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Solar - Geophysical Data

NO. 438 FEBRUARY 1981 Supplement

NATIONAL GEOPHYSICAL AND SOLAR - TERRESTRIAL DATA CENTER
BOULDER, COLORADO

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To standardize referencing these reports in the open literature, the following format is recommended:
Solar-Geophysical Data, 426 Part I (or Part II), pages, February 1980, U.S. Department of Commerce (Boulder, Colorado, U.S.A. 80303).

SOLAR-GEOPHYSICAL DATA
EXPLANATION OF DATA REPORTS

INTRODUCTION

This supplement contains the description and explanation of the data in the monthly publication, *Solar-Geophysical Data,* compiled by the National Geophysical and Solar-Terrestrial Data Center (NGSDC) in Boulder, Colorado, U.S.A. NGSDC is one of the several components of the Environmental Data and Information Service in the National Oceanic and Atmospheric Administration. The monthly bulletins are available on a data-exchange basis through World Data Center A for Solar-Terrestrial Physics, which is operated by NGSDC, or at a nominal cost.*

These data reports continue a series that was issued by the Central Radio Propagation Laboratory of the National Bureau of Standards, beginning November 1955 and known for many years as the CRPL-F Series Part B. The title *Solar-Geophysical Data* was first used in 1955. The name of the organization compiling the data reports has changed many times, but the personnel involved are generally the same. From June 1965 to January 1977 the compilation and editing were done by Miss Hope I. Leighton under the supervision of Miss J. Virginia Lincoln. As of February 1977 Helen E. Coffey has become editor. Mr. J.F. Lander is Acting Director of NGSDC.

Solar-Geophysical Data is intended to keep research workers informed on a timely schedule of the major events 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 that follow.

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

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, plus late data. Part II (Comprehensive Reports) contains data for 6 and 7 months prior to the month of publication, plus, from time to time, late data. 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 in which such data sets are marked as provisional. Errata or revisions are included from time to time. Additions to this descriptive text will appear with the data when new material is added, or revision is made.

The first two pages of each issue of Part I and II give the general contents and 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 the present supplement.

In various places in this text, data types are identified both by name and an alphanumeric designation (A.2, C.3, etc.). The latter come from the data categories given in *Guide to International Data Exchange,* issued by the ICSU Panel on World Data Centres, Washington, D.C. 1979.

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 by the National Space Science Data Center, NASA, Goddard Space Flight Center, Greenbelt, MD 20771, Feb. 1971. (The Handbook is also available through World Data Center A for Solar-Terrestrial Physics.)

*For sale from the National Geophysical and Solar-Terrestrial Data Center, NOAA, D63, 325 Broadway, Boulder, CO 80303. Subscription Price: $48.00 annually for both Part I (Prompt Reports) and Part II (Comprehensive Reports) or $24.00 annually for either part. This supplement is included. For foreign mailing add $32.00 for both parts or $16.00 for either part. Single issue price $2.00 for either part and $1.50 for this extra issue. $3.00 handling charge per order. Make checks and money orders payable to: Department of Commerce, NOAA/NGSDC.

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

Solar-Geophysical Data, 426 Part I (or Part II), pages, February 1980, *U.S. Department of Commerce* (Boulder, Colorado, U.S.A. 80303).

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DATA FOR MISCELLANEOUS TIME PERIODS

ALERT PERIODS (H.60)

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

These alerts are of the types recommended by the International Ursigram and World Days Service. A description of the IUWDS program can be found in *Synoptic Codes for Solar and Geophysical Data,* revised by RWC Circular Letters, Third Revised Edition 1973. This code book and its revision are available from the IUWDS Secretary for Ursigrams, G.R. Heckman, NOAA, 325 Broadway, Boulder, Colorado, U.S.A., 80303.

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. They report the current level of solar activity and forecast 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 laaab 2cccd 3eeef 4gggh

4gggh: cosmic ray intensity and events

3eeef: geomagnetic A index and events

2cccd: 10 cm flux and number of bursts

laaab: relative sunspot number, and number of new spot groups

9HHJJ: signifies indices for preceding 24 hours follow [repeat for each region] QXXYY nnijk ...FLARE JJHHmm QXXYY

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

MAGSTORM JJHHmm 8HHJJ 7777C

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

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

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

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

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

III = warning center of origin

MEU - Meudon	TOK - Tokyo
WWA - Boulder (SOLTERWARN)	SYD - Sydney
MOS - Moscow	DAR - Darmstadt

NN = originating center's serial number
DDHHmm = date (DD) hour (HH) and minutes (mm) in UT of issue of message

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

3 = key number to indicate magnetic activity follows
eee = A_k index for Greenwich date

f important event, if any, where

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

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

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

Q = quadrant (heliographic coordinates) of the active region where

1 = NE (north-east)	3 = SW (south-west)
2 = SE (south-east)	4 = NW (north-west)

[XX = distance to central meridian in degrees (longitude)
[YY = heliographic latitude in degrees
[heliographic location of active region

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

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

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

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

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

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

OUTSTANDING EVENTS

...FLARE = key word to indicate OUTSTANDING event data follows, where

- <u>PROTON</u>FLARE - protons from this flare <u>have been observed</u> in the earth's <u>vicinity</u>
- <u>MAG</u>FLARE - a geomagnetic and/or cosmic storm <u>has been associated</u> with this flare
- <u>MAJOR</u>FLARE - this flare is the basis for the forecast of geomagnetic storm, cosmic storm and/or protons in the earth's vicinity

JJHHmm = UT of beginning of OUTSTANDING flare

Q = quadrant of the OUTSTANDING flare location, where

1 = NE (north-east)	3 = SW (south-west)
2 = SE (south-east)	4 = NW (north-west)

[XX = distance to central meridian in degrees
[YY = heliographic latitude in degrees
[heliographic location of OUTSTANDING FLARE

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

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

DETAILED FORECASTS

8 = key number to indicate 24-hour forecast information follows
HHJJ = the UT hour (HH) and date (JJ) of the beginning of the 24-hour forecast period
7777 = key numbers to indicate available local observatories follow
C = definitions of available local observatories, where

0 = none	3 = all (optical and radio)
1 = solar radio observations	
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 ---- / STRATWARM EXISTS ---- } includes day of week and geographical area
STRATWARM ENDS

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

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

Relative Sunspot Numbers and Adjusted 2800 MHz Solar Flux -- Beginning January 1, 1981, the Zurich relative sunspot number program is replaced by the "Sunspot Index Data Center" (c/o Dr. A. Koeckelenbergh, 3 av. Circulaire, B - 1180 BRUXELLES, Belgium) on the same basis as in Zurich, with several observers still there, and with the same network of observatories as before. Details will be given in the 1982 issue. These relative sunspot numbers are now designated R_I (International) instead of R_Z (Zurich). The first table presents International relative sunspot numbers, R_I, for the month. The corresponding data for 11 earlier months are reprinted to permit the trend of solar activity to be followed. On the same page is presented a similar table of 12 months of daily solar flux values at 2800 MHz adjusted to one Astronomical Unit, S_a, as reported by the Algonquin Radio Observatory (ARO) of the National Research Council near Ottawa.

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

Historical Table of Sunspot Numbers and Solar Flux

This table presents the monthly mean and smoothed R_Z or R_I, R_a, R_s and S_a for the past three years. R_Z is the Zurich relative sunspot number, R_I the International sunspot number; R_a is the final American relative sunspot number available two months after observation beginning with January 1981 data; and S_a is the Ottawa daily solar flux value at 2800 MHz, adjusted to 1 AU. R_s is a relative sunspot number computed directly from S_a using the equation $R_s = -62+1.08\ S_a$. This equation was derived from a linear regression between R_Z data and S_a data for the years 1947-1979. Studies are being done to produce a better R_s definition. The current R_s definition gives values on the average to within 4% of the R_Z value.

Also included in this table are predictions for 1 year ahead for R_Z or R_I, R_a and R_s. These are computed using the McNish-Lincoln method (see below).

Graphs of Sunspot Cycles and Table of Observed and Predicted Relative Sunspot Numbers--The first graph shows the mean cycle, the observations to date of Cycle 21, and the 12th month ahead predictions for Cycle 21. All are shown on the same time base, which is that for Cycle 21, beginning with the sunspot minimum at June 1976. The second graph again shows the mean cycle, along with the three latest completed cycles, Cycles 18, 19 and 20, presented on the same time base as that for Cycle 21.

All data in the graph and in the succeeding table are smoothed relative sunspot numbers, which are defined as:

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

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.

The predicted sunspot numbers in the table (and for the 12th month after the latest observation point in the graph) are computed using the method of A.G. McNish and J.V. Lincoln [*Trans. Am. Geophy. Union, 30*, 673-685, 1949] and modified using regression coefficients and mean cycle values computed for Cycles 8 through 20. The 90% confidence interval is shown by parentheses for each month of predictions in the table and by a bar on the graph. This indicates the uncertainty above and below the predicted number. The predictions are always based on the latest observed data available and will change each month as a new observation is included in the calculations. Final Zurich or International sunspot numbers, as they become available, are used in deriving the smoothed data.

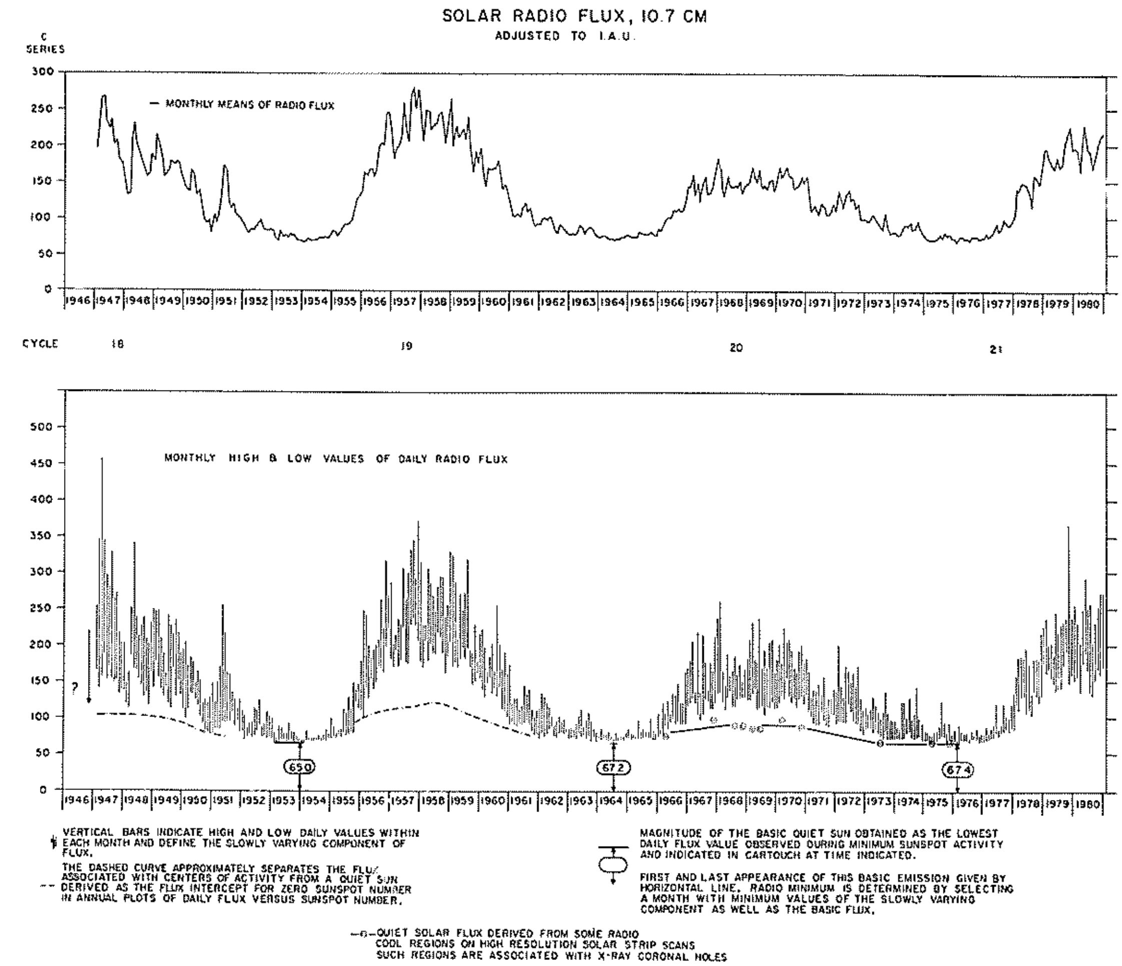
Prediction of Sunspot Maximum -- Sunspot maximum was predicted by the McNish-Lincoln method with reasonable confidence limits 1 year ahead. The predictions more than 1 year ahead regress rapidly toward the mean cycle value. Other methods may also be considered for predicting the smoothed sunspot number at maximum. The method of Ohl [A.I. Ohl, "Forecasting of the Maximum Wolf Number for the Current Eleven-Year Cycle," Problems of the Arctic and Antarctic, 28, 137-139, 1968] relates the intensity of recurrent geomagnetic activity at the very beginning of a solar cycle to the smoothed sunspot number at the maximum of that cycle. A thorough examination and application of the Ohl method by Sargent [H.H. Sargent III, "A Prediction of the Next Sunspot Maximum," EOS, 58, 12, 1220, December 1977] predicted a maximum smoothed number of 154 for Cycle 21. Kane has also prepared a method similar to Ohl's and predicts a large maximum smoothed number (R.P. Kane, "Predicted Intensity of the Solar Maximum," Nature, 274, 139-140, July 1978). Still other methods of predicting the maximum, such as those using spectral analysis of past records and those involving planetary influence, have resulted in a wide range of predicted maximum numbers of Cycle 21, ranging from very small to very high values, depending on the statistical method used in treating essentially the same data base. For this reason of nonuniqueness, these methods are not considered in the predictions published here. A number of published predictions also include in their data base the "observed" data from Cycles 1 to 7 despite the fact that McNish and Lincoln showed those early data to be from a different statistical population. Recent work [J.A. Eddy, "The Maunder Minimum," Science, 192, 1189, 1976] has also found discrepancies in the observational data prior to 1848.

The NOAA sunspot maximum prediction was a combination of the McNish-Lincoln prediction and the Ohl method (as done by Sargent). The time of maximum was predicted 1 year ahead as November 1979 with a value of 154 ± 29. A maximum according to provisional numbers of 165 occurred in December 1979-January 1980 as indicated in the footnote.

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 Zurich relative sunspot numbers, R_Z, were based upon observations made at Zurich and its two branch stations in Arosa and Locarno and are communicated by M. Waldmeier of the Weiss Federal Observatory. These are replaced as of January 1981 by the International relative sunspot numbers, R_I, using the same network of observatories communicated by A. Koeckelenbergh, Brussels. The daily American relative sunspot numbers, R_a, are compiled by Robert Ammons, 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, and each with many years of experience. The counts are made visually with small, suitably protected telescopes.

Final values of R_Z and R_I 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, are provisional in the month after observation. Final R_a are prepared two months after observation upon collection of reports from overseas standard observers.

Daily Solar Flux Values - Ottawa-ARO -- Daily observations of the 2800 MHz radio emissions that originated from the solar disk and from any active regions are made at the Algonquin Radio Observatory (ARO) of the National Research Council of Canada with a reflector of 1.8 m diameter. These are a continuation of observations that commenced in Ottawa in 1947. Numerical values of flux in the tables are in units of $10^{-22} Wm^{-2} Hz^{-1}$ and refer to a single calibration made near local noon at 1700 UT. When the flux changes rapidly, or when there is a burst in progress at that time, the reported value, the best estimate of the undisturbed level, 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 are reduced under the assumption of two equal orthogonal polarizations. Graphs showing the monthly mean adjusted flux and the monthly high and low values since 1947 are shown on page 11. Relative errors over long periods of time are believed to be ±2%, over a few days may be ±0.5%. The characteristics of the observations are surveyed in "Solar Radio Emission at 10.7 cm" by A.E. Covington, [*J. Royal Astron. Soc., Canada, 63*, 125, 1969]. Values of the quiet sun for the minima of January 1954 and July 1964 have been derived as 65.0 and 67.2 s.f.u. using the solar flux adjusted to 1 A.U. [Covington, *J. Royal Astron. Soc., Canada, 68*, 31, 1974]. When the same method is applied to the daily values for 1975-76, it would appear that the basic quiet sun was observed on a number of days from March 1975 to March 1976, and that the average of the 8 quietest days is 67.3 s.f.u. A minimum value of 2.7 s.f.u. for the slowly varying component was observed in February 1976 and defines radio sunspot minimum as the slow increase in both the monthly quiet sun values and the s.v.c. continued.
Though experiments have indicated that a multiplying factor of 0.90 should be applied to the reported flux values in order to derive the absolute flux values, the published flux values have not been corrected by this factor because of the number of data series that have been computerized listing these values. Maintaining homogeneity of the published series is considered more important than having the absolute flux values published. A review of the history of the absolute calibration of the Ottawa series, as well as a number of other series of observations made within the microwave region, has been prepared by H. Tanaka of the Research Institute of Atmospherics, Nagoya University, as convener of a Working Group of then Comm. 5 of URSI [H. Tanaka *et al.*, "Absolute calibration of solar radio flux density in the microwave region," *Solar Physics, 29*, 243, 1973].

The numerical data for the graph shown above and a selected bibliography are given in *Algonquin Radio Observatory Report No. 5*, entitled "A Working Collection of Daily 2800 MHz Solar Flux Values 1946-1976" by A. E. Covington, Herzberg Institute of Astrophysics N.R.C. of Canada, Ottawa, Canada.

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

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

The Air Force Geophysics Laboratory transferred operation of the observatory to Detachment 2, 3rd Weather Wing of the Air Weather Service in October 1978. However, AFGL continues to work in an advisory capacity to the observatory. Det 2, 3WW and AFGL completed an absolute calibration of several frequencies using Cassiopeia A as a reference source. The results are presented in the table below (apply correction factor to all data before indicated date.)

Frequency	Data to Date	Correction Factor
242 MHz	1 Aug 79	1.55
410	3 Aug 79	1.33
610	21 Nov 79	1.33
610	21 Nov 79 - 27 Sep 80	1.17
1415	15 Nov 79	1.11

SOLAR FLARES (C.1)

The Hα solar flare data in Part I (Prompt Reports) are presented as a preliminary record of those flares received on a rapid schedule. Definitive data are published later in Part II (Comprehensive Reports). After 6 months the flares have been grouped and an attempt made to verify that errors in reporting have been eliminated. The explanation of these definitive flare data begins on page 39 of this text. It includes an explanation of the column headings together with definition of the letters used in the Remarks column. A table of solar flare patrol observatories is on page 41.

The solar flare reports are received from throughout the world at World Data Center A for Solar-Terrestrial Physics, NOAA, Boulder, Colorado. 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. The USAF operates Ramey, Holloman, Palehua, and Learmonth. NOAA also supports the Learmonth operation.

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

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

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

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

These daily distributions are plotted on the same chart giving diagrams of evolution. Points of equal intensity given in relative units are joined day after day in the form of isophotes. Four equal intensity levels have been chosen to draw the isophotes. 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 - Toyokawa 3 cm -- East-west drift curves of the sun at 3 cm are observed at Toyokawa Observatory (N34.83 E137.37), The Research Institute of Atmospherics, Nagoya University, Toyokawa, Japan.

The array, consisting of 32 2-m paraboloids, gives an angular resolution of 1.1 arc min on the meridian. The main lobe separation is 40 arc min at local noon. The observed drift curves are normalized by the total flux measured simultaneously with the 3-cm radiometer. The quiet sun curve in the first frame is obtained by connecting the most probable lowest values in each bin of 27-day data.

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

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

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

Outstanding Occurrences (SELECTED) -- A list of SELECTED centimeter and millimeter wavelength events at fixed frequencies is published one month following observations. Selections are made to provide 24-hour coverage as nearly as possible. See page 42, Outstanding Occurrences, for descriptions of the types of events and observatory characteristics.

CORONAL HOLES (A.7f)

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

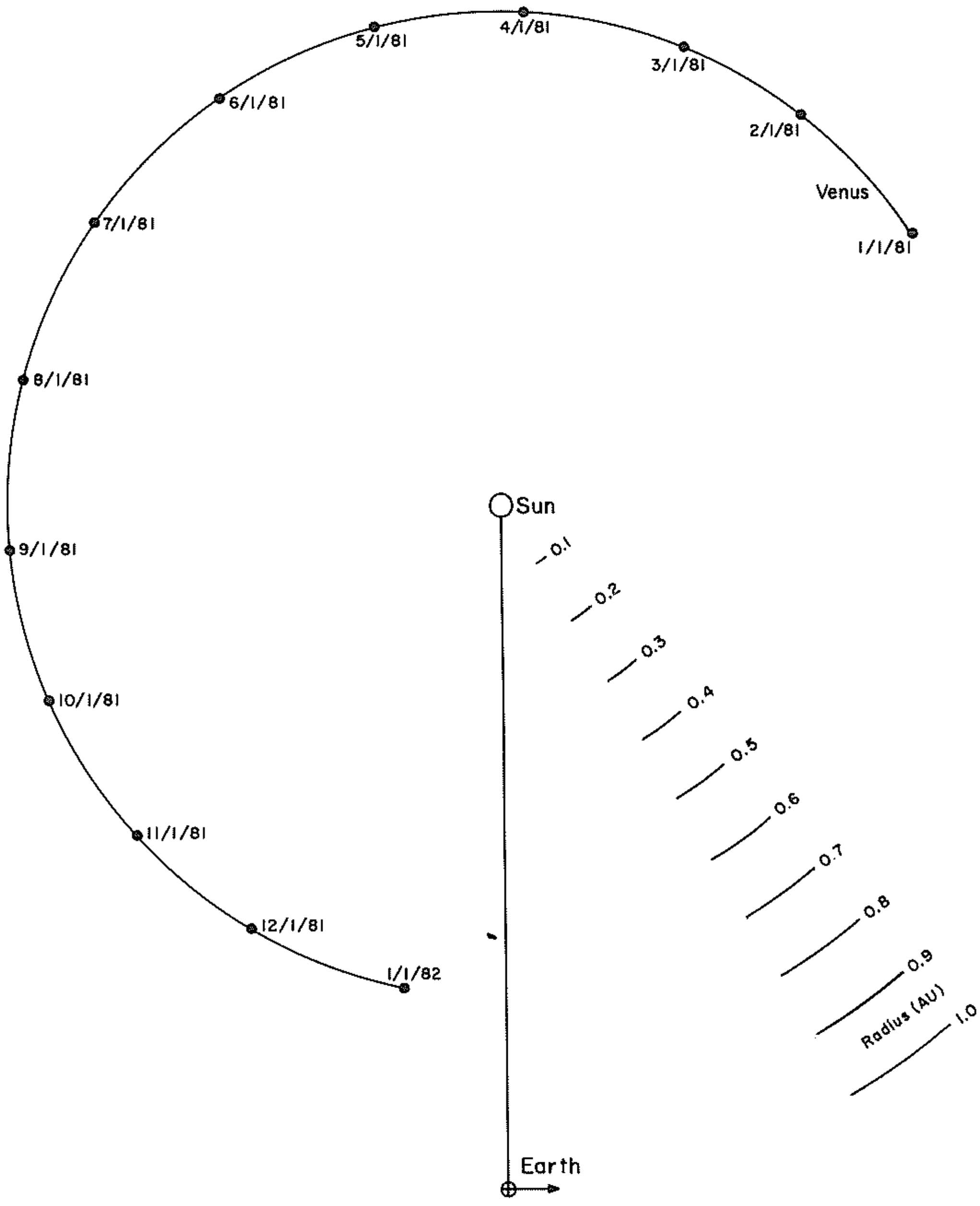
Observational and theoretical evidence that the gaps in the D3 chromosphere correspond to coronal holes has been presented by H. Zirin [*Ap. J.*, *199*, L63, 1975], who showed that the properties of the helium lines can be explained by a model in which the helium is photoionized by coronal back-radiation.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

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

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

SOLAR WIND MEASUREMENTS (A.13)

Pioneer Venus (Pioneer 12) Measurements -- Interplanetary solar wind data from the NASA Ames Research Center Plasma Probe on board the Pioneer Venus Orbiter (Pioneer 12) are supplied by John H. Wolfe. These data include the date, the observation time in UT, the solar wind proton bulk velocity U_{H+} in kilometers/second, the density N_{H+} in protons/cubic centimeter, the temperature T_{H+} in degrees Kelvin, and the Earth-Sun-Venus (ESV) angle in degrees (see graph for location of Venus relative to the Earth).



Location of Venus (Ecliptic Plane Projection) relative to the Earth (in a fixed Sun-Earth line plot) as viewed from the North Ecliptic Pole for 1981.

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 corotation 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 was not developed for these data.

The corotation delay, τ, defined as the time in days required for a steady state solar corotating plasma beam to rotate from the spacecraft to earth. A diagram showing the angular positions of Pioneers 6 through 9 with respect to the earth is shown below. Viewing from the North Ecliptic Pole onto the Ecliptic plane, note that Pioneers 6, 7, and 9 are lagging the earth and therefore the τ is positive. Pioneer 8 is leading the earth and therefore its τ is negative. The corotation 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 corotating Interplanetary Magnetic Field.

The equation used to compute the corotation delay, τ, follows:

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

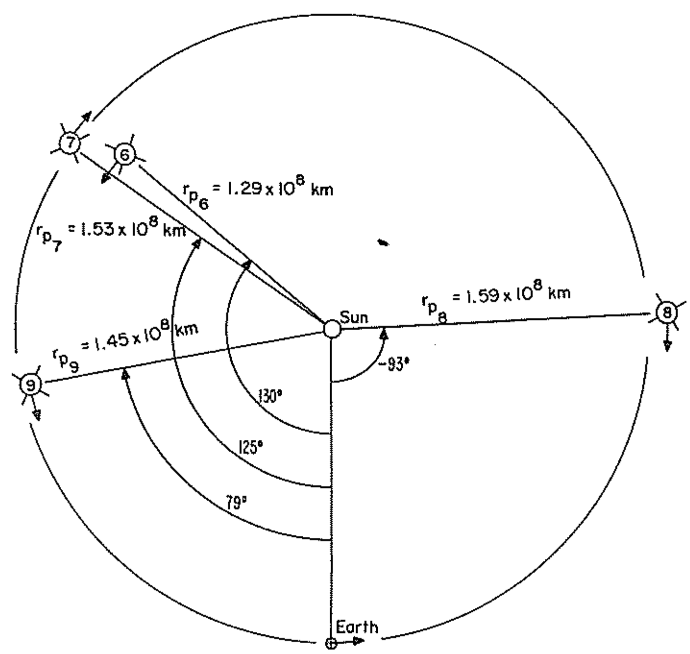
where ω is the angular velocity of the sun (in radians/second) corresponding to a 27-day solar synodical rotation period, and ϕ is the Earth-Sun-Probe angle (in radians).

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

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

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

A difference of approximately 0.008 radians (0.5°) between ϕ' and ϕ occurs when $\alpha_2 = 45°$ and $\alpha_1 = 135°$ (or vice versa). The difference is less than 0.5° for other combinations of α_2 and α_1. Hence using ϕ rather than ϕ' is sufficiently accurate for the purposes of these calculations.



Locations of Pioneers 6 through 9 on 1 Jan 81 in the Ecliptic Plane relative to the Earth (in a fixed Sun-Earth line plot) as viewed from the North Ecliptic Pole.

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 IPS stations are Borrego Springs (33°20'N 116°17'W), La Posta (32°41'N 116°26'W) and Carlsbad (33°09'N 117°15'W). 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. Eighteen radio sources are observed each day but useful speed estimates are typically obtained from only six.

Each velocity can be considered as a weighted average from along the line-of-sight to the radio source, where the weighting factor decreases rapidly with distance from the sun. Details of the spatial weighting function can be computed and examples are shown in Figure 1 on the assumption of a power law shape for the electron 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.

The 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. At large solar elongations where this point would be closer to the earth than 0.3 A.U., P is taken to be at the point 0.3 A.U. from the earth along the line-of-sight. The heliographic coordinates of P vary slowly over the year as shown in Figure 2.

The IPS 'midpoint' speed is interpreted as an estimate of the solar wind speed at the point P. Close agreement is found between ecliptic IPS observations and IMP spacecraft observations which are mapped to the point P (see Figure 3 of Coles, Harmon, Sullivan and Lazarus, *J. Geophys. Res., 83,* 337, 1978). This ecliptic calibration allows confidence to be placed on IPS wind speed determinations out of the ecliptic.

