN IZMIR),IRKUTSK,USSR
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 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).

The table on page 11 gives the solar flare observatories presently cooperating in international data interchange through the World Data Centers 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. As errata are received the punched cards are corrected. These errata are not always published in these reports. Copies of the cards, 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.*

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 the quiet sun, shown at the center of the photosphere, is based on an assumed quiet sun of 60 solar 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 minutes 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 observation. Selections are made to provide 24-hour coverage as nearly as possible. See page 47. Outstanding Occurrences, for descriptions of the types of events and observatory characteristics.

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

The Space Environment Monitor (SEM) aboard the Synchronous Meteorological Satellite (SMS) includes a 1/2 to 4 Å x-ray ion chamber and a 1-8 Å chamber. SMS-1, the first of a series of five geostationary satellites, is stationed over Brazil. The SEM's data 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 ERL-SEL Tech. Report*, to be published]. 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 SEL Preprint No. 122*].

The 1-8Å ion chamber has 800 mm Hg of Argon as a filler gas and a beryllium window that is 5 x 10^{-5} m thick with an x-ray viewing area of 1.9 x 10^{-4} m^2. The listed 1 - 8Å flux is based on a gray-body spectrum of 3 x 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 3 to 100 x 10^6 °K. The 1/2 - 4 Å ion chamber has 180 mm Hg of Xenon as a filler gas, with a beryllium window that is 5 x 10^{-4} m thick with an area of 5.8 x 10^{-4} m^2. The listed 1/2-4 Å flux is based on a 10^7 °K gray body spectrum.

The average x-ray flux values include data obtained during solar flares. Low values of the x-ray flux are contaminated by a photoelectric effect and by particle interference during solar proton events. therefore, no flux values below 10^{-7} W m^{-2} for the 1-8 Å detector or 10^{-8} W m^{-2} for the 1/2-4 Å detector are reported. A "B" in the hourly average table indicates the flux was below these cut-off levels. An "M" in these tables denotes periods of missing data. The hourly average flux values are averages of 5-minute averaged data. The daily average values are averages of the 1-hour averaged data. The list of events does not include events with a maximum flux less than 3 x 10^{-6} W m^{-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.

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 or convective velocity of the solar wind. On Pioneers 6/7, the peak velocities are reported because a least squares program is not developed for these data.

The co-rotation delay, τ, is 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 15. Viewing from the North Ecliptic Pole onto the Ecliptic plane, note that Pioneer 8 is lagging the earth and therefore the τ is positive. Pioneers 6, 7 and 9 are leading the earth and therefore their 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.

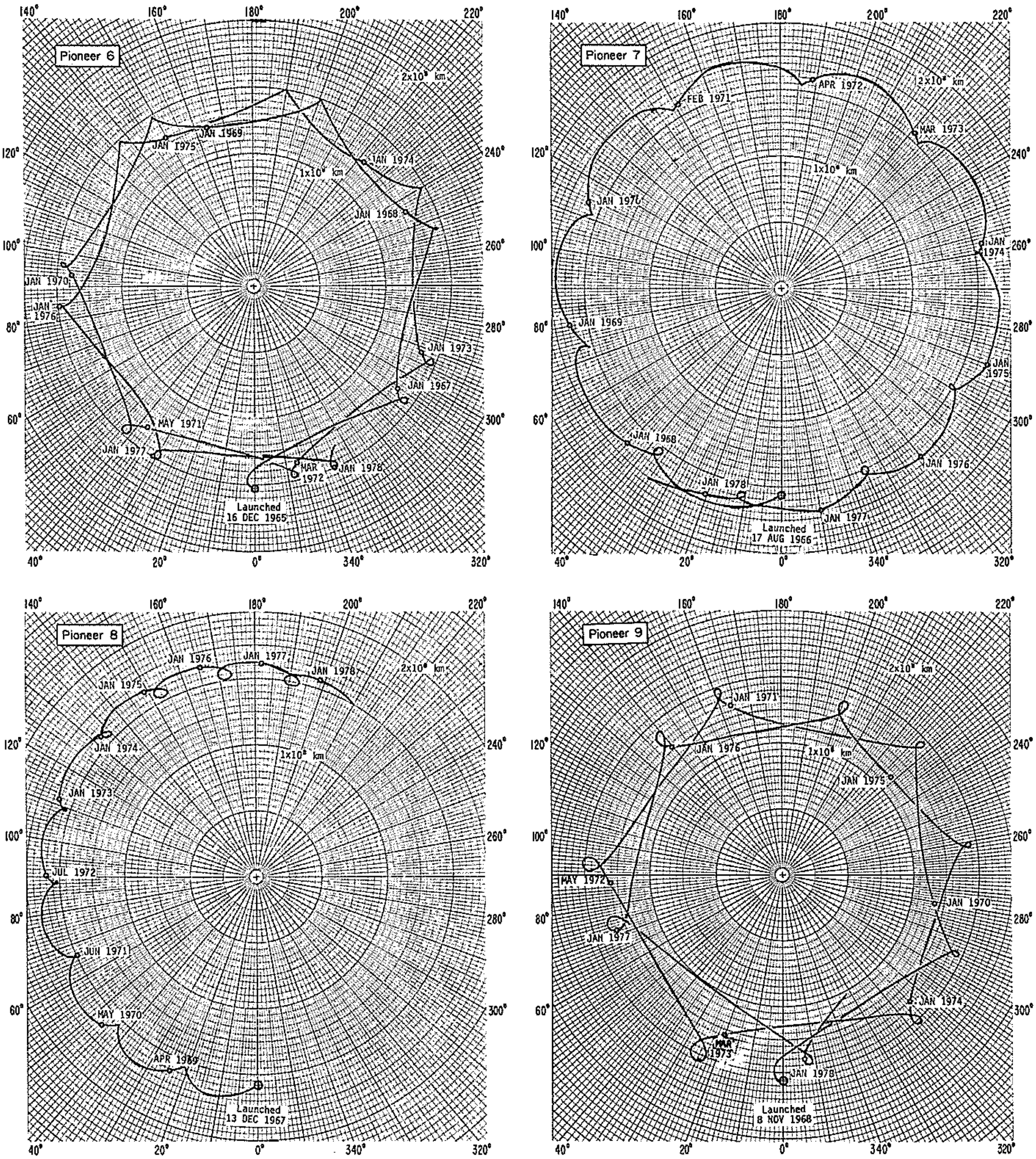
The equation used to compute the co-rotation delay, τ, follows:

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

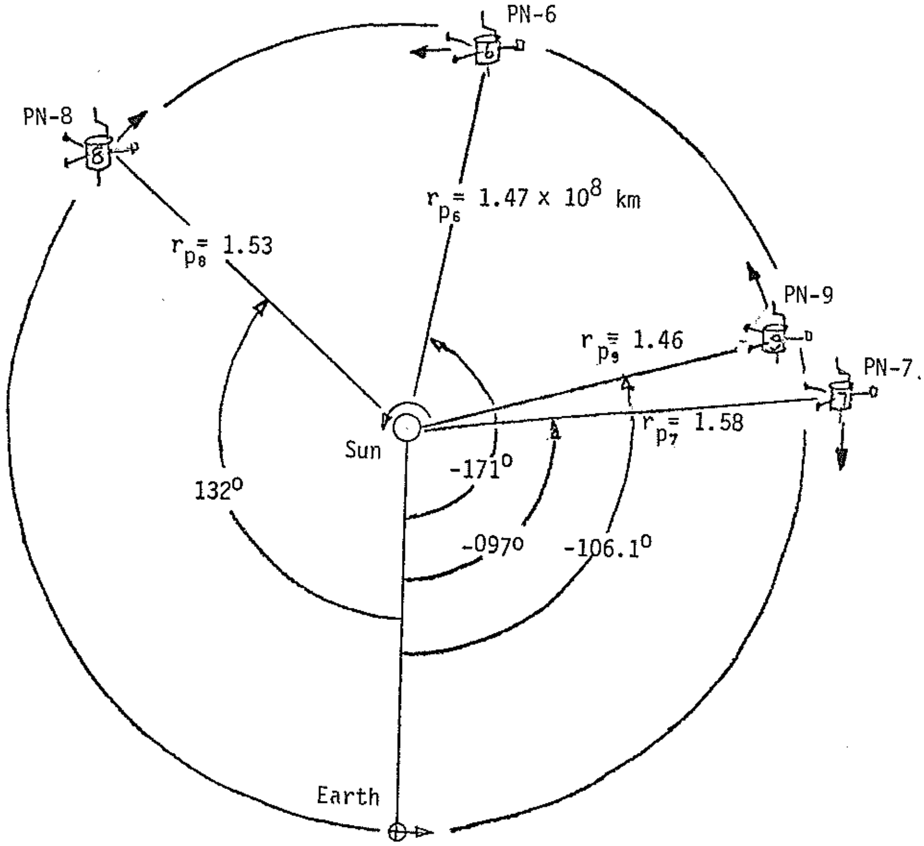
where ω is the angular velocity of the sun (in radians/second) corresponding to a 27 day solar synodical rotation period, and ϕ is the Earth-Sun-Probe angle (in radians).

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 paragraphs.

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.



Locations of Pioneers 6 through 9 on 1 Jul 74 in the Ecliptic Plane relative to the Earth (in a fixed Sun-Earth line plot) as viewed from the North Ecliptic Pole.

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 angle 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 the 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:

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

or

$$\phi' = \tan^{-1}(0.9925 \tan\alpha_2) - \tan^{-1}(0.9925 \tan\alpha_1)$$

A difference of approximately 0.008 radians (0.5°) between ϕ' and ϕ occurs when $\alpha_2 = 45°$ and $\alpha_1 = 135°$ (or vice versa). The difference is less than 0.50 for other combinations of α_2 and α_1. Hence 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 will be 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 will be 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 AU. In the latter case, P is taken to be at the

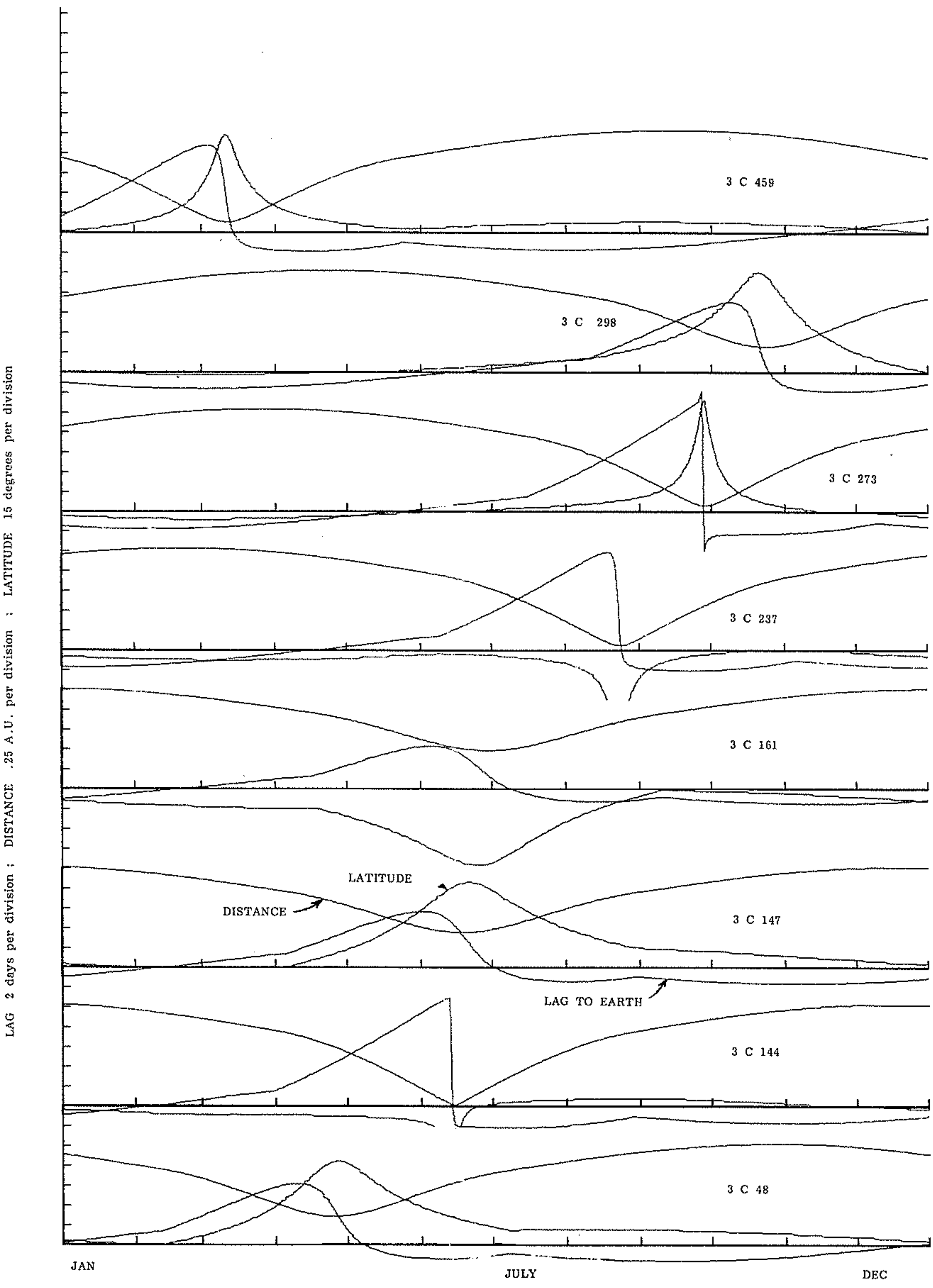

LAG 2 days per division ; DISTANCE .25 A.U. per division ; LATITUDE 15 degrees per division
3 C 459
3 C 298
3 C 273
3 C 237
3 C 161
LATITUDE
DISTANCE
3 C 147
LAG TO EARTH
3 C 144
3 C 48
JAN
JULY
DEC
DATE OF OBSERVATION

Figure 1

point 0.3 AU 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 AU), 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 observations 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, in preparation 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 we analyze the regular data under the assumption that the flow is indeed radial. This allows 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. We also estimate the flow angle but only use it 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 "mid-point" of the correlation functions. This is found to be a reliable and unbiased 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 "peak" velocity and other parameters of the scintillations are also computed, but will not be 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).

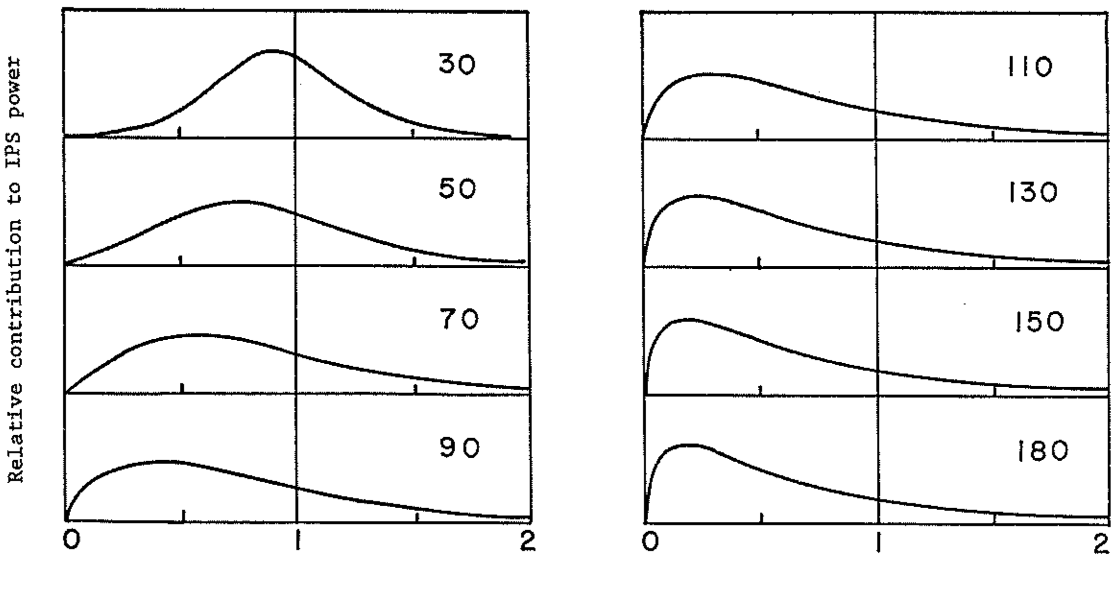


Figure 2. Computed IPS weighting functions along the line-of-sight, at the solar elongation angles indicated. The density spectrum was assumed to be power law $\propto q^{-3.3} r^{-4}$ (where q is wave number and r is solar distance); a source diameter of 0.25 sec of arc was also assumed.