Coles and Kaufman [*Radio Science, 13,* 591, 1978] carefully analyzed the flow angle, as well as the speed, and found it to be very close to radial. Thus the speed is estimated under the assumption that the flow is radial; however the angle is also estimated. An algorithm is used that avoids any bias due to anisotropy in the scintillation pattern and 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° (where the distance to P becomes equal to 0.3 A.U.), the pattern velocity is less than the radial velocity at P; the tabulated velocities have been corrected for this projection effect.

We assign a rating of (0-4) daily for each source on the basis of the strength of the IPS and the freedom from contaminating interference. Listed each month are all speed estimates with a rating of 2 or better. Scintillations at 74 MHz maximize at an elongation of ∿ 35° [Armstrong and Coles, *Ap. J., 220,* 346, 1978]. Our rating values vary systematically throughout the year and generally reflect this change in IPS strength. The tabulated data do not include daily values from a source 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

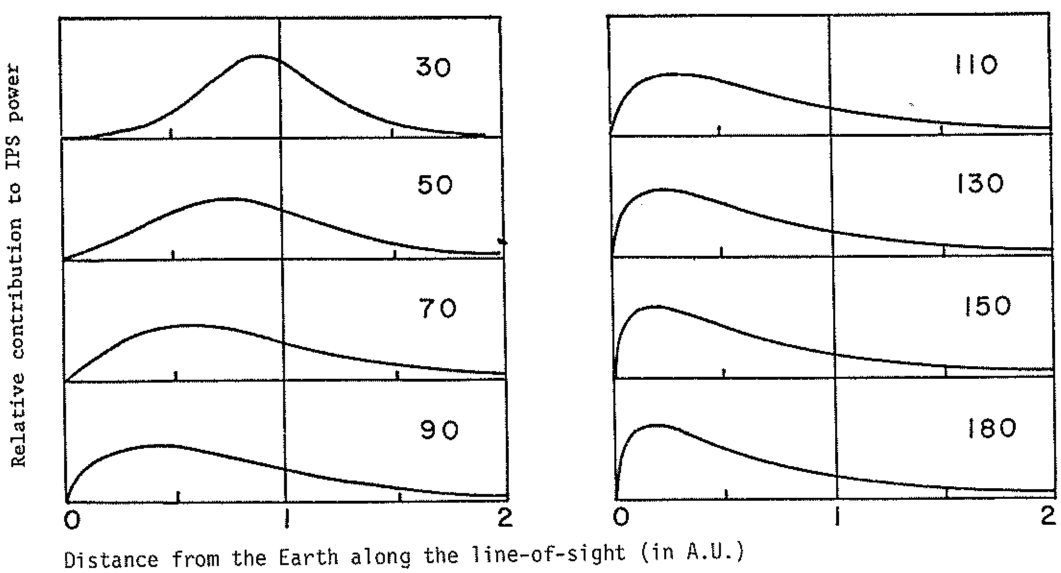


Figure 1. Computed IPS weighting functions along the line-of-sight, at the solar elongation angles indicated. The density spectrum was assumed to be power law $\propto q^{-3.3}r^{-4}$ (where q is wave number and r is solar distance); a source diameter of 0.25 sec of arc was also assumed.

data rejected by these criteria; those interested in particular periods should contact the authors directly.

Since January 1980 the printed data format has been revised. Observations of each radio source are averaged (from 10-120 minutes) and are entered as a single line in the list as follows: The UT date, day of the year, and UT in hours at the middle of the integration time; the 'midpoint' velocity and its error (see below for explanation); the 'peak' velocity and its error; the source rating from 2 to 4; the number of the radio source in the 3CR catalog [Bennet, *A.S. Mem. R.A.S.*, *68*, 163, 1962]; the elongation angle between Sun and source. The next five parameters give the coordinates of point P; its heliographic latitude and solar distance; the longitude of the earth minus that of P; the time lag for a spiral (defined by the midpoint speed) to rotate from the earth to P; and lastly the Carrington rotation (integer and fraction) of the photospheric footpoint of the spiral through P. For the latter two of these parameters we assume a constant

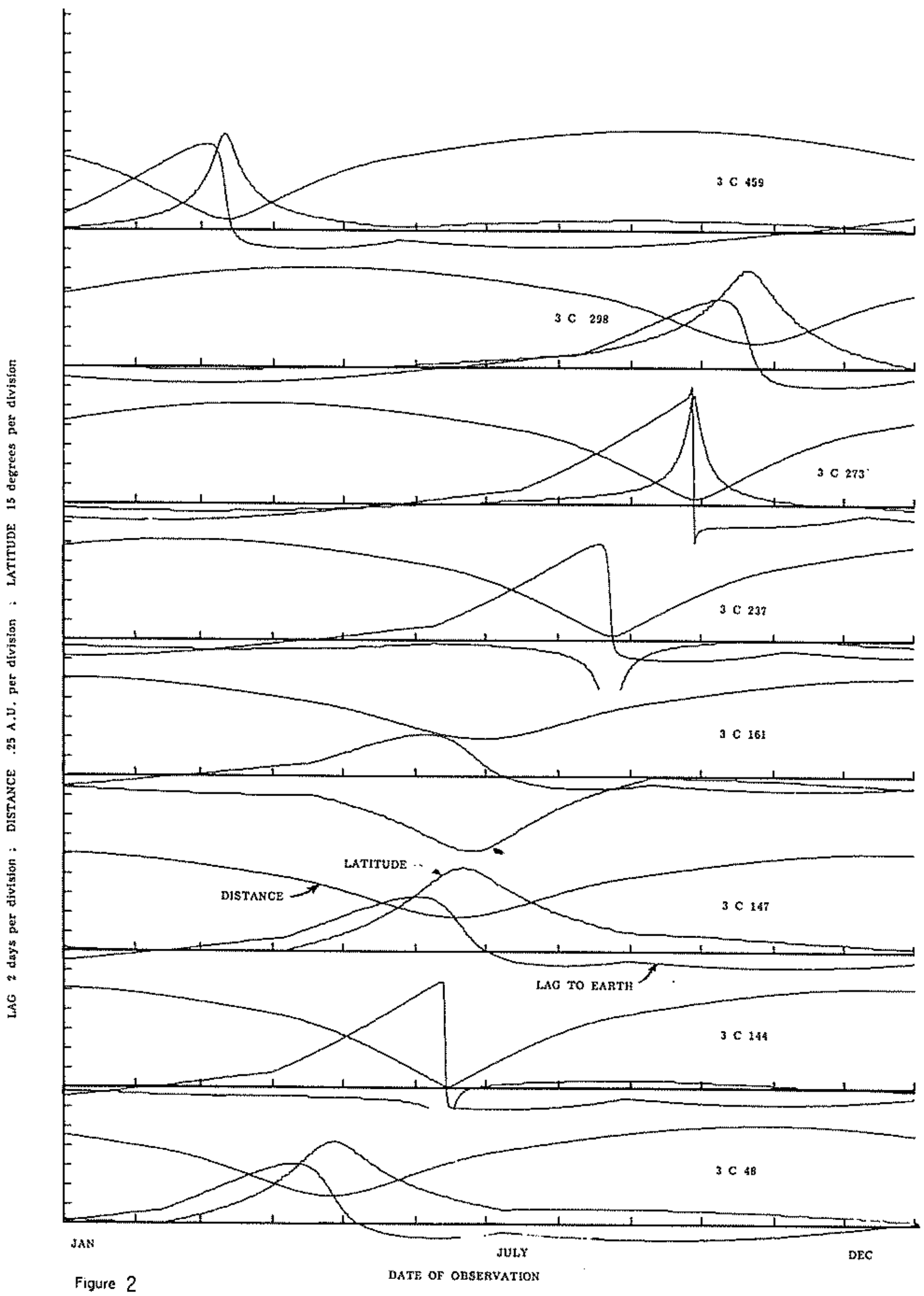


Figure 2

radial velocity for the solar wind.

The 'midpoint' speed should be used as an estimate of the average speed in a region along the line-of-sight. For a spherically symmetrical speed and density distribution, the 'peak' speed should be only a few percent greater than the 'midpoint'. If the peak speed is significantly different from the midpoint, a wide range of velocities is distributed along the line of sight; normally this causes the peak to exceed the midpoint and indicates that some speeds as high as the peak are present. Occasionally the midpoint exceeds the peak, indicating large variations are present and the earth is in relatively slow wind. The speed errors listed are the formal statistical errors in deriving the IPS pattern speeds; systematic differences of up to $\sim$ 50 km/s can also exist between the IPS speed and the true solar wind speed at point P.

Support for the IPS observations at UCSD is provided by the Atmospheric Sciences Division of NSF (ATM-78 06770) and the Air Force Geophysical Laboratories (F19628-77-C-0161).

INFERRED INTERPLANETARY MAGNETIC FIELD (A.17c)

The table shows daily inferences of the polarity of the interplanetary magnetic field. The first half of the day is based principally on magnetograms produced by the magnetometer at the Vostok Antarctic Station of the USSR. The magnetometer of the U.S. Air Weather Service operated at Thule by the Danish Meteorological Institute is used for the second half of the day. The inference relies on the studies of Mansurov [*Geomag. Aeron., 9,* 622-623, 1969] and Svalgaard [*Geophys. Pap. R-6,* 11 pp. Dan. Meteorol. Inst., Copenhagen, 1968] relating the variation of the polar cap magnetic field to the polarity of the interplanetary magnetic field. During 1972, the inferred polarity agreed with spacecraft observations on 83% of the days for which a definitive polarity was inferred. The rate of successful inferences for "toward" (interplanetary field directed toward the sun) days was somewhat greater than "away" days, 85% and 80%, respectively [Russell *et al., J. Geophys. Res., 80,* 4747, 1975]. Forming a combined index from the two individual station inferences yields an overall success rate of 87% [Wilcox *et al., J. Geophys. Res., 80,* 3685, 1975].
The data on the vertical component of geomagnetic field from the Resolute Bay station of Canada have been used since July 1976 to increase the reliability of daily inferences.

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

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

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

MEAN SOLAR MAGNETIC FIELD (A.3d)

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

An individual mean field observation consists of a measurement of the mean magnetic field seen in the line Fe I 5250Å and a measurement of the instrumental zero offset in the magnetically insensitive line Fe I 5124Å. A complete observation, including several checks for instrumental errors, takes about 20 minutes. Several observations are made each day. The reported value is a weighted average of all observations for the particular local day. The daily observations are usually centered about local noon (2000 UT). The uncertainty in each day's mean field is about 2 micro-teslas (0.02 gauss). The observations started on May 16, 1975. A more complete explanation of the observation program may be found in the report "The Mean Magnetic Field of the Sun: Observations at Stanford" [P. H. Scherrer et al., *Solar Physics, 54*, 353-361, (1977)]. The data are provided in two forms: a simple tabulation by date and a Bartels rotation type polarity diagram. In the Bartels diagram the data have been shifted 5 calendar days to allow for Sun-Earth transit time for easier comparison with at-Earth observations. For further information contact P.H. Scherrer or J.M. Wilcox, Stanford Electronics Labs., Stanford University, Stanford, California 94305.

GEOMAGNETIC ACTIVITY (D.1)

Boulder Geomagnetic Substorm Log -- This is a tabulation of substorm occurrences as observed in Boulder. A substorm is a localized geomagnetic disturbance which usually occurs near local midnight and is restricted in longitude. However, the current systems developed during a substorm affect ground magnetometers in the entire nighttime sector. Additionally, individual substorms may occur at local times, away from midnight, and may be as large as 24 hours (global) in longitudinal extent. By noting the time, location and scale of a substorm, one may estimate the effect of a substorm at a specific location. Among the many substorm effects are ionospheric effects (which influence radio communications) and telluric effects (which may disturb long distance electric power and communications systems). The familiar aurora is a visible manifestation of the geomagnetic substorm.

Currently, the Log provides the date, onset time (in UT) and direction (from Boulder) of each substorm. The direction is listed as "East", "West" or "Centered" (over Boulder). The comment section further describes the geomagnetic field for a particular day. These data are prepared by the NOAA Space Environment Services Center, Boulder, Colorado, 80303.

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 NGSDC staff.

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 2 MONTHS BEFORE MONTH OF PUBLICATION
DAILY SOLAR SOLAR ACTIVITY CENTERS
(A.1,A.3a,A.3c,A.3e,A.4,A.5,A.5a,A.5b,A.6,A.6c,A.6d,A.7g,A.7h)

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

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

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

The positions of magnetic polarity reversal are inferred according to the techniques described by McIntosh [*Rev. Geophys. and Space Phys., 11*, 837-846, 1972; also *Solar Activity Observations and Predictions*, McIntosh and Dryer, ed., MIT Press, 1972]. The Hα 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 Hα filtergrams from several consecutive days. Seldom does a single photograph show the patterns in their complete form, owing to the transient nature of the filaments and the variable observing conditions.

Magnetic polarities are inferred from Hale's law: leader sunspots in opposite solar hemispheres have opposite polarities. Northern leaders possess positive polarity during odd numbered solar cycles, while southern leaders are negative. The present solar cycle is #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. Solar magnetograms from Kitt Peak National Observatory and sunspot polarities from Mt. Wilson Observatory are usually available for corroboration and for assistance in mapping regions with unusual structure. Polarity information is occasionally available from the NOAA Space Environment Services Center spectroheliograph and from the U.S. Air Force SOON observatory network.

The Hα neutral-line patterns are mapped as they appeared during the latter half of their disk transits, but include active regions and filaments that may have formed even during the last day before west limb passage. The complete patterns are never visible on a single photograph, owing to the transient nature of filaments and the variable observing conditions. Every location on the Sun must be studied carefully on every day of its disk transit in order to accumulate complete information on the neutral lines. Whenever a pattern undergoes a conspicuous change from the time of first visibility to the time near west limb passage, the former neutral-line position is depicted as a line with crosses, similar to a "railroad track" symbol.

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. These versions may often be incomplete, or even inaccurate in limited areas, due to variations in the amount and quality of the solar data available in real time. More definitive versions may be published at a later date in atlas form, using complete data from several observatories for a careful and comprehensive mapping. The date in the lower right corner of the charts is the date of last revision.

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

Stanford Solar Magnetic Field Synoptic Charts -- These charts are derived from the Stanford Solar Observatory daily magnetograms (see 23). They are made by projecting each magnetogram onto a grid with points spaced each 10-degrees of heliographic latitude and longitude. For each 10 degrees of Carrington longitude, the available magnetograms are averaged together weighted with distance from central meridian and the sky conditions. The resulting synoptic charts are plotted in the same format and scale as the H-alpha charts (A.6). The symbols "v" at the top of the charts mark the times of magnetograms used. While this format provides more visual weight to higher latitudes where the observations are less accurate, it is a useful form for comparison to the H-alpha charts. The iso-Tesla lines are shown at ± 20, 50, 100, etc. micro-Tesla. The field strength shown will tend to be somewhat lower than the corresponding central meridian magnetogram due to the interpolation and averaging procedures used. Although the absolute calibration of solar magnetogram data (particularly when made with low spatial resolution) is somewhat uncertain, the position of the zero line is reasonably well determined. A direct comparison with the H-alpha inferred magnetic patterns is reported by T. L. Duvall Jr. *et al.* [*Solar Physics*, *55*, 63-68 (1977)].

Solar Magnetic Field Synoptic Chart, Kitt Peak National Observatory -- Daily full disk magnetograms (described under Kitt Peak Observatory Solar

Magnetograms) are transformed to a Carrington coordinate system with a resolution of 1 degree in longitude and 1/90 in the sine of the latitude. Shortly after the end of each solar rotation, these transformed observations are merged into a single, equal-area cylindrical projection with a weighting system that strongly emphasizes observations nearest to the central meridian on a given date. The final synoptic chart is produced by photographing a cathode-ray-tube display of the data. Marginal ticks indicate 10 degree increments of Carrington longitude and selected north and south latitudes. The positions of the central meridians corresponding to the times of the observations are indicated by longer marginal ticks with dates appended.

The gray-scale display labeled "flux" represents the average longitudinal field strength in each latitude and longitude resolution element weighted heavily by the observations made closest to central meridian. The gray-scale display labeled "polarity" represents the ratio of the weighted average of the field measurements in each resolution element to the weighted average absolute value of the field measurements. Thus, if all the measurements in a resolution element have the same polarity, the element is displayed as full white or black, and if the measurements are equally distributed between positive and negative polarity, the resolution element is displayed as middle gray. In both displays white represents positive (toward the observer) magnetic polarity, and black represents negative polarity. If no observations are available, the corresponding latitude and longitude elements are shown as full black.

Further information can be obtained from J. Harvey or W. Livingston, Kitt Peak National Observatory, P.O. Box 26732, Tucson, AZ 85726 USA. The magnetic field observations are supported in part by assistance from NOAA and NASA which is gratefully acknowledged.

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

Each daily observation is corrected for limb darkening and then transformed to a Carrington coordinate system with a resolution of 1 degree in longitude and 1/90 in the sine of the latitude. Shortly after the end of each solar rotation, these transformed observations are merged into a single, equal-area cylindrical projection with a weighting system that strongly emphasizes observations nearest to the central meridian on a given date. The final synoptic map is produced by photographing a cathode-ray-tube display of the data. Marginal ticks indicate 10 degree increments of Carrington longitude and selected north and south latitudes. The positions of the central meridians corresponding to the times of the observations are indicated by longer marginal ticks with dates appended.

The gray-scale display represents the strength of the 10830 Å helium absorption line. Areas for which no data are available are reproduced as black. The darkest features are filaments and active regions. Quiet regions are represented by a fairly uniform grey mottling which corresponds to the chromospheric network. Irregularly shaped light areas correspond to areas with abnormally low coronal radiation, i.e. coronal holes or filament cavities. It is frequently difficult to distinguish between locations of coronal holes and filament cavities on these helium observations. However, the filament cavities always fall on the boundary between two magnetic polarities, whereas the coronal holes have never been observed to do so, and an examination of the magnetic synoptic chart allows the distinction to be made.

Many small coronal holes have short lifetimes, and these may not be reproduced on the synoptic maps unless they happen to be observed near the central meridian. Similarly, the boundaries of many coronal holes are highly variable on a time scale of a day or so. The boundaries reproduced on the maps are thus a complicated average of a spatially and temporally varying phenomenon.

Further information can be obtained from J. Harvey or W. Livingston, Kitt Peak National Observatory, P.O. Box 26732, Tucson, AZ 85726 USA. The 10830 Å observations are supported in part by assistance from NOAA and NASA which is gratefully acknowledged.

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 at the end of this publication 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 1980 Explanation of Data Reports the large-size transparencies were modified and the small-size were regular. In this issue the large ones are regular and the small modified. 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, largest sizes of these photographs or charts can be made available at cost through the World Data Cnter A for Solar-Terrestrial Physics.

These solar maps for each day include solar magnetograms, λ5303 coronal intensities, calcium plage and sunspot tracings, Hα filtergrams and 8.6-mm and 2-cm spectroheliograms. The sunspot drawings also show prominences.

Details of these individual observations follow:

Coronal Green-Line Intensity at $1.15R_{\odot}$ -- Scans of the solar corona are made with the Sacramento Peak Observatory Green-Line Coronal Photometer, designed by R.R. Fisher [AFCRL-TR-73-0696 and *Solar Phys.*, *36*, 343, 1974]. The intensity of the corona is recorded at 120 points around the limb with an aperture of 1.1 arc min by chopping between the corona and sky at a rate of 100 kHz. The scans depicted here are made at $1.15R_{\odot}$, although at least one other height is routinely recorded. Effective September 1, 1978 (DOY 244) the assumed solar scan radius was changed permanently from a (fixed) value of 9450 spar steps to a (time-dependent) value of (radius in arcsec) x 9.57 spar steps, or 9115 spar steps on this date. Thus, prior to this date, nominal "R = 1.15" scans had been occurring at R $\cong$ 1.16 to 1.20 depending on the time of year. On 31 August the actual scan radius was 1.19. Beginning September 1, 1978, the nominal and actual scan radii are now the same.

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

Mount Wilson Observatory Solar Magnetograms -- The Mount Wilson Observatory solar magnetograms are computer-plotted isogauss drawings made with the magnetograph at the 150-foot tower telescope on Mount Wilson. The program is supported in part by the Office of Naval Research, the National Aeronautics and Space Administration, and the National Science Foundation. The polarities are indicated with "Plus" signifying the magnetic vector pointed toward the observer. The gauss levels are also indicated. This instrument measures the longitudinal component of the magnetic field using the line λ5250.216 Fe I. A solar magnetograph is basically a flux measuring instrument. It measures the total flux over the aperture which is being used. The magnetograph apertures are square (image slicer is used) and the raster scan lines are separated by the dimension of the aperture. This separation of the scan lines is given by the ΔY (DELTAY) printed on the magnetogram. The 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 included. In general the magnetic field strengths on the map are low by about a factor of two because of these effects, but this varies somewhat with distances from the disk's center. For more details c.f. *Solar Physics*, *22*, 402-417, 1972.

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

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

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

World Data Center A for
Solar-Terrestrial Physics
NOAA D63 325 Broadway
Boulder, Colorado, U.S.A. 80303

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

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

Stanford Solar Observatory Magnetograms -- The Stanford Solar Observatory magnetograms are presented as computer-drawn plots of the Sun's large scale magnetic fields. The observations are made daily with the same instrument as the mean solar magnetic field observations (A.3d) except that instead of observing in integrated light, a 6 cm image is formed at the spectrograph entrance aperture.

In this mode of observation the instrument and procedures are very similiar to those for the Mt. Wilson Observatory magnetograms (A.3a). The aperture corresponds to 180 arc sec square and is scanned boustrophedonically. The scan lines are oriented E-W on the disk with the aperture stepped 90 arc sec between measurements. The scan lines are spaced 180 arc sec in the N-S direction. At each point the field data are averaged for 15 seconds with the resulting noise level less than 10 micro-Tesla. The zero level is believed to be better than 5 micro-Tesla. The field is measured in the line Fe I 5250Å with the line Fe I 5124Å used as a magnetic zero reference. A complete scan procedure with calibrations takes about 2 hours.

With a 3-minute aperture the magnetogram only crudely shows regions of strong or complex fields (The Mt. Wilson and Kitt Peak magnetograms better represent these fields). The large scale organization of net fields can usually be clearly seen in the Stanford observations.

The contour lines are plotted at intervals of ± 20, 50, 100, 200, 500, etc. microTesla. The lowest three levels plotted are shown. The iso-Tesla lines corresponding to fields directed out of the sun are shown as solid lines. The zero line is shown as a thick solid line. The data and time given are for the middle of the observation. The equator line shown is calculated from the velocitygrams made at the same time as the magnetograms. Magnetic synoptic charts derived from these observations are also published in Solar-Geophysical Data. More details about the observations are available on request from P. H. Scherrer, Institute for Plasma Research, Stanford University, Stanford, CA 94305.

Daily H-alpha Filtergrams -- The H-alpha filtergrams are furnished by the Sacramento Peak Observatory, Air Force Geophysics Laboratory, Sunspot, New Mexico. The telescope is a 10 cm (4 inch) refractor 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, and by photographs from the 25 cm (10 inch) SOON telescope at Holloman Air Force Base, Alamogordo, New Mexico, operated by the U.S. Air Force 12th Weather Squadron of the third Weather Wing. Also used are the Big Bear Solar Observatory photographs from their 6 inch telescope.

Daily Sunspot Drawings -- These drawings are simplified copies of originals made at either the Boulder Solar Observatory operated by the NOAA Space Environment Services Center, or the San Fernando Observatory of the California State University, Northridge. Sunspot groups are boxed according to a judgement of bipolar pairs based on sunspot group evolution and the structure of associated H-alpha plage, following guidelines developed by P.S. McIntosh of the NOAA Space Environment Laboratory. Magnetic measurements of sunspot polarities, provided by the Mt. Wilson Observatory, and Kitt Peak magnetograms are used as an additional aid to ascertain individual sunspot groups. Serial numbers appearing adjacent to the sunspot groups are the last three digits in the Hale plage number. It is not uncommon for more than one sunspot group to occur within the same large calcium plage. Photographic observations, provided by the Big Bear Solar Observatory and reduced by the San Fernando Observatory may be used when NOAA - Boulder and San Fernando data are missing.

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

Calcium Plage Maps -- The contours are visually estimated and drawn for all plages which are recognizable centers of activity on full disk K232 images of the sun from Mt. Wilson Observatory. The Mt. Wilson calcium plage data replace the calcium plage data and reports that were supplied to *Solar Geophysical Data* by the McMath-Hulbert Observatory of the University of Michigan until 1 Oct. 1979. For days when Mt. Wilson data are not obtained, CaII negatives may be supplied by either Sacramento Peak Observatory or Haleakala Observatory and reduced at the Mt. Wilson Offices. There is no discontinuity in numbering between the former McMath plage numbers and the new Hale plage numbers assigned by the Mt. Wilson Observers. The last McMath plage number is 16345, which crossed the central meridian on 30 Sep. 1979, and the first Hale plage number is 16339, the first region to cross central meridian after 1 Oct. 1979. The plage numbers are assigned in the order of their appearance on the disk but are listed in the order of their dates of central meridian passage.

The calcium plage maps show the same regions which are tabulated below under Individual Regions of Solar Activity. Listed beside the drawings in each case are the quality of the day's observations and the initials of the data reduction analyst 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.

Since 1 Nov. 1979, the Mt. Wilson daily magnetograms have been used as an aid in identifying and assigning numbers to the individual centers of activity. The use of the magnetograms makes it possible to more consistently label and track the evolution of the active centers. One consequence of using this additional information is a more frequent one-to-one identification of sunspot groups with the corresponding plages. The change has occurred because some large complex plages that would previously have been assigned a single McMath plage number are now divided and assigned more than one Hale plage number.

Contiguous regions are those plages which would appear to be a single entity in the absence of the magnetic field information. They are indicated in the table following the list of Individual Regions of Solar Activity.

Individual Regions of Solar Activity -- The tabulated data provide a history of each active center visible on the sun using full disk images from Mt. Wilson Observatory and NOAA (area, count, and Brunner classification of sunspots).

The lead line gives the Hale Plage number, the Greenwich date of central meridian passage, and the number assigned to the region during the prior rotation if the region was not identified as new.

Following the lead line, a one-line entry is made for each plage each day beginning with the year, month, and day. Next, the Hale calcium plage number is repeated followed by the latitude, central meridian distance, and the heliographic longitude 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 the time of observation on that day on a scale of 1 = faint to 5 = very bright, referring to the brightest part of the plage.
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 data reduction analyst, see daily calcium maps. The Mt. Wilson 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 data reduction analyst.

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

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

The sunspot classification in column marked "Class" is represented by three consecutive uppercase leters. 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

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

distribution or compactness of the group. This classification is included in the USSPS code, IUWDS, *Synoptic Codes for Solar and Geophysical Data,* Third Revised Edition, p. 108, 1973. 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 Hα 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).

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 or 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 Zurich Class (first upper case letter in Table)

A A unipolar group with no penumbra. There is no upper limit to the length of Class B groups.

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. There is no upper limit to the length of Class C groups.

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. Attendent spots are less than three heliographic degrees from the penumbra of the main spot. 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 Table)

"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 penumbrae 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 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.