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 $D_1 \bar{D}_2 \bar{D}_4$ (protons and helium nuclei 0.6-13 Mev/nucleon, electrons 400-700 kev), $D_1 D_2 \bar{D}_4$ (protons 13-175 Mev, helium nuclei >13 Mev/nucleon and $\bar{D}_1 \bar{D}_2 D_3 \bar{D}_4$ (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].

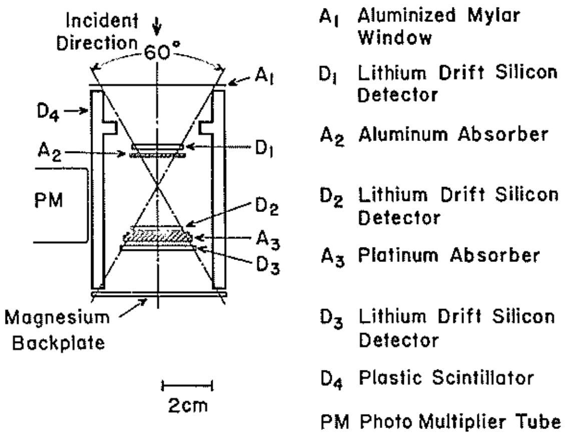
The counting rates are prepared from quick-look data, and are subject to future revision when the final data tapes reach the University of Chicago. Times given are only approximate, (time accurate to ± 15 minutes), and the counting rates are accurate to ~ 10%. When one of the two high-energy counting 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.

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.



Pioneer 6/7 Cosmic Ray Telescope

Solar Proton Monitor (SPM) -- The Solar Proton Monitor (SPM) is a joint effort by C. O. Bostrom and J. W. Kohl of the Johns Hopkins University Applied Physics Laboratory, and D. J. Williams of the NOAA Space Environment Laboratory. The personnel listed above are those responsible for the construction, spacecraft integration (JHU/APL) and calibration of the experiment and the data reduction, handling and presentation (JHU/APL and NOAA) of the monitor data. The initial conception, design, and proposal of the SPM were carried out by C. O. Bostrom and D. J. Williams.

The SPM's are flown on NOAA satellites in the Improved TIROS Operational Satellite (ITOS) system and are launched for NOAA by the National Aeronautical and Space Administration. They are placed into circular, sun-synchronous near-polar orbits at average altitudes of 1500 km above the earth's surface, with orbital inclinations of 102° (retrograde), and average nodal periods of 115 minutes. Thus these satellites make 12½ orbital passes every 24 hours. The earth rotates 28.75° during the 115 minutes between successive orbital tracks. NOAA 2 was launched 15 October 1972, NOAA 3 was launched 6 November 1973, and NOAA 4 was launched 15 November 1974.

The primary purpose of the SPM is to provide systematic monitoring of solar cosmic rays over at least half a solar cycle. The basic requirements set forth for such a monitoring program were:

1) to furnish simple reliable flux and spectral measurements,

2) to operate over a wide flux range and in particular provide coverage for very large events,

3) to provide a simple and easily reproducible detector system to form the basis of an operational monitoring program.

The SPM satisfies the above requirements. Data from the monitor are continuously being made available to the scientific community through this monthly bulletin.

The SPM consists of an array of solid state detectors designed to measure proton intensities in the following energy ranges E_p > 10 Mev, E_p > 30 Mev, and E_p > 60 Mev.

Since the overall design goal was to obtain a standard, reliable and easily reproducible detection scheme specifically aimed at monitoring solar cosmic rays, the method chosen was to use separate detectors for each energy range and to employ combinations of discriminator levels and shielding thicknesses to define the energy response of each channel. Such a method allows for accurate absolute flux determinations and for unit to unit comparisons when using a series of payloads to monitor the solar flux over an extended time period ($\geq$0.5 solar cycles).

The following table indicates the SPM response to alpha particles which will introduce an ambiguity in the solar proton flux observations. To estimate the size of this uncertainty, reproduced as Figure 1, is Figure 29-5 from Fichtel [Part 29, *Proceedings of AAS-NASA Symposium on the Physics of*

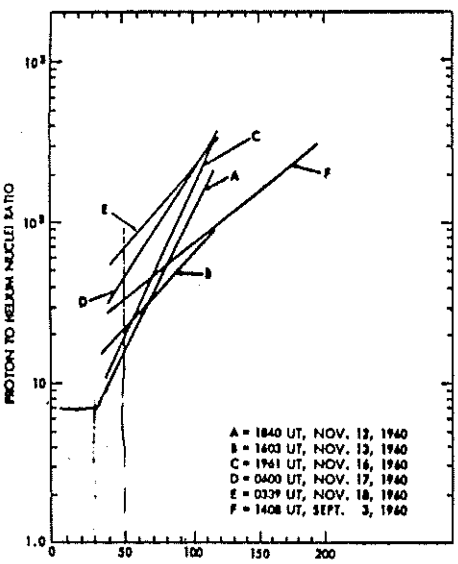


Figure 1

Solar Flares, Oct. 1963, edited by W. N. Hess, NASA SP-50] which shows the proton to helium nuclei observed during 1960 as a function of energy per nucleon. From this figure it is seen that a maximum uncertainty of ~10% may be expected due to the alpha particle flux at the energies shown in Figure 1.

Proton and Alpha Particle Energy Sensitivities of SPM

Channel	E_p	E_α
1	≥ 60 Mev	≥ 240 Mev
2	≥ 30 Mev	≥ 120 Mev
3	≥ 10 Mev	≥ 40 Mev

A more detailed description of the detectors follows.

Channel 1 (E_p ≥60 Mev) and Channel 2 (E_p ≥30 Mev):

Each of these two higher energy channels consists of three solid state detectors mounted on orthogonal axes and surrounded by a hemispherical shield. Figure 2 shows the assembly of these units. This arrangement is a straightforward method of obtaining a large area and a relatively smooth geometric factor when using disk shaped detectors.

The shielding thickness is by far the most important factor in determining the energy threshold in this particular arrangement. The thicknesses used are 5.6 mm Cu and 1.6 mm Cu and are indicated in Figure 2.

The detectors used in this assembly are surface barrier solid state detectors, fully depleted, 700 microns thick, having a usable surface area of 0.83 cm^2 and a noise level nominally <20 kev at the operating bias voltage. These units fully deplete at <150 volts and are operated at 200 volts.

The three detector outputs are fed in parallel to a preamp-amplifier-discriminator package and thence to the data processing electronics. Three 20 kev detectors yield a total detector noise level of ~35 kev in channels 1 and 2. This coupled with a preamp noise level of 25 kev yields a measured total system noise level of ~40 kev.

At minimum ionizing energies, the proton energy loss in 700μ of silicon is ~280 kev. A discriminator bias level of 150 kev is both well below the minimum ΔE_p of 280 kev and well above the system noise level of 40 kev. The 150 kev discriminator level causes but a negligible shift of the energy threshold (<10 kev). Also, the response of the unit is relatively independent of discriminator level shifts.

Due to the high bias levels, the shielding thicknesses and mode of operation radiation damage effects will be negligible for several years for channels 1 and 2.

Channel 3 (E_p ≥ 10 Mev):

This detector consists of a 3 mm cubic Li drifted solid state detector surrounded by a 170 mg/cm^2 (0.63 mm) Al shield. Figure 3 is a diagram of this unit.

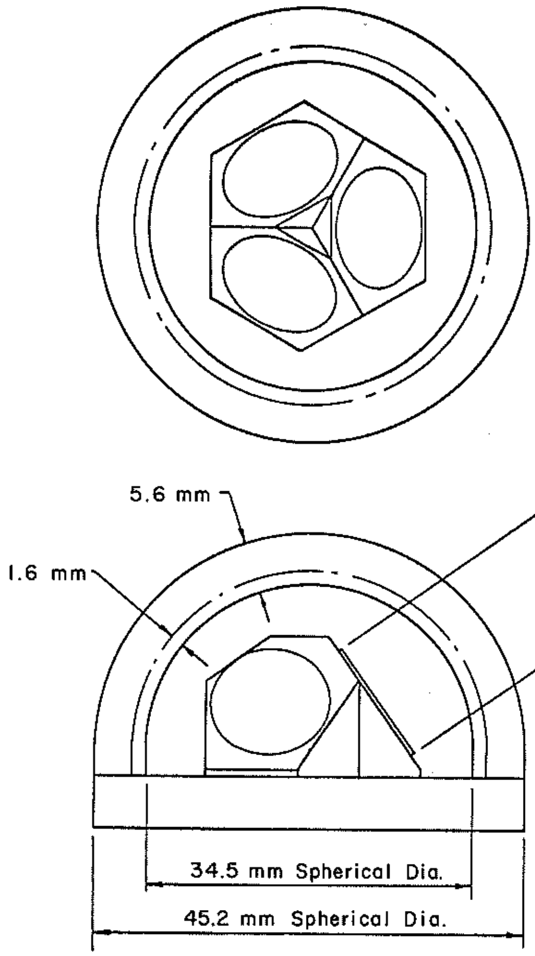
The detector has a noise level of <50 kev at its operating bias of 200 volts. The discriminator level of 300 kev will raise the energy threshold ~25 kev. Radiation damage effects in channel 3 will be negligible for at least a year.

The flux values listed and plotted are accurate to ±25% for the ≥60 Mev and ≥30 Mev channels and to ±50% for the ≥10 Mev channel only during the times of solar cosmic ray events.

The directional factor becomes more nearly 4π for galactic cosmic rays due to their much higher characteristic energy. Therefore the background fluxes which are due to galactic cosmic rays are incorrect as shown on the plots. These have not been corrected because more accurate start times and initial fluxes for solar events may be obtained if the detector response is seen to rise from its own background.

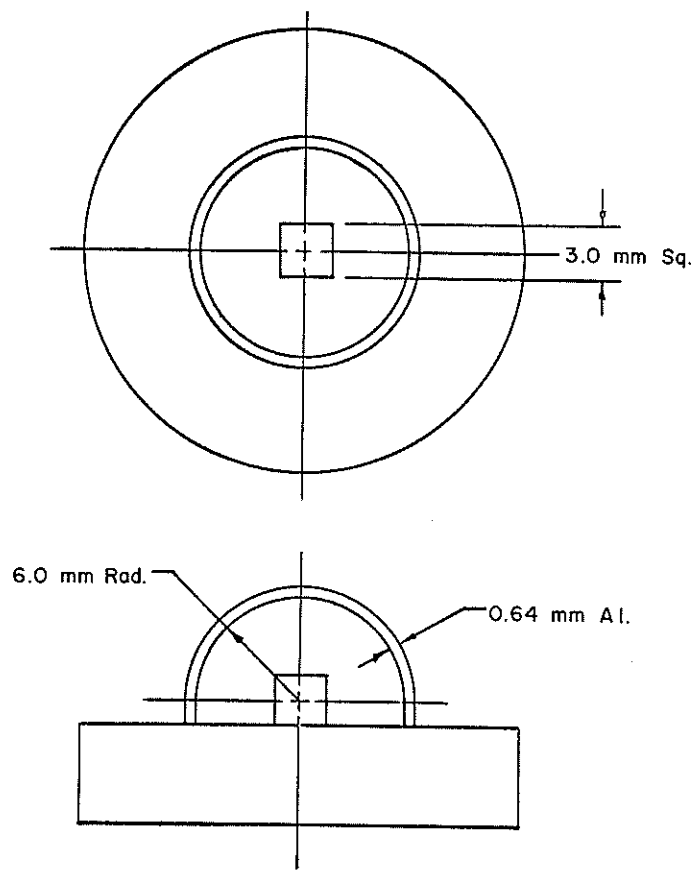
The ≥60 Mev and ≥30 Mev channels indicate a similar background flux whereas the ≥10 Mev channel shows a slightly different background flux value. This is due to differences in (i) edge effects in a cube versus disk detector, and (ii) differences in satellite shielding. These effects are more important at galactic cosmic ray energies than at the solar cosmic ray energies of this experiment.

The data from the SPM display the observed flux of low energy cosmic ray protons in the >10 Mev, >30 Mev, and >60 Mev energy ranges averaged over each polar cap. The polar cap is identified as satellite geomagnetic latitudes exceeding 75° using a centered dipole model. Data gaps result



SHIELDING MATERIAL-COPPER

Figure 2



SCALE 4:1

Figure 3

simultaneously in the three plots when the satellite orbit does not exceed 75° in latitude. The accumulated values for each 12-second sample are averaged for the duration of the traverse over a polar cap and plotted at the half-hour in which the satellite entered the polar cap.

These plots combine data from all satellites and for both polar caps. Several values may appear for the same half hour when all satellites report for the same time or, rarely, when the data sampling technique provides two values for a polar cap. In these cases, the values are not averaged but plotted as raw data points for the same half hour.

The sensitivity of the >30 Mev and the >60 Mev instruments is sufficient to monitor variations in the <u>nominal cosmic ray proton background level</u>. This normal background is defined as less than 2.5×10^{-1} particles cm^{-2} sec^{-1} $ster^{-1}$ and is shown by the shaded area on the two plots. However the >10 Mev instrument is not sensitive to protons in this region and only values greater than the background are plotted.

These data are provided by Dr. D. J. Williams of NOAA's Space Environment Laboratory. They are received in near-real time and should be considered as preliminary raw data subject to future correction.

I N T E R P L A N E T A R Y M A G N E T I C A N D E L E C T R I C F I E L D S (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) 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 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 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 re-orient 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 quick-look data are not corrected for sensor off-set in the component along the spin axis of the spacecraft. This, in general, gives an uncertainty in the field magnitude of less than one (1) 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 seconds 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 narrow-band (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 by the Air Force Cambridge Research Laboratories at the Thule Geopole Station 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) days was somewhat greater than "away" days, 85% and 80%, respectively [Russell et al., *J. Geophys. Res.,* submitted 1975]. Forming a combined index from the two individual station inferences yields an overall success rate of 87% [Wilcox et al., *J. Geophys. Res.,* submitted 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,* 371, 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.

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.7, A.9d, A.11e)

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), 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 value for 0^h UT each day appears at the top of the pages of photographs and charts. 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 negative polarity during even-numbered solar cycles, while southern leaders are positive. The current solar cycle is #20. The polarity rules should reverse with the first active centers of Cycle #21. 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. Constant use of the inferred magnetic-field data since 1967 has demonstrated their 90% accuracy when compared with magnetograph data.

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 1974 Descriptive Text 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, calcium plage and sunspot tracings, and Hα filtergrams. The sunspot drawing also shows prominences and green line corona.