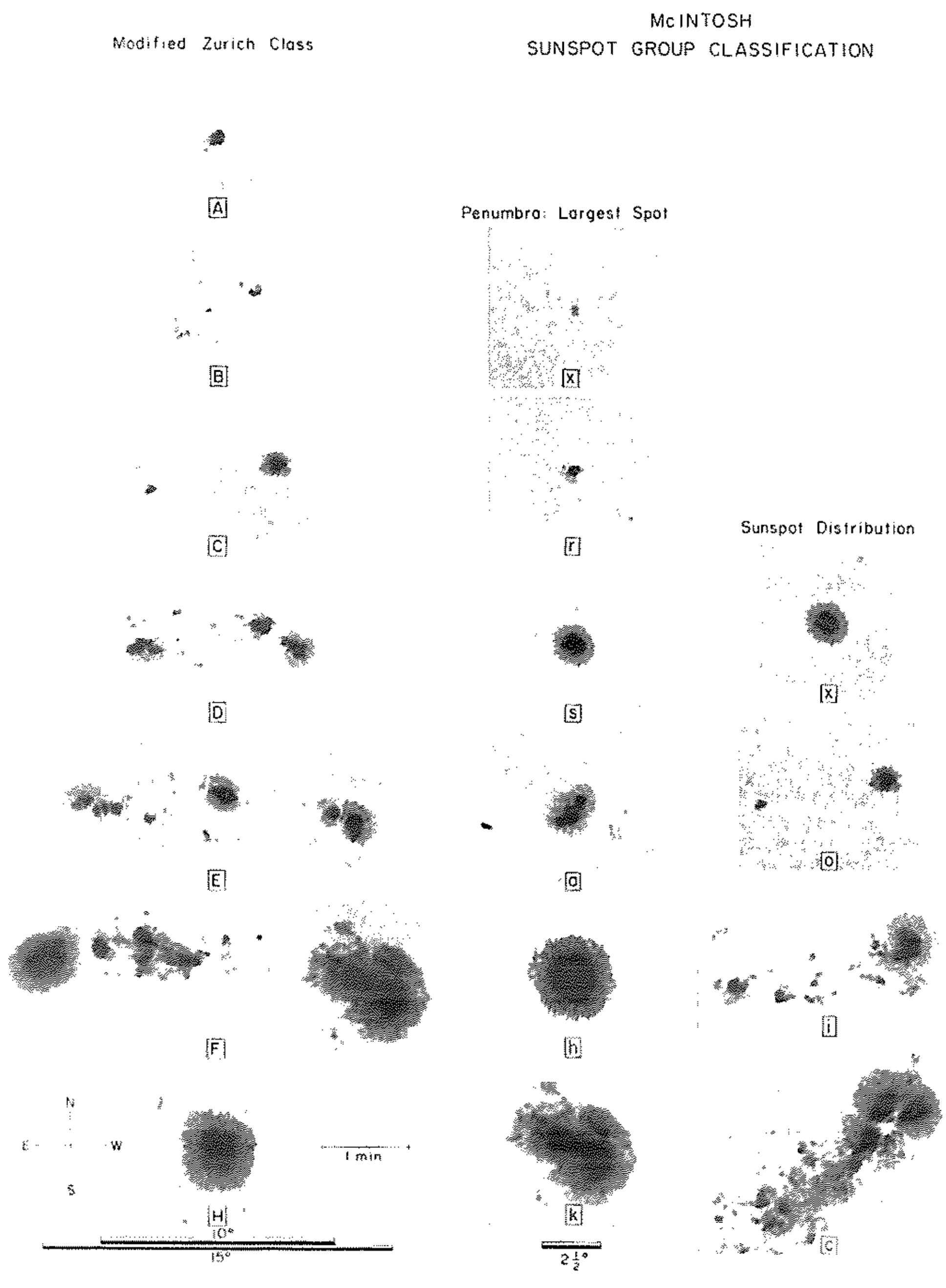
Sunspot Distribution (third upper case letter in Table)

"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		
	Eso	Fso	
	Eao	Fao	Brunner class G
	Eho	Fho	
	Eko	Fko	
	Hrx		
	Hsx		Brunner class J
	Hax		

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

Daily 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 (Hale Observatory data)

Θ_i = central meridian distance of plage i in degrees

ϕ_i = latitude of plage i.

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

SUDDEN IONOSPHERIC DISTURBANCES (C.6)

Sudden ionospheric 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 Hale region of the associated flare, if known.

The table on page 28 of this text gives the two-letter station code, 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, 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 29 by their longitude and by the type of SID recorded. The small triangles throughout the chart indicate the midpoint of transmitting paths for SWF, SPA, SES, and SFD for only those stations that are underlined. (Many of the non-underlined SWF stations are commercial terminals, and the location of the transmitters being recorded are not always known.) The worldwide 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.

N.B. The detailed data as formerly published are available at cost of reproduction from World Data Center A for Solar-Terrestrial Physics, NOAA, D63, 325 Broadway, Boulder, Colorado 80303.

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

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

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

S-SWF (S) : sudden drop-out and gradual recovery

Slow S-SWF (SL) : drop-out taking 5 to 15 minutes and gradual recovery

G-SWF (G) : gradual disturbance: fade irregular in either drop-out or recovery or both.

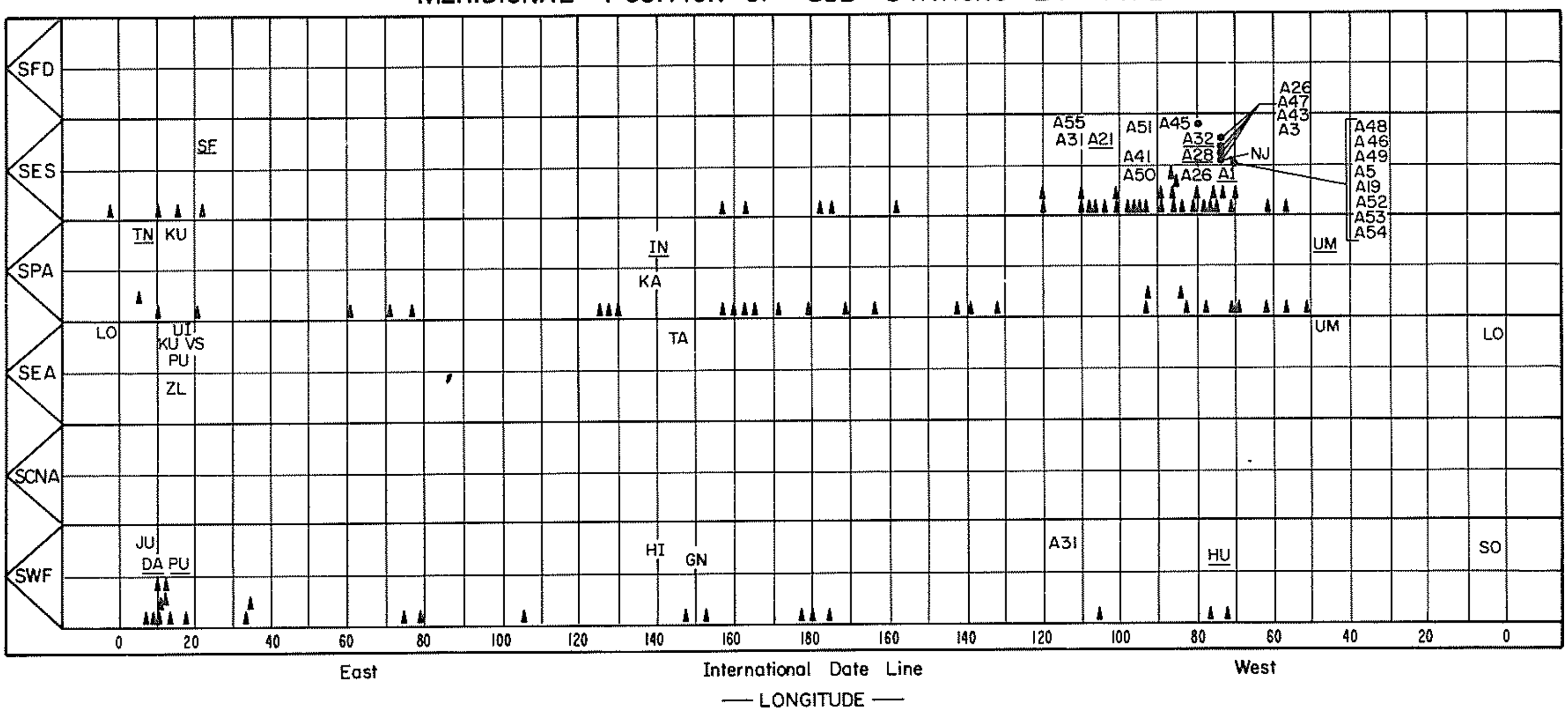
SCNA-SEA -- Sudden ionospheric disturbances recognized on recorders for detecting cosmic noise absorption at about 18 or 25 MHz are known as SCNA, or recognized on records for detecting enhancements of low frequency atmospherics at about 27 kHz are known as SEA.

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

STATION LIST OF SUDDEN IONOSPHERIC DISTURBANCES

CODE	STATION	SWF	SCNA	SEA	SES	SFD	SPA	SFA
DA	Darmstadt, GFR	X						
GN	Glenorchy, Tasmania, Australia	X						
HI	Hiraiso, Japan	X						
HU	Huancayo, Peru	X						
IN	Inubo, Japan						X	
JU	Juliusruh, GDR	X						
KA	Kasugai, Japan						X	
KU	Kuhlungsborn, GDR			X			X	
LO	Preston, United Kingdom			X				
MI	Maui, Hawaii, USA	X						
NJ	Trenton, New Jersey, USA				X			
PU	Panska Ves, Czechoslovakia	X		X				X
SC	St. Cloud, Minnesota, USA				X			
SF	Sofia, Bulgaria				X			
SO	Somerton, United Kingdom	X						
TA	Hobart, Tasmania, Australia			X				
UI	Upice, Czechoslovakia			X				
UM	Sao Paulo, Brasil			X			X	
VS	Vsetin, Czechoslovakia			X				
ZL	Zilina, Czechoslovakia			X				
	AMERICAN ASSOCIATION OF VARIABLE STAR OBSERVERS (AAVSO)							
A1	Valley Cottage, New York, USA				X			
A3	Paterson, New Jersey, USA				X			
A5	Mahwah, New Jersey, USA				X			
A19	Latrobe, Pennsylvania, USA				X			
A26	Louisville, Kentucky, USA				X			
A28	Cleveland, Ohio, USA				X			
A31	Missoula, Montana USA	X			X			
A32	Lake Hiawatha, New Jersey, USA				X			
A41	Fort Riley, Kansas, USA				X			
A46	West Paterson, New Jersey, USA				X			
A48	Thornwood, New York, USA				X			
A49	Tavares, Florida, USA				X			
A50	Houston, Texas, USA				X			
A51	Portage, Michigan, USA				X			
A52	Garden City, New York, USA				X			
A53	Agassiz, Massachusetts, USA				X			
A54	Durham, North Carolina, USA				X			
A55	Eureka, Montana, USA				X			

Meridional Position of SID Stations By Type



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

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

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

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

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

SOLAR RADIO WAVES SPECTRAL OBSERVATIONS (C.4)

Solar spectral events from Bleien (Switzerland), Culgoora (Australia), Dwingeloo (Netherlands), Fort Davis (Texas), Learmonth (Australia), Manila (Philippines), Palehua (Hawaii), Sagamore Hill (Massachusetts) and Weissenau (GFR) 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 -- BLEN = Bleien, CULG = Culgoora, DWIN = Dwingeloo, HARV = Fort Davis, LEAR = Learmonth, MANI = Manila, PALE = Palehua, SGMR = Sagamore Hill, WEIS = Weissenau

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

Spectral type --

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

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

Symbols appended to spectral type:

- B = Single burst
- G = Small group (<10) of bursts
- GG = Large group (>10) of bursts
- C = Underlying continuum (particularly with type I)
- S = Storm in the sense of intermittent but apparently connected activity
- N = Intermittent activity in this period
- U = U-shaped burst of Type III
- RS = Reverse slope burst
- DP = Drifting pairs

DC = Drifting chains
H = Herringbone
W = Weak activity
P = Pulsations
MOV = Moving (Type IV)
STA = Stationary (Type IV)
Z = Zebra patterns (parallel drifting bands)
F = Fiber bursts (intermediate drift bursts)

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

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

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

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

Weissenau Radio Astronomy Observatory, Astronomical Institute of Tübingen University -- This research work is supported by the University of Tübingen, Baden-Württemberg, GFR. Instrumental descriptions are given by:

[1] H.W. Urbarz, *Solar Phys., 7,* 147-152, 1969; H.W. Urbarz, *Information Bulletin Solar Radio Observations, No. 25,* 8-10, 1969
[2] Kraemer, *Kleinheubacher Berichte, 13,* FTZ Darmstadt, 165-168
[3] H.W. Urbarz, *Z. Astrophys., 67,* 321-337, 1967
[4] H.W. Urbarz, *Mittlg. Astron. Ges. No. 40,* Hamburg 220-221, 1976
[5] H.W. Urbarz, *Kleinheubacher Berichte, 21,* FTZ Darmstadt, 421-429, 1978
[6] H.W. Urbarz and Th. Wachter, *Kleinheubacher Berichte, 21,* FTZ Darmstadt, 413-420, 1978
[7] W. Brunner, H.W. Urbarz and L.v.Zech-Burckersroda, *Kleinheubacher Berichte, 22,* FTZ Darmstadt, 501-514, 1979
[8] H.W. Urbarz and L.v.Zech-Burckersroda, *Kleinheubacher Berichte, 23,* FTZ Darmstadt 207-218, 1980

A 35-mm film is used with a 0.2-mm/s feed, the sweep rate is 4-cycles/s. The number of resolution elements of recorded events is about 100 per octave on film. The frequency range is 30-1000 MHz, the frequency scale is stepped in 6 octave-wide channels: 30-46-86-160-290-540-1000 MHz, each of which is linear. The approximate flux densities including minimum fluxes and saturation fluxes corresponding to antenna temperatures are given in [8]. The new flux calibration is a result of new antennas used in channels 1, 2 and 3 since Nov. 1976 (groups of log-periodic dipoles) and a result of a new IC-Video device matching the radiometer outputs to the scope since Aug. 1978 and of the automatic calibration unit in operation since Oct. 1979.

Harvard Radio Astronomy Station, Fort Davis, Texas 79734, U.S.A. -- Summaries are presented of the spectral characteristics of solar radio bursts recorded over the frequency range 10 - 580 MHz. In 1980, the Harvard Station put into operation in this frequency range new dynamic spectrum analyzers of higher sensitivity. The Station will also operate spectrum analyzers of high sensitivity covering the band 550 - 2000 MHz at selected intervals. The characteristics of the antennas have been described earlier by Maxwell [Solar Phys., 16, 224, 1971]. At 100 MHz, the intensity ranges of solar bursts listed as 1, 2 and 3 correspond approximately to 1-50, 50-500, and >500 x 10^{-22} $Wm^{-2}Hz^{-1}$, in accordance with the international standards.

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

Sagamore Hill Solar Radio Observatory -- Prior to 12 July 1970, the monitored frequency range was 19-41 MHz and prior to 12 August 1975, the monitored frequency range was 24-48 MHz. Currently, a special purpose radiometer sweeps over 25-75 MHz frequency range once per second. The interferometer array consists of two semi-bicone stationary antennas spaced 300 meters apart on an E-W line. The spectrogram fringe patterns are recorded on a Versatec Electrostatic Recorder (Model 1100) for a real time readout. Sagamore Hill reports dekameter spectral type bursts and uses the recommended intensity classification listed above.

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

Bleien Radio Spectrograph, Switzerland -- The Bleien spectrograph (formerly located in Dürnten) was constructed with support of the Swiss National Science Foundation. It is located in Bleien near

Zürich, Switzerland. This analog spectrograph is a routinely operated subsystem of the digital spectrometer "IKARUS", the data of which are not routinely published. The analog spectrograph registers on 35-mm film the frequency range from 100 - 1000 MHz in one continuous sweep. Maximum flux densities are estimated from the film according to the following criteria and corresponding to the following levels:

1:	< 100 sfu	(weak)
2:	100 - 300 sfu	(not saturated)
3:	> 300 sfu	(clearly saturated)

For a description of the whole system see: Perrenoud, M.R., Thesis, Zürich, and for detailed information on the spectrograph see: Tarnstrom, G.L., *Astr. Mitt. Eidgen. Sternwarte Zurich* No. 317, 1973.

Learmonth and Palehua Observatories -- These two observatories (Learmonth, Australia and Palehua, Hawaii) observe in the spectral range 25-75 MHz, and also coordinate their observations with the observers at Sagamore Hill.

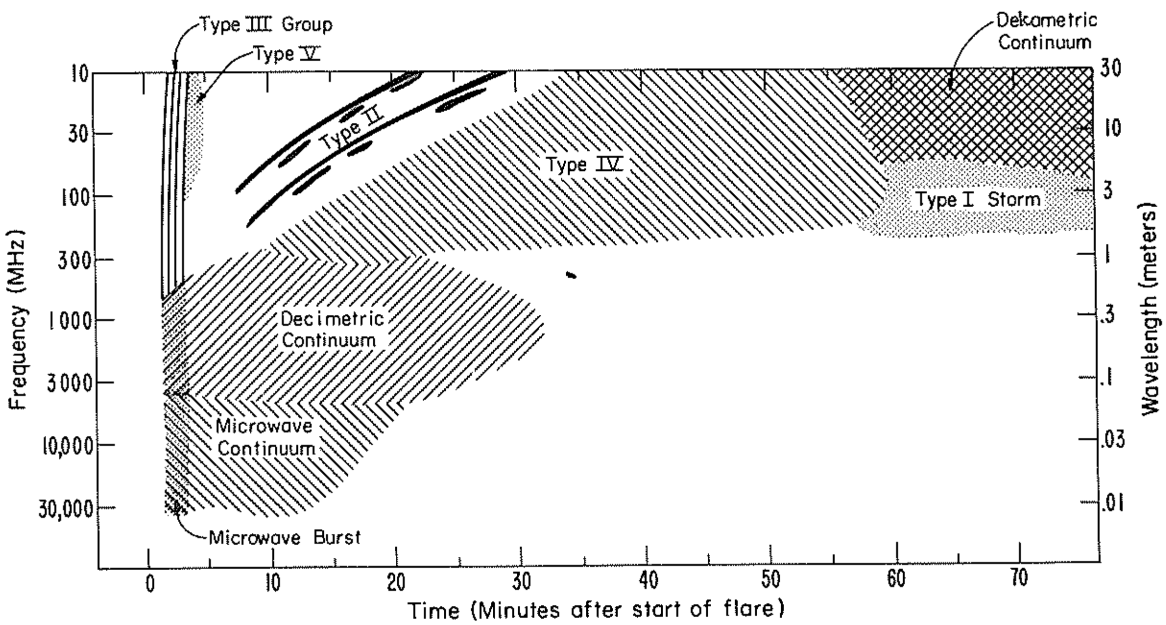
Dwingeloo Radio Spectrograph, Netherlands -- The radiospectrograph at Dwingeloo is operated by the Netherlands Foundation for Radio Astronomy, which is financed by the Netherlands Organization for the Advancement of Pure Research (Z.W.O.). It is a 60-channel receiver measuring intensity and circular polarization. The intensity is displayed in two ways: one sensitive for fluctuations, which has a dynamical range of ± 1.7 dB, and one with a logarithmic measuring range of about 15 dB over quiet sun level (q.s.l.). Saturation occurs about 20 dB over q.s.l. The threshold sensitivity is 0.2 dB. The time resolution for magnetic recording is 1 ms. The bandwidth of the channels is 0.9 MHz. The outputs are routinely recorded on 35-mm cinefilm. In addition, for particularly interesting events, they are recorded digitally on magnetic tape. The receiver is regularly calibrated.

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

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

2: 50 - 500 flux units.

3: >500 flux units.



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.

Since June 1978, the spectrograph has been tuned between 509 and 666 MHz with 10 channels between 509 and 553 MHz (spacing 2.7 MHz), 45 channels between 574 and 614 MHz (spacing 0.9 MHz) and 5 channels between 655 and 666 MHz (spacing 2.7 MHz). During 1980 the primary band will be expanded to 400-880 MHz. Tuning of the channels may be changed to exploit this band.

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

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

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

The heliograph pencil beam can track the Sun for 6 hours and 40 minutes centered on local noon. The mechanical movement of the antennas is limited to 4 hours and 48 minutes (slightly less near the summer and winter solstices) so that the Sun drifts into and out of the broad antenna beams during the first and the last hour of observation. The normal observing hours are approximately 2300 to 0500 UT.

The 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 analog display of the taped, digital heliograph data; the expected relative accuracy is about 0.1 $R_\odot$ in distance and 10° in PA. The polarization is described qualitatively as weak (ℓ or r) or strong (L or R) circular polarization. The intensity is given on a scale 1 to 3, with the corresponding flux densities, S, very approximately in the range:

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

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

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

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

INTERPLANETARY MAGNETIC FIELD

Pioneer 12 -- The interplanetary magnetic field data from the UCLA magnetometer on Pioneer 12 (Pioneer Venus Orbiter) are being supplied by C.T. Russell of UCLA. The data supplied are the absolute magnitudes of the field in gammas (nanoteslas). The instrument is a triaxial fluxgate magnetometer mounted on a 5-meter boom. The magnetometer has a $\pm 128\gamma$ range and $\pm .0625\gamma$ resolution. These data are being obtained from quick look listings created once each day at apogee. While these listings contain the three components of the vector field, they do not have inertial reference information from which to deduce the direction in the ecliptic plane. If data tapes later begin to arrive with short delays, we will use these data to provide vector field information.

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, Kiel, Climax, Tokyo, and Huancayo. 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	Kiel	Climax	Tokyo	Huancayo
Geog. Lat., N.	76°35'	82°31'	46°06'	51°05'	54°18'	39°22'	35°45'	-12°02'
Geog. Long., E.	291°35'	297°40'	282°30'	245°52'	10°06'	253°49'	139°43'	248°40'
Cutoff, GV	0.00	0.00	1.02	1.09	2.28	3.03	11.61	13.45
Altitude, m	260	66	145	1128	54	3400	20	3400
Detector type	NM 64	NM 64	NM 64	NM 64	NM 64	IGY	NM 64	NM 64
Scaling factor	100	100	300	100	100	100*	256	100
Baro. coeff., %/mm Hg	1.00	.987	.987	1.0155	.961	.943	.888	.96
Mean press. mm Hg	730	752	747	671	755	504	760.5	518

* From January 1, 1966.

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

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

The high counting rate neutron monitor at Calgary has a value for magnetic cutoff rigidity comparable to the Deep River monitor. The asymptotic cones of acceptance "look" approximately in the equatorial plane in essentially the same direction in space. The data, beginning January 1971, from the Calgary super neutron monitor is communicated by D. Venkatesan and T. Mathews of the Department of Physics, University of Calgary, Calgary 44, Alberta, Canada. The station has a mean barometric pressure of 833 mb. The barometric coefficient used to correct the data is 0.7718%/mb. *Hourly mean data from the installation is routinely distributed to the scientific community and the World Data Center A for Solar-Terrestrial Physics, Boulder, Colorado.* The data began January 1964 and are available at the World Data Center as stated. The station was set up by B. G. Wilson (now at Simon Fraser University, Burnaby, British Columbia).

The Thule nucleonic intensity detector, of standard IQSY design, was originally located at the Geopole Station Greenland: latitude 76°36'N, longitude 68°48'W, altitude 260m, geomagnetic threshold rigidity essentially zero. At the end of 1976, it was moved to a new site on Thule Air Base. The coordinates are essentially unchanged except that the altitude is now close to sea level. The data are communicated by Martin A. Pomerantz, Bartol Research Foundation, Newark, DE 19711. 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 (18-NM-64) and Tokyo (36-NM-64), 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 the Kiel and Tokyo data began with the December 1973 data. The data from both neutron monitors are routinely submitted to the World Data Centers A, B, C1 and C2 for Cosmic Rays as well as to listed researchers. Kiel data have been available since September 1964 and Tokyo (or Tokyo-Itabashi) data since January 1970. Since there were changes in the number of counters, a revision of pressure reduction, and so on, the level of Tokyo data has changed several times. The refined data will be published elsewhere in the near future. The data are communicated to Solar-Geophysical Data by M. Wada after receiving the Kiel data from K. Röhrs.

Charts -- Variations of cosmic ray intensity are depicted in chart form for the above stations. The vertical scale lines mark the days of the month in Universal Time. The horizontal scale lines are in intervals of 5% deviation from an arbitrarily chosen 100% reference level for each station. The 100% reference levels are based upon (after barometric correction) 0.6740×10^6 counts per hour for Deep River; 0.7132×10^6 for Alert; 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)

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

The data are made available by the International Service of Geomagnetic Indices under the auspices of the International Association of Geomagnetism and Aeronomy through Division V: Observatories, Instruments, Indices and Data. The Institute für Geophysik, Göttingen University, computes the planetary and equivalent amplitude indices Kp and Ap and determines the "international quiet and disturbed days," Q and D. The aa indices and the hemispherical indices Kn, Ks, and the planetary index Km are provided by the Institut de Physique du Globe, Paris, France. Many of the activity indices are described by J. Bartels in *Annals of the IGY, 4,* 227-236, London, Pergamon Press, 1957, and by P.N. Mayaud in "Derivation, Meaning, and Use of Geomagnetic Indices" Geophysical Monograph, 22, American Geophysical Union, Washington, D.C., 1980.

Kp is the mean standardized K-index from 13 observatories between geomagnetic latitudes 47 and 63 degrees. The scale is 0 (very quiet) to 9 (extremely disturbed), expressed in thirds of a unit, e. g., 5- is 4 and 2/3, 5o is 5 and 0/3, and 5+ is 5 and 1/3. This planetary index is designed to measure solar particle-radiation by its magnetic effects, specifically to meet the needs of research workers in the other geophysical fields.

A full description of the indices Kn, Ks, Km is given in a monograph, *Indices Kn, Ks et Km, 1964-1967,* edited in 1968 by the Centre National de la Recherche Scientifique, 15 quai Anatole, France, 75007 PARIS, which contains these indices for 1964-1967 while *IAGA Bulletin No. 39* contains those for 1959-1963. Yearly computations of these data are published in the series of *IAGA Bulletin No. 32.* All of them are available on magnetic tape at the appropriate World Data Center.

Briefly, the three-hourly indices Kn and Ks for the Northern and Southern hemispheres respectively are derived from the K indices of observatories approximately well distributed in latitude and in longitude. The indices are standardized according to the distances of the stations to the auroral zones. The stations are arranged in groups representing a longitude sector in one of the hemispheres (5 in the Northern hemisphere, 3 in the Southern until 1 January 1979 and then 4). However, from January 1, 1979, onward, 4 groups are used in the Southern hemisphere by splitting into 2 groups the former group made up of Eyrewell, Toolangi, and Gnangara. Lauder is associated with Eyrewell, and Toolangi with Gnangara. This change reduces the small residual daily variation of the southern as-index, owing to the insufficient number of groups in the Southern hemisphere. The observatories currently in use are:

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

The mean standardized K of each sector is converted into an equivalent amplitude and the weighted (in longitude) averages an and as of these amplitudes are converted back into Kn and Ks. Km is derived in the same way from am, the average of an and as. Indices an, as, and am are expressed in gammas (one gamma equals one nanoTesla) and correspond to the magnetic activity level (as it can be inferred from K indices) at an invariant magnetic latitude of 50°. Indices Kn, Ks, and Km are expressed in the same units as Kp. Values published in these reports are only provisional because in some months all observatories used in each longitude sector have not sent K indices at the right time and because K indices of Antarctic stations have to be rescaled at the end of each wintering.

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

Ap is a daily index of magnetic activity on a linear scale rather than on the quasi-logarithmic scale of the K indices. It is the average of the eight values of an intermediate 3-hourly index ap, defined as approximately one-half the average gamma range of the most disturbed of the three force components, in the three-hour interval at standard stations; in practice, ap is computed from the Kp for the 3-hour interval. The extreme range of the scale of Ap is 0 to 400. Values of Ap (like Kp and Cp) have been published for 1932 to 1961 in *IAGA Bulletin No. 18* by J. Bartels. Yearly compilations of these data, as well as the selected days, are published in the series of *IAGA Bulletin No. 32 (the continuation of IAGA Bulletin No. 12). These Bulletins are available from the IUGG Publications Office 39, Rue Gay Lussac, Paris (V). These indices are also available at the appropriate World Data Centers.*

The aa indices are the continuation of the series beginning in the year 1868. A full description of these indices is given in the *IAGA Bulletin 33*, which contains them for the years 1868-1967. Descriptions are also given (especially comparisons with am, ap, or Ci indices) in two short papers [*Ann. Geoph. 27*, 62-70, 1971, and *J. Geophys. Res., 77*, 6870-6874, 1972]. The aa values for 1968-1975 are contained in *IAGA Bulletin 39*. From 1976 onward they are included in *IAGA Bulletin 32*. Revised aa values for the years 1969-1976 have been distributed in 1979 to the recipients of *IAGA Bulletin 32* in the form of loose sheets to be inserted in the *Bulletins 39* (1968-1975) and *32f* (1976). A graph of these values through 1977 is published in the February 1977 issue of *Solar-Geophysical Data, Part II*. Revised aa values for 1969-76 also appear there. Briefly, such three-hourly indices as these, computed from K indices of two antipodal observatories (invariant magnetic latitude 50°), provide a quantitative characterization of the magnetic activity, which is homogeneous through the whole series. Half-daily and daily values give an estimation of the activity level very close to that obtained with am indices. Values are in gammas and correspond to the activity level at an invariant magnetic latitude of 50°. The aa indices are computed for:

N = daily values for the Northern Hemisphere,

S = daily values for the Southern Hemisphere,

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

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

The magnetically quiet and disturbed days (Q & D are selected in accordance with the general outline in *Terr. Mag.* (Predecessor to *J. Geophys. Res.) 48*, 219-227, 1943. The method in current use calls for ranking the days of a month by their geomagnetic activity as determined from the following three criteria with equal weight: (1) the sum of the eight Kp's; (2) the sum of the squares of the eight Kp's and (3) the greatest Kp.