Details of these individual observations follow:

X-ray Spectroheliograms from OSO-5 -- A grazing incidence telescope built by the University College London and Leicester University Groups has been operating on the OSO-5 satellite since launch in January 1969. The telescope provides simultaneous x-ray images of the sun in seven wavelength bands over the 8-18 Å range in a period of 5 minutes with an inherent spatial resolution of 1.6 arc minutes. An additional slit collimated detector provides fan beam sweeps in the wavelength range 3-9 Å with a time period of 6 seconds. The wavelength ranges which have been constant since launch are checked by an in-flight calibration system.

The maps reproduced here are from one or two orbits of "quick-look" data and represent the solar image at 9.6 -11.1 Å. They have been selected from non-flare periods of data where possible and the observation period used is shown with each map. Crystal spectrometer studies have indicated the 9.1 - 11.1 Å waveband to be dominated, under non-flare conditions, by the radiation of the Mg^{+10} ion. This radiation is produced most efficiently at temperatures above 4 million degrees and hence the x-ray emission features highlight the hot components of active regions in the corona. At present the position of the solar disk is approximate. The contours on the spectroheligrams are plotted as follows: 2, 5-20 in intervals of 5, and 20 upwards in intervals of 10.

Further information on the instrument and additional data may be obtained on request from: John Herring or John Parkinson, Mullard Space Science Laboratory, Holmbury St. Mary, Nr. Dorking, Surrey, England.

From December 1972 to July 6, 1974 x-ray spectroheliograms from OSO-7 were included here in place of those from OSO-5. The OSO-5 satellite was reacquired when OSO-7 entered the earth's atmosphere.

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 AFCRL. The geographic coordinates of the observatory are: Long. 116° 26' 6".43 W, Lat. 32° 40' 39".33 N, Elevation 1188 m MSL.

The anntena 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 boustrophendonic 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 preventative 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, Attention: Fred L. Wefer.

Mount Wilson Observatory Solar Magnetograms -- The Mount Wilson Observatory solar magnetograms are computer-plotter iso-gauss drawings. The polarities are indicated. "Plus" signifies the magnetic vector pointed toward the observer. The gauss levels are indicated. The observations are 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 and the National Aeronautics and Space Administration. 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 units 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 accounted for. In general the magnetic field strengths on the map are low by about a factor 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.

A number of errors can still be present. One of the most common of these is the zero setting of the magnetograph. At times there may be an obvious bias of the field over the whole disk toward one or the other polarity. This will tend to show very weak features of one polarity more readily than those of the other polarity. Occasionally for one reason or another a scan line may be skipped. In this case the isogauss lines will be drawn across the skipped line as if there were no scan line there. Other problems may arise from time to time. In general any feature which is present on only one day should be discounted as an artifact unless there is some particular reason to accept its reality.

Because of the difficulties with the zero offset from day to day, the polar fields will appear to vary. The polar fields can only be studied by comparing them with other weak-field regions observed on the same day.

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 entrace 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. We believe these high resolution maps will 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.

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.

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 Squardron 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 judgment 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.

Coronal Emission -- Emission intensity values for each 5° interval together with peak values greater than 255 are presented adjacent to the sunspot-drawing disks for each day that data are available for the λ5303 Å (FeXIV) coronal line. The measurements are expressed in millionths of an angstrom (10^{-6}Å) of the continuum of the center of the solar disk (at the same wavelength as the line) that would contain the same energy as the observed coronal lines [Billings, D. E., *A Guide to the Solar Corona*, Academic Press, p. 104, 1966]. The date of data presentation corresponds to the date of observation. The data are from a single station selected in the following priority: Kislovodsk, Pic-du-Midi, Wendelstein, Norikura and Lomnicky Stit.

The data are presented for three intensity levels: 80-119, 120-199, and 200-249. Any values equal to or greater than 250 will be shown as a peak and its actual value given. The values will be centered on the appropriate 5° interval, overlapping on both side by 2½°. The three levels of intensity are indicated by arcs: the one nearest the disk represents the lowest level, the next arc the intermediate level, and the highest arc the highest level.

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) supplemented by data from Catania for days of no data at McMath-Hulbert; 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 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	Code	Maximum Field Strength in Gauss
1	100- 500	6	2600-3000
2	600-1000	7	3100-3500
3	1100-1500	8	3600-4000
4	1600-2000	9	4100-4500
5	2100-2500	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 "C" is represented by three consecutive upper-case 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.)

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

Unipolar Group: 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.

Bipolar (Elongated) Group: 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.

Modified Zürich Class (first upper case letter in column "C")

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.

Penumbra: Largest Spot (second upper case letter in column "C")

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

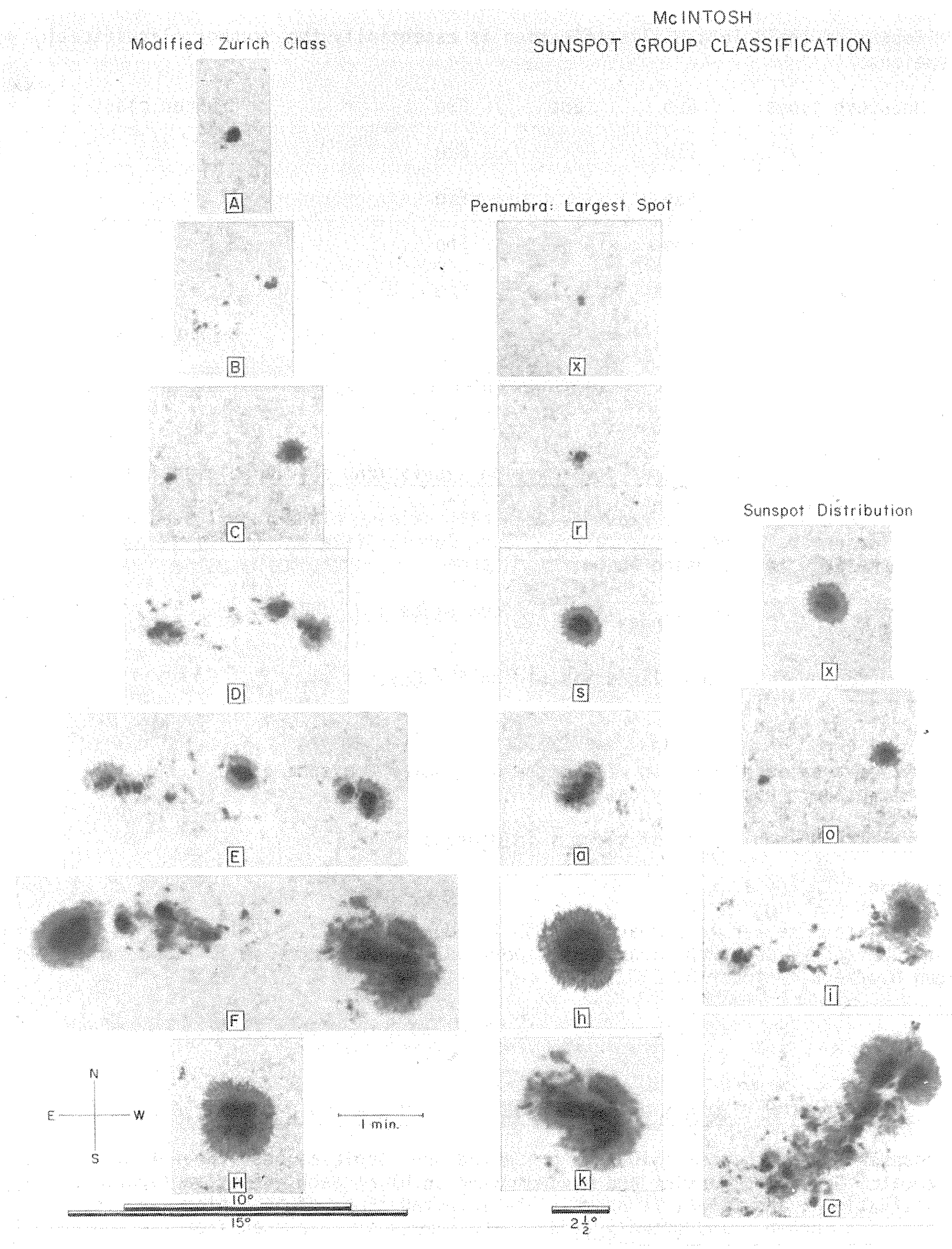
"r" The penumbra is rudimentary. It is usually incomplete, irregular in outline, as narrow as three arc seconds, brighter intensity than normal penumbra and has a mottled, or granular, fine structure. Rudimentary penumbra represents the transition between photospheric granulation and filamentary penumbra. Recognition of rudimentary penumbra will ordinarily require photographs or 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 diameter along a solar meridian greater 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 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 in column "C")

"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 visible 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.

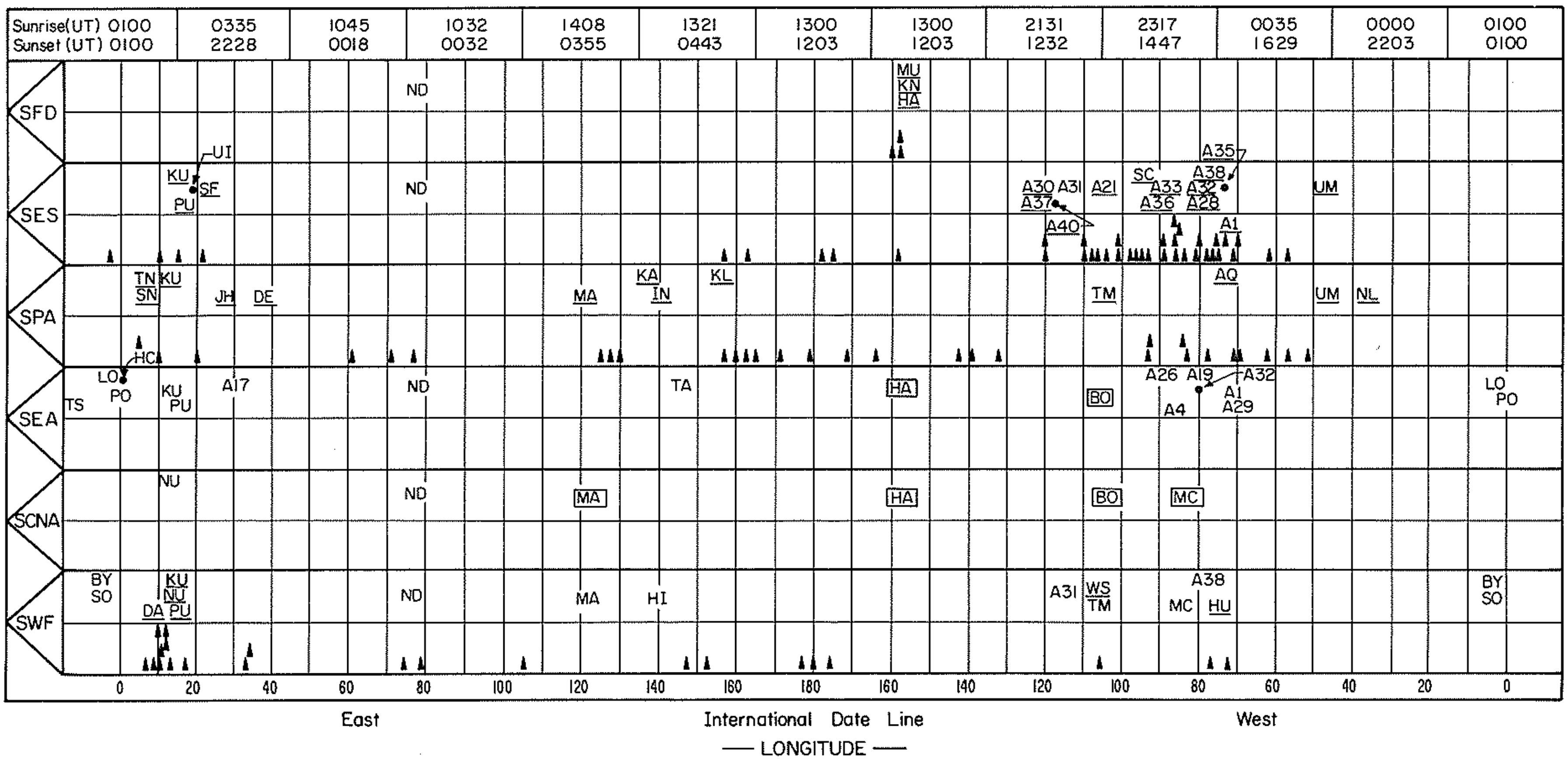
SUDDEN IONSPHERIC DISTURBANCES (C.6)

Sudden ionospheric disturbances (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.

STATION LIST FOR SUDDEN IONOSPHERIC DISTURBANCES TABLE

CODE STATION LOCATION	SWF	SCNA	SEA	SES	SFD	SPA
AQ = AREQUIPA, PERU						X
BO = BOULDER, COLORADO, USA		X	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					
HK = HONG KONG	X					
HU = HUANCAYO, PERU	X					
IN = INUBO, JAPAN						X
JH = JOHANNESBURG, SO AFERICA						X
KA = KASUAGI, JAPAN						X
KL = KULA, MAUI, HAWAII, USA						X
KN = KONA, HAWAII, HAWAII, USA					X	
KU = KUHLUNGSBORN, GDR	X		X	X		X
LO = PRESTON, ENGLAND			X			
MA = MANILA, PHILIPPINE ISLANDS	X	X				X
MC = MCMATH-HULBERT OBS., MICHIGAN, USA	X	X				
MU = HANA, MAUI, HAWAII, USA					X	
ND = NEW DELHI, INDIA	X	X	X	X	X	
NL = NATAL, BRAZIL						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		
SN = SAN FERNANDO, SPAIN						X
SO = SOMERTON, ENGLAND	X					
TA = HOBART, TASMANIA			X			
TM = TABLE MOUNTAIN (BOULDER, COLO, USA)	X					X
TN = TORINO, ITALY						X
TS = TORTOSA, SPAIN			X			
UI = UPICE, CZECHOSLOVAKIA			X			
UM = SAO PAULO, BRAZIL				X		X
WS = WHITE SANDS, NEW MEXICO	X					
AMERICAN ASSOCIATION OF VARIABLE STAR OBSERVERS (AAVSO)						
A1 = VALLEY COTTAGE, NEW YORK, USA			X	X		
A4 = COLUMBUS, OHIO, USA			X			
A17 = DURBAN, SOUTH AFRICA			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	X		
A33 = GLENNELLYN, ILLINOIS, 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		
A40 = LA CRESCENTA, CALIFORNIA, 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.

The table on page 33 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 34 by their longitude and by the type of SID recorded. 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. (Many of the non-underlined SWF stations are commerical terminals, and the locations 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 four 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 absorption (SCNA), enhancement or decrease of low frequency atmospheric (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 recordings of distant high-frequency radio transmissions.

In the coordinated program, the abnormal fades of field strength not obviouslv 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 absorption at about 18 MHz are known as SCNA, or recognized on recorders 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 sky-wave 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 propgation 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.