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

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

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

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

Table and Graph of Provisional Hourly Equatorial Dst Index -- The equatorial Dst index at a 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.

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

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

GEOMAGNETIC OBSERVATORIES

Code	Station	Geomag. Latitude
ABG	Alibag	9.5N
ANN	Annamalainagar	1.5N
API	Apia	16.0S
COL	College	64.6N
EYR	Eyrewell	47.9S
FRD	Fredericksburg	49.6N
GNA	Gnangara	43.2S
GUA	Guam	4.0N
GUL	Gulmarg	24.5N
HER	Hermanus	33.7S
HON	Honolulu	21.1N
HUA	Huancayo	0.6S
HYB	Hyderabad	7.6N
IRK	Irkutsk	41.0N
JAI	Jaipur	17.3N
KGL	Kerguelen	56.5S
NEW	Newport	55.1N
PMG	Port Moresby	18.6S
SHL	Shillong	14.7N
SIT	Sitka	60.0N
SJG	San Juan	29.9N
TOO	Toolangi	46.7S
TRD	Trivandrum	1.1S
TUC	Tucson	40.4N
UJJ	Ujjain	13.5N
WIT	Witteveen	54.2N

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

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

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

Transmission Frequency Ranges -- The North Atlantic path (Lüchow (53.0°N, 11.2°E) - New York) is represented by six frequencies, 4.331, 6.376, 8.630, 13.033, 16.972, and 22.518 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 highly directive rhombic antennas (except the short-haul paths Bracknell-Lüchow and Moscow-Lüchow which are received with non-directional vertical antennas). The quality figures are calculated for a twenty-four hour period (0600 - 0600 UT) using transmissions from Tokyo, Japan; New York, USA; Moscow, USSR; Canberra, Australia; and Bracknell, England. The following frequencies are currently in use:

Tokyo	New York	Moscow
22.770 MHz	22.518 MHz	15.9 MHz
18.220	16.972	11.0
13.597	13.033	7.7
9.970	8.630	5.4
3.622	6.376	3.9
	4.331	

Canberra	Bracknell
19.690 MHz	18.261 kHz
13.920	14.436
11.030	11.086
5.100	8.040
	4.782
	3.289

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

LATE DATA

This section contains data received too late for publication in the normal Prompt Reports issue.

DATA FOR 6 MONTHS BEFORE MONTH OF PUBLICATION
ACTIVE REGION SUMMARY (A.6b)*

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

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

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

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

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

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

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

2) Mean co-ordinates for each active region.

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

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

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

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

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

Hα SOLAR FLARES (C.1ba, C.1e, C.1d)*

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

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

The "group report" line is intended as a summary of all individual reports. The principal criteria for grouping reports together are flare position and times. The following new rules have been

*These data have been considerably delayed because high solar maximum activity has produced large data-handling problems.

adopted to determine times, areas and importances of grouped events:

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

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

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

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

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

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

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

The columns in the table are as follows:

-- Group Number and Reporting Observatories using IAU abbreviation (see p. 41).
-- The Universal date.
-- Beginning time in UT. (An "E" after the time means that the flare began before this time.)
-- Time of maximum phase in UT (more than one maxima may be listed) (A "U" after the time indicates an uncertainity in the time of maxima.)
-- Ending time in UT. (A "D" after this time means that the flare continued after this end time, but the observatory stopped observing before the flare ended.)
-- The heliographic coordinates in degrees for the "center of gravity" of the emission region, corresponding to the time of maximum intensity.
-- The distance from the center of disk in units of disk radius.
-- Hale serial number of the associated plage region.
-- The time of central meridian passage of the position of the flare in tenths of the Universal date.
-- Duration in minutes.
-- The flare importance on the IAU scale of Sf* to 4b. (In summary line for the group, a "?" will be used when there has been too much discrepancy among individual reports to determine accurately the probable importance of the event).
-- Observing conditions where 1 means poor, 2 fair, and 3 good. (Observatories at Ramey, Palehua, Athens and Holloman use a scale of 1-5.)
-- Nature and completeness of available observations where

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

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

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

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.

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

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

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

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

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

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

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

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

SOLAR FLARE OBSERVATORIES

COMPUTER CODE NO.	OBS. TYPE	IAU CODE	NAME, PLACE AND COUNTRY
824	C	ABST	ABASTUMANI, GEORGIA, USSR
508	V	ATHN	ATHENS, GREECE
549	C	BERN	BERN, SWITZERLAND
650	C	BIGB	BIG BEAR CITY, CALIFORNIA, USA
647	V	BOUL	BOULDER, COLORADO, USA
560	CV	BUCA	BUCHAREST, RUMANIA
570	C	CATA	CATANIA, SICILY, ITALY
402	C	CULG	CULGOORA, NEW SOUTH WALES, AUSTRALIA
912	V	GEOR	GEORGIANA, BUDAPEST, HUNGARY
478	C	HALE	HALEAKALA, MAUI, HAWAII, USA
649	C	HOLL	HOLLOMAN AIR FORCE BASE, NEW MEXICO, USA
563	C	HTPR	HAUTE PROVENCE, FRANCE
718	C	HUAN	HUANCAYO, PERU
358	V	ISTA	ISTANBUL, TURKEY
382	P	KAND	KANDILLI, TURKEY
547	C	KANZ	KANZELHOEHE, AUSTRIA
827	P	KHAR	KHARKOV, UKRAINE, USSR
828	C	KIEV	KIEV, UKRAINE, USSR
309	V	KODA	KODAIKANAL, INDIA
876	CV	LVOV	LVOV, UKRAINE, USSR
468	V	MANI	MANILA, PHILIPPINES
314	C	MITK	MITAKA, TOKYO, JAPAN
555	C	MONT	MONTE MARIO, ROME, ITALY
476	C	PALE	PALEHUA, HAWAII, USA
387	C	PASA	PASADENA, CALIFORNIA, USA
368	P	PEKG	PEKING, PEOPLE'S REPUBLIC OF CHINA
359	C	PURP	PURPLE MT, NANKING, PEOPLE'S REPUBLIC OF CHINA
648	C	RAMY	RAMEY AIR FORCE BASE, PUERTO RICO
833	CP	TACH	TASHKENT, UZBEK, USSR
342	C	TELV	TEL AVIV, ISREAL
514	P	UPIC	UPICE, CZECHOSLOVAKIA
834	CPV	VORO	VOROSHILOV, USSR
546	C	WEND	WENDELSTEIN, GERMAN FEDERAL REPUBLIC
361	C	YUNN	YUNNAN, KUNMING, PEOPLE'S REPUBLIC OF CHINA

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

Note: *All the flare data are recorded on punched cards. Copies of tabulations from them or magnetic tapes of the data are available at cost through the World Data Center A for Solar-Terrestrial Physics, NOAA, D63, 325 Broadway Boulder, Colorado U.S.A. 80303.*

Flare Index -- The daily flare index is defined as

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

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

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

A regional flare index is described in the text for the data for seven months before month of publication on page 55.

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 12 for more detail.)

SOLAR RADIO WAVES (C.3)

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

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

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

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

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

At Sagamore Hill a new 35000-MHz radiometer has been developed and put into operation with approximately ten times greater sensitivity than the original system. This improved sensitivity will make it possible to detect solar bursts with peak flux densities of 10 to 20 x $10^{-22}Wm^{-2}Hz^{-1}$.

Sagamore Hill and other Air Weather Service RSTN observatories report event types using only the following nine morphological classifications:

RSTN Burst Type		SGD Translation		
01	Noise storm or fluctuations	43	NS	if start time exact or uncertain;
		44	NS	if start time is "in progress".
02	Rise and fall (non-impulsive)	20	GRF	(impossible to distinguish between the four types of Simple 3 bursts).
03	Simple impulsive (<50 sfu)	8	S	if duration ⩽ 2 min;
		4	S/F	otherwise.
04	Impulsive (⩾50 sfu but <500 sfu)	8	S	if duration ⩽ 2 min;
		46	C	if more than one peak flux reported;
		4	S/F	otherwise.
05	Great burst (⩾500 sfu)	48	C	if duration ⩽ 10 min & more than one peak reported;
		49	GB	if duration > 10 min & more than one peak reported;
		47	GB	otherwise.
06	Castelli U	49	GB	
13	Complex (<50 sfu)	45	C	
14	Complex (⩾50 but <500 sfu)	46	C	
15	Complex great (⩾500 sfu)	48	C	

Bursts are reported on any given frequency only when they exceed 10 sfu.

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

Event Types According to the *Instruction Manual for Monthly Report*
(prepared by H. Tanaka for ICSU-STP-IAU)
The key for identifying types of event by numerical SGD code and letter symbol.

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

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

- S = Simple : Mostly nonthermal 'microwave impulsive burst' or 'decimetric burst' (see p. 30).
- C = Complex : Combination of a few or many simple bursts.
- F = Fluctuation : Minor C sometimes superposed in the main burst.
- GB = Great Burst : Major C of special importance.
- PRE = Precursor : Preburst activity connected to the main burst.
- PBI = Post Burst Increase : Tail of the main burst which may be regarded as enhancement of S-component.
- GRF = Gradual Rise and Fall : Temporal enhancement of S-component or similar activation in the flaring region. It may sometimes start with relatively sharp rise like a simple burst. If this sharp rise can be clearly recognized as simple burst, GRF becomes PBI. Note that both have similar characteristics.
- ABS = Absorption : Absorption due to surge-like material mainly appears after the burst and is sometimes called post-burst decrease. This phenomenon may occur frequently, but it can only be recognized when the flux comes down to preburst level. Temporal fall of flux which is sometimes called negative burst may be listed as ABS, but it may simply be the temporal fall of emission.

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

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

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

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

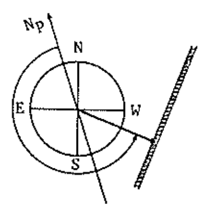
S, FAL and SER may also be used.

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

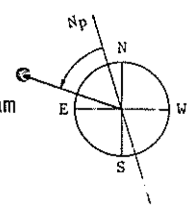
Polarization information is denoted by the letters R (right-handed) or L (left-handed). The degree of polarization in percent is shown in two digits. When precise values are not available, the degree of polarization is expressed in symbols, W = weak, M = moderate or S = strong. For example, 83R means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

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

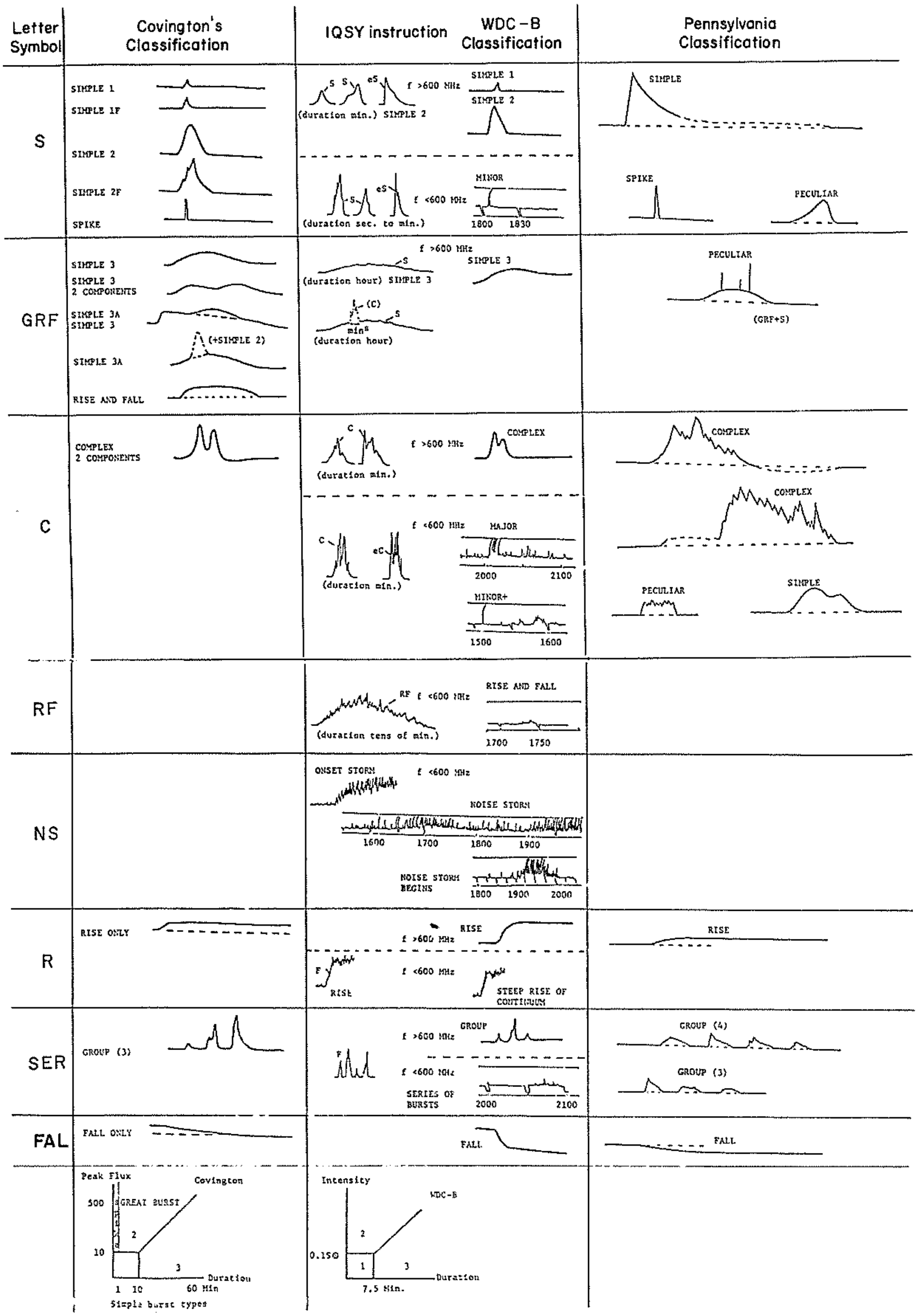
Fan Beam

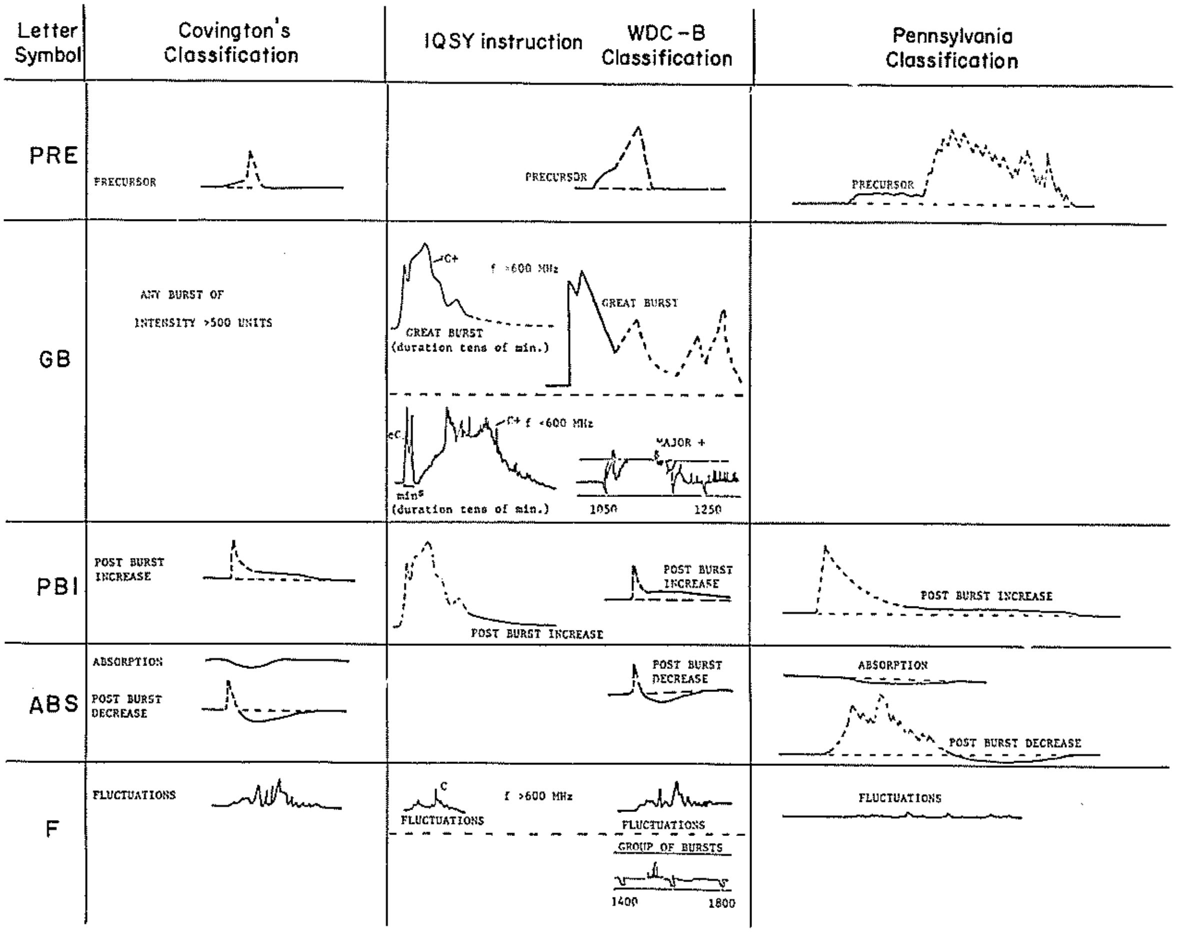


Pencil Beam



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

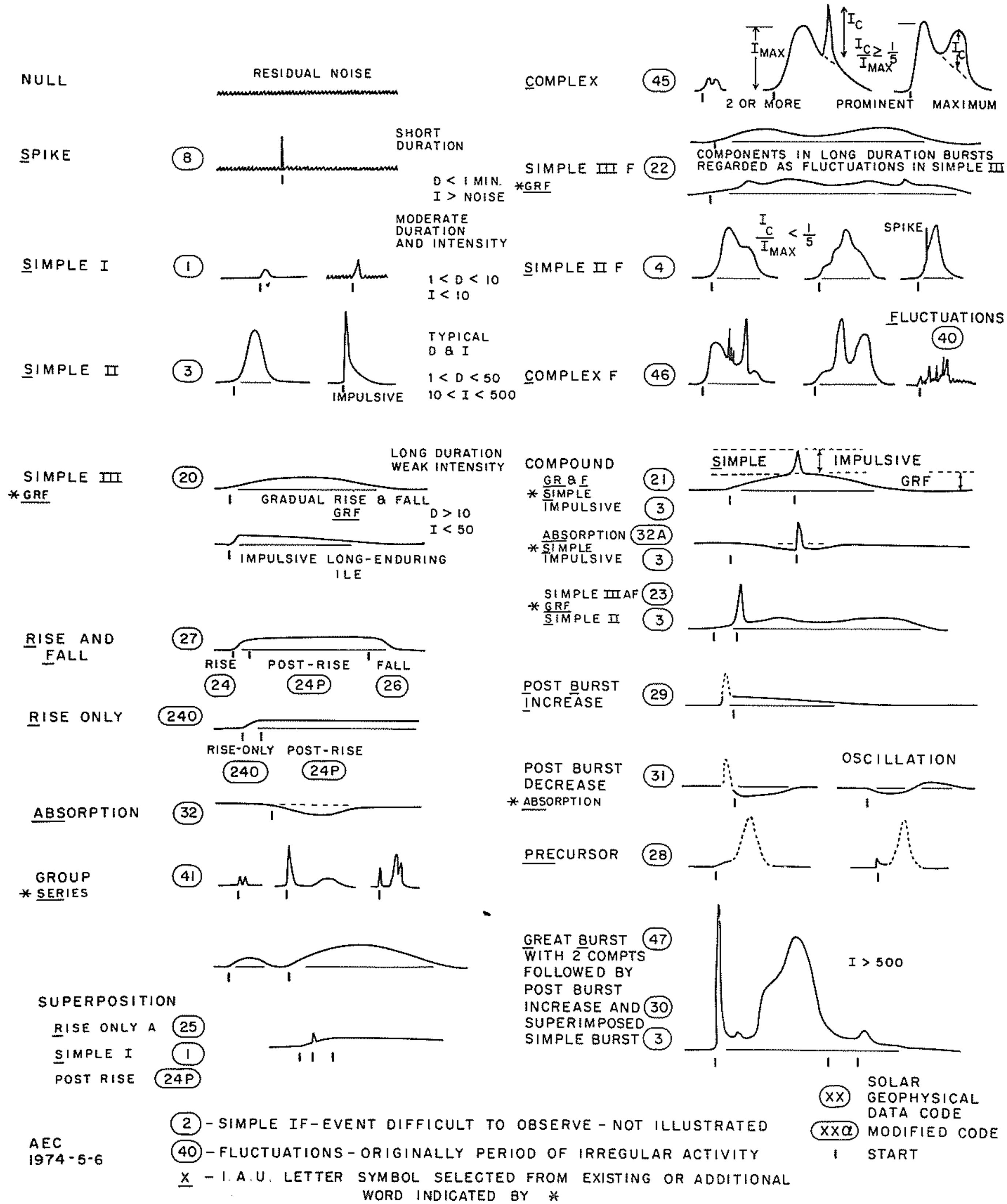

Letter Symbol
Covington's Classification
IQSY instruction
WDC-B Classification
Pennsylvania Classification
S
SIMPLE 1
SIMPLE 1F
SIMPLE 2
SIMPLE 2F
SPIKE
f >600 MHz
(duration min.) SIMPLE 2
SIMPLE 1
SIMPLE 2
f <600 MHz
(duration sec. to min.)
MINOR
1800 1830
SIMPLE
SPIKE
PECULIAR
GRF
SIMPLE 3
SIMPLE 3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



Covington Additions to Tanaka's Proposed IAU Key

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

2800-2700 MHz SOLAR BURST PROFILES



SOLAR RADIO OBSERVATORIES
(FIXED FREQUENCY OBSERVATIONS)

CODE NAME	STATION	ALTERNATE NAME	GEOGRAPHIC LAT	LONG	FREQUENCIES REPORTED (MHZ)
ABST	Abastumani		42N	43E	221
ATHN	Athens		38N	24E	8800, 4995, 2695, 1415
BERN	Bern	Bumishus	47N	07E	92500, 35000, 19600, 11800, 8400, 5200, 3200
BORD	Bordeaux	Floriac	44N	01W	930
CRIM	Simferopol	Crimea	44N	34E	3100
DWIN	Dwingeloo		53N	06E	10715, 2650
GORK	Gorky	Zimenki	56N	44E	9100, 2950, 950, 650, 200, 100
HARS	Harestua	Blindern	60N	10E	228
HIRA	Hiraiso		36N	140E	500, 200, 100
HUAN	Huancayo		12S	75W	9400
IRKU	Irkutsk	Siberian IZMIR	52N	104E	5730
IZMI	Moscow IZMIRAN	Krasnaja Pakhra	55N	37E	204
KISV	Kislovodsk		43N	42E	15000, 6100
KRAK	Krakow		50N	19E	810, 430
LEAR	Learmonth		22S	114E	15400, 8800, 4995, 2695, 1415, 606, 410, 245
MANI	Manila		14N	121E	8800, 4995, 2695, 1415, 606
NAGO	Nagoya		35N	137E	35000
NOBE	Nobeyama		36N	138E	17000
ONDR	Ondrejov		49N	14E	808, 536, 260
OTTA	Ottawa	Algonquin	45N	78W	2800
PALE	Palehua		21N	158W	15400, 8800, 4995, 2695, 1415, 606, 410, 245
PENT	Penticton		49N	119W	2695
POTS	Potsdam	Tremsdorf	52N	13E	9500, 3000, 1470, 234, 113
SAOP	Sao Paulo	Itapetinga	23S	46W	7000
SGMR	Sagamore Hill		42N	71W	35000, 15400, 8800, 4995, 2695, 1415, 410, 610, 242
SYDN	Sydney		34S	151E	1520, 700
TORN	Torun		53N	19E	127
TRST	Trieste		46N	14E	408, 237
TYKW	Toyokawa		34N	137E	9400, 3750, 2000, 1000
UPIC	Upice		50N	16E	33, 29
VORO	Voroshilov	Ussurisk	43N	132E	2930

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

A series of data plots are presented using data obtained on the NASA spacecraft IMP 8 and through September 1978 IMP 7. The purpose of the plots is to convey on as near continuous a basis as possible the state of the interplanetary particle environment. The plots consist of hourly averaged solar wind plasma parameters and representative fluxes of energetic electrons, protons, and alpha particles.

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

IMP 7 (Explorer 47, IMP H) was launched into a near-circular geocentric, ~ 12 day, orbit at 30-40 R_E on September 23, 1972. IMP 8 (Explorer 50, IMP J) was launched on October 26, 1973 into a similar orbit. The two spacecraft were instrumented to measure the plasmas, fields, and energetic particle fluxes found in the interplanetary medium and in the distant magnetosheath and magnetotail. The relative orbital phase of the two spacecraft evolved such that the percent of each 12-day period during which at least one spacecraft was in the interplanetary medium was 100% until mid-1975, decreased to a minimum of about 65% near January 1976, and returned to 100% in late 1976. IMP 7 was deactivated in October 1978.

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

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

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

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

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

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

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

TABLE 1

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

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

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

TABLE 2

RATIO OF AVERAGE TO TRUE DIFFERENTIAL

FLUX AT MIDPOINT OF ENERGY INTERVAL

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

TABLE 3

RATIO OF ENERGY AT WHICH TRUE FLUX =

AVERAGE FLUX TO MIDPOINT ENERGY

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

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

on IMP 7 and 0.23 cm^2 sr on IMP 8. Illustrations and further descriptions of the instruments can be found in Hurford *et al.* [*Ap. J., 192,* 541, 1974], and in Mewaldt *et al.* [*Ap. J., 205,* 931, 1976].

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

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

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

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

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

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

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

MAGNETOGRAMS OF GEOMAGNETIC STORMS (D.1e)

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

Recent progress in magnetospheric physics has made it clear that a comprehensive study of the asymmetric growth of the ring current belt is essential in understanding the mechanism of its formation and generating mechanism of magnetospheric storms as well. For this purpose, Dst is not necessarily the most suitable index. Auroral electrojets have a lifetime of order 1 to 3 hours and the increasing availability of 2.5-min AE(11)* provides indices having excellent time resolution for the study of these high-latitude magnetic variations. However, the delay inherent in acquisition and processing of all magnetograms used in deriving AE(11) and the desirability of including a record of magnetic variations at mid-latitude and equatorial locations suggest that no combination of indices is completely self-sufficient.

For these reasons, actual records of magnetic variations at a number of observatories are still very useful. In this publication, a few interesting geomagnetic events may be chosen and are illustrated by reconstructed H-component magnetograms. The magnetograms are reduced from the original records to display the same amplitude scale and time base. Such common scale magnetograms are included from about 11 of the 19 observatories listed in the table on page 53, although delays in receipt of some magnetograms may necessitate using records from substitute stations. If an adequate coverage of auroral zone observatories is available, preliminary AU and AL graphs are also prepared for each event. No reduced magnetograms are prepared for months having activity of only minimal interest.

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

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

Table of Observatories

	Geog. Lat.	Coord. Long.	Geomag. Lat.	Coord. Long.
Narssarssuaq	61.20	314.60E	71.14	37.42E
Leirvogur	64.18	338.30	70.12	71.51
Yellowknife	62.40	245.60	69.00	292.80
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
Sodankyla	67.37	26.63	63.76	119.99
Dixon Island	73.55	80.57	63.01	161.84
Cape Wellen	66.17	190.17	61.79	237.10
Tixie Bay	71.58	129.00	60.48	191.72
Tashkent	41.33	69.62	32.30	144.43
San Juan	18.12	293.85	29.57	3.63
Kakioka	36.23	140.18	26.09	106.38
Honolulu	21.32	202.00	21.17	266.99
Davao	07.08	125.58	-4.00	194.97
Tangerang	-06.17	106.63	-17.62	175.93

UAG-37 "Auroral Electrojet Magnetic Activity Indices AE(10) for 1966," by Joe Haskell Allen, Carl C. Abston and Leslie D. Morris, National Geophysical and Solar-Terrestrial Data Center, Boulder, CO, December 1974, 142 pp, $0.75.