SOLAR RADIO WAVES

SPECTRAL OBSERVATIONS (C.4)

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

Universal (Greenwich) date

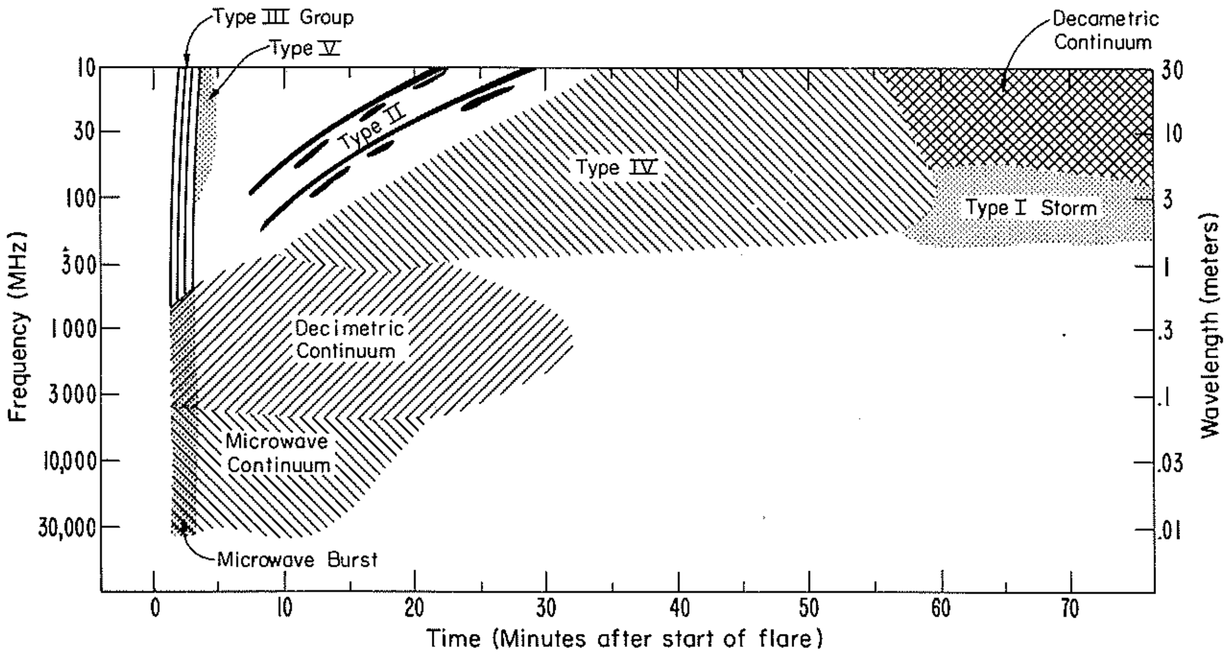
Observing periods during day (UT) -- aligned with first burst from observatory

Station -- HARV = Fort Davis, CULG = Culgoora, BOUL = Boulder, 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 BOUL and 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. There has been little uniformity among observatories in interpreting the intensity levels. The reason for this stems from the fact that equipments 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

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, was 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 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.

Astro-geophysics Department, University of Colorado -- Data are presented on solar radio emission recorded at Nederland near Boulder, Colorado in the spectral range 7.6 to 80 MHz. This range is broken into three subranges; each is swept in 0.5 seconds. The collecting area of the antennas is approximately 1000 square meters, in two corner reflectors forming an interferometer pair. Observations are taken routinely throughout the Boulder observing day from about 1400 UT to 2400 UT. On the low-frequency side, strong bursts are frequently limited by external reflection of the wave above the ionosphere; weaker bursts are obscured by ionospherically reflected telecommunications stations at frequencies lower than about 20 or 25 MHz, and by television stations near 54 MHz and near 68 MHz. The equipment is described by R. H. Lee and J. W. Warwick, *Radio Science*, *68D*, 807, 1964.

Examples taken with this equipment are published in J. W. Warwick, *Solar System Radio Astronomy*, (J. Aarons, ed.), Plenum Press 1967. Intensities are on a rough scale from 1- to 3+, crudely convertible to flux densities as follows:

1- to 1+;	$5 \times 10^{-22} < S < 2 \times 10^{-21}$
2- to 2+;	$2 \times 10^{-21} < S < 8 \times 10^{-21}$
3- to 3+;	$8 \times 10^{-21} < S \leq 3 \times 10^{-20}$

Above about 3 x $10^{-20}Wm^{-2}Hz^{-1}$, the equipment saturates and does not indicate relative intensitives satisfactorily.

Bursts lying exclusively above 40 MHz are reported as metric band events and those lying exclusively below 40 MHz are reported as dekametric band events. Most bursts are observable in both bands and are so reported.

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 24-48 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 frequency interval is the same as the one at the Manila Observatory, Quezon City, Republic of the Philippines. With the 24-48 MHz equipment at Sagamore Hill:

Intensity 1 = 8 to 80 flux units
Intensity 2 = 80 to 1600 flux units
Intensity 3 = >1600 flux units

where 1 flux unit = $10^{-22}Wm^{-2}Hz^{-1}$.

Dürnten Spectrograph, Switzerland -- The Dürnten spectrograph has been constructed by means 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 threshold intensity I_{th} amounts to about 70±30 flux units between 100 and 500 MHz. Between 500 and 1000 MHz the threshold intensity is related to the frequency by the expression $I_{th} = (f-500)^2/100 \pm 20\%$ (where f is in 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. Eidge. Sternwarte Zürich, No. 317,* 1973.

Culgoora Radioheliograph at 43.25, 80 or 160 MHz -- The radioheliograph at the CSIRO Solar Observatory, Culgoora (Australia) is a circular array of 96 paraboloid reflector aerials 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 aerials 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 aerials 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 aerial 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 positions 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 analogue 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.

COSMIC RAYS (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. These monitors have different values of magnetic cutoff rigidity, while their asymptotic cones of acceptance "look" approximately in the equatorial plane in essentially the same direction in space. The eight sets of data can therefore be used to estimate the rigidity dependence of fluctuations which occur in the primary cosmic radiation.

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	2.29	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, station B305, 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 electrons see J. A. Simpson, *Annals of the IGY, Vol. IV,* Part VII, 351-373, 1957. The publication of 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, Station B211, 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 OR6, 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. 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, is located at AFCRL Geopole Station Greenland: latitute 76°36'N, longitude 68°48'W, altitude 260m, geomagnetic threshold rigidity essentially zero. 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 begin with the December 1973 data.

The data from both 18-NM-64 neutron monitors are routinely submitted to World Data Center 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 marks 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 hour 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, Ci, Cp, Ap, aa, and Selected Quiet and Disturbed Days -- The data in the table are: five quietest days (QQ), ten quietest days (QQ or Q), and five most disturbed days of the month (D) adjacent to date; three-hour range indices Kp; international character figure, Ci; character figure, Cp (standardized Ci); daily "equivalent amplitude", Ap; and aa indices.

The data are made available by the Permanent Service of Geomagnetic Indices of IUGG: Association of Geomagnetism and Aeronomy through Commission IV: Magnetic Activity and Disturbances. The Meteorological Institute, De Bilt, The Netherlands, collects the data from magnetic observatories distributed throughout the world, and compiles the Ci and selected days data. The Institut für Geophysik, Göttingen University, computes the planetary and equivalent amplitude indices.

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 third 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.

The Ci-figure is the arithmetic mean of the subjective classification by observatories of each day's magnetic activity on a scale of 0 (quiet) to 2 (storm).

The Cp-figure is a standardized version of the Ci-figure 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 Ci and 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 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 year 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 1968-1973 will soon be published in IAGA Bulletin 32 series. A graph of these values through 1974 is published in the February 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 a 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 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.

Chart of Kp by Solar Rotations -- Monthly a graph of Kp is given for eight 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.

The activity indices are described by J. Bartels in *Annals of the IGY, Vol IV*, 227-236, London, Pergamon Press, 1957. Below the chart of Kp a table of Ap indices for the last 12 months is presented so that trends in magnetic activity can be easily followed.

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 20910.

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 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.

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. Finally, in the last three columns the maximum ranges in D, H and Z during the storm are given. For each date the data are listed in north-to-south geomagnetic latitude order. The table below gives the abbreviation used for the observatory names.

GEOMAGNETIC OBSERVATORIES

Code	Station	Geomag. Latitute	Code	Station	Geomag. Latitude
AA	Addis Ababa	5.3N	HU	Huancayo	0.6S
AL	Alibag	9.5N	HD	Hyderabad	7.6N
AM	Amberley	47.7S	IR	Irkutsk	41.0N
AN	Annamalainagar	1.5N	KG	Kerguelen	56.5S
AP	Apia	16.0S	MB	M'Bour	21.3N
BD	Boulder	48.9N	NE	Newport	55.1N
CO	College	64.6N	PM	Port Moresby	18.7S
EB	Ebro	43.9N	SJ	San Juan	29.9N
FR	Fredericksburg	49.6N	SI	Sitka	60.0N
GN	Gnangara	43.2S	TO	Toolangi	46.7S
GU	Guam	4.0N	TV	Trivandrum	1.1S
HR	Hermanus	33.7S	TU	Tucson	40.4N
HO	Honolulu	21.1N	WI	Witteveen	54.2N

Sudden Commencements and Solar Flare Effects -- These reports are provided by A. Romaña for the Permanent Service of Geomagnetic Indices of IUGG, Association of Geomagnetism and Aeronomy, Commission IV: Magnetic Activity and Disturbances. The sudden commencements (s.s.c.), sudden impulses (s.i.) 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. These reports have been published quarterly in *Solar-Geophysical Data* beginning with data for January 1966. Previous to that time they were published periodically in the *Journal of Geophysical Research.*

Beginning with December 1970 these data are based on fewer reports and, thus, will 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.51)

One can take as the definition of a radio propagation quality index: the measure of the efficiency of a medium-powered radio circuit operated under ideal conditions in all respects, except for the variable effect of the ionosphere on the propagation of the transmitted signal. The indices given here are derived from monitoring and circuit performance reports, and are the nearest practical approximation to the ideal index of propagation quality.

Quality indices are expressed on a scale that ranges from one to nine. Indices of four or less are generally taken to represent a significant disturbance. (Note that for geomagnetic K-indices, disturbance is represented by high numbers.) The adjectival equivalents of the integral quality indices, known as the CRPL quality figure scale, are as follows:

1 = useless	4 = poor-to-fair	7 = good
2 = very poor	5 = fair	8 = very good
3 = poor	6 = fair-to-good	9 = excellent

The forecasts are expressed on the same scale.

The quality figures represent a consensus of experience with radio propagation conditions. Since they are based entirely on monitoring or traffic reports, the reasons for low quality are not necessarily known and may not be limited to ionospheric storminess. For instance, low quality may result from improper frequency usage for the path and time of day. Although, wherever it is reported, frequency usage is included in the rating of reports, it must often be an assumption that the reports refer to optimum working frequencies. It is more difficult to eliminate from the indices conditions of low quality for reasons such as multipath or interference. These considerations should be taken into account in interpreting research correlations between the Q-figures and solar, auroral, geomagnetic or similar indices.

North Atlantic Radio Path -- The quality figures are compiled by the Telecommunication Services Center, Office of Telecommunications, at Boulder, Colorado from radio traffic data for North Atlantic transmission paths closely approximating New York-to-London. These are reported by the Canadian Broadcasting Corporation, International Telephone and Telegraph, Radio Corporation of America, U. S. Coast Guard, and Federal Communications Commission.

The original reports are submitted on various time intervals. The observations for each 6-hour interval are averaged on the original scale. These 6-hour indices are then adjusted to the 1 to 9 quality-figure scale by a conversion table prepared by comparing the distribution of these indices for at least four months, usually a year, with a master distribution determined from analysis of the reports originally made on the 1 to 9 quality-figure scale. A report whose distribution is the same as the master is thereby converted linearly to the Q-figure scale. The 6-hourly quality figure is the mean of the reports available for that period.

The 6-hourly quality figures are given in this table to the nearest one-third of a unit, e.g. 5o is 5 and 0/3; 5- is 4 and 2/3; 5+ is 5 and 1/3. Other data included are:

(a) Whole-day radio quality indices, which are averages of the four 6-hourly indices.

(b) Short-term forecast, issued every six hours by the Telecommunication Services Center. These are issued one hour before 02^h, 08^h, 14^h, and 20^h UT and are applicable to the period 1 to 7 hours ahead.

(c) Weekly Radio Telecommunication Forecasts (WF) are issued once a week and are applicable to 1 to 7 days ahead for HF radio propagation conditions on typical high latitude paths passing through or near the auroral zone. They are scored against the average of the whole day North Atlantic quality figures. They are modified as necessary by a supplemental forecast.

(d) Half-day averages of the geomagnetic K indices measured by the Fredericksburg Magnetic Observatory of the NOAA Environmental Research Laboratories, K_{Fr}.

(e) Daily A indices calculated from the 3-hourly K indices measured at Fredericksburg.

North Pacific Radio Area -- A local tape-recorded service, telephone (area code 907) 753-9228 is operated at the Anchorage NOAA station giving a statement of current magnetic conditions, a forecast of geomagnetic conditions for the coming day, current ionospheric conditions, HF radio propagation conditions for the past 24 hours and predicted conditions for the next 24 hours.

Transmission Frequency Ranges -- The North Atlantic path (Lüchow (53.0°N, 11.2°E) - Halifax) is represented by five frequencies, 6.425, 8.542, 12.813, 17.084 and 22.378 MHz, recorded continuously. They are shown in a series of diagrams one for each day. The heavy solid lines represent field strength ≥ -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 rhombic antennas. The quality figures are calculated for a twenty-four hour period (0600 - 0600 UT) from Tokyo, Japan; Halifax, Canada; Mauritius, South Africa: Canberra, Australia; and Bracknell, England. The following frequencies are currently in use:

Tokyo	Halifax	Mauritius	Canberra	Bracknell
22.770 MHz	22.378 MHz	22.617 MHz	19.690 MHz	18.261 MHz
18.220	17.084	17.031	13.920	14.436
13.597	12.813	13.034	11.030	9.203
9.970	8.542	8.626	5.100	4.782
3.622	6.425			

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

S O L A R F L A R E S

(C.1ba, C.1e, C.1d)

Confirmed and Unconfirmed -- Beginning with flare data for January 1968, the flare reports published in the sixth month after observation are divided into two tables as described below. In one of the tables is collected the most homogeneous and reliable flare data. The remaining data appear in the second table. (See page 10 of this text for description of the column headings).

This change has been made possible through close cooperation with G. Olivieri, Observatoire de Paris, 92 Meudon, France, who prepares the flare listing for the *IAU Quarterly Bulletin on Solar Activity* (QBSA). The cooperation of NOAA with the Meudon Observatory involves effective sharing of the work and responsibilities in preparing the flare compilations for publication in these monthly *Solar-Geophysical Data* reports and in the *IAU Quarterly Bulletin on Solar Activity*. Data analysis programs have been prepared at Meudon by R. Servajean and at Boulder by C. Sawyer and C. McLellan. The data appearing in these reports will thus be coordinated with the data appearing in the QBSA.

Raymond Michard of Meudon developed the filtering technique for determined "confirmed" flares based on a comparison of reports from the station, or stations, which see a flare (positive reports) and stations who do not see it, although observing at the same time (negative reports).

Both types of reports are weighted according to the observing technique in use at each station and according to the continuity of its patrol at the supposed time of the event. For a reported flare to be rejected from the QBSA, the total weight of negative reports should exceed the total weight of positive reports by a factor larger than two. However, the flare events reported by at least 3 stations are accepted without any filtering. Negative reports are weighted depending on whether or not they contain the maximum. Also visual stations are given only half weight.

The first table, entitled "Confirmed", contains the flares that will be published in the *Quarterly Bulletin* with mean parameters that will differ slightly from those in *Solar-Geophysical Data*, and in addition contains the subflares confirmed by the NOAA grouping program. These latter are indicated by two minus signs preceding the brightness letters. The second table, entitled "Unconfirmed", contains all of the remaining individual observatory reports and the corresponding group reports. When this program was first started, the second table was entitled "Small or Unconfirmed" since it then contained the "Confirmed" subflares that were faint or of less than 1 heliographic square degree as well as the "Unconfirmed" events.

Reports of the same flare from different observatories are listed together, and headed by the summary "group report" (GRP) that gives average values for each quantity. The principal criteria for grouping reports together are position and time of maximum. Each maximum time reported by at least two observatories forms the basis of a separate group description, but a single group number is assigned to several group reports when they describe successive maxima of a single flare. The maximum reported by the largest number of observatories appears first. The mean importance of secondary maxima is marked with an asterisk.