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, Boulder, CO, May 1974, 142 pp, $0.75.

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, Boulder, CO, October 1973, 148 pp, $0.75.

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, Boulder, CO, February 1974, 142 pp, $0.75.

UAG-22 "Auroral Electrojet Magnetic Activity Indices (AE) for 1970," by Joe Haskell Allen, National Geophysical and Solar-Terrestrial Data Center, Boulder, CO, November 1972, 146 pp, $0.75.

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, Boulder, CO, February 1975, 144 pp, $2.05.

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

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

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

UAG-60 "Geomagnetic Data for January 1976 (AE(7) Indices and Stacked Magnetograms)," by Joe Haskell Allen, Carl C. Abston and Leslie D. Morris, National Geophysical and Solar-Terrestrial Data Center, Boulder, CO. July 1977, 57 pp, $1.07.

UAG-73 "Auroral Electrojet Magnetic Activity Indices AE(11-12) for January - June 1975," by J.H. Allen, C.C. Abston, J.E. Salazar and J.A. McKinnon, National Geophysical and Solar-Terrestrial Data Center, NOAA, Boulder, CO, August 1979, 114 pp, $1.75.

UAG-76 "Auroral Electrojet Magnetic Activity Indices AE(12) for July - December 1975," by J.H. Allen, C.C. Abston, J.E. Salazar and J.A. McKinnon, National Geophysical and Solar-Terrestrial Data Center, NOAA, Boulder, CO, August 1980, 116 pp, $2.50.

UAG-62 "Geomagnetic Data for February 1976 (AE(7) Indices and Stacked Magnetograms)," by Joe Haskell Allen, Carl C. Abston and Leslie D. Morris, National Geophysical and Solar-Terrestrial Data Center, Boulder, CO, September 1977, 55 pp, $1.11.

UAG-63 "Geomagnetic Data for March 1976 (AE(7) Indices and Stacked Magnetograms)," by Joe Haskell Allen, Carl C. Abston and Leslie D. Morris, National Geophysical and Solar-Terrestrial Data Center, Boulder, CO, September 1977, 57 pp, $1.11.

UAG-64 "Geomagnetic Data for April 1976 (AE(8) Indices and Stacked Magnetograms)," by Joe Haskell Allen, Carl C. Abston and Leslie D. Morris, National Geophysical and Solar-Terrestrial Data Center, Boulder, CO, February 1978, 55 pp, $1.00.

UAG-18 "A Study of Polar Cap and Auroral Zone Magnetic Variations," by K. Kawasaki and S.-I Akasofu, University of Alaska, Fairbanks, AK, June 1972, 21 pp, $0.20.

UAG-78 "The Equatorial Latitude of Auroral Activity During 1972-1977," by N.R. Sheeley, Jr. and R.A. Howard, E. O. Hulbert Center for Space Research, U.S. Naval Research Laboratory, Washington, DC, and B.S. Dandekar, Air Force Geophysics Laboratory, Hanscom AFB, MA, October 1980, 61 pp, $3.00.

UAG-55 "Equivalent Ionospheric Current Representations by a New Method, Illustrated for 8-9 November 1969 Magnetic Disturbances," by Y. Kamide, Cooperative Institute for Research in Environmental Sciences, University of Colorado, Boulder, CO; H.W. Kroehl, Data Studies Division, National Geophysical and Solar-Terrestrial Data Center, Boulder, CO; M. Kanamitsu, Advanced Study Program, National Center for Atmospheric Research, Boulder, CO; Joe Haskell Allen, Data Studies Division, National Geophysical and Solar-Terrestrial Data Center, Boulder, CO; and S.-I Akasofu, Geophysical Institute, University of Alaska, Fairbanks, AK, April 1976, 91 pp, $1.60 (microfiche only).

UAG-56 "Iso-intensity Contours of Ground Magnetic H Perturbations for the December 16-18, 1971, Geomagnetic Storm," by Y. Kamide, Cooperative Institute for Research in Environmental Sciences, University of Colorado, Boulder, CO, April 1976, 37 pp, $1.39.

UAG-71 "Magnetic Potential Plots over the Northern Hemisphere for 26-28 March 1976," A.D. Richmond, NOAA Space Environment Laboratory, Boulder, CO; H.W. Kroehl, National Geophysical and Solar-Terrestrial Data Center, Boulder, CO; M.A. Henning, Lockheed Missiles and Space Co., Aurora, CO; and Y. Kamide, Kyoto Sangyo University, Kyoto, Japan, April 1979, 118 pp, $1.50.

UAG-75 "The Alaska IMS Meridian Chain: Magnetic Variations for 9 March - 27 April 1978," by H.W. Kroehl and G.P. Kosinski, National Geophysical and Solar Terrestrial Data Center, Boulder, CO; S.-I. Akasofu, G.J. Romick, C.E. Campbell and G.K. Corrick, University of Alaska, Fairbanks, AK; and C.E. Hornback and A.M. Gray, NOAA Space Environment Laboratory, Boulder, CO, June 1980, 107 pp, $3.00.

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

The Space Environment Monitor (SEM) aboard the Synchronous Meteorological Satellites (SMS) and the Geostationary Operational Environmental Satellites (GOES) include 0.5-4A and 1-8A X-ray ion chambers. SMS-1 was launched in May 1974; SMS-2 in February 1975; GOES-1 in October 1975; GOES-2 in June 1977; GOES-3 in June 1978; and GOES-4 in September 1980. The X-ray data from GOES-2 is the main source of data for SGD.

The GOES satellites presently operating are located over the Western Hemisphere and provide nearly continuous solar x-ray data. The SEM's data from two satellites are recorded, processed, and disseminated in real time by the NOAA Space Environment Laboratory in Boulder, Colorado. Further details of these x-ray data are given in "Solar X-Ray Measurements From SMS-1, SMS-2, and GOES-1: Information for Data Users," by Donnelly, R.F., R.N. Grubb, and F.C. Cowley, *NOAA Technical Memorandum* ERL SEL-48, NOAA Space Environment Lab., Boulder, Colorado, June 1977.

No flux values below 10^{-7} Wm^{-2} for the 1-8Å detector or 10^{-8} Wm^{-2} for the 0.5-4Å detector are reported. The data are presented graphically, 6 days to a page. The values are plotted every 3 seconds. The ordinate values are the exponent of ten for the Wm^{-2}: i.e., -8 signifies 10^{-8} Wm^{-2}.

MASS EJECTIONS FROM THE SUN (A.6)

In response to the request of the Working Group of Commission 10 on Solar Activity of the International Astronomical Union (IAU), World Data Center A (WDC-A) publishes in the monthly Solar-Geophysical Data Comprehensive Report, a table of solar transients listing monthly reports of Mass Ejections. This summary table is compiled from data reports sent to us within four months after the observation month. The table includes H-alpha, EUV, X-ray, white light, coronal line and radio observations with comments as to the type of associated activity (i.e., surge, spray, eruptive prominence, expanding loop, white light, coronal transients, moving Type IV, etc.).

The following is the suggested classification mainly of the optical events:

Surge: S - (Flare-surge if there is a known flare association)
Spray: SP - (Flare-spray if there is a known flare association)

Eruptive Prominence: A - Eruptive (Active region prominence)
Q - Eruptive (Quiescent prominence)

Coronal Transient - Enhancement: E
Depletion: D
Cloud Bubble: CB
Expanding Loop: EL
Ray or Streamer: R
Radio Burst: Moving Type IV - IVm

The term DP (disparition brusque) is not included because although it is a most descriptive term, it is perhaps limited to the disk manifestation of the eruptive quiescent prominence. In the literature one of the confusing issues is whether a prominence activation is related to the quiescent or active region prominence, a distinction that should be made in this regard. Another term omitted is the high-speed (or fast) ejection. Examples of its use in the literature are not common, and most of those would correspond to sprays or the A-Eruptive prominence.

For further definitions of the terms proposed, see Bruzek and Durrant (Eds.) *Illustrated Glossary for Solar and Solar-Terrestrial Physics.*

FLARE INDEX BY REGION (C.1f)

An index that characterized the flare productivity of Hale 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 41. The same formula,

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

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

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

DATA FOR MISCELLANEOUS TIME PERIODS

RETROSPECTIVE WORLD INTERVALS (H.63)

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

OTHER DATA

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

SOME OTHER SOURCES OF DATA

Data Available: Some data available in publication form are cited here. A list is given, along with addresses of the responsible institutions. The WDC-A for Solar-Terrestrial Physics publishes the Toyokawa, Ottawa and Penticton radio data in its monthly publication, *Solar-Geophysical Data.* The WDC-A for Solar-Terrestrial Physics also receives most of the periodicals when they become available.

Belgium: *Bulletin d'Observations: Activite Solaire - Observations Radio-electriques Solaires - 600 MHz (Humain, Belgium)* Observatoire Royal de Belgique, Ave. Circulaire 3, Brussels, Belgium (monthly since 1962)

Canada: *Solar Noise Observations at 2800 Mc/s (Ottawa - ARO) and 2700 Mc/s (Penticton - DRAO)* Series C Monthly Report, National Research Council, Radio Astronomy Section Ottawa 7, Ontario, Canada (since 1947)

France: *Carte Synoptiques de la Chromosphere Solaire* Observatoire de Paris, 92 Meudon, France (monthly since 1931)

Germany: *Daily Mean Value of Solar Flux Density* Heinrich-Hertz Institut, 1199 Berlin-Adlershof, Rudower Chaussee 5, G.D.R. (monthly since Jul 1957)

Italy: *Solar Phenomena - Monthly Bulletin and Photographic Supplement* Osservatorio Astronomica di Roma, Monte Mario, Rome, Italy (monthly since 1958); *Osservazion Solari, Solar Flux and Distinctive Events* Osservatorio Astronomico Di Trieste (quarterly since 1965); *Solar Observations made at Catania Astrophysical Observatory* (annually since 1967)

Japan: *Monthly Report of Solar Radio Emission* Radio Astronomy Section, Research Institute of Atmospherics, Nagoya University, Toyokawa, Japan (since 1956); *Solar Activity Chart* WDC-C2, Toyokawa Observatory, Nagoya University, Toyokawa, Japan (annually since 1968); *IAU Quarterly Bulletin on Solar Activity* Tokyo Astronomical Observatory, Mitaka, Tokyo, Japan (since 1978)

Netherlands: *Geomagnetic Data* IAGA Bulletin No. 12 (1932-69), No. 32 (since 1970) IUGG Publications Office, 39 ter, Rue Gay-Lussac, Paris V, France (annually)

Philippines: Manila Observatory "Solar Maps and Activity", Manila Observatory, P.O. Box 1231, Manila, Philippines (monthly)

Switzerland: Bulletin of "Berne Solar Observations", Institute of Applied Physics, Div. of Solar Observations, Sidlerstrasse 5, 3012 Berne, Switzerland (since 1968)

Taiwan: *Report on Sunspot Observations* Taiwan Provincial Weather Bureau Observatory, Taipei, Taiwan (quarterly since 1957)

USSR: СОЛНЕЧНЫЕ ДАННЫЕ *(Solar Data)* USSR Academy of Science (monthly since 1958); КОСМИЧЕСКИЕ ДАННЫЕ *(Cosmic Data)* (monthly since 1962); *Magnetic Fields of Sunspots* (bimonthly since 1964)

USA: *Preliminary Report and Forecast of Solar-Geophysical Activity* Space Environment Services Center, NOAA, Boulder, Colorado 80303 USA (weekly); *Solar-Geophysical Data* NOAA, Boulder, Colorado 80303 USA (monthly since November 1955)

SOME OTHER SOURCES OF DATA THAT HAVE CEASED OR APPARENTLY CEASED PUBLICATION

Data Available: Some data available in publication form are cited here. A list is given, along with the addresses of the responsible institutions. The WDC-A for Solar-Terrestrial Physics holds most of these publications.

Argentina: *Solar Radio Emission 408 MHz Data,* Observatorio de Fisica Cosmica, 3226 Mitre, San Miguel (FCGSM) Buenos Aires, Argentina (monthly 1967 - Apr 1972)

Belgium: *Observations Photospheriques Solaires - Nombre de Wolf (Uccle, Belgium)* (1957 - Jun 1974) ; *Observations Chromospheriques Solaires - Eruptions, Protuberances (Uccle)* (1947-71) Observatoire Royal de Belgique, Ave. Circulaire 3, Brussels, Belgium (monthly)

England: *Photoheliographic Results, Greenwich Royal Observatory Bulletins* Royal Greenwich Observatory, Herstomonceux Castle, Hailsham, Sussex, England (annually 1874-1976)

Germany: *Daily Maps of the Sun* Fraunhofer Institut, Freiburg i/Breisgau, GFR (twice monthly 1957-73)

Italy: *Photographic Journal of the Sun* Osservatorio Astronomica di Roma, Monte Mario, Rome, Italy (monthly) (27 day rotation) (1966-78)

Japan: *Bulletin of Solar Phenomena* Tokyo Astronomical Observatory, Tokyo, Japan (quarterly 1949-70);*Solar Radio Emission* Tokyo Astronomical Observatory, University of Tokyo, Mitaka, Japan (monthly 1959-73)

Lebanon: *Solar Photospheric Observations* Monthly Bulletin, Astronomical Section, Lee Observatory,American University of Beirut, Lebanon (monthly Apr 1956-Apr 1975)

Netherlands: *Solar Radio Noise Observations - Stations Nera and Paramaribo* Sonnenborgh Observatory, Servaas Bolwerk 15, Utrecht, Netherlands (monthly 1959 - Jun 1970)

Switzerland: *IAU Quarterly Bulletin on Solar Activity, Eidgen Sternwarte,* Zurich, Switzerland (1917-77)

United States of America:
AFCRL Geophysics and Space Data Bulletin AFCRL, L.G. Hanscom Field, Bedford, Massachusetts, USA (quarterly 1964-74);*Solar Radio Flux Observed at University Park* Pennsylvania Radio Astronomy Observatory, Pennsylvania State University,University Park, Pennsylvania, USA (quarterly 1964 - May 1975)

PARTIAL LIST OF CONTRIBUTORS

These monthly reports would not be possible without the continuing support and cooperation of scientists throughout the world. Much of the data included have been obtained through either the International Ursigram and World Days Service program or the international exchange of geophysical observations between World Data Centers in accordance with the principles set forth in recommendations of relevant organizations of the International Council of Scientific Unions. (See *Guide to International Data Exchange,* issued in 1979 by the ICSU Panel on World Data Centres).

Special thanks are due to many individuals, including the following:

Name	Organization	Data Type
R. Ammons	American Association of Variable Star Observers Solar Division 411 Keith Avenue Missoula, MT 59801 USA	Sunspots, SES, SWF
P. S. McIntosh	Space Environment Laboratory NOAA, 325 Broadway Boulder, CO 80303 USA	Sunspots, Hα photographs, Hα synoptic charts
M. J. Martres	Section de Physique Observatoire de Paris 92190 Meudon, France	Active regions
A. Koeckelenbergh	3 Av. Circulaire B-1180 Bruxelles, Belgium	Sunspots
S. Martin W. Marquette	San Fernando Observatory 14031 San Fernando Road Sylmar, CA 91342	Calcium plages
	Osservatorio Astrofisico Citta Universitaria Viale A. Doria 95123 Catania, Italy	Flares
R. Howard J. M. Adkins	Mount Wilson Observatory 813 Santa Barbara Street Pasadena, CA 91101 USA	Magnetic classifications of sunspots, solar magnetograms, calcium plages
J. W. Harvey W. Livingstone F. Receley	Kitt Peak National Observatory P. O. Box 26732 Tucson, AZ 85726 USA	Solar magnetograms Helium 10830 A synoptic chart
R. C. Altrock	Sacramento Peak Observatory Sunspot, NM 88349 USA	Corona
A. A. Giesecke M. Ishitsuka	Observatorio de Huancayo Instituto Geofisico del Peru Apartado 46 Huancayo, Peru	SID, solar radio emission flares
V. Badillo F. J. Heyden	Manila Observatory P. O. Box 1231 Manila, Philippines	Flares, SID, solar radio emission, sunspots
M. Bernot P. Simon	Observatoire de Meudon 92190 Meudon, France	Flares
A. Magun H. Wiehl W. Schöchlin N. Kampfer	Institute of Applied Physics Division of Solar Observations Sidlerstrasse 5 CH-3012 Berne, Switzerland	Digital solar radio emission, data photographs and digital H-alpha flare data

Name	Organization	Data Type
H. Tanaka S. Enome	Toyokawa Observatory The Research Institute of Atmospherics Nagoya University Toyokawa, 442 Japan	Solar radio emission
E. Eadon	Det 2, 3WW (MAC) Sagamore Hill Solar Radio Obs. Box 394 South Hamilton, MA 01982 USA	Solar radio emission
A. Watkinson	School of Electrical Engineering University of Sydney Sydney, N.S.W. 2006, Australia	Solar radio emission
M. B. Bell	Astrophysics Branch National Research Council Ottawa, Ontario, Canada K1A 0R6	Solar radio emission
A. Maxwell	Harvard Radio Astronomy Station Fort Davis, TX 79734 USA	Solar radio emission
H. Urbarz	Aussenstelle Astronomie Institut der Universitaet Tübingen 7981 Weissenau Federal Republic of Germany	Solar radio emission
A. O. Benz M. R. Perrenoud	Microwave Laboratory Gloriastrasse 35 CH-8006 Zürich, Switzerland	Solar radio emission
C. Slottje	Solar Radio Observatory Netherlands Foundation for Radio Astronomy Dwingeloo, Netherlands 7514	Solar radio emission
M. Pick	Observatoire de Meudon 92190 Meudon, France	Solar radio emission
K. V. Sheridan	CSIRO Division of Radio Physics Culgoora Solar Observatory P. O. Box 76 Epping N.S.W. 2121 Australia	Solar radio emission
H. Zirin A. P. Patterson	Big Bear Solar Observatory California Institute of Technology North Shore Drive Big Bear City, CA 92314 USA	Coronal holes, flares
B. J. Rickett	University of California, San Diego Dept. of Applied Physics and Information Science La Jolla, CA 92037 USA	Solar wind
J. H. Wolfe	NASA Mail Code 245-11 Electrodynamics Branch Ames Research Center Moffett Field, CA 94035 USA	Solar wind
J. Sullivan	Massachusetts Institute of Technology Center for Space Research Cambridge, MA 02139 USA	Solar wind

Name	Organization	Data Type
C. Russell	UCLA Space Science Center Institute of Geophysics and Planetary Physics Los Angeles, CA 90024	IP Magnetic Field
D. S. Colburn (C. P. Sonett)	NASA/ARC Moffett Field, California 94035	IP Electric Field
F. L. Scarf	Space Science Department TRW Systems One Space Park Bldg. R-5, Rm 1280 Redondo Beach, California 90278	IP Electric Field
N. F. Ness	Laboratory for Extraterrestrial Physics NASA/GSFC, Code 690 Greenbelt, Maryland 20771	IP Magnetic Field
F. Mariani	Instituto Fisica Universita Piazza Annunziata 67100 L'Aquila, Italy	IP Magnetic Field
R. Post	NSSDC NASA/GSFC Code 601 Greenbelt, MD 20771 USA	Solar particles, plasmas
W. R. Webber J. A. Lezniak	Physics Department University of New Hampshire Demerritt Hall Durham, New Hampshire 03824	Solar cosmic ray protons
G. Heckman	Space Environment Services Center NOAA, 325 Broadway Boulder, CO 80303 USA	Solar proton events Inferred IP Magnetic Fields
A. Zaitsev	IZMIRAN P.O. Akademogorodok Moscow Region, 142092, USSR	Inferred IP Magnetic Fields
J. M. Wilcox P. H. Scherrer	Institute for Plasma Research Stanford University Via Crespi, Stanford, CA 94305 USA	Solar Mean Magnetic Fields
C. Hornback	Table Mountain Geophysical Monitoring Station Space Environment Laboratory NOAA Boulder, CO 80303 USA	SID, Solar radio emission
S. Barnes	Ionospheric Sounding Station P.O. Box 578 Puunene, Maui, HI 96784 USA	SPA
P. C. Yuen Kazutoshi Najita	Department of Electrical Engineering University of Hawaii Honolulu, HI 96822 USA	SFD

Name	Organization	Data Type
R. F. Donnelly	Space Environment Laboratory NOAA, 325 Broadway Boulder, CO 80303 USA	Solar x-rays
M. Bercovitch Margaret D. Wilson	National Research Council of Canada Herzberg Institute of Astrophysics Ottawa, Ontario, Canada K1A OR6	Cosmic rays
D. Venkatesan M. Tjoei	Department of Physics University of Calgary Calgary, Alberta, Canada T2N, 1N4	Cosmic rays
J. A. Simpson G. Lentz	LASR Enrico Fermi Institute University of Chicago 933 E. 56th Street Chicago, IL 60637 USA	Cosmic rays Solar cosmic ray protons
M. A. Pomerantz	Bartol Research Foundation The Franklin Institute University of Delaware Newark, DE 19711 USA	Cosmic rays
M. Wada	Institute of Physical and Chemical Research 7-13 Kaga-1, Itabashi Tokyo, Japan 173	Cosmic rays
K. Röhrs	Institut für Reine und Angewandte Kernphysik Olshausenstr. 40/60, Gebäude N20a 23 Kiel, German Federal Republic	Cosmic rays
M. Siebert	Institut für Geophysik Herzberger Landstrasse 180 34 Göttingen, G.F.R.	Magnetic indices
D. Van Sabben	Kon. Nederlands Meteorlogisch Instituut DeBilt, The Netherlands	Magnetic indices
M. Sugiura	Magnetic and Electric Fields Branch NASA/GSFC, Code 625 Greenbelt, MD 20771 USA	Magnetic indices
M. Menvielle	Institut de Physique du Globe 4, Place Jussieu - Tour 14 75230 Paris, France	Magnetic indices
A. Romaña	Observatorio del Ebro Roqueta (Tarragona) Spain	ssc, sfe
W. Paulishak	NGSDC/EDIS/NOAA D63, 325 Broadway Boulder, CO 80303 USA	Magnetograms
T. Damboldt	Forschungsinstitut der Deutschen Bundespost 61 Darmstadt, Postfach 800 German Federal Republic	Radio quality figures

DETAILED DATA COVERAGE FOR SOLAR-GEOPHYSICAL DATA

An index to *Solar-Geophysical Data* beginning with the data for the year 1957 can be found on pages 63-85. 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

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

KEY TO DETAILED DATA COVERAGE FOR SOLAR-GEOPHYSICAL DATA

A. Solar and Interplanetary Phenomena		Mo/Yr	Mo/Yr
A.1	Sunspot Drawings	1/67 -	present
A.1a	Sunspot Data (see A.5a)	7/57 -	present
A.2a	Zurich Provisional Relative Sunspot numbers, R_Z	7/57 -	12/80
A.2aa	International Provisional Relative Sunspot numbers, R_I	1/81 -	present
A.2b	Zurich Final Sunspot numbers, R_Z	7/57 -	12/80
A.2c	American Relative Sunspot numbers, R_A'	7/57 -	present
A.2d	27-day Plot of Relative Sunspot numbers (see D.1c)	7/57 -	present
A.2e	Sunspot Cycle (Smoothed numbers) Graphs - in each issue	7/57 -	present
A.2f	Table of Observed and Predicted Smoothed Sunspot numbers	10/64 -	present
A.3a	Mt. Wilson Magnetograms	9/66 -	present
A.3b	Mt. Wilson Sunspot Magnetic Field Classifications	1/62 -	present
A.3c	Kitt Peak Magnetograms	7/74 -	present
A.3d	Mean Solar Magnetic Field (Stanford)	1/77 -	present
A.3e	Stanford Magnetograms	1/79 -	present
A.4	H-alpha Filtergrams	1/67 -	present
A.5	Calcium Plage Drawings - Mt. Wilson previously McMath (or Catania)	1/67 -	present
A.5a	Calcium Plage (McMath - Mt. Wilson) and Sunspot Regions	7/57 -	present
A.5b	Daily Calcium Plage Index	12/70 -	present
A.6	H-alpha Synoptic Charts	6/73 -	present
A.6b	Synoptic Chart and Active Regions	4/76 -	present
A.6c	Stanford Solar Magnetic Field Synoptic Charts	1/79 -	present
A.6d	Kitt Peak Solar Magnetic Field Synoptic Charts	4/79 -	present
A.6e	Mass Ejections from the Sun	3/80 -	present
A.7a	Coronal Line Emission Indices (Provisional)	7/57 -	5/66
A.7b	Coronal Line Emission Indices (Final)	1/60 -	present
A.7c	White Light Corona (NRL OSO-7, 1971-083A)	2/72 -	6/74
A.7e	Solar XUV Coronagrams (NRL OSO-7, 1971-083A)	10/72 -	12/73
A.7f	Helium D3 Coronal Holes (Big Bear)	1/76 -	present
A.7g	Helium Synoptic Maps (KPNO)	1/77 -	present
A.7h	λ5303Å Coronal Intensities (Sac Peak or Wendelstein)	1/77 -	present
A.8aa	2800 MHz (ARO-Ottawa) Daily Observed Values of Solar Flux	7/57 -	present
A.8ab	2800 MHz (Ottawa) Final - Daily Observed Values of Solar Flux	1/62 -	12/66
A.8ac	2800 MHz (ARO-Ottawa) Daily Values Solar Flux Adjusted to 1 AU	1/64 -	present
A.8ad	2800 MHz (Ottawa) Final - Daily Values of Solar Flux Adjusted to 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 (AFGL) Solar Flux Adjusted to 1 AU (15400 MHz began 6/69, 245 MHz began 10/69, 410 MHz began 9/71)	1/67 -	present
A.9a	9.1 cm (Stanford) Radio Maps of the Sun	4/60 -	8/73
A.9aa	9.1 cm Spectroheliogram tabulated Data (Stanford)	1/69 -	8/73
A.9b	21 cm (Fleurs) Radio Maps of the Sun	12/64 -	12/73
A.9c	8.6 mm (Prospect Hill) Radio Maps of the Sun	4/70 -	2/74
A.9cb	8.6 mm (NOSC) Radio Maps of the Sun	11/74 -	12/80
A.9d	2 cm (NOSC) Radio Maps of the Sun	6/74 -	12/80
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.10f	3 cm (Toyokawa) East-West Solar Scans	1/78 -	present
A.11aa	Solar X-ray Background Levels (NRL) satellites, see below	1/64 -	10/79
A.11ab	Solar X-ray Background Levels (NRL Graphs) " " "	3/65 -	10/79
A.11ac	Solar X-ray Background Levels (Boulder) " " "	12/65 -	11/68
A.11ad	Solar X-ray Background Levels (France) " " "	4/66 -	5/66
A.11ae	Solar X-ray Background Levels (Aberdeen, S.D.) " "	1/66 -	11/68

Popular Name	Satellite Designation		
SOLRAD 7A	1964-1D	1/64 -	10/64
SOLRAD 7B	1965-16D	3/65 -	12/65
SOLRAD 8 (Explorer 30)	1965-93A	1/66 -	12/67
OGO-4	1967-73A	1/68 -	3/68
OSO-4	1967-100A		

	SOLRAD 9 1968-17A	3/68 - 7/72
	(Explorer 37)	6/73 - 4/74
	(Beginning 12/68 daily/hourly averages presented)	
	SOLRAD-10 1971-58A	8/72 - 6/73
	(Explorer 44)	
	SOLRAD-11 1976-023D	1/78 - 10/79
A.11b	Solar X-ray Background Levels, 0-20Å Injun 1/SOLRAD-3, 1962-02	6/61 - 12/61
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	7/69 - 11/72
	(University College London, Leicester Univ.)	7/74 - 6/75
A.11f	Solar X-ray (GSFC OSO-7, 1971-083A) Spectroheliograms	12/72 - 7/74
A.11g	Solar X-ray Background Levels (SMS-1/GOES, 1974-033A; SMS-2/GOES, 1975-011A; GOES 2, 1977-048A)	1/74 - present
A.11h	Solar X-ray (OSO-8, 1975-057 A) 2-14 keV (Lockheed)	8/75 - 9/78
A.11i	Solar X-ray (OSO-8, 1975-057A) (Columbia University)	
A.11ja	Solar EUV Spectroheliograms FeXV 284Å (GSFC OSO-7, 1971-083A)	5/72 - 3/74
A.11jb	FeXV - 284Å Spectroheliograms	2/76 - 12/76
A.12aa	Solar Protons, Daily-hourly Values, JPL/GSFC (satellites, see below)	5/67 - 5/73
A.12ab	Solar Protons, Graphs, JPL/GSFC " " "	5/67 - 5/73