On the Group line under "Remarks" are given the number of observatories reporting the maximum, the number of values entering the average importance, the number entering the average measured area and the number of observatories patrolling the sun at time of maximum. In cases of mutliple maxima the "Remarks" apply only to that maximum with which the entry appears and not to the entire flare event. A line of explanation has been added before each flare event having more than one maxima. The total number of stations reporting at least one maximum of the event is given. The number of stations observing at the time of the principal maximum, but not reporting the event, is given in the second statement. For some months, the averages are obtained by correcting each reported value of importance and of measured area by an amount that depends on the reported value, the position of the flare on the solar disk, and the reporting observatory. Grouping and averaging are done by an electronic computing machine. The rules have been changed from time to time, so these data are not completely homogeneous.

Intervals when no observatory reported patrol observations are listed chronologically in the table. Discrepancies noted by the grouping program that might indicate an error in the report are listed at the end of the table, and the reported value questioned is marked by an asterisk to the left of the report in question.

Changes in the Solar Flare presentation are expected to be made with the January 1975 data to be published in the July 1975 issue. These changes are being made in cooperation with Dr. P. Simon of Meudon who is preparing the input to "IAU Quarterly Bulletin on Solar Activity". A new text will be included at that time.

Flare Index -- The daily flare index, calculated from the confirmed flares, is defined as

$$I_f = \frac{7600}{T^*} \sum A_d^2$$

where individual flare areas A_d are measured in square degrees and T* is the effective observing time in minutes. Only those confirmed flares of greater than 1 square degree in area, as included in the *IAU Quarterly Bulletin on Solar Activity*, are used in calcuating the flare index. 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 Confirmed Solar Flares. Beginning with the January 1975 data, this index will be calculated using all flares.

A regional flare index is described in the text for the data for seven months before month of publication on page 60.

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 48.

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 will begin with the January 1975 data. In the case of OTTA and PENT observations, letters are sometimes appended to the SGD numerical code. See page 54 for explanation. 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).

Solar Radio Observatories
(Fixed Frequency Observations)

CODE NAME	STATION	ALTERNATE NAME	GEOGRAPHIC LAT	LONG	FREQUENCIES REPORTED (MHz)
ABST	Abastumani		42N	43E	221
ARCE	Arcetri		44N	11E	9240, 2830, 1420
ATHN	Athens		38N	24E	8800, 4995, 2695; 1416
BERL	Berlin-Adlershof		52N	13E	9500, 3000, 1470
BERN	Berne		47N	07E	10500
BORD	Bordeaux	Floriac	44N	01W	930
BOUL	Boulder		40N	105W	18 (Univ. of Colo.) 4995, 2695, 1420, 245 (NOAA)
CRIM	Simferopol	Crimea	44N	34E	3100
DWIN	Dwingeloo		53N	06E	315, 283
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	Irkustsk	Siberian IZMIR	52N	104E	9300
IZMI	Moscow IZMIRAN	Krasnaja Pakhra	55N	37E	207
KIEL	Kiel		54N	10E	1420, 1000, 800, 600, 400, 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	156W	8800, 1415
PENN	Penn. State Univ.		41N	78W	10700, 2700, 960
PENT	Penticton		49N	119W	2695
POTS	Potsdam	Tremsdorf	52N	13E	510, 234, 113
SAOP	Sao Paulo		22S	46W	7000
SGMR	Sagamore Hill		52N	72W	35000, 15400, 8800, 4995, 2695, 1415, 606, 410, 245
SLOU	Slough		51N	00E	71000, 37000, 19000, 9400,
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	30
VORO	Voroshilov	Ussurisk	43N	132E	2930, 202

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. 36).
C	= Complex	:	Combination of a few or many simple bursts.
F	= Fluctuation	:	Minor C sometimes superposed on 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 postburst 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.

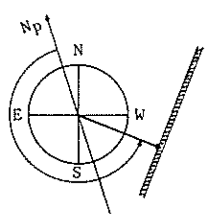
S, FAL and SER may also be used.

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

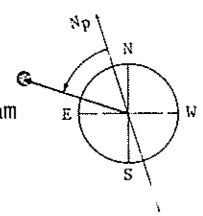
Polarization information is denoted by the letters R (right-handed) or L (left-handed). The degree of polarization in percent is shown in two digits. When precise values are not available, the degree of polarization is expressed in symbols, W = weak, M = moderate or S = strong. For example, 83R means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

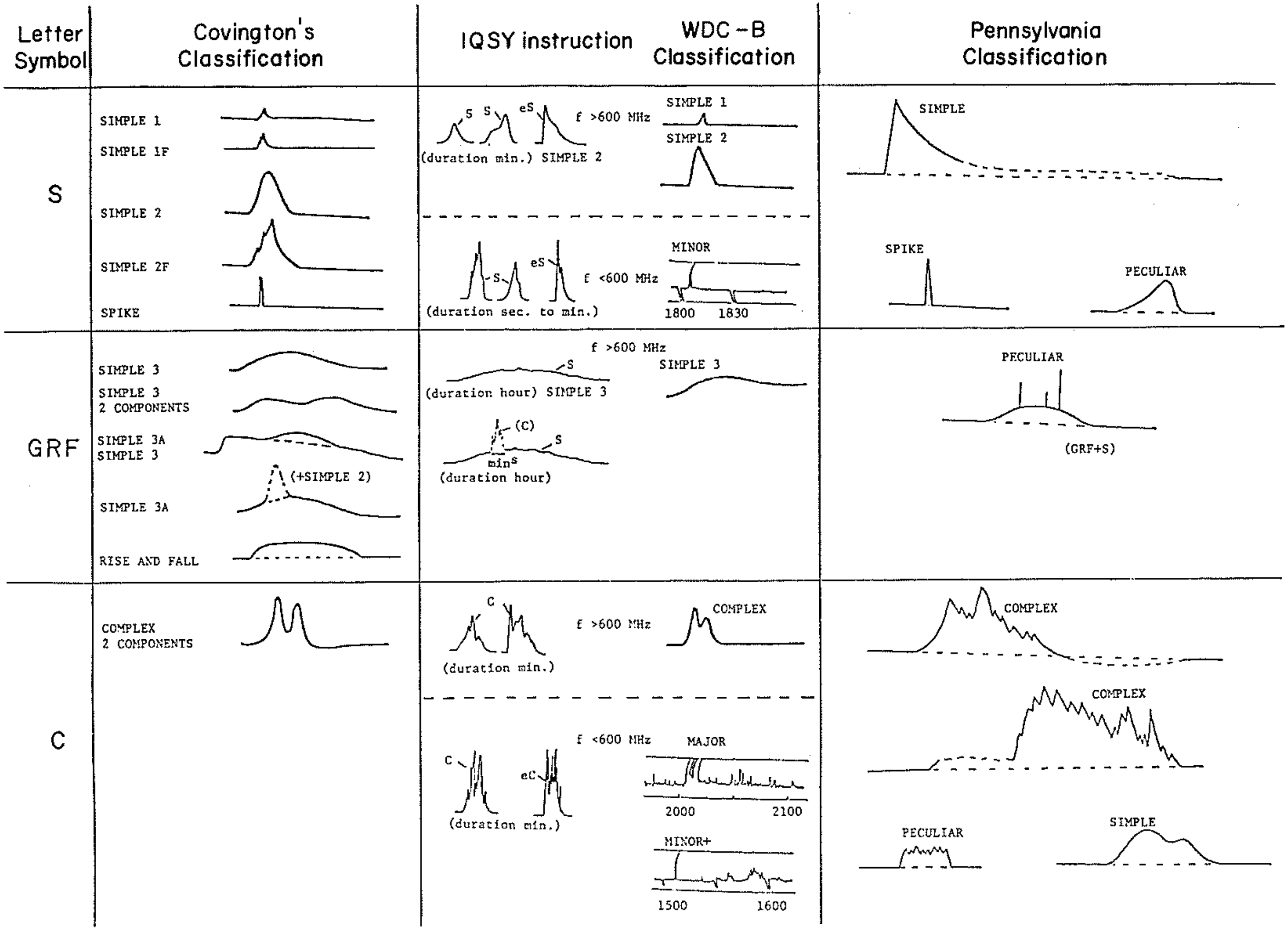
Fan Beam



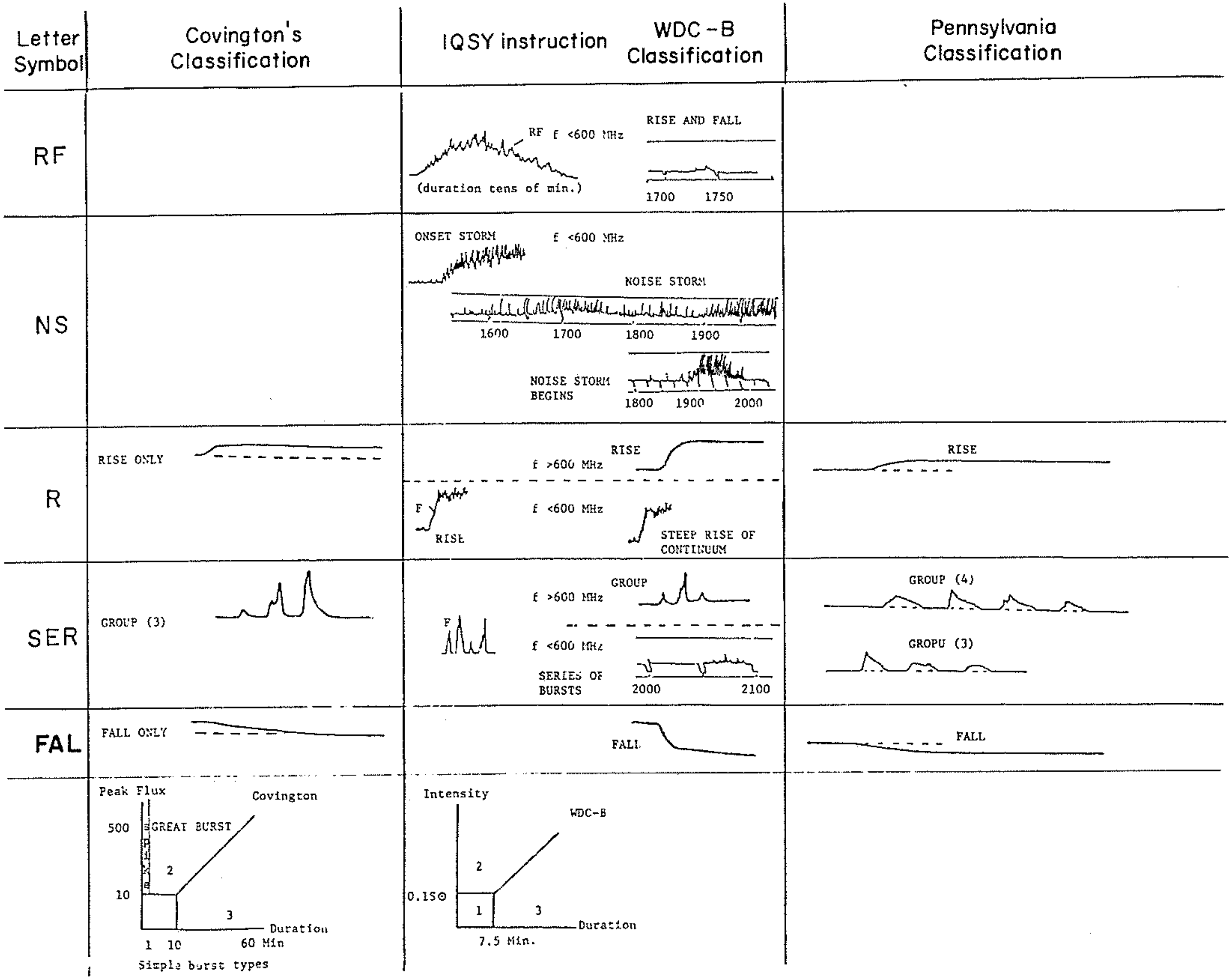
Pencil Beam

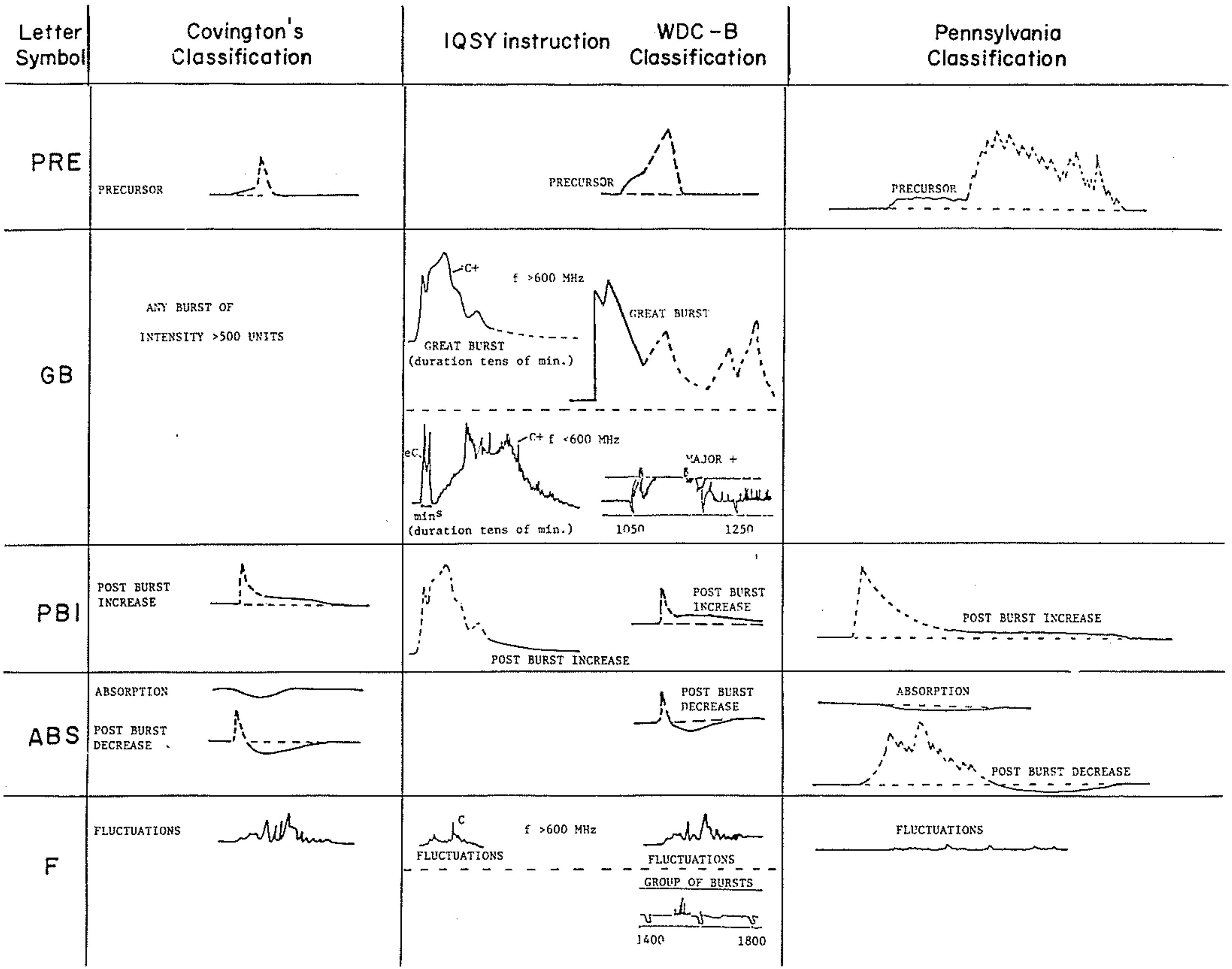


Details of Observatories -- In previous issues of the Descriptive Text details have been given concerning the equipment used, frequencies observed, and methods of data reduction for Western Hemisphere Observatories. These were for the Sagamore Hill Solar Radio Observatory of the Air Force Cambridge Research Laboratories, the Pennsylvania State University Radio Astronomy Observatory, the Algonquin Radio Observatory and the Dominion Radio Astrophysical Observatory (called Ottawa and Penticton in these reports), the Huancayo Observatory of the Instituto Geofisico del Peru, the



Letter Symbol
Covington's Classification
IQSY instruction
WDC – B Classification
Pennsylvania Classification
S
SIMPLE 1
SIMPLE 1F
SIMPLE 2
SIMPLE 2F
SPIKE
S
S
eS
f >600 MHz
(duration min.) SIMPLE 2
SIMPLE 1
SIMPLE 2
SIMPLE
eS
S
f <600 MHz
(duration sec. to min.)
MINOR
1800
1830
SPIKE
PECULIAR
GRF
SIMPLE 3
SIMPLE 3
2 COMPONENTS
SIMPLE 3A
SIMPLE 3
(+SIMPLE 2)
SIMPLE 3A
RISE AND FALL
f >600 MHz
S
(duration hour) SIMPLE 3
SIMPLE 3
(C)
S
min S
(duration hour)
PECULIAR
(GRF+S)
C
COMPLEX
2 COMPONENTS
C
f >600 MHz
(duration min.)
COMPLEX
COMPLEX
COMPLEX
C
eC
f <600 MHz
(duration min.)
MAJOR
2000
2100
MINOR+
1500
1600
PECULIAR
SIMPLE


Letter Symbol
Covington's Classification
IQSY instruction
WDC-B Classification
Pennsylvania Classification
RF
RF f <600 MHz
(duration tens of min.)
RISE AND FALL
1700 1750
NS
ONSET STORM
f <600 MHz
NOISE STORM
1600 1700 1800 1900
NOISE STORM BEGINS
1800 1900 2000
R
RISE ONLY
f >600 MHz
RISE
F
RISE
f <600 MHz
STEEP RISE OF CONTINUUM
RISE
SER
GROUP (3)
F
f >600 MHz
GROUP
f <600 MHz
SERIES OF BURSTS
2000 2100
GROUP (4)
GROPU (3)
FAL
FALL ONLY
FALL
FALL
Peak Flux
Covington
500
GREAT BURST
2
10
3
Duration
1 10 60 Min
Simple burst types
Intensity
WDC-B
2
0.15⊙
1
3
Duration
7.5 Min.


Letter Symbol
Covington's Classification
IQSY instruction
WDC-B Classification
Pennsylvania Classification
PRE
PRECURSOR
PRECURSOR
PRECURSOR
GB
ANY BURST OF
INTENSITY >500 UNITS
C+
f >600 MHz
GREAT BURST
(duration tens of min.)
GREAT BURST
eC
C+ f <600 MHz
mins
(duration tens of min.)
MAJOR +
1050
1250
PBI
POST BURST INCREASE
POST BURST INCREASE
POST BURST INCREASE
POST BURST INCREASE
ABS
ABSORPTION
POST BURST DECREASE
POST BURST DECREASE
ABSORPTION
POST BURST DECREASE
F
FLUCTUATIONS
C
f >600 MHz
FLUCTUATIONS
FLUCTUATIONS
GROUP OF BURSTS
1400
1800
FLUCTUATIONS

Umuarama Radio Observatory of Mackenzie University of Sao Paulo, Brazil, and the Observatorio de Fisica Cosmica de San Miguel, Argentina. We no longer feel it necessary to repeat this information year after year, especially since we are not providing similar information from the worldwide network. Special notes for some of these observatories follow.

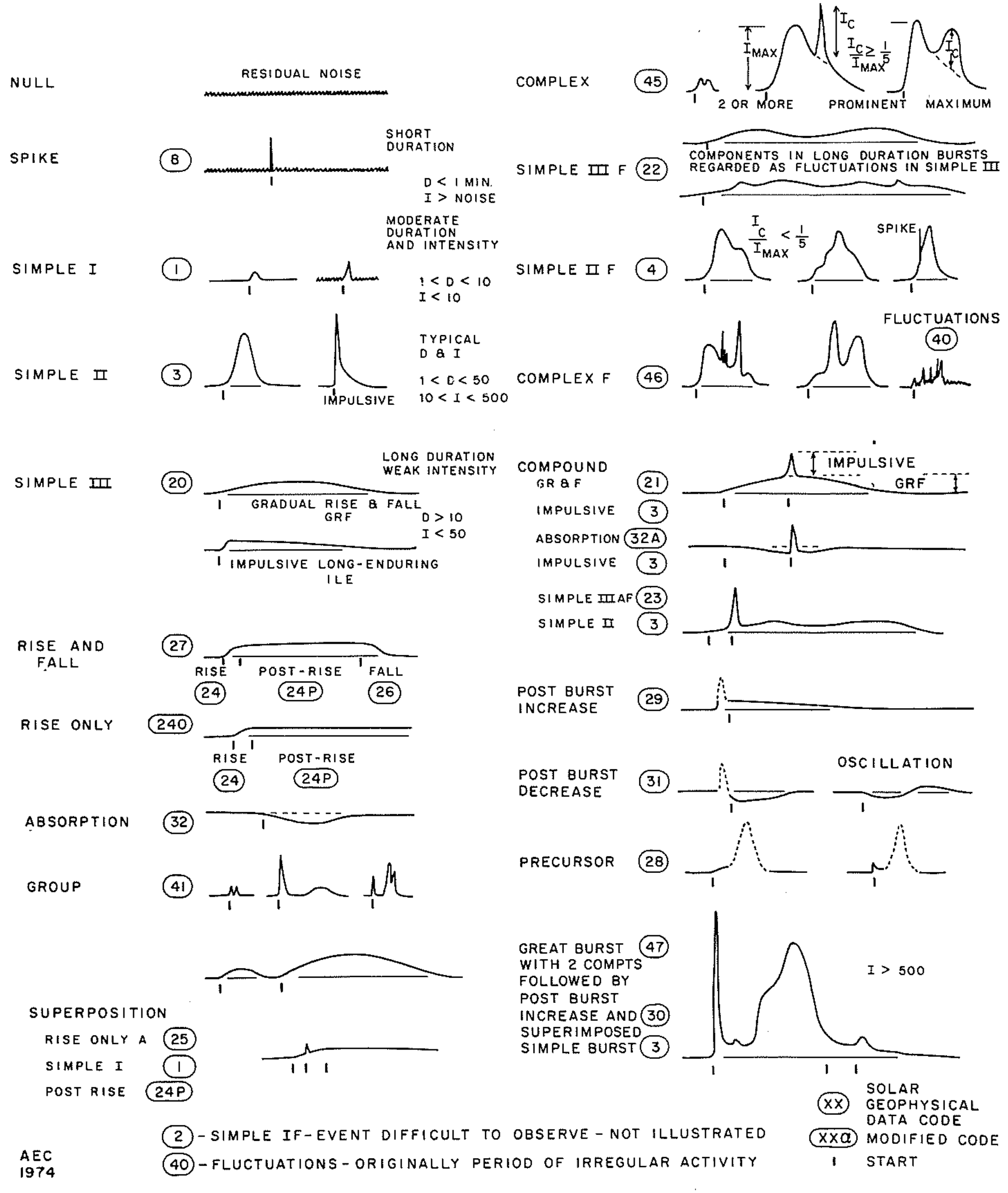
At Sagamore Hill verification of the accuracy of their patrol measurements at 15,400 MHz has continued. The first phase of a system for automated data correction and handling was integrated into the patrol operation in June 1974. After an evaluation period, this unit will supply the data reduction now done manually. On the reports provided to WDC-A for Solar-Terrestrial Physics, in addition to the peak flux and mean flux for each burst, the integrated flux density will be given.

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. These are illustrated by the figure on page 55. Records observed simultaneously at these widely separated stations have led to the recognition of other unique variations representing new types of events at cm wavelengths. These are the relatively small intensity, rise only event (which appears as a discontinuity in the daily level), the absorption only event, the GRF events of great duration, isolated events of very short duration or spikes, and the single cycle of a sinusoid. These basic profiles and all the others are shown in idealized form in the figure described above, identified by SGD numerical code and appended letters. Clarification of some of the profiles follow. To identify rise only encode as 240, and to identify the post-rise enhanced level following the rise encode as either 24P or 25P. Through the types, the letter A can be added to indicate the basic or longest enduring part of a compound event or apparent compound 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 elementary form are denoted by the letter F added to the SGD numerical code for the event so modified. The following table defines these additions:

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	
23A	GRF	Simple 3AF GRF	
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



MAGNETOGRAMS OF GEOMAGNETIC STORMS (D.1e)

In the past the Kp and Ci 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 the 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 are 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 have been reduced from the original records to display the same amplitude scale and time base. It is planned to include reduced magnetograms from about 10 of the 16 observatories listed below 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 will also be prepared for each event. No reduced magnetograms will be prepared for months having activity of only minimal interest.

Table of Observatories

	Geog. Coord.		Geomag. Coord.	
	Lat.	Long.	Lat.	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

	Geog. Coord.		Geomag. Coord.	
	Lat.	Long.	Lat.	Long.
Dixon Island	73.55	80.57E	63.01	161.84E
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	206.38
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

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* 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-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-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-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-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.

These reduced magnetograms and index graphs are now produced by J. H. Allen and H. Kroehl 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, reduced magnetograms were provided by Dr. S.-I. Akasofu.

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 April 1971 were published in Nos. 7-10.) 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 synotic chart for the same month which was originally published at the beginning of the second section of Part I (Prompt Reports).

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. Only the flares in the confirmed list are used. 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-1 GOES (.5-4A; 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 Permanent Service of Geomagnetic Indices (Göttingen) of IAGA. [*Annals of the IGY*, Vol. 4, pp. 227-236]. Beside the Ap value will appear, when appropriate, "D" for one of the five most disturbed days, "Q" for one of the 10 most quiet days and "QQ" for one of the five most quiet days. 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°. These reports are shown by a tick mark for single time reports, an arrow for duration reports with the geomagnetic latitude, the type of auroral event and, for the Western European report, the location where visible. Remarks concerning auroral displays over Western Europe and noctilucent cloud dates are provided by Mary Hallissey and D.H. McIntosh. N. V. Pushov provides descriptions of aurora summarizing reports from a network of about 130 stations between 30° and 140° E longitude. The North American sector data are no longer available.

The following descriptions 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); 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).
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 unit 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. 47 of this text).

-- The daily Ca plage index is given next (see p. 32 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 Ip is for polar cap blackout, and the index Ia 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 College data have been substituted for Point Barrow for Ia, and only Resolute Bay and Thule data are available for Ip.

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 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 characterizes 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 47. The same formula,

$$I_f = \frac{7600}{T^*} \sum A_d^2 ,$$

is used where A_d is the measured (apparent) area in square degrees and the same flares (IAU "confirmed") are counted, 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 CONTRIBUTIONS

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 1972 by the ICSU Panel on World Data Centers).

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. 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
G. Godoli	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. Livingston	Kitt Peak National Observatory P. O. Box 26732 Tucson, Arizona 85726	Solar magnetograms
A. A. Giesecke M. Ishitsuka	Observatorio de Huancayo Instituto Geofisico del Peru Apartado 46 Huancayo, Peru	SID, solar radio noise, flares
R. G. Giovanelli	CSIRO Division of Physics City Road, Chippendale N.S.W., Australia 2008	Flares
V. Badillo	Manila Observatory P. O. Box 1231 Manila, Philippines	Flares, SID, solar noise, sunspots
U. Kusoffsky	Stazione Astrofisica Svedese Via Fraita 4 I-80071 Anacapri, Italy	Flares
G. Olivieri	Observatoire de Meudon 92 Meudon, France	Flares
H. Tanaka	Toyokawa Observatory The Research Institute of Atmospherics Nagoya University Toyokawa, 442 Japan	Solar noise

Name	Organization	Data Type
J. P. Castelli Wm. R. Barron	USAF Cambridge Research Laboratories L. G. Hanscom Field Code LIR Bedford, Massachusetts 01730	Solar noise
W. N. Christiansen Arthur Watkinson	School of Electrical Engineering University of Sydney Sydney, N.S.W. 2006, Australia	Solar noise
A. E. Covington M. B. Bell	Astrophysics Branch National Research Council Ottawa 27 Ontario, Canada	Solar noise
J. P. Hagen W. J. Decker	Department of Astronomy 525 Davey Laboratory The Pennsylvania State University University Park, Pennsylvania 16802	Solar noise
P. Marques dos Santos	Universidade Mackenzie, CRAAM Rua Maria Antonia, 403 Caixa Postal 8792 Sao Paulo 3, Brazil	Solar noise
A. Maxwell	Harvard Radio Astronomy Station Fort Davis, Texas 79734	Solar noise
H. Urbarz	Aussenstelle Astronomy Institut der Universitat Tübingen 7981 Weissenau Federal Republic of Germany	Solar noise
A. O. Benz G. L. Tarnstrom H. K. Asper	Microwave Laboratory Gloriastrasse 35 8006 Zürich, Switzerland	Solar noise
C. Slottje	Solar Radio Observatory Netherlands Foundation for Astronomy Dwingeloo, Netherlands	Solar noise
M. Pick	Observatoire de Meudon 92 Meudon, France	Solar noise
J. W. Warwick	Dept. of Astro-geophysics University of Colorado Boulder, Colorado 80302	Solar noise
J. P. Wild S. F. Smerd	CSIRO Division of Radio Physics P. O. Box 76 Epping N.S.W. 2121 Australia	Solar noise
M. P. Bleiweiss F. L. Wefer	NELC La Posta Rt. 1 Box 591 Campo, California 92006	Solar radio maps
W. A. Coles 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 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

Name	Organization	Data Type
F. L. Scarf	Systems Group of TRW Inc. Bldg. R-5, Rm 1280 One Space Park Redondo Beach, California 90278	IP Electric Field
N. F. Ness	Laboratory for Extraterrestrial Physics NASA/GSFC Greenbelt, Maryland 20771	IP Magnetic Field
F. Mariani	Marconi Institute of Physics University of Rome Rome, Italy	IP Magnetic Field
C. O. Bostrom	Applied Physics Laboratory The Johns Hopkins University 8621 Georgia Avenue Silver Spring, Maryland 20910	Solar protons
W. R. Webber J. A. Lezniak	Physics Department University of New Hampshire Demerritt Hall Durham, New Hampshire 03824	Solar cosmic ray protons
D. J. Williams H. H. Sauer	Space Environment Laboratory NOAA Boulder, Colorado 80302	Solar protons
A. Frosolone	Space Weather Consultants P. O. Box 213 Moffett Field, California 94035	Pioneer spacecraft
R. B. Doeker G. Heckman	Space Environment Services Center NOAA Boulder, Colorado 80302	Solar proton events Inferred IP Magnetic Fields
	Cable & Wireless Engineer in Chief's Department Mercury House Theobalds Road London, W. C. 1, England	SID
C. Hornback	Table Mountain Geophysical Monitoring Station Space Environment Laboratory NOAA Boulder, Colorado 80302	SID, Solar radio noise
S. Katahara	Ionospheric Sounding Station P. O. Box 578 Puunene, Maui, Hawaii 96784	SPA
A. P. Mitra	Radio Research Committee National Physical Laboratory of India Hillside Road New Delhi 12, India	SID
P. C. Yuen	Department of Electrical Engineering University of Hawaii Honolulu, Hawaii 96822	SFD
R. F. Donnelly	Space Environment Laboratory NOAA Boulder, Colorado 80302	Solar x-rays
J. H. Parkinson	Department of Physics University College London Mullard Space Science Laboratory Holmbury St. Mary Dorking Surrey, England	X-ray maps

Name	Organization	Data Type
M. Bercovitch Margaret D. Wilson	National Research Council of Canada Ottawa, Ontario, Canada K1A OR6	Cosmic rays
D. Venkatesan M. Tjoei	Department of Physics University of Calgary Calgary 44, Alberta, Canada	Cosmic rays
J. A. Simpson	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 Kaga-1, Itabashi Tokyo, Japan 173	Cosmic rays
O. Binder	Institut für Reine und Angewandte Kernphysik der Christian-Albrechts- Universitat Kiel 23 Kiel, German Federal Republic	Cosmic rays
M. Siebert	Geophysikalisches Institut 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 Greenbelt, Maryland 20771	Magnetic indices
D. J. Poros	Computer Sciences Corporation Silver Spring, Maryland 20910	Magnetic indices
P. N. Mayaud	Institut de Physique de Globe Tour 14, 3e etage 9, Quai Saint-Bernard 75-Paris, France	Magnetic indices
A. Romaña	Observatorio del Ebro Roqueta (Tarragona) Spain	ssc, si, sfe
J. H. Allen H. Kroehl	NGSDC/EDS/NOAA Boulder, Colorado 80302	Magnetograms
R. Eyfrig	Fermeldetechnisches Zentralamt 61 Darmstadt, Postfach 800 G.F.R.	Radio quality figures
K. D. Boggs	Institute for Telecommunication Sciences Office of Telecommunications Boulder, Colorado 80302	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 67-82. 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 meridians calibrated in degrees from CMP are included to fit the Mount Wilson magnetograms. The two sizes as calibrated in degrees or days from CMP are reversed from those published in the last Descriptive Text which may also be used with these maps.