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

A.12ba	Cosmic Ray Protons, Ep 0.6-13, 13-175, >175 Mev, Univ. of Chicago (Pioneer 6; 1965-105A and Pioneer 7; 1966-75A)	3/69 - present
A.12bb	Cosmic Ray Protons, Ep 13.9, >64 or >40 Mev, Univ. of New Hampshire (Pioneer 8; 1967-123A and Pioneer 9; 1968-100A)	12/69 - present
A.12c	Cosmic Ray Protons, Ep 5-21, 21-70 Mev, Aerospace (ATS-1; 1966-110A)	1/70 - 8/72
A.12d	Low Energy Protons (NOAA satellites 1972-082A, 1973-086A, 1974-089A)	7/74 - 11/74
A.12e	Energetic Solar Particles (IMP H, 1972-073A and IMP J, 1973-078A)	8/75 - present
A.12f	Energetic Solar Particles (GMS/SEM, 1977-065A)	9/77 - 7/78
A.13a	Solar Wind (Pioneer 6, 1965-105A; and Pioneer 7, 1966-75A) NASA Ames	12/65 - present
A.13ab	Solar Wind (Pioneer 8, 1967-123A; Pioneer 9, 1968-100A) NASA Ames	4/72 - present
A.13b	Solar Wind, M.I.T.	
	Pioneer 6, 1965-105A	3/69 - 2/70
		12/73 - present
	Pioneer 7, 1966-75A	6/69 - 12/69
A.13c	Solar Wind (Vela 3, 1964-40A; Vela 5, 1965-58A)	1/69 - 6/72
A.13d	Solar Wind from IPS Measurements (UCSD)	1/75 - present
A.13e	Solar Plasma Data (IMP H, 1972-073A and IMP J, 1973-078A)	8/75 - present
A.13f	Solar Wind (Pioneer 12 (Venus) 1978-051A)	1/79 - present
A.17	Interplanetary Magnetic Field	
	Pioneer 8, 1967-123A	10/72 - present
	Pioneer 9, 1968-100A	4/72 - present
	Pioneer 12, 1978-051A	9/79 - 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. <u>Ionospheric (and Radio Wave Propagation) Phenomena</u>

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

C. Flare-Associated Events

C.1a	H-alpha Solar Flares (Preliminary)	7/57 - present
C.1ba	H-alpha Solar Flares (including Standardization Data) (Divided into Confirmed and Unconfirmed Flares from 1/68-12/74)	9/66 - present
C.1c	H-alpha Subflares (included in C.1a and C.1b after 1/62)	7/57 - present
C.1d	H-alpha Flare Patrol (The most recent issue listed for a month contains the comprehensive flare patrol.)	7/57 - present
C.1e	H-alpha Flare Index (Daily)	9/69 - present
C.1f	H-alpha Flare Index (by Region)	9/70 - present
C.1g	Frequency of Occurrence 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 - 12/65
C.3b	470 MHz (Boulder) Outstanding Occurrences	7/57 - 3/58
C.3c	167 MHz (Boulder) Outstanding Occurrences	7/57 - 10/60
C.3ca	167 MHz (Boulder) Hours of Observation	1/59 - 12/59
C.3d	200 MHz (Cornell) Outstanding Occurrences	7/57 - 12/58
C.3e	9530 MHz (USNRL) Outstanding Occurrences	2/58 - 4/59
C.3f	3200 MHz (USNRL) Outstanding Occurrences	2/58 - 4/59
C.3g	200 MHz (Hawaii) Outstanding Occurrences	6/59 - 8/59
C.3h	108 MHz (Boulder) Outstanding Occurrences	1/60 - 6/66
C.3ha	108 MHz (Boulder) Hours of Observation	1/60 - 12/65
C.3i	221 MHz (Boeing-Seattle) Outstanding Occurrences (Interferometric) - Changed to 223 MHz in May 1963	4/62 - 7/63 5/65 - 11/65
C.3j	107 MHz (Haleakala) Outstanding Occurrences	6/65 - 3/66
C.3k	10700, 2700, 960 MHz (Pennsylvania State Univ.) Outstanding Occurrences	7/64 - 5/75
C.3l	486 MHz (Washington State Univ.) Outstanding Occurrences	7/66 - 4/69
C.3m	18 MHz Bursts (Boulder) (reported with C.6 1/63 - 11/66, C.6ab prior to 1/63)	11/67 - 12/77
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 Miguel) Outstanding Occurrences	10/67 - 4/72
C.3s	18 MHz (McMath-Hulbert) Bursts	1/68 - 9/79
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)	
	100 - 580 MHz	7/57 - 12/58
	25 - 580 MHz	1/59 - 12/62
	50 - 320 MHz	1/63 - 3/65
	25 - 320 MHz	4/65 - 12/66
	10 - 580 MHz	1/67 - 2/70
	10 - 1000 MHz	3/70 - 4/70
	10 - 2000 MHz	5/70 - 5/73
	10 - 4000 MHz	5/73 - 3/74
	25 - 320 MHz	4/74 - 12/77
	25 - 580 MHz	1/78 - present
C.4ab	2100-3900 MHz Solar Radio Spectrograms of Events (Fort Davis)	1/60 - 12/61
C.4b	Solar Radio Spectrograms of Events (Boulder)	
	7.6 - 41 MHz	3/61 - 8/68
	7.6 - 80 MHz	9/68 - 6/76
C.4c	450-1000 MHz Solar Radio Spectrograms of Events (Owens Valley)	11/60 - 10/61
C.4d	Solar Radio Spectrograms of Events (Culgoora)	
	10 - 210 MHz	1/67 - 7/69
	8 - 2000 MHz	8/69 - 2/70
	8 - 4000 MHz	3/70 - 10/70
	8 - 8000 MHz	11/70 - present
C.4e	30-1000 MHz Solar Radio Spectrograms of Events (Weissenau, GFR)	3/68 - present

C.4f	Solar Radio Spectrograms of Events (AFCRL - Sagamore Hill)	
	19 - 41 MHz	1/68 - 7/70
	24 - 48 MHz	7/70 - 7/75
	25 - 75 MHz	8/75 - present
C.4g	20-60 MHz Solar Radio Spectrograms of Events (Clark Lake)	4/70 - 9/70
C.4h	160-320 MHz Solar Radio Spectrograms of Events (Dwingeloo)	1/74 - present
C.4i	100-1000 MHz Solar Radio Spectrograms of Events (Durnten/Bleien)	1/74 - present
C.4j	24-48 MHz Solar Radio Spectrogram of Events (Manila)	4/74 - present
C.4k	25-75 MHz Solar Radio Spectrograms of Events (Learmonth)	8/79 - present
C.4l	25-75 MHz Solar Radio Spectrograms of Events (Palehua)	8/79 - present
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 - 10/79
C.5d	Solar X-ray Events (McMath-Hulbert) OSO-3; 1967-20A (8-12Å)	3/67 - 8/67
C.5e	Solar X-ray Events (SMS-1/GOES, 1974-033A; SMS-2/GOES, 1975-011A; GOES 2 1977-048A)	11/74 - present
C.5f	Solar X-ray Events (OSO-8, 1975-057A) (Columbia University)	
C.6	Sudden Ionospheric Disturbances (SID)	1/63 - present
C.6aa	Sudden Ionospheric Disturbances (SWF) (included with C.6 after 12/62)	7/57 - present
C.6ab	Sudden Ionospheric Disturbances (SCNA, SEA bursts) "	1/58 - present
C.6ac	Sudden Ionospheric Disturbances (SPA) "	6/61 - present
C.7	Solar Proton Events--Direct Measurement--same as A.12	5/67 - present
C.8	Solar Proton Events--Riometer	1/67 - 6/67
C.8ba	Solar Protons, 26 MHz Riometer Events (South Pole) Provisional	9/63 - 11/67
C.8bc	Solar Protons, 30 MHz Riometer Events (Frobisher Bay)	1/65 - 5/65
C.8be	Solar Protons, 30 MHz Riometer Events (Great Whale River)	6/65 - 2/67

D. Geomagnetic and Magnetospheric Phenomena

D.1a	Geomagnetic Indices Ci, Ks, Kn, Km, Cp, Kp, Ap, aa, Selected Days (aa first published 1/74; Ks, Kn, Km first published 12/75; Ci discontinued 8/75)	7/57 - present
D.1b	27-day Chart of Kp for Year	7/57 - present
D.1ba	27-day Chart of Kp Indices	7/57 - present
D.1c	27-day Chart of C9 for Year	7/57 - present
D.1ca	aa graph 1868 - present	annually
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
D.1h	Geomagnetic Substorm Log (Boulder)	3/78 - present

F. Cosmic Rays

F.1a	Cosmic Ray Daily Averages Neutron Monitors (Deep River--graph of hourly values, daily averages begin 11/65)	1/59 - present
F.1b	Cosmic Ray Daily Averages Neutron Monitors (Climax)	9/60 - 3/72
	Daily Averages and Graph of hourly values	12/74 - present
F.1c	Cosmic Ray Daily Averages Neutron Monitors (Dallas)	1/64 - 3/74
F.1d	Cosmic Ray Daily Averages Neutron Monitors (Churchill)	5/64 - 6/72
F.1e	Cosmic Ray Daily Averages Neutron Monitors (Alert)	3/74 - present
	Graph of hourly values (Alert)	7/66 - present
F.1f	Cosmic Ray Daily Averages Neutron Monitors (Calgary--also graph of hourly values)	1/71 - present
F.1g	Cosmic Ray Daily Averages Neutron Monitors (Sulphur Mountain--also graph of hourly values)	1/71 - 8/78
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
F.1k	Cosmic Ray Daily Averages Neutron Monitors (Kula--also graph of hourly values)	5/77 - 2/80
F.1l	Cosmic Ray Daily Averages Neutron Monitors (Huancayo--also graph of hourly values)	2/79 - 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 (temporarily suspended)	12/68 - 3/79
H.63	Retrospective World Intervals	1/66 - 12/67

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A.2b	166	166	166	166	166	166	175	175	175	175	175	175	175	175	175	175	175	175
A.2c	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174
A.5a	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173
A.7	156	157	158 165	159 165	160 165	161 165	162 165 171	163 171	164 171	166 171	166 171	167 171	168 171	169	170	171	172	173
A.8aa	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173
A.8b	156	157	158	159	161	162	163	164	165									
A.8c	156	157	158	159	162	162	163	164	165	167	168	169	170	172	173	174	175	176
A.8d	156	157	158	159	160	161	163	163	164	165	167	167	168	169	170	171	172	173
A.8e								176	175	174	172	170	170	170	170	171	172	173
A.8f								176	175	174	172	170	170	170	170	171	172	173
A.10a	171	171	171	171	171	171	171	171	171	171	171	171	171	171	171	171	172	173
B.51aa	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174
B.51ab	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174
B.51ba	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174
B.51bb	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174
B.52	157	159	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174
C.1a	156 166 169 174	157 167 174	158 168 174 175	159 168 174	160 169 161 174	161 169 174	162 170 174	163 170	164 171 174	165 171 174	166 172 174	167 172	168 173	169 173	170 174	171 174 176	172 175	173 175
C.1c	156	157	158	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174
C.1d	158 166 176	158 167 176	158 168 176	159 168 176	160 169 176	161 169 176	162 170 176	163 170 176	164 171 176	165 171 176	166 172	167 172	168 173	169 173	170 174	171 174	172 175	173 175
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	165 166	165 166	167	168	168 169	170	171	172	173

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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
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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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.4c	198	201	202	202	202	203	207	207	207	207	207													
C.6aa	199	200	201	202	203	204	207	206	207	208	209	210	211	212	213	214	215	216	219	219	219	220	221	222
C.6ab	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	219	219	219	220	221	222
C.6ac						204	205	206	207	208	209	210	211	212	213	214	215	216	219	219	219	220	221	222
D.1a	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222
D.1b	208	208	208	208	208	208	208	208	208	208	208	208	221	221	221	221	221	221	221	221	221	221	221	221
D.1c	226	226	226	226	226	226	226	226	226	226	226	226	226	233	233	233	233	233	233	233	233	233	233	233
F.1a	199	200	201	202	203	204	204	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.3j	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.31																			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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Key *	1967 Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	1968 Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
A.1	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294
A.2a	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293
A.2b	282	282	282	282	282	282	282	282	282	282	282	282	295	295	295	295	295	295	295	295	295	295	295	295
A.2c	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293
A.3a	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294
A.3b	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293
A.4	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294
A.5	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294
A.5a	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293
A.7b	271	272	273	275	275	276	277	278	279	280	282	282	283	284	285	286	287	288	289	290	291	292	293	294
A.8aa	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293
A.8ac	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293
A.8g	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293
A.9a	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294
A.9b	271	272	273	274	275	276	277	278	---	280	281	282	283	284	285	286	---	288	289	290	291	292	293	294
A.10a	270	271	272	273	---	---	277	277	279	279	280	---	---	---	284	285	287	287	288	289	290	291	292	293
A.10b	270	271	272	273	275	275	276	277	279	279	280	281	282	283	284	285	287	287	288	289	290	291	292	293
A.10c	270	271	272	273	274	275	276	277	278	280	280	281	282	283	284	285	286	287	288	289	290	291	292	293
A.10d	270	271	272	273	274	275	276	277	278	280	280	281	282	283	284	285	286	287	288	289	290	291	292	293
A.10e													---	---	---	---	---	287	288	289	290	291	292	293
A.11aa	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294
A.11ab	275	276	277	278	279	280	281	---	---	---	---	---												
A.11ac	271	272	273	274	275	---	---	278	279	280	281	---	---	---	---	---	---	288	289	290	291	292	293	---
A.11ae	---	272	273	274	---	276	277	---	279	280	---	---	---	---	---	---	---	288	289	290	291	292	293	---
A.11d	---	---	278	279	279	280	281	282	---	---	---	---												
A.12aa					282	282	282	282	283	284	285	286	287	288	289	290	291	292	293	298	298	298	300	301
A.12ab					282	282	282	282	283	284	285	286	287	288	289	290	291	292	293	298	298	298	300	301
A.13a	305	305	305	305	305	305	305	305	305	305	281	281	282	283	284	285	286	287	288	289	290	291	292	293
B.51ca	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294
B.51cb	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294
B.52	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294
C.1a	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293
C.1ba	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298
			278																					
C.1d	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293
	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298
C.1g													295	295	295	295	295	295						
C.3a	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293
C.3k	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293
C.3l	270	271	272	273	274	275	276	277	278	279	280	281	---	283	284	---	---	---	---	---	290	291	---	293
C.3m											280	281	282	283	284	285	286	287	288	289	290	291	292	293
C.3n	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293
C.3p	---	---	272	273	274	275	276	277	278	279	280	281	282	---	---	---	---	---	288	289	290	291	292	293
C.3q											280	281	282	283	284	285	286	287	288	289	290	291	292	293
C.3r										279	280	281	282	283	284	285	286	287	288	289	290	291	292	293
C.3s													282	---	284	285	286	287	288	289	290	291	292	293
C.4aa	277	277	277	277	277	277	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294
C.4b	270	271	272	273	274	275	276	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294
C.4d	277	277	277	277	277	277	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294
C.4e													---	---	285	286	287	288	289	290	292	292	293	294
C.4f													283	284	285	286	287	288	289	290	291	292	293	294
C.5b	278	278	278	280	280	281	281	283	283	284	285	287	287	288	289	290	291	292	293	294	295	296	297	299
C.5c	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294
C.5d	---	---	278	279	279	280	281	282	---	---	---	---												
C.6	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	287	288	289	290	291	292	293
													287	288	289	290	291	292	293	294	295	296	297	298
C.8	284	284	284	284	284	284	---	---	---	---	---	---												
C.8ba	---	---	273	274	275	276	277	278	279	280	281	---												
C.8be	271	272	---	---	---	---	---	---	---	---	---	---												
D.1a	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294
D.1b	282	282	282	282	282	282	282	282	282	282	282	282	294	294	294	294	294	294	294	294	294	294	294	294
D.1c	282	282	282	282	282	282	282	282	282	282	282	282	294	294	294	294	294	294	294	294	294	294	294	294
D.1d	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294
D.1e	297																					298	298	
D.1f	277	277	277	280	280	280	283	283	283	285	285	285	290	290	290	291	291	291	295	295	295	296	296	296
F.1a	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294
F.1b	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294
F.1c	288	288	288	288	288	288	288	288	288	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294
F.1d	288	288	288	288	288	288	288	288	288	288	288	282	288	284	285	286	287	288	289	290	291	292	293	294
F.1e	271	272	273	274	275	276	277	278	279	280	281	282	---	284	285	286	287	288	289	290	291	292	293	294
H.60	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293
H.62	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	299
H.63	282	282	282	282	282	282	282	282	282	282	282	282												

* See "Key" on pages 63 and following.

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

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

* See "Key" on pages 63 and following.

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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

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

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*See "Key" on page 63 and following.

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

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

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Key*	1976 Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
A.												
A.1	379A 26	380A 36	381A 30	382A 26	383A 26	384A 24	385A 26	386A 22	387A 26	388A 26	389A 26	390A 28
A.2a	378A 7	379A 7	380A 7	381A 7	382A 7	383A 7	384A 7	385A 7	386A 7	387A 7	388A 7	389A 7
A.2b	391A 6	391A 6	391A 6	391A 6	391A 6	391A 6	391A 6	391A 6	391A 6	391A 6	391A 6	391A 6
A.2c	378A 7	379A 7	380A 7	381A 7	382A 7	383A 7	384A 7	385A 7	386A 7	387A 7	388A 7	389A 7
A.3a	379A 26	380A 36	381A 30	382A 26	383A 26	383A 24	385A 26	386A 22	387A 26	388A 26	389A 26	390A 28
A.3b	379A 88	380A 94	381A 92	382A 86	383A 88	384A 84	385A 88	386A 84	387A 86	388A 88	389A 86	390A 90
A.3c	379A 26	380A 36	381A 30	---	---	---	---	386A 22	387A 26	388A 26	389A 26	390A 28
A.3d	390A 21	390A 21	390A 21	390A 21	390A 21	390A 21	390A 21	390A 21	390A 21	390A 21	390A 21	390A 21
A.4	379A 26	380A 36	381A 30	382A 26	383A 26	384A 24	385A 26	386A 22	387A 26	388A 26	389A 26	390A 28
A.5	379A 26	380A 36	381A 30	382A 26	383A 26	384A 24	385A 26	386A 22	387A 26	388A 26	389A 26	390A 28
A.5a	379A 88	380A 94	381A 92	382A 86	383A 88	384A 84	385A 88	386A 84	387A 86	388A 88	389A 86	390A 90
A.5b	379A 93	380A100	381A 97	382A 91	383A 94	384A 90	385A 93	386A 89	387A 93	388A 94	389A 90	390A 95
A.6	379A 25	380A 33	381A 29	382A 25	383A 25	384A 23	385A 24	386A 20	387A 26	388A 26	389A 26	390A 26
A.6b	---	---	---	386B 4	387B 4	388B 4	389B 4	390B 4	391B 4	392B 4	393B 4	394B 4
A.7b	379A 26	380A 36	381A 30	382A 26	383A 26	384A 24	385A 26	386A 22	387A 26	388A 26	389A 26	390A 28
A.7f	378A 23	379A 21	380A 30	381A 24	382A 21	383A 21	384A 19	385A 21	---	387A 20	388A 21	389A 21
A.8aa	378A 7	379A 7	380A 7	381A 7	382A 7	383A 7	384A 7	385A 7	386A 7	387A 7	388A 7	389A 7
A.8ac	378A 7	379A 7	380A 7	381A 7	382A 7	383A 7	384A 7	385A 7	386A 7	387A 7	388A 7	389A 7
A.8g	378A 7	379A 7	380A 7	381A 7	382A 7	383A 7	384A 7	385A 7	386A 7	387A 7	388A 7	389A 7
A.9cb	379A 26	380A 36	381A 30	382A 26	383A 26	384A 24	385A 26	386A 22	387A 26	388A 26	389A 26	390A 28
A.9d	379A 26	380A 36	381A 30	382A 26	383A 26	384A 24	385A 26	386A 22	387A 26	388A 26	389A 26	390A 28
A.10a	378A 13	379A 12	380A 15	381A 13	382A 12	383A 13	384A 12	---	386A 12	387A 12	388A 12	389A 12
A.10c	378A 15	379A 14	380A 17	381A 15	382A 14	383A 15	384A 14	385A 14	387A101	388A101	388A 14	389A 14
A.10d	378A 16	379A 15	380A 18	381A 16	382A 15	383A 16	384A 15	385A 15	387A102	388A102	388A 15	389A 15
A.10e	378A 14	379A 13	380A 16	381A 14	382A 13	383A 14	384A 13	385A 13	386A 13	387A 13	388A 13	389A 13
A.11g	378A 20	379A 19	380A 26	381A 21	382A 18	383A 19	384A 17	385A 18	386A 16	387A 18	388A 19	389A 18
A.11h	379A 26	380A 36	381A 30	382A 26	383A 26	384A 24	385A 26	386A 22	387A 26	388A 26	389A 26	390A 28
A.11i									391B 25			
A.11jb	---	380A 36	381A 30	382A 26	383A 26	384A 24	385A 26	386A 22	387A 26	388A 26	389A 26	390A 28
A.12ba	---	---	---	---	---	---	---	---	386A 15	367A 16	388A 18	---
A.12bb	---	---	---	---	---	---	---	---	---	387A 17	---	---
A.12e	383B 17	384B 10	385B 16	386B 20	387B 16	388B 15	389B 12	390B 23	391B 20	392B 18	393B 15	394B 17
A.13a	378A 19	379A 18	---	---	---	---	---	---	386A 15	387A 16	388A 18	---
A.13ab	---	---	---	---	---	---	---	---	---	387A 17	---	---
A.13d	378A 18	380A123	380A 25	381A 20	382A 17	383A 18				387A 15	388A 17	389A 17
A.13e	383B 16	384B 9	385B 15	387B 36	387B 15	388B 14	389B 11	390B 22	391B 19	392B 19	393B 15	394B 17
A.17	---	---	---	---	---	---	---	---	---	---	---	---
A.17	---	---	---	---	---	---	---	---	---	387A 17	---	---
A.17c	378A 24	379A 22	380A 31	381A 25	382A 22	383A 22	384A 20	385A 22	386A 18	387A 21	388A 22	389A 22
A.18	---	---	---	---	---	---	---	---	---	---	---	---
A.18	---	---	---	---	---	---	---	---	---	387A 17	---	---
B.												
B.51ca	379A115	380A119	381A126	382A113	383A118	384A108	385A113	386A111	387A115	---	---	---
B.52	379A116	380A120	381A127	382A114	383A120	384A110	385A114	386A112	387A116	388A116	389A110	390A116
B.53	379A118	380A122	381A129	382A116	383A119	384A109	385A116	386A114	387A118	388A118	389A109	390A118
C.												
C.1a	378A 10	379A 10	380A 10	381A 10	382A 10	383A 10	384A 10	385A 10	386A 10	387A 10	388A 10	389A 10
C.1ba	383B 4	384B 4	385B 4	386B 7	387B 6	388B 6	389B 6	390B 6	391B 8	392B 8	393B 8	394B 8
C.1d	378A 12	379A 11	380A 14	381A 12	382A 11	383A 12	384A 11	385A 11	386A 11	387A 11	388A 11	389A 11
C.1d	383B 10	384B 7	385B 14	386B 12	387B 10	388B 11	389B 9	390B 11	391B 13	392B 13	393B 12	394B 13
C.1e	383B 9	384B 6	385B 13	386B 11	387B 9	388B 10	389B 8	390B 10	391B 12	392B 12	393B 11	394B 12
C.1f	384B 24	385B 56	386B 34	387B 30	388B 30	389B 26	390B 39	391B 39	392B 35	393B 31	394B 33	395B 33
C.3	383B 11	384B 8	385B 15	386B 13	387B 11	388B 12	389B 10	390B 12	391B 14	392B 14	393B 13	394B 14
	378A 17	379A 16	380A 19	381A 17	382A 16	383A 17	384A 16	385A 16	386A 14	387A 14	388A 16	389A 16
C.3t	379A102	380A106	381A114	383B 37	383A103	385B 60	385A100	390B 42	390B 43	390B 44	391B 45	391B 46
C.4a	379A 95	380A102	381A100	382A 93	383A 96	384A 92	385A 95	386A 91	387A 95	388A 96	389A 92	390A 97
C.4b	379A 95	380A102	381A100	382A 93	383A 96	384A 92	---	---	---	---	---	---
C.4d	379A 95	380A102	381A100	383B 34	383A 96	385B 58	385A 95	387B 32	339B 29	389B 32	389A 92	391B 47
C.4e	379A 95	380A102	381A100	382A 93	383A 96	384A 92	385A 95	386A 91	387A 95	388A 96	389A 92	390A 97
C.4f	379A 95	381B 45	381A100	382A 93	383A 96	384A 92	385A 95	386A 91	387A 95	388A 96	389A 92	390A 97
C.4h	379A 95	---	381A100	382A 93	383A 96	384A 92	---	386A 91	387A 95	388A 96	389A 92	390A 97
C.4i	379A 95	380A102	381A100	382A 93	383A 96	384A 92	385A 95	386A 91	387A 95	388A 96	389A 92	390A 97
C.4j	379A 95	381B 45	381A100	382A 93	383A 96	384A 92	385A 95	386A 91	387A 95	388A 96	389A 92	390A 97
C.5e	378A 22	---	380A 28	381A 23	382A 20	---	---	385A 20	---	---	---	389A 20
C.5f									391B 25			
C.6	379A 94	380A101	381A 98	382A 92	383A 95	394A 91	385A 94	386A 90	387A 94	388A 95	389A 91	390A 96
D.												
D.1a	379A108	380A112	381A119	382A106	383A111	385B 61	385A106	386A104	387A108	388A108	389A102	390A107
D.1ba	379A109	380A114	381A121	382A108	383A113	384A103	385A108	386A106	387A110	388A110	389A104	390A109
D.1c	390A110	390A110	390A110	390A110	390A110	390A110	390A110	390A110	390A110	390A110	390A110	390A110
D.1d	379A113	380A117	381A124	382A111	383A116	384A106	385A111	386A109	387A113	388A113	389A107	390A114
D.1e		---				---	---	---			---	---
D.1f	379A114	380A118	381A125	382A112	383A117	384A107	385A112	386A110	387A114	388A114	389A108	390A115
D.1g	379A112	380A116	381A123	382A110	383A115	384A105	385A110	386A108	387A112	388A112	389A106	390A113
F.												
F.1a	379A103	380A107	381A118	382A101	383A104	384A 96	385A101	386A 99	387A103	388A103	389A 97	390A106
F.1b	379A103	380A107	381A118	382A101	383A104	384A 96	385A101	386A 99	387A103	388A103	389A 97	390A106
F.1e	379A103	380A107	381A118	382A101	383A104	384A 96	385A101	386A 99	387A103	388A103	389A 97	390A106
F.1f	380B 28	381B 44	381A118	382A101	383A104	384A 96	385A101	386A 99	387A103	388A103	389A 97	390A106
F.1g	380B 28	381B 44	381A118	382A101	383A104	384A 96	385A101	386A 99	387A103	388A103	389A 97	390A106
F.1h	379A103	380A107	381A118	383B 38	383A104	---	---	---	---	---	---	
F.1i	379A103	380A107	381A118	382A101	383A104	384A 96	385A101	386A 99	387A103	388A103	389A 97	390A106
F.1j	379A103	380A107	381A118	382A101	383A104	384A 96	385A101	386A 99	387A103	388A103	389A 97	390A106
H.												
H.60	378A 5	379A 5	380A 4	381A 4	382A 4	383A 5	384A 5	385A 5	386A 5	387A 4	388A 5	389A 4
H.62	384B 17	385B 49	386B 27	387B 23	388B 23	389B 19	390B 32	391B 32	392B 28	393B 24	394B 26	395B 26