The dates shown were for 1969 but are within 1 day of appropriate date for 1975. See any Ephemeris.

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A. Solar and Interplanetary Phenomena

		Mo/Yr		Mo/Yr
A.1	Sunspot Drawings	1/67	-	present
A.1a	Sunspot Data (see A05a)	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 - in each issue since IER-FB-294, updated each month, for period	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.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.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	-	present
A.7d	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.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 AU	1/64	-	present
A.8ad	2800 MHz (Ottawa) Final - Daily Values of Solar Flux Adjusted to 1 AU.	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 AU (15400 MHz began 11/67 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 Data - included in A.5a since 1/69			
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 (Nancay) Interferometric Observations	7/57	-	present
A.10b	408 MHz (Nancay) 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	Mo/Yr		Mo/Yr
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

		Mo/Yr		Mo/Yr
A.11b	Solar X-ray Background Levels, 0-20Å Injun 1/SOLRAD-3, 1961-02	6/61	-	12/61

A. Solar and Interplanetary Phenomena (continued)

A.11c	Solar X-ray Background Levels (Vela 1,2; 1963-39A,C)	(10/63)
A.11d	Solar X-ray Background Levels (McMath) (OSO-3; 1967-20A), 8-12Å	3/67 - 8/67
A.11e	Solar X-ray (OSO-5; 1969-6A) Spectroheliograms (University College London, Leicester Univ.)	7/69 - 11/72 7/74 - present
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)	11/74 - present
A.12aa	Solar Protons, Daily-hourly Values, JPL/GSFC (satellites, see below)	5/67 - 9/74
A.12ab+	Solar Protons, Graphs, JPL/GSFC " " "	5/67 - 9/74
	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 - 9/74
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, 1974-089A)	7/74 - present
A.13a	Solar Wind (Pioneer 6, 1965-105A; and Pioneer 7, 1966-75A) NASA Ames	12/65 - 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.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 - present
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) (Divided into Confirmed and Unconfirmed Flares as of 1/68)	9/66 - present
C.1c	H-α Subflares	7/57 - present, included in C.1a after 1/62 and in C.1ba
C.1d	H-α Flare Patrol (The most recent issue listed for a month contains the comprehensive flare patrol.)	7/57 - present
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 Occurence of Confirmed Solar Flares	1/68 - 6/68
C.3a	2800 MHz (Ottawa) Outstanding Occurrences	7/57 - present
C.3aa	2800 MHz (Ottawa) Hours of Observation	7/57 - with C.3a after 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. Flare-Associated Events (continued)

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 - with C.3h after 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 - present
C.3l	486 MHz (Washington State Univ.) Outstanding Occurrences	7/66 - 4/69
C.3m	18 MHz Bursts (Boulder) (reported in 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
	20 - 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 - present
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 - 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)	11/74 - present
C.6	Sudden Ionospheric Disturbances (SID)	1/63 - present
C.6aa	Sudden Ionospheric Disturbances (SWF)	7/57 - included in C.6 after 12/62
C.6ab	Sudden Ionospheric Disturbances (SCNA, SEA, bursts)	1/58 - included in C.6 after 12/62
C.6ac	Sudden Ionospheric Disturbances (SPA)	6/61 - included in C.6 after 12/62
C.7	Solar Proton Events - Direct Measurement - same as A.12	5/67 - present
C.8	Solar Proton Events - Riometer Confirmed Polar Cap Absorption Events (ESSA)	1/67 - 6/67
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, Cp, Kp, Ap, aa, Selected Days (aa first published 1/74)	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 - 3/72
F.1b	Cosmic Ray Daily Averages Neutron Monitors (Climax)	9/60 - 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 - graph of hourly values)	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
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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 67 and following.

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Key *	1959 Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	1960 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	184	185	186	187	188	189	190	191	192	193	195	196	196	197
										185	185													
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	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197
	176	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200
	178	185	185	185	185	185	185	185			191	189	191	191	194	194	201	195	201	201	201	199	201	201
	185											191	194	194				201				201		
														196										
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	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197
	176	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200
	178	185	185	185	185	185	185	185			191	191	191	191			202	202	202	202	202	202	202	202
	185					200																		
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												
											198													
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	195	195	195	195	196	197	198
																	205							
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

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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	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221
	201	202	203	204	205	206	207	208	210-	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224
	208	208	208	208	208		208																	
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	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221
	201	202	203	204	205	206	207	208	210	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224
	208	208	208	208	208		208																	
C.3a	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221
							206		209		209													
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.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	206	207	208	209	210	211	212	213	214	223	223	223	223	223	223	233	222
							205																	
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

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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

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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	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269
	249	250	251	252	253	255	255	256	257	258	259	260	261	262	263	264	265	266	267	268				
														266		266	266			270				
																268								
C.1ba																					269	272	273	274
																					271			
C.1d	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269
	249	250	251	252	253	255	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	272	273	274
																				270	271			
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

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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	206	207	280	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												

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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 67 and following.

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	313 91	---	---	---	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 67 and following.

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 67 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.7d	---		---		---		---		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	342B	109	---	
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	21	---		---		---		---	
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.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	342B	105	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	337B	104	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	342B	111	333	98	334	102	335	124	336	116	337	126	338	116	339	110	340	118	341	98	342	102
F.1d	331	100	342B	111	342B	111	342B	111	342B	111	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	350B	100	350B	100	350B	101	350B	101
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 67 and following.

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Key*	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.7d	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	350B	102	353B	64	353B	70	353B	76	353B	82	---		---		---		---		---		---		---	
A.12ab	350B	102	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.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

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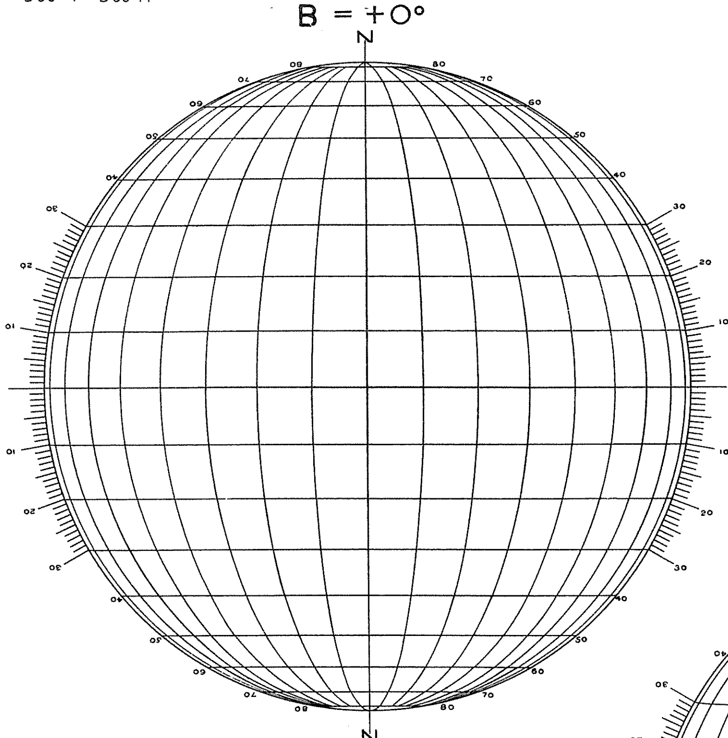
Key*	1974 Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
A.												
A.1	355 24	356 24	357 26	358 30	359 22	360 42	361 30	362 32	363 28	364 32	365 26	366 24
A.2a	354 7	355 7	356 7	357 7	358 7	359 7	360 7	361 7	362 7	363 7	364 7	365 7
A.2c	354 7	355 7	356 7	357 7	358 7	359 7	360 7	361 7	362 7	363 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.7d	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.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				
C.1d	359B 12	360B 12	361B 10	362B 23	363B 18	364B 17	365B 26	366B 14				
C.1e	359B 9	360B 10	361B 8	362B 18	363B 14	364B 13	365B 20	366B 10				
C.1f	360B 29	361B 22	362B 47	363B 41	364B 39	365B 81	366B 29					
C.3	359B 13	360B 13	361B 11	362B 24	363B 19	364B 18	365B 27	366B 15				
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	---	---	---	---	---	---	---	---	---	---	364 23	365 18
C.6	355 96	356 90	357 97	358 98	359 95	360 111	361 103	362 103	363 99	364 102	365 93	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	---				
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					

* See "Key" on pages 67 and following.

DEGREES FROM CENTRAL MERIDIAN

June 3 – June 10
Dec 4 – Dec 11

B = +0°

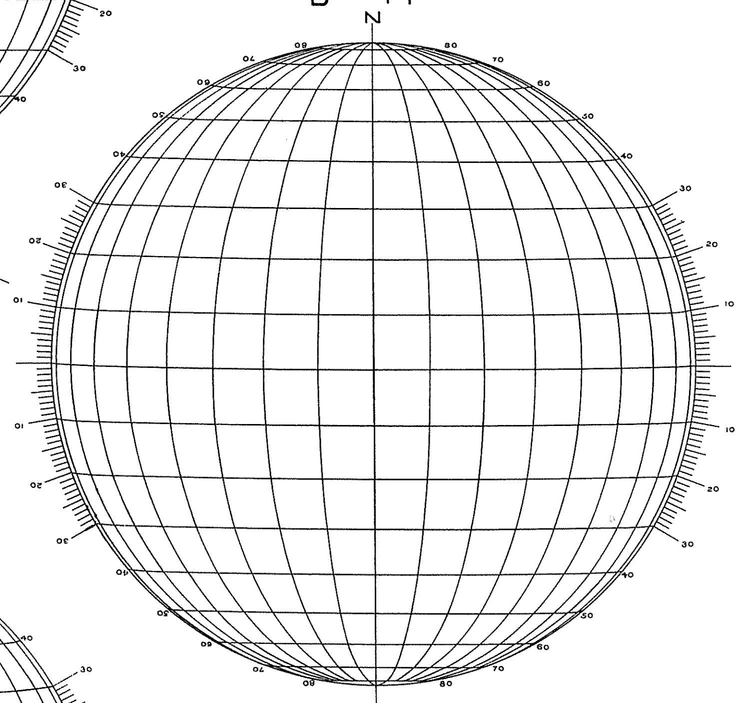


B = −0°

June 3 – June 10
Dec 4 – Dec 11

June 11 – June 18
Nov 26 – Dec 3

B = +1°

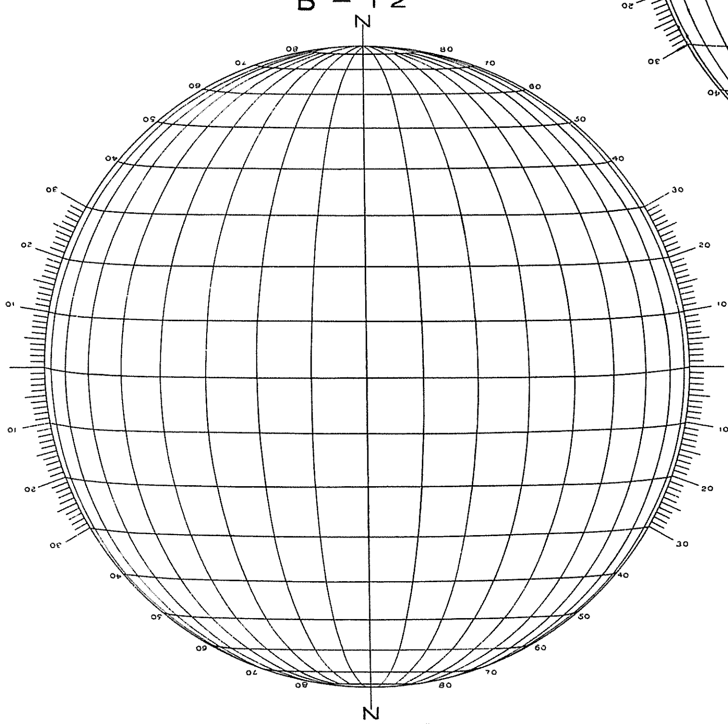


B = −1°

May 25 – June 2
Dec 12 – Dec 19

June 19 – June 27
Nov 18 – Nov 25

B = +2°

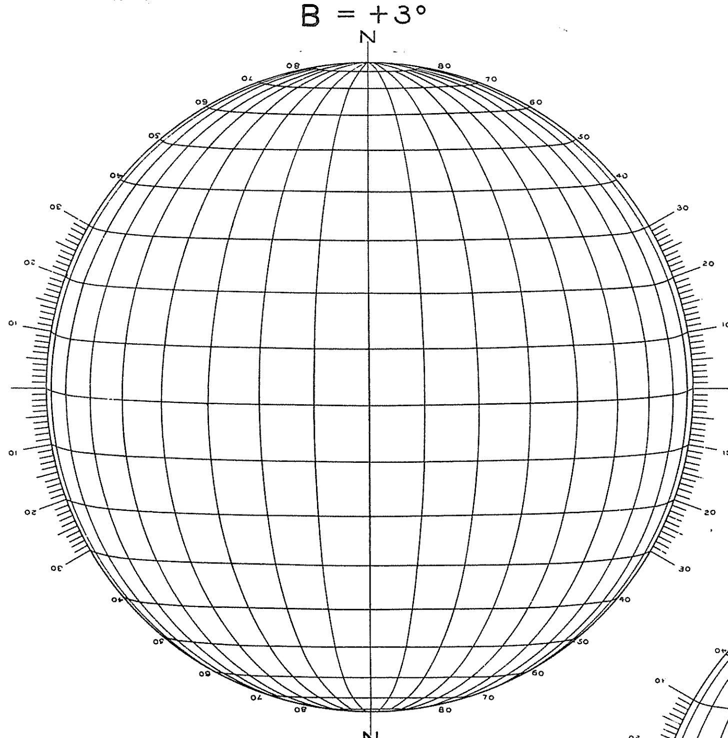


B = −2°

May 17 – May 24
Dec 20 – Dec 27

June 28 – July 6
Nov 10 – Nov 17

B = +3°

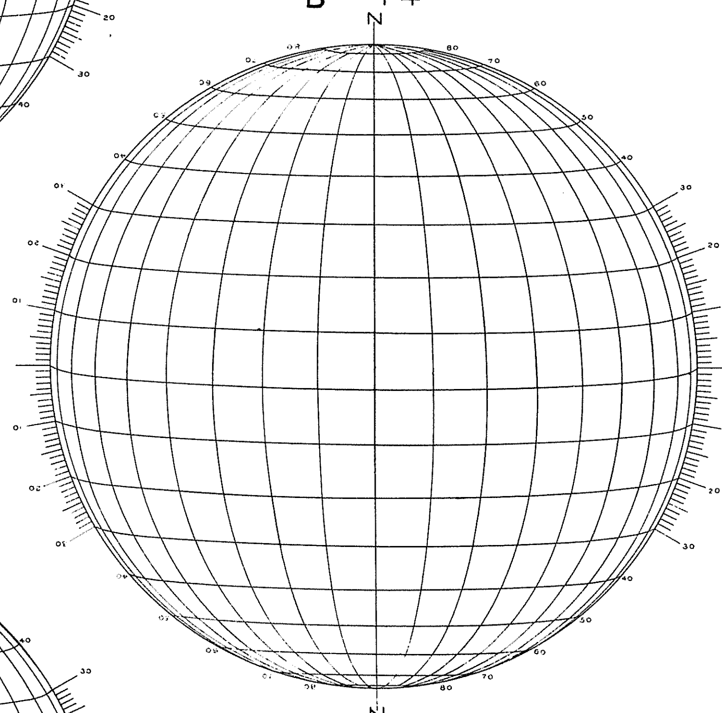


B = −3°

May 8 – May 16
Dec 28 – Jan 4

July 7 – July 16
Oct 31 – Nov 9

B = +4°

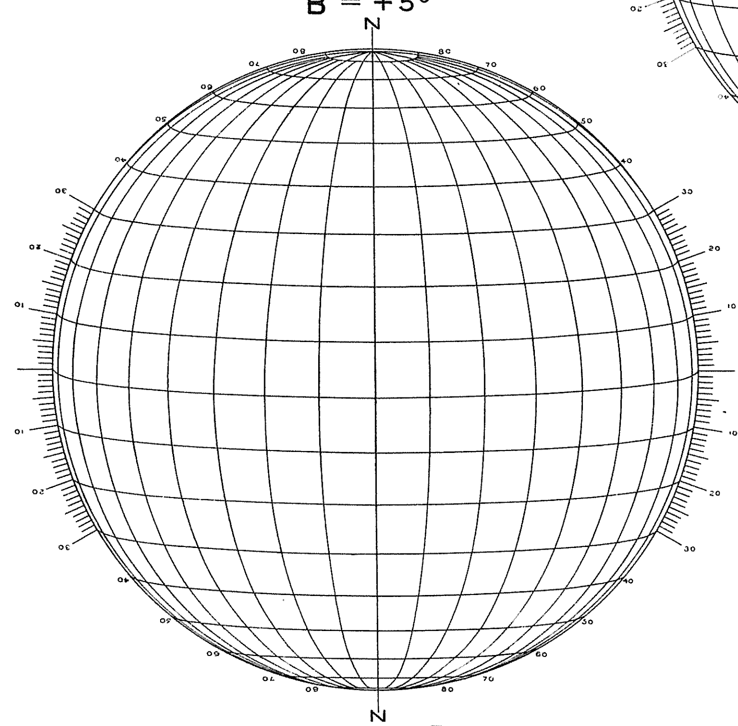


B = −4°

Apr 28 – May 7
Jan 5 – Jan 14

July 17 – July 27
Oct 20 – Oct 30

B = +5°

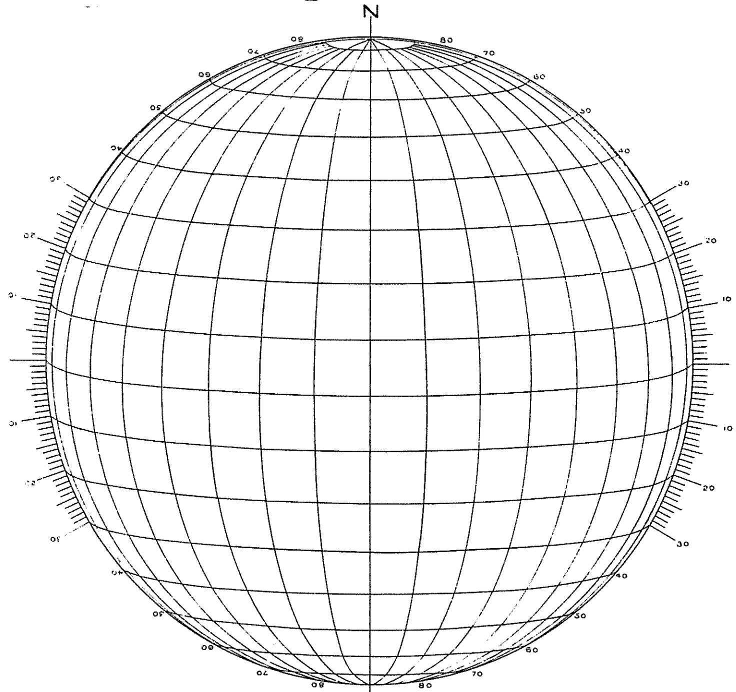


B = −5°

Apr 17 – Apr 27
Jan 15 – Jan 24

July 28 - Aug 12
Oct 5 - Oct 19

B = +6°

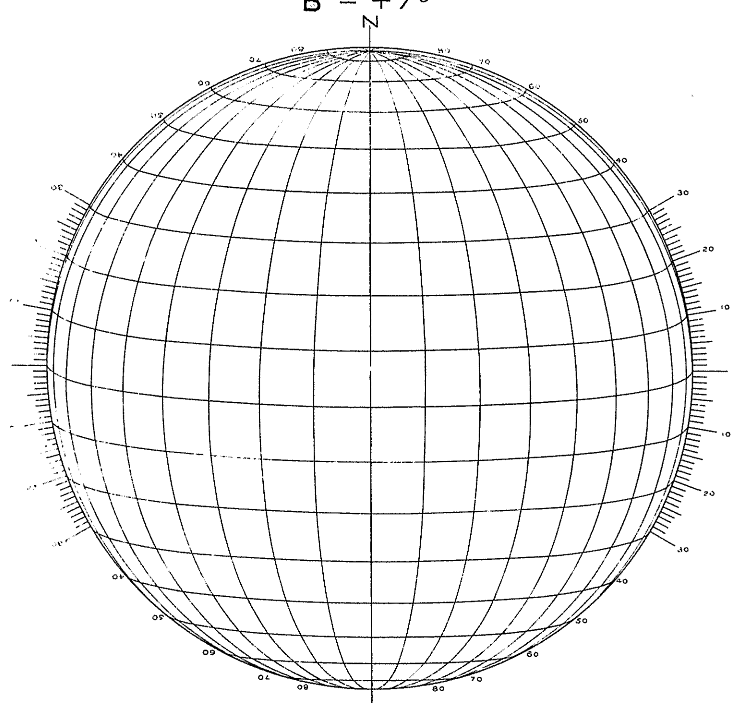


B = −6°

Apr 2 - Apr 16
Jan 25 - Feb 8

Aug 13 - Oct 4

B = +7°

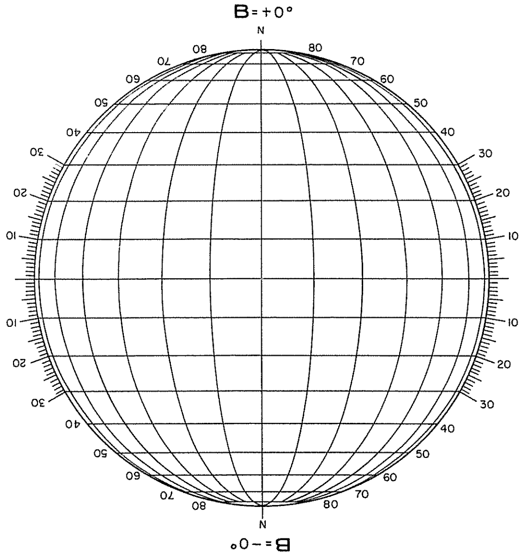


B = −7°

Feb 9 - Apr 1

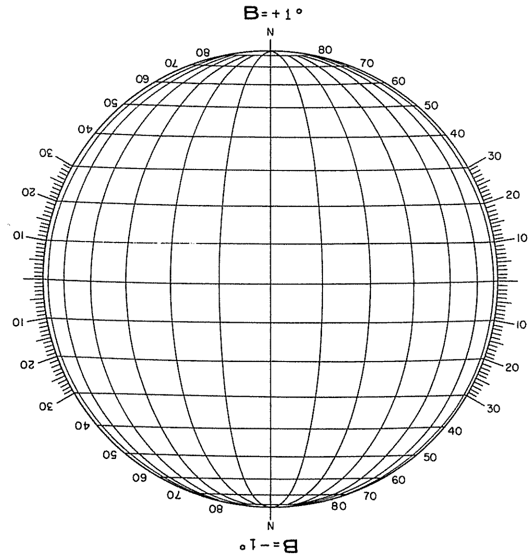
DAYS FROM CENTRAL MERIDIAN

June 3 - June 10
Dec 4 - Dec 11



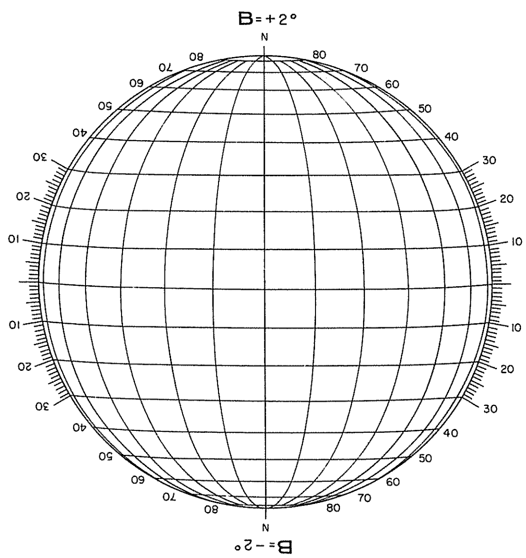
June 3 - June 10
Dec 4 - Dec 11

June 11 - June 18
Nov 26 - Dec 3



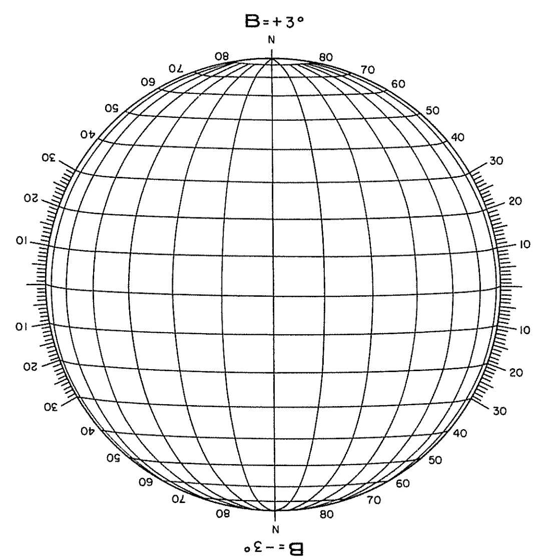
May 25 - June 2
Dec 12 - Dec 19

June 19 - June 27
Nov 18 - Nov 25



May 17 - May 24
Dec 20 - Dec 27

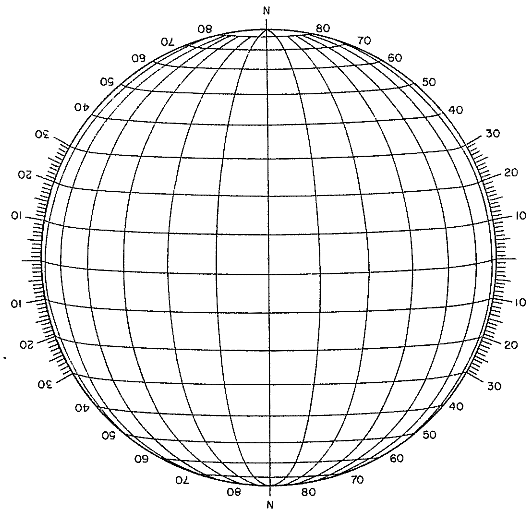
June 28 - July 6
Nov 10 - Nov 17



May 8 - May 16
Dec 28 - Jan 4

July 7 – July 16
Oct 31 – Nov 9

B = +4°

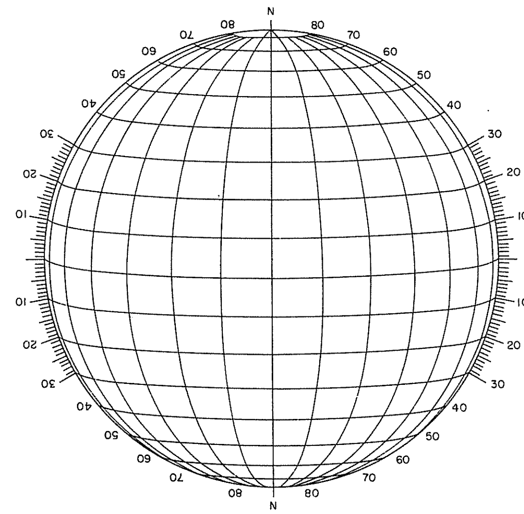


B = −4°

Jan 5 – Jan 14
Apr 28 – May 7

July 17 – July 27
Oct 20 – Oct 30

B = +5°

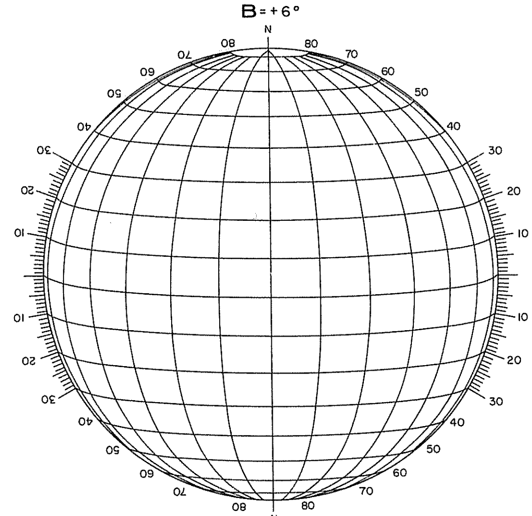


B = −5°

Jan 15 – Jan 24
Apr 17 – Apr 27

July 28 – Aug 12
Oct 5 – Oct 19

B = +6°

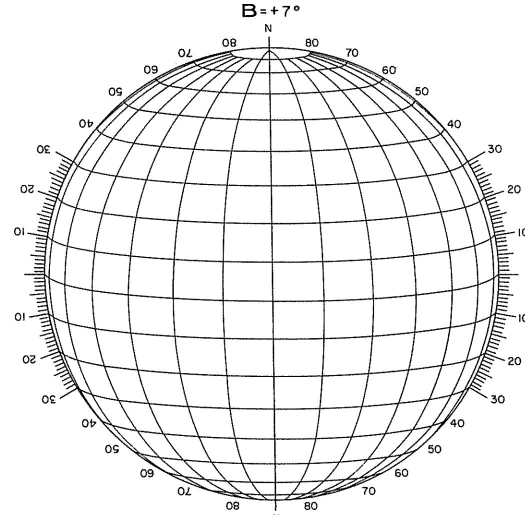


B = −6°

Jan 25 – Feb 8
Apr 2 – Apr 16

Aug 13 – Oct 4

B = +7°



B = −7°

Feb 9 – Apr 1