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A.2a	390A 7	391A 7	392A 7	393A 7	394A 7	395A 7	396A 7	397A 7	398A 7	399A 7	400A 7	401A 7
A.2b	404A 8	404A 8	404A 8	494A 8	404A 8	404A 8	404A	404A 8	404A 8	404A 8	404A 8	404A 8
A.2c	390A 7	391A 7	392A 7	393A 7	394A 7	395A 7	396A 7	397A 7	398A 7	399A 7	400A 7	401A 7
A.3a	391A 34	392A 28	393A 34	394A 32	395A 36	396A 34	397A 32	398A 36	399A 34	400A 30	401A 36	402A 38
A.3b	391A 96	392A 84	393A 96	394A 92	395A 98	396A 94	397A 94	398A 98	399A 94	400A 92	401A 96	402A100
A.3c	391A 34	392A 28	393A 34	394A 32	395A 36	396A 34	397A 32	398A 36	399A 34	400A 30	401A 36	402A 38
A.3d	390A 21	391A 29	392A 21	393A 29	394A 27	395A 29	396A 29	397A 25	398A 29	399A 29	400A 24	401A 31
A.4	391A 34	392A 28	393A 34	394A 32	395A 36	396A 35	397A 32	398A 36	399A 34	400A 30	401A 36	402A 38
A.5	391A 34	392A 28	393A 34	394A 32	395A 36	396A 35	397A 32	398A 36	399A 34	400A 30	401A 36	402A 38
A.5a	391A 96	392A 84	393A 96	394A 92	395A 98	396A 94	397A 94	398A 98	399A 94	400A 92	401A 96	402A100
A.5b	391A101	392A 88	393A100	394A 96	395A104	396A 99	397A101	398A105	399A 99	400A 99	401A100	402A105
A.6	391A 32	392A 26	393A 32	394A 30	395A 34	396A 32	397A 30	398A 34	399A 32	400A 28	401A 35	402A 36
A.6b	395B 4	396B 4	397B 4	398B 4	399B 4	400B 4	401B 4	402B 4	403B 4	404B 4	405B [illegible]	406B 6
A.7f	390A 18	391A 22	392A 18	---	394A 21	---	396A 20	397A 19	398A 24	399A 24	400A 21	401A 28
A.7g	390A 19	391A 23	392A 19	393A 23	394A 22	395A 24	396A 22	397A 20	398A 22	399A 23	400A 20	401A 27
A.7h	391A 34	392A 28	393A 34	395B 36	395A 36	396A 34	397A 32	398A 36	399A 34	400A 30	401A 36	402A 38
A.8aa	390A 7	391A 7	392A 7	393A 7	394A 7	395A 7	396A 7	397A 7	398A 7	399A 7	400A 7	401A 7
A.8ac	390A 7	391A 7	392A 7	393A 7	394A 7	395A 7	396A 7	397A 7	398A 7	399A 7	400A 7	401A 7
A.8g	390A 7	391A 7	392A 7	393A 7	394A 7	395A 7	396A 7	397A 7	398A 7	399A 7	400A 7	401A 7
A.9cb	391A 34	392A 28	393A 34	394A 32	395A 36	396A 35	397A 32	398A 36	400B 57	400A 30	401A 36	402A 38
A.9d	391A 34	392A 28	393A 34	394A 32	395A 36	396A 35	397A 32	398A 36	400B 52	400A 30	401A 36	402A 38
A.10a	390A 12	391A 13	392A 12	393A 13	394A 12	395A 14	396A 12	397A 13	398A 14	399A 14	400A 12	401A 15
A.10c	391B 43	391A 15	393B 35	393A 15	394A 14	395A 16	396A 14	397A 15	398A 16	399A 16	400A 14	401A 17
A.10d	391B 44	391A 16	393B 36	393A 16	394A 15	395A 17	396A 15	397A 16	398A 17	399A 17	400A 15	401A 18
A.10e	390A 13	391A 14	392A 13	393A 14	394A 13	395A 15	396A 13	397A 14	398A 15	399A 15	400A 13	401A 16
A.10f												403B 68
A.11g	390A 15	391A 19	392A 15	393A 20	394A 18	395A 21	396A 17	---	398A 25	399A 20	400A 17	401A 22
A.11h	391A 34	392A 28	393A 34	394A 32	395A 36	396A 34	397A 32	398A 36	399A 34	400A 30	401A 36	402A 38
A.11i	402B 51	402B 54	402B 57	402B 60	402B 63	402B 66						
A.12ba	---	391A 25	---	393A 24	394A 23	395A 26	396A 24	397A 23	---	399A 26	---	---
A.12bb	---	391A 27	---	393A 26	394A 24	395A 27	396A 25	---	---	399A 27	---	---
A.12e	395B 17	396B 20	397B 15	398B 22	399B 18	400B 34	401B 20	402B 24	403B 37	404B 35	405B 22	406B 43
A.13a	---	391A 25	---	393A 24	394A 23	395A 26	396A 24	397A 23	---	399A 26	---	---
A.13ab	---	391A 27	---	393A 26	394A 24	395A 27	396A 25	---	---	399A 27	---	---
A.13d	390A 24	391A 24	392A 23	393A 27	394A 25	395A 31	396A 27	397A 27	398A 27	399A 25	400A 25	401A 29
A.13e	395B 17	396B 19	397B 15	398B 21	399B 17	400B 33	401B 19	402B 23	403B 22	404B 34	408B 81	408B 82
A.17	---	---	---	---	---	395A 27	396A 25	---	---	---	---	---
A.17	---	---	---	---	---	395A 27	396A 25	---	---	---	---	---
A.17c	390A 20	391A 28	392A 20	393A 28	394A 26	---	396A 28	397A 24	398A 28	400A 22	400A 22	401A 30
A.18	---	---	---	---	---	395A 27	396A 25	---	---	399A 27	---	---
A.18	---	391A 27	---	393A 28	394A 24	---	396A 26	---	---	---	---	---
B.												
B.52	391A118	392A104	393A122	394A118	395A122	396A118	397A120	398A124	399A128	400A120	401A116	402A132
B.53	391A120	392A103	393A121	394A120	395A124	396A120	397A122	398A126	399A127	400A122	401A118	402A131
C.												
C.1a	390A 10	391A 11	392A 10	393A 10	394A 10	395A 10	396A 10	397A 10	398A 10	399A 10	400A 10	401A 10
C.1ba	395B 8	396B 8	397B 8	398B 8	399B 8	400B 8	401B 8	402B 8	403B 8	404B 8	405B 8	406B 8
C.1d	390A 11	391A 12	392A 11	393A 12	394A 11	395A 13	396A 11	397A 12	398A 13	399A 13	400A 11	401A 14
C.1d	395B 13	396B 13	397B 11	398B 14	399B 13	400B 19	401B 15	402B 17	403B 21	404B 22	405B 16	406B 25
C.1e	395B 12	396B 12	397B 10	398B 13	399B 12	400B 18	401B 14	402B 16	403B 20	404B 21	405B 15	406B 24
C.1f	396B 35	397B 31	398B 41	399B 33	400B 49	401B 35	402B 39	403B 53	404B 53	405B 38	406B 59	407B 49
C.3	395B 14	396B 14	397B 12	398B 15	399B 14	400B 20	401B 16	402B 18	403B 22	404B 23	405B 17	406B 26
	390A 14	391A 17	392A 14	393A 17	394A 16	395A 18	396A 16	397A 17	398A 18	399A 18	400A 16	401A 19
C.3t	393B 40	393B 41	393A108	394A105	396B 41	398B 44	398B 46	399B 36	399A113	401B 44	403B 64	403B 65
C.4a	391A103	392A 90	393A102	394A 98	395A106	396A102	397A103	398A107	399A102	400A101	401A102	402A108
C.4d	391A103	393B 37	393A102	394A 98	396B 38	397B 34	397A103	400B 62	399A102	401B 38	403B 56	403B 59
C.4e	391A103	392A 90	393A102	394A 98	395A106	397B 34	397A103	398A107	399A102	400A101	402B 42	402A108
C.4f	391A103	392A 90	393A102	394A 98	395A106	396A102	397A103	398A107	399A102	400A101	401A102	402A108
C.4h	391A103	392A 90	393A102	394A 98	395A106	396A102	397A103	398A107	399A102	400A101	401A102	402A108
C.4i	391A103	392A 90	393A102	394A 98	395A106	396A102	397A103	398A107	399A102	400A101	401A102	402A108
C.4j	391A103	392A 90	393A102	394A 98	395A106	396A102	397A103		399A102	400A101	401A102	402A108
C.5e	390A 17	391A 21	392A 17	393A 22	394A 20	395A 21	396A 17	397A 22	399B 37	399A 22	400A 19	401A 24
C.5f	402B 51	402B 54	402B 57	402B 60	402B 63	402B 66						
C.6	391A102	392A 89	393A101	394A 97	395A105	396A100	397A102	398A106	399A100	400A100	401A101	402A106
D.												
D.1a	391A114	392A 97	393A114	394A111	395A115	397B 39	397A114	398A117	399A120	400A113	401A109	402A125
D.1ba	391A116	392A 99	393A116	394A113	395A117	396A113	397A116	398A119	399A122	400A115	401A111	402A127
D.1c												
D.1d	391A117	392A101	393A119	394A116	395A120	396A116	397A119	398A122	399A125	400A118	401A114	402A130
D.1e	412B 69	---	412B 70	412B 71	412B 72	---	412B 73	---	412B 74	412B 76	---	412B 77
D.1f	392B 38	392A102	393A120	394A117	395A121	396A117	398B 47	398A123	399A126	400A119	401A115	403B 69
D.1g		392A100	393A118	394A115	395A119	396A115	397A118	398A121	399A124	400A117	401A113	402A129
F.												
F.1a	391A109	393B 44	393A109	394A110	395A114	396A110	397A109	398A116	399A115	400A112	402B 47	402A124
F.1b	391A109	392A 96	393A109	394A110	395A114	396A110	397A109	398A116	399A115	400A112	401A108	406B 73
F.1e	391A109	393B 44	393A109	394A110	395A114	396A110	397A109	398A116	399A115	400A112	402B 47	402A124
F.1f	393B 44	394B 36	394B 36	394A110	395A114	396A110	397A109	400B 70	400B 70	402B 47		
F.1g	393B 44	394B 36	394B 36	394A110	395A114	396A110	397A109	400B 70	---	402B 47		
F.1h												
F.1i	391A109	392A 96	393A109	394A110	395A114	396A110	397A109	398A116	399A115	400A112	401A108	402A124
F.1j	391A109	392A 96	393A109	394A110	395A114	396A110	397A109	398A116	399A115	400A112	401A108	402A124
F.1k					395A114	396A110	397A109	398A116				
H.												
H.60	390A 4	391A 5	392A 5	393A 5	394A 5	395A 4	396A 5	397A 4	398A 4	399A 4	400A 4	401A 4
H.62	396B 28	397B 24	398B 34	399B 26	400B 42	401B 28	402B 32	403B 46	404B 16	405B 30	406B 52	407B 42

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A.2a	402A 9	403A 9	404A 9	405A 9	406A 9	407A 9	408A 9	409A 9	410A 11	411A 11	412A 9	413A 11
A.2b	415A 10	415A 10	415A 10	415A 10	415A 10	415A 10	415A 10	415A 10	415A 10	415A 10	415A 10	415A 10
A.2c	402A 9	403A 9	404A 9	405A 9	406A 9	407A 9	408A 9	409A 9	410A 11	411A 11	412A 9	413A 11
A.3a	403A 46	404A 40	405A 48	406A 54	407A 46	408A 50	409A 38	410A 48	411A 46	412A 40	413A 48	414A 48
A.3b	403A108	404A 96	405A110	406A114	407A108	408A110	409A100	410A110	411A106	412A102	413A108	414A110
A.3c	403A 46	404A 40	405A 48	406A 54	407A 46	408A 50	409A 38	410A 48	411A 46	412A 40	413A 48	414A 48
A.3d	402A 33	404A 33	404A 33	405A 36	406A 40	407A 40	408A 41	409A 31	410A 41	411A 40	412A 34	413A 42
A.4	403A 47	404A 40	405A 48	406A 54	407A 46	408A 50	409A 38	410A 48	411A 46	412A 40	413A 48	414A 48
A.5	403A 47	404A 40	405A 48	406A 54	407A 46	408A 50	409A 38	410A 48	411A 46	412A 40	413A 48	414A 48
A.5a	403A108	404A 96	405A110	406A114	407A108	408A110	409A100	410A110	411A106	412A102	413A108	414A110
A.5b	403A114	404A104	405A119	406A124	407A118	408A119	409A110	410A120	411A116	412A114	413A116	414A121
A.6	403A 44	404A 38	405A 46	406A 52	407A 44	408A 48	409A 38	410A 46	411A 44	412A 38	413A 46	414A 46
A.6b	407B 4	408B 4	409B 4	410B 70	411B 4	412B 4	413B 4	414B 4	415B 4	416B 4	417B 4	418B 4
A.7f	402A 29	403A 36	404A 29	405A 31	406A 35	407A 34	408A 37	409A 28	410A 37	411A 36	—	413A 38
A.7g	402A 28	403A 35	404A 27	405A 32	406A 36	407A 36	408A 38	409A 29	410A 39	411A 35	412A 30	413A 36
A.7h	403A 46	404A 40	405A 48	406A 54	407A 46	408A 50	409A 38	410A 48	411A 46	412A 40	413A 48	414A 48
A.8aa	402A 9	403A 9	404A 9	405A 9	406A 9	407A 9	408A 9	409A 9	410A 11	411A 11	412A 9	413A 11
A.8ac	402A 9	403A 9	404A 9	405A 9	406A 9	407A 9	408A 9	409A 9	410A 11	411A 11	412A 9	413A 11
A.8g	402A 9	403A 9	404A 9	405A 9	406A 9	407A 9	408A 9	409A 9	410A 11	411A 11	412A 9	413A 11
A.9cb	403A 47	404A 40	405A 48	406A 54	407A 46	408A 50	409A 38	410A 48	411A 46	—	—	—
A.9d	403A 47	404A 40	405A 48	406A 54	407A 46	408A 50	409A 38	410A 48	411A 46	—	—	—
A.10a	402A 16	403A 20	404A 17	405A 17	406A 19	407A 20	408A 19	409A 17	410A 23	411A 20	412A 18	413A 21
A.10c	402A 19	403A 23	404A 20	405A 20	406A 22	407A 23	408A 22	409A 20	412B 58	411A 23	412A 21	413A 24
A.10d	402A 20	403A 24	404A 21	405A 21	406A 23	407A 24	408A 23	409A 21	412B 59	411A 24	412A 22	413A 25
A.10e	402A 18	403A 22	404A 19	405A 19	406A 21	407A 22	408A 21	409A 19	410A 25	411A 22	412A 20	413A 23
A.10f	402A 17	403A 21	404A 18	405A 18	406A 20	407A 21	408A 20	409A 19	410A 24	411A 21	412A 19	413A 22
A.11k	403A116	404A108	405A122	406A129	407A123	408A123	410B 82	410A123	411A120	412A118	413A119	414A126
A.11g	402A 24	403A 29	404A 24	405A 29	406A 30	407A 29	408A 31	409A 25	416B 96	416B 52	417B 41	418B 31
A.11h	403A 46	404A 40	405A 48	406A 54	407A 46	408A 50	409A 38	410A 48	411A 46	—	—	—
A.11i									—	—	—	—
A.12ba	402A 30	—	—	—	—	—	—	—	—	—	—	—
A.12bb	402A 31	—	—	—	—	—	408A 43	—	—	—	412A 29	—
A.12e	407B 33	408B 62	410B100	411B 88	413B 83	413B 88	413B 63	414B 32	416B 91	416B 46	417B 36	418B 26
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A.13a	402A 30	—	—	—	—	—	—	—	—	—	—	—
A.13ab	402A 31	—	—	—	—	—	408A 43	—	—	—	412A 29	—
A.13d	402A 34	403A 37	404A 31	405A 37	406A 41	407A 35	408A 39	409A 33	410A 39	414B 50	414B 51	414B 52
A.13e	408B 83	408B 61	409B 35	410B 67	411B 53	412B 44	413B 62	414B 31	415B 53	416B 45	417B 35	418B 25
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A.18	—	—	—	—	—	—	—	—	—	—	—	—
A.18	402A 31	—	—	—	—	—	—	—	—	—	412A 29	—
B.												
B.52	403A148	404A144	405A158	406A171	407A168	408A168	409A142	410A160	411A158	412A162	413A160	414A172
B.53	403A150	404A146	405A157	406A170	407A167	408A170	409A144	410A162	411A160	412A161	413A159	414A174
C.												
C.1a	402A 12	403A 12	404A 12	405A 12	406A 12	407A 12	408A 12	409A 12	410A 14	411A 14	412A 12	413A 14
C.1ba	407B 8	408B 8	409B 8	410B 8	411B 8	412B 8	413B 8	414B 8	415B 6	416B 8	417B 6	
C.1d	402A 15	403A 19	404A 16	405A 16	406A 18	407A 19	408A 18	409A 16	410A 22	411A 19	412A 17	413A 20
C.1d	407A 22	408B 35	409B 24	410B 29	411B 25	412B 29	413B 35	414B 24	415B 32	416B 30	417B 25	
C.1e	407A 21	408B 34	409B 23	410B 28	411B 24	412B 28	413B 34	414B 23	415B 31	416B 29	417B 24	
C.1f	408B 77	409B 47	410B 80	411B 66	412B 55	413B 80	414B 48	415B 65	416B 70	417B 58		
C.3	407B 23	408B 36	409B 25	410B 30	411B 26	412B 30	413B 36	414B 25	415B 33	416B 31	417B 26	418B 6
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C.3t	405B 45	405B 48	406B 62	407B 67	407A151	408A152	409A129	410A147	411A144	412A148	413A147	414A159
C.4a	403A132	404A122	405A138	406A144	407B 52	408A138	411B 72	411B 75	411A135	414B 53	414B 55	414A142
C.4d	404B 56	405B 40	406B 64	407B 59	407A139	408A138	409A115	410A139	412B 60	412A134	413A134	414A142
C.4e	403A132	404A122	405A138	406A144	407A139	408A138	409A115	410A139	411A135	412A134	413A134	414A142
C.4f	403A132	404A122	405A138	406A144	407B 52	408A138	409A115	410A139	411A135	412A134	413A134	414A142
C.4h	403A132	404A122	405A138	—	—	—	—	—	411A135		413A134	414A142
C.4i	403A132	404A122	405A138	406A144	407A139	408A138	409A115	410A139	411A135	412A134	413A134	
C.4j	406B 70	404A122	405A138	406A144	407B 52	408A138	409A115	410A139	411A135	412A134	413A134	414A142
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C.5f									—	—	—	—
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D.1ba	403A144	404A141	405A153	406A164	407A162	408A162	409A137	410A155	411A153	412A157	413A154	414A166
D.1c	414A167	414A167	414A167	414A167	414A167	414A157	414A167	414A167	414A167	414A167	414A167	414A167
D.1d	403A145	404A143	405A156	406A167	407A165	408A165	409A140	410A158	411A156	412A160	413A157	414A170
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F.												
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F.1b	406B 73	406B 73	406B 73	406A161	411A 69	411A 69	411A 69			415B 72	415B 72	415B 72
F.1e	403A138	404A138	405A150	407B 70	407A155	408A155	410B 98	410A152	411A150	412A154	414B 57	414A161
F.1f												
F.1g												
F.1h												
F.1i	403A138	404A138	405A150	406A161	407A155	408A155	409A134	410A152	411A150	412A154	413A149	418B 74
F.1j	403A138	404A138	405A150	406A161	407A155	408A155	409A134	410A152	411A150	412A154	413A149	418B 74
F.1k												
H.												
H.60	402A 5	403A 5	404A 4	405A 4	406A 4	407A 4	408A 5	409A 5	410A 5	411A 4	412A 4	413A 5
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A.2b	428A 9	428A 9	428A 9	428A 9	428A 9	428A 9	428A 9	428A 9	428A 9	428A 9	428A 9	428A 9
A.2c	414A 11	415A 11	416A 11	417A 9	418A 11	419A 11	420A 11	421A 11	422A 11	423A 11	424A 11	425A 11
A.3a	415A 52	416A 50	417A 44	418A 48	419A 48	420A 50	421A 50	422A 52	423A 50	424A 50	425A 48	426A 50
A.3b	418B 50	418B 60	417A106	418A108	419A110	420A110	421A112	422A 11	423A110	424A112	425A108	428A150
A.3c	415A 52	416A 50	417A 44	418A 48	419A 48	420A 50	421A 50	422A 52	423A 50	424A 50	425A 48	426A 50
A.3d	414A 42	415A 44	416A 42	417A 36	418A 38	419A 38	420A 40	421A 40	422A 42	423A 40	424A 40	425A 36
A.3e	415A 52	416A 50	417A 44	418A 48	419A 48	420A 50	421A 50	422A 52	423A 50	424A 50	425A 48	426A 50
A.4	415A 52	416A 50	417A 44	418A 48	419A 48	420A 50	421A 50	422A 52	423A 50	424A 50	425A 48	426A 50
A.5	415A 52	416A 50	417A 44	418A 48	419A 48	420A 50	421A 50	422A 52	423A 50	424A 50	425A 48	426A 50
A.5a	418B 50	418B 60	417A106	418A108	419A110	420A110	421A112	422A114	423A110	424A112	425A108	428A150
A.5b	415A125	416A116	417A118	418A118	419A123	420A121	421A125	422A129	423A124	424A125	425A121	426A112
A.6	415A 48	416A 46	417A 40	418A 42	419A 43	420A 44	421A 44	422A 46	423A 44	424A 44	425A 40	426A 42
A.6b	419B 4	420B 4	421B 4	426B 38	426B 39	426B 40	426B 41	427B 48	429B 38	430B 30	432B 42	432B 43
A.6c	415A 49	416A 47	417A 41	418A 43	419A 44	420A 46	421A 46	422A 48	423A 46	424A 46	425A 42	426A 44
A.6d				418A 45	419A 45	420A 48	421A 48	422A 50	423A 48	424A 48	425A 44	426A 46
A.7f	---	---	416A 38	417A 33	418A 34	419A 34	420A 35	421A 37	422A 38	423A 41	425B 28	425A 37
A.7g	414A 34	415A 40	416A 36	417A 32	418A 33	419A 33	420A 34	421A 36	423B 75	425A 46	425A 47	425A 48
A.7h	415A 52	416A 50	417A 44	418A 48	419A 48	420A 50	421A 50	422A 52	423A 50	424A 50	425A 48	426A 50
A.8aa	414A 11	415A 11	416A 11	417A 9	418A 11	419A 11	420A 11	421A 11	422A 11	423A 11	424A 11	425A 11
A.8ac	414A 11	415A 11	416A 11	417A 9	418A 11	419A 11	420A 11	421A 11	422A 11	423A 11	424A 11	425A 11
A.8g	414A 11	415A 11	416A 11	417A 9	418A 11	419A 11	420A 11	422B 84	422A 11	423A 11	424A 11	425A 11
A.9cb	---	---	---	---	419A 48	420A 50	421A 50	422A 52	423A 50	424A 50	425A 48	426A 50
A.9d	---	---	---	---	419A 48	420A 50	421A 50	422A 52	423A 50	424A 50	425A 48	426A 50
A.10a	414A 24	415A 25	416A 25	417A 21	419B 52	420B 69	420A 24	422B 85	422A 25	423A 27	424A 25	426A148
A.10c	414A 27	415A 28	416A 28	417A 24	418A 25	420B 70	420A 27	421A 28	422A 28	423A 30	424A 28	425A 27
A.10d	414A 28	415A 29	416A 29	417A 25	418A 26	420B 71	420A 28	421A 29	422A 29	423A 31	424A 29	415A 28
A.10e	414A 26	415A 27	416A 27	417A 23	418A 24	419A 26	420A 26	421A 27	422A 27	423A 29	424A 27	425A 26
A.10f	414A 25	415A 26	416A 26	417A 22	418A 23	419A 25	420A 25	421A 26	422A 26	423A 28	424A 26	425A 25
A.11k	415A129	416A120	417A119	418A122	419A126	420A124	421A129	422A133	423A128	426A158	---	---
A.11g	419B 33	420B 53	421B 35	422B 31	423B 17	424B 29	425B 20	426B 24	427B 28	428B 24	429B 26	430B 16
A.12ba	414A 36	---	---	---	---	---	---	---	---	---	---	---
A.12bb	414A 37	---	---	---	---	---	---	---	424B 39	---	---	---
A.12e	421B 43	420B 48	421B 30	422B 26	424B 40	427B 37	426B 33	427B 42	430B 24	[illegible]	429B 37	434B 50
A.13a	414A 36	---	---	---	---	---	---	---	---	---	---	---
A.13ab	414A 37	---	---	---	---	---	---	---	424B 39	---	---	---
A.13d	414A 39	415A 45	416A 39	417A 37	418A 35	419A 35	420A 37	422B 89	422A 39	424B 36	424A 37	426A146
A.13e	419B 32	419B 47	421B 29	422B 25	423B 17	424B 28	425B 19	426B 23	427B 27	428B 23	429B 25	430B 15
A.13f	414A 38	428A 39	416A 35	417A 31	418A 32	419A 32	420A 36	421A 35	422A 37	423A 37	424A 36	425A 32
A.17	---	---	---	---	---	---	---	---	---	---	---	---
A.17	414A 37	---	---	---	---	---	---	---	424B 39	---	---	---
A.17									423B 73	424B 38	425B 29	426A116
A.17c	415A 42	415A 42	417A 34	417A 34	418A 36	419A 36	420A 38	421A 38	422A 40	423A 38	424A 38	425A 34
A.18	---	---	---	---	---	---	---	---	---	---	---	---
A.18	414A 37	---	---	---	---	---	---	---	424B 39	---	---	---
B.												
B.52	415A162	416A166	417A166	418A166	419A168	420A166	421A166	422A178	423A174	424A154	425A152	426A142
B.53	415A161	416A165	417A165	418A165	419A167	420A168	421A165	422A180	423A173	424A153	425A151	426A141
C.												
C.1a	414A 14	414A 15	416A 14	417A 12	418A 14	419A 14	420A 14	421A 14	422A 14	423A 15	424A 15	425A 15
C.1ba	420B 82	422B 38	423B 25	430B 32	430B 68	431B 34	434B 15	436B 50				
C.1d	414A 23	415A 24	416A 24	417A 20	418A 23	419A 24	420A 23	421A 25	423B 72	423A 26	424A 24	425A 24
C.1d	420B120	422B 72	424B 45	430B 66	430B108	431B 67	434B 49	436B 89				
C.1e	420B119	422B 72	423B 58	430B 64	430B107	431B 66	434B 48	436B 88				
C.1f	422B 91	423B 83	430B 31	430B 67	431B 70	434B 55	436B 92					
C.3	419B 8	420B 8	421B 10	422B 4	423B 4	424B 4	425B 5	426B 5	427B 5	428B 5	429B 5	420B 5
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C.3t	415A147											
C.4a	417B 60	417B 62	417A138	420B 72	420B 75	420A139	423B 76	423B 78	423A143	426A149	426A153	426A117
C.4d	415A129	416A134	417A138	418A137	419A142	420A139	421A145	422A149	423A143	424A130	425A125	426A117
C.4e	415A129	416A134	417A138	418A137	419A142	420A139	422B 86	422A149	423A143	424A130	425A125	426A117
C.4f	415A129	416A134	417A138	418A137	419A142	420A139	421A145	---	---	---	---	---
C.4h	415A129	416A134	417A138	418A137	419A142	---	421A145	422A149	423A143	424A130	425A125	426A117
C.4i	415A129	416A134	417A138	418A137	419A142	---	---	422A149	423A143	424A130	425A125	426A117
C.4j	415A129	416A134	417A138	418A137	419A142	420A139	421A145	422A149	---	424A130	425A125	426A117
C.4k								422A149	423A143		425A125	
C.4l								422A149	423A143		425A125	
C.5e	419B 33	420B 53	421B 35	422B 31	423B 17	424B 29	425B 20	426B 24	427B 28	428B 24	429B 26	430B 16
C.6	415A126	416A117	417A119	418A119	419A124	420A122	421A126	422A130	423A125	424A126	425A122	426A113
D.												
D.1a	415A155	416A158	417A158	418A158	419A160	420A160	421A159	422A170	423A166	424A147	425A144	426A133
D.1ba	415A157	416A160	417A160	418A160	419A162	420A162	421A161	422A172	423A168	424A149	425A146	426A135
D.1c	426A136	426A136	426A136	426A136	426A136	426A136	426A136	426A136	426A136	426A136	426A136	426A136
D.1ca	426A137	426A137	426A137	426A137	426A137	426A137	426A137	426A137	426A137	426A137	426A137	426A137
D.1d	415A158	416A163	417A163	418A163	419A165	420A165	421A164	422A175	423A171	424A152	425A149	426A140
D.1e	---	437B 47	---	437B 48	---	---	---	437B 51	---	---	---	--
D.1f	415A160	416A164	418B 76	419B 63	419A166	421B 42	422B 90	422A177	423A172	425B 33	425A150	427A164
D.1g	416B 90	416A162	417A162	418A162	419A164	420A164	421A163	422A174	423A170	424A151	425A148	426A139
D.1h	414A 43	415A 46	416A 43	417A 38	418A 39	419A 39	420A 41	421A 41	422A 43	423A 42	424A 41	425A 38
F.												
F.1a	415A154	416A151	417A151	418A151	419A153	420A155	421A158	422A165	423A161	[illegible]	427A159	[illegible]
F.1b	416B 88	416A151	417A151	418A151	419A153	420A155	421A158	422A165	423A161	425B 32	425A143	426A132
F.1e	415A154	416A151	417A151	418A151	420B 78	420A155	421A158	422A165	423A161	425B 32	427A159	427A159
F.1f												
F.1h	419B 62	419B 62	419B 62	419B 62	419A153	420A155	421A158	422A165	423A161	424A146	425A143	426A132
F.1i	415A154	416A151	417A151	418A151	419A153	420A155	421A158	422A165	423A161	427A159	425A143	426A132
F.1j	415A154	416A151	417A151	418A151	419A153	420A155	421A158	422A165	423A161	427A159	425A143	426A132
F.1k												
F.1l		417B 67	418B 72	419B 58	420B 79	420A155	421A158	423B 81	425B 32	[illegible]	426A177	427A159
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A.2b												
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A.3c	427A 50	428A 44	429A 42	430A 52	431A 48	432A 50	433A 48	434A 46	435A 50	436A 50	437A 60	
A.3d	426A 38	427A 38	428A 34	429A 35	430A 44	431A 41	432A 42	433A 40	434A 38	435A 42	436A 42	437A 48
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A.4	427A 50	428A 44	429A 42	430A 52	431A 48	432A 50	433A 48	434A 46	435A 50	436A 50	437A 60	
A.5	427A 50	428A 44	429A 42	430A 52	431A 48	432A 50	433A 48	434A 46	435A 50	436A 50	437A 60	
A.5a	427A112	428A102	429A104	430A112	431A110	432A110	433A110	434A108	435A110	436A112	437A120	
A.5b	427A122	428A112	429A115	430A123	431A121	432A128	433A127	434A125	435A127	436A127	437A134	
A.6	427A 42	428A 38	429A 39	430A 48	431A 44	432A 46	433A 44		435A 46	436A 46	437A 52	
A.6b	434B 14		436B 96	436B 97	437B 40							
A.6c	427A 44	428A 40	429A 40	430A 49	431A 45	432A 47	433A 45	434A 43	435A 47	436A 47	437A 54	
A.6d	427A 46	428A 42	429A 41	430A 50		432A 48	433A 46	434A 44	435A 48	436A 48	437A 56	
A.6e	436B 93	436B 94	434B 56	435B 85	435B 47	436B 46	436B 36					
A.7f	426A 39	427A 39	428A 35	429A 36	430A 41	432A167	432A 37	433A 35	436A177	436A177	436A 39	437A 44
A.7g	427A 48		431A162	430A 51	431A 46	432A 49	433A 47	434A 45	435A 49	436A 49	437A 58	
A.7h	427A 50	428A 44	429A 42	430A 52	431A 48	432A 50	433A 48	434A 46	435A 50	436A 50	437A 60	
A.8aa	426A 10	427A 9	428A 10	429A 9	430A 11	431A 11	432A 11	433A 11	434A 11	435A 11	436A 11	437A 11
A.8ac	426A 10	427A 9	428A 10	429A 9	430A 11	431A 11	432A 11	433A 11	434A 11	435A 11	436A 11	437A 11
A.8g	426A 10	427A 9	428A 10	429A 9	430A 11	431A 11	432A 11	433A 11	434A 11	435A 11	436A 11	437A 11
A.9cb	427A 50	428A 44	429A 42	430A 52	431A 48		433A 48	434A 46	435A 50	436A 50	437A 60	
A.9d	427A 50	428A 44	429A 42	430A 52	431A 48		433A 48	434A 46	435A 50	436A 50	437A 60	
A.10a	426A 23	427A 23	428A 20	429A 22	430A 26	432A166	432A 24	433A 22	434A 25	436A176		
A.10c	426A 26	427A 26	429A150	429A 25	430A 29	431A 28	432A 27	433A 25	434A 28	435A 30	436A 29	437A 34
A.10d	426A 27	427A 27	429A151	429A 26	430A 30	431A 29	432A 28	433A 26	434A 29	435A 31	436A 30	437A 35
A.10e	426A 25	427A 25	428A 22	430A175	430A 28	431A 27	432A 26	433A 24	434A 27	435A 29	436A 28	437A 33
A.10f	426A 24	427A 24	428A 21	429A 23	430A 27	431A 26	432A 25	433A 23	434A 26	435A 28	436A 27	437A 32
A.11g	431B 27	432B 30	433B 26	434B 6	435B 41	436B 41	437B 30					
A.12bb	426A 32	427A 33	428A 28	429A 32	431A160	431A 38	432A 38	---	---	---	---	---
A.12e	437B 42											
A.13a	---	427A 32	428A 27	429A 32	---	431A 38	432A 39	433A 36	---	---	---	---
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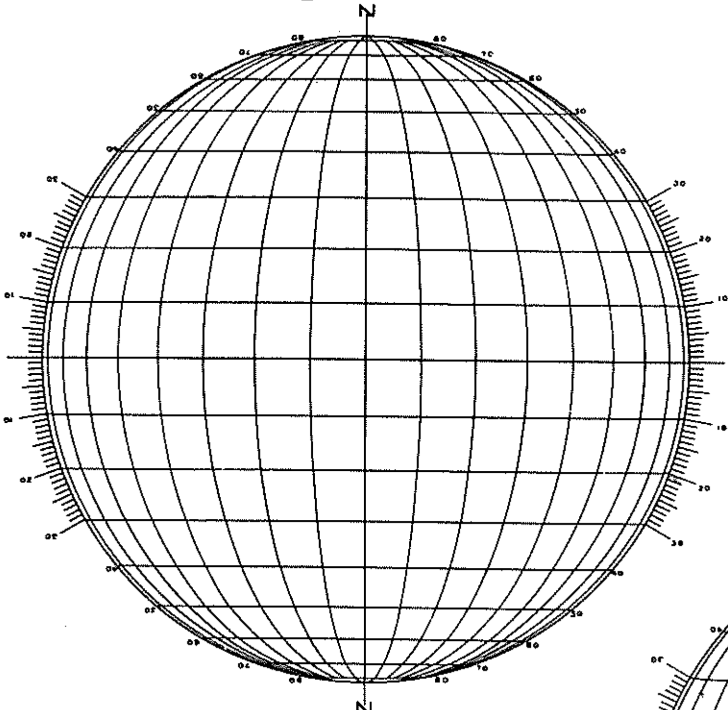
A.13d	426A 34	427A 35	428A 30	430A164	430A 37	431A 36	432A 34	433A 31	434A 34	435A 37	436A 37	437A 41
A.13e	432B 36	432B 29	435B 50	434B 5	436B100	436B 40	437B 29					
A.13f	426A 33	427A 34	428A 29	429A 33	431A161	431A 39	432A 39	433A 37	435A160	435A 43	436A 43	437A 45
A.17	426A 32	427A 33	428A 28	429A 32	431A160	431A 38	432A 38	433A 37	---	---	---	---
A.17	---	---	429A119	430A127	431A125	432A132	433A131	---	---	436A132		
A.17c	426A 36	427A 36	428A 32	430A 42	430A 42	432A 40	432A 40	433A 38	436A 40	436A 40	436A 40	437A 46
A.18	426A 32	427A 33	428A 28	429A 32	431A160	431A 38	432A138	---	---	---	---	---
B.												
B.52	427A154	428A140	429A146	430A160	431A156	432A162	433A154	434A154	435A156	436A172	437A170	
B.53	427A153	428A139	429A148	430A159	431A155	432A164	433A156	434A153	435A158	436A174	437A169	
C.												
C.1a	426A 15	427A 14	428A 15	429A 14	430A 16	431A 16	432A 16	433A 16	434A 16	435A 16	436A 16	437A 16
C.1ba												
C.1d	427A158	427A 22	---	---	430A 46	431A 25	432A 23	433A 21	434A 24	435A 27	436A 26	437A 31
C.1d												
C.1e												
C.1f												
C.3	431B 5	432B 5	433B 5	435B 51	435B 5	436B 5	437B 5					
	426A 28	427A 28	428A 23	429A 27	430A 31	431A 30	432A 29	433A 27	434A 30	435A 32	436A 31	437A 36
C.4a	427A126	428A116	429A120	430A128	431A126	432A133	433A132	434A129	435A131	436A133	437A139	
C.4d	427A126	428A116	429A120	430A128	431A126	432A133	433A132	434A129	435A131	436A133	437A139	
C.4e	427A126	428A116	429A120	430A128	431A126	432A133	434A177	434A129	435A131	436A133	437A139	
C.4f	---	---	429A120	430A128	431A126	433A158	433A132	434A129	435A131	436A133	437A139	
C.4h	427A126	429A116	439A120	430A128	431A126	432A133	433A132	434A129	435A131	436A133	437A139	
C.4i	427A126	428A116	429A120	430A128	431A126	432A133	434A177	434A129	435A131	436A133	437A139	
C.4j	427A126	---										
C.4k	427A126	428A116	429A120	430A128	431A126	433A158	433A132	434A129	435A131	436A133	437A139	
C.4l	427A126	428A116	429A120	430A128	431A126	433A158	433A132	434A129	435A131	436A133	437A139	
C.5e	431B 27	432B 30	433B 26	434B 6	435B 41	436B 41	437B 30					
C.6	427A123	428A113	429A116	430A124	431A122	432A129	433A128	434A126	435A128	436A128	437A135	
D.												
D.1a	427A148	429A154	429A142	430A155	431A151	432A158	433A150	434A147	435A152	436A166	437A163	
D.1ba	427A150	428A137	429A144	430A157	431A153	432A160	433A152	434A149	435A154	436A168	437A165	
D.1c												
D.1ca												
D.1d	427A151	428A138	429A145	430A158	431A154	432A161	433A153	434A152	435A155	436A171	437A168	
D.1e												
D.1f	427A152	431A168	431A168	431A169	433A168	433A168	434A188	435A164	436A179	437A176	437A169	
D.1g	428A147	429A155	431A166	431A167	433A167	434A186	434A187		436A178	436A168	437A176	
D.1h	426A 40	427A 40	428A 36	429A 37	430A 45	431A 42	432A 43	433A 41	434A 40	435A 44	436A 44	437A 49
F.												
F.1a	428A146	429A153	429A137	430A154	432A170	433A165	434A183	434A146	435A151	436A165		
F.1b	428A146	428A134	430A167	430A154	431A150	433A165	433A147	435A161		436A165		
F.1e	428A146	429A153	429A137	430A154	432A170	433A165	434A183	434A146	435A151	436A165		
F.1h	427A147	428A134	429A137	430A154	431A150	432A155	433A147	434A146	435A151	436A165	437A162	
F.1i	427A147	428A134	429A137	430A154	431A150	432A155	433A147	434A146	435A151	436A165	437A162	
F.1j	427A147	428A134	429A137	430A154	431A150	430A155	433A147	434A146	435A151	436A165	437A162	
F.1k	---	---	---	---	---	---	---	---	---	---		
F.1l	428A146	430A167	430A167	431A163	433A165	435A161	437A175	437A175	437A175			
H.												
H.60	426A 4	427A 4	428A 4	429A 4	430A 5	431A 5	432A 5	433A 5	434A 5	435A 5	436A 5	437A 5
H.62												

*See "Key" on pages 63 and following.

DEGREES FROM CENTRAL MERIDIAN

June 3 - June 10
Dec 4 - Dec 11

B = +0°

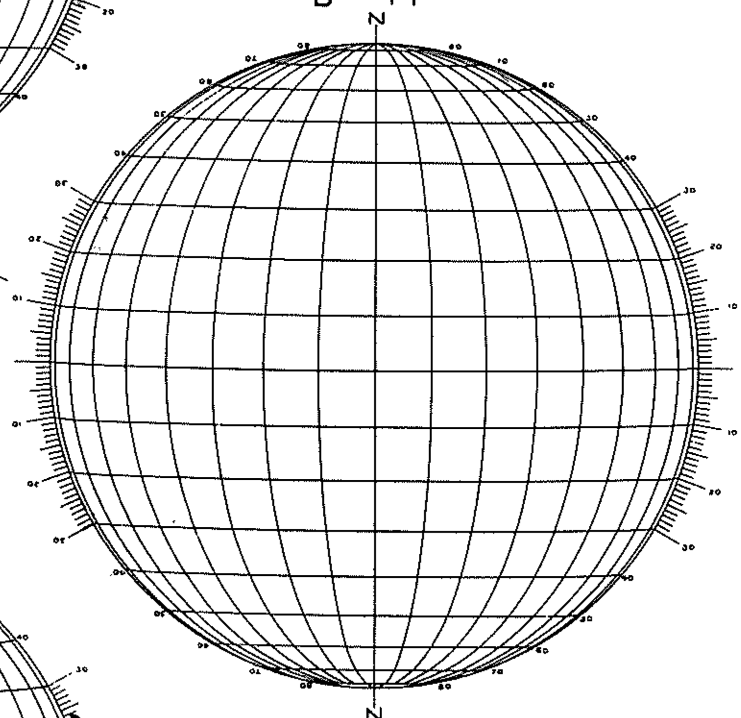


B = −0°

Dec 4 - Dec 11
June 3 - June 10

June 11 - June 18
Nov 26 - Dec 3

B = +1°

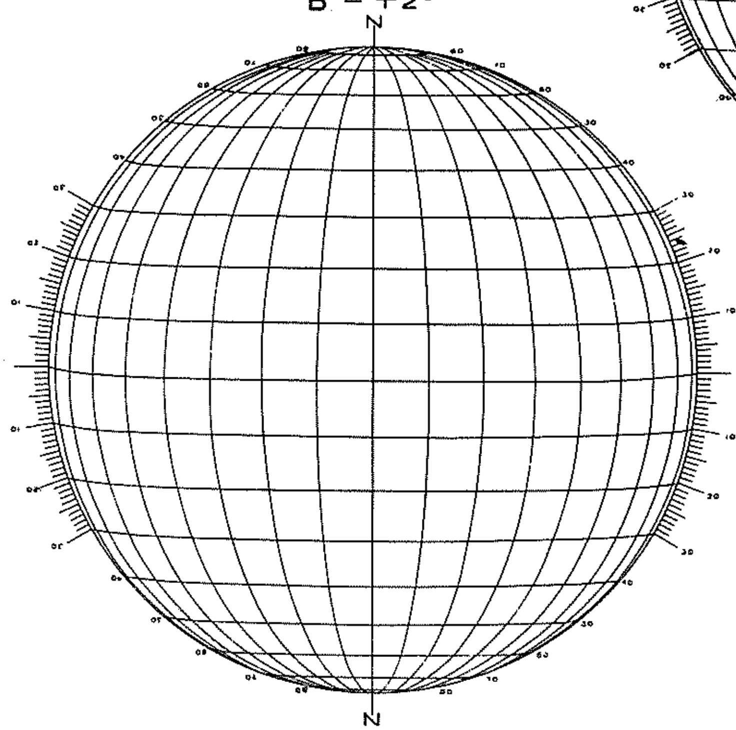


B = −1°

Dec 12 - Dec 19
May 25 - June 2

June 19-June 27
Nov 18 - Nov 25

B = +2°

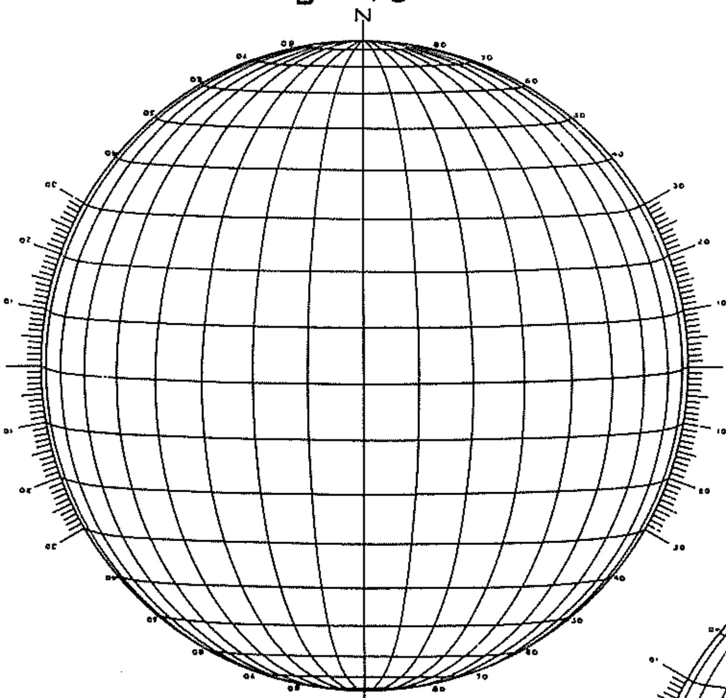


B = −2°

Dec 20-Dec 27
May 17 - May 24

June 28 – July 6
Nov 10 – Nov 17

B = +3°

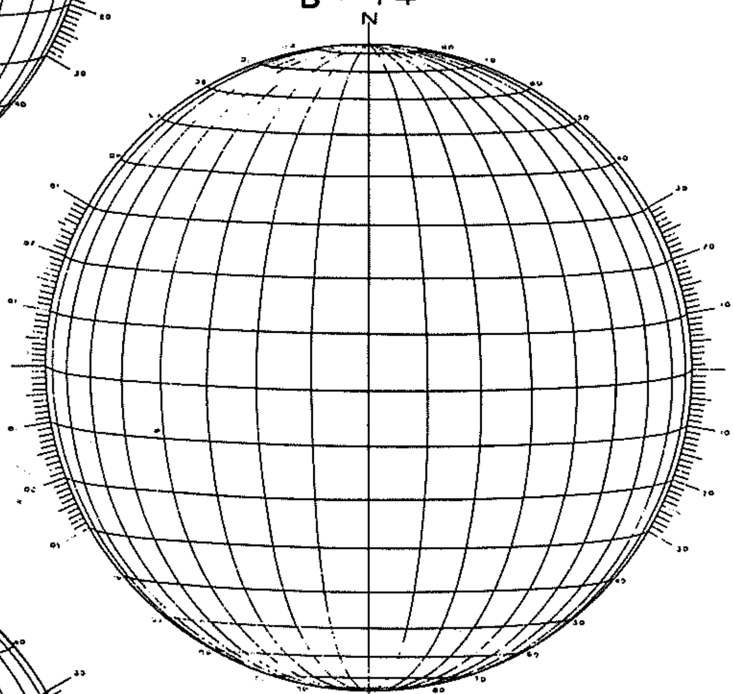


B = −3°

May 8 – May 16
Dec 28 – Jan 4

July 7 – July 16
Oct 31 – Nov 9

B = +4°

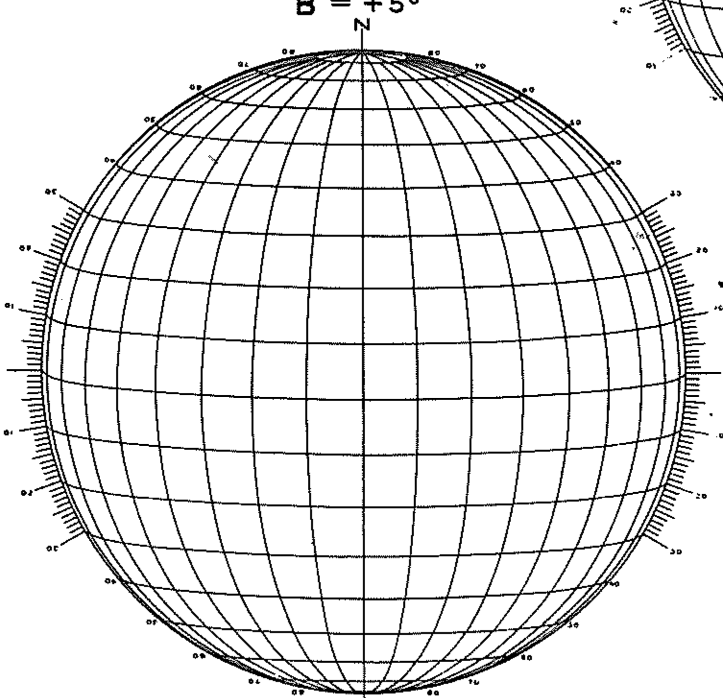


B = −4°

Apr 28 – May 7
Jan 5 – Jan 14

July 17 – July 27
Oct 20 – Oct 30

B = +5°

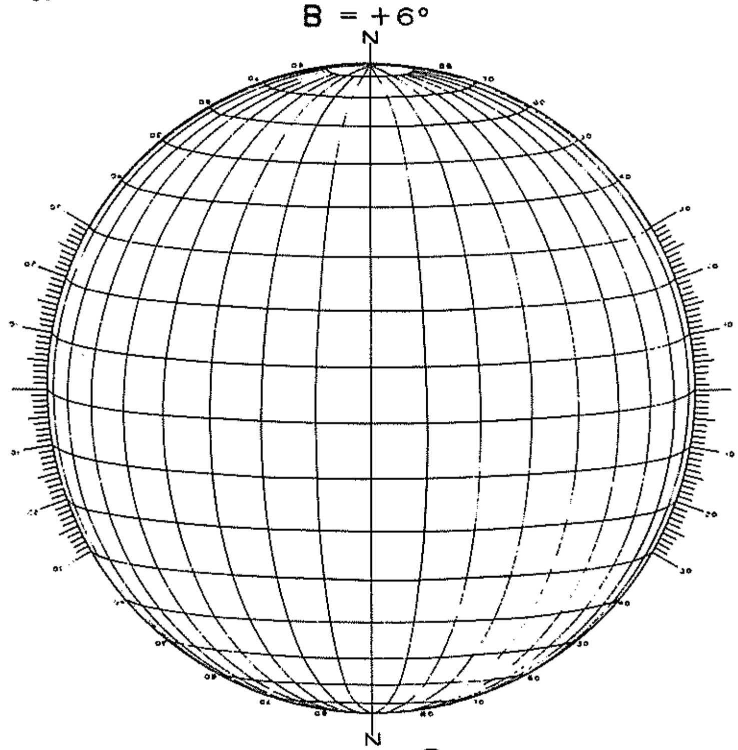


B = −5°

Apr 17 – Apr 27
Jan 15 – Jan 24

July 28 - Aug 12
Oct 5 - Oct 19

B = +6°

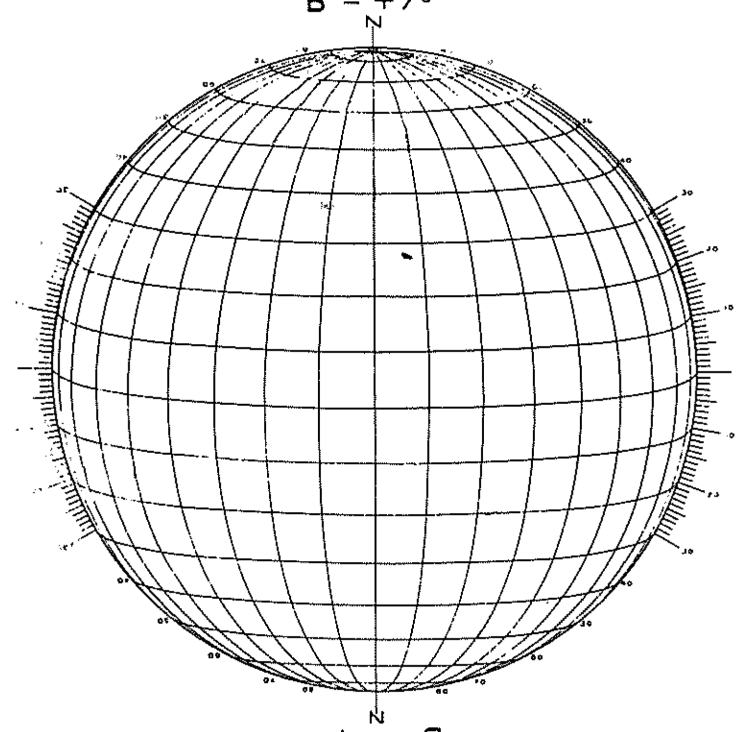


B = −6°

Jan 25 - Feb 8
Apr 2 - Apr 16

Aug 13 - Oct 4

B = +7°

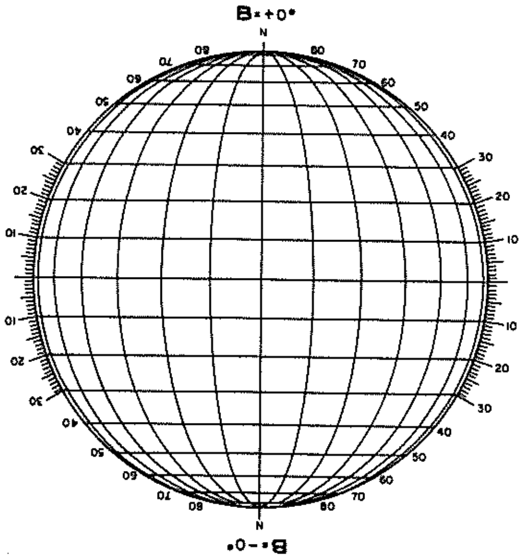


B = −7°

Feb 9 - Apr 1

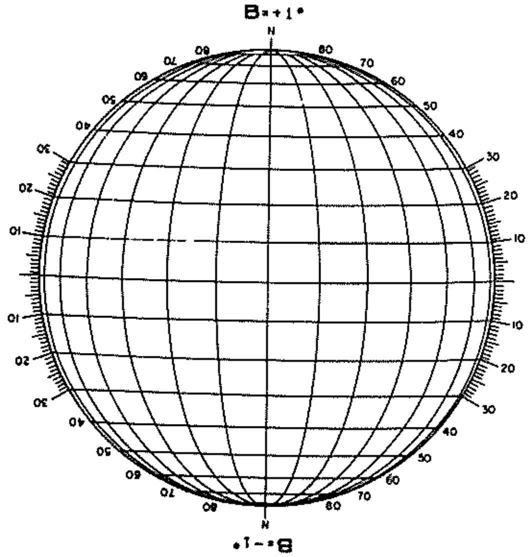
DAYS FROM CENTRAL MERIDIAN

June 3 - June 10
Dec 4 - Dec 11



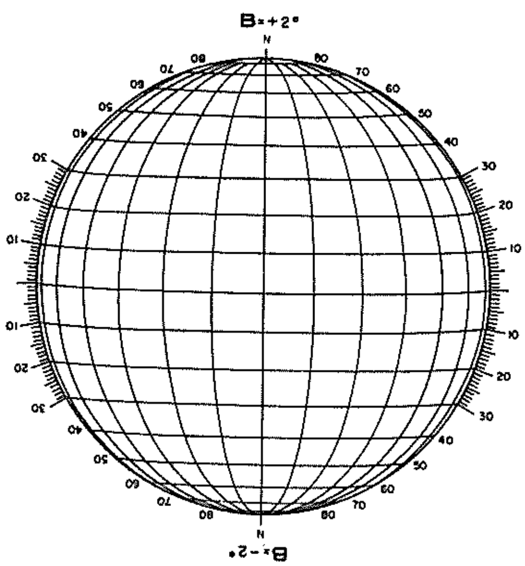
Dec 4 - Dec 11
June 3 - June 10

June 11 - June 18
Nov 26 - Dec 3



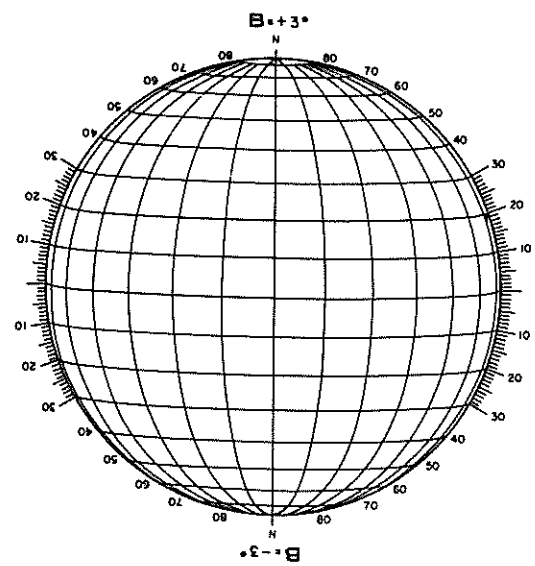
Dec 12 - Dec 19
May 25 - June 2

June 19 - June 27
Nov 18 - Nov 25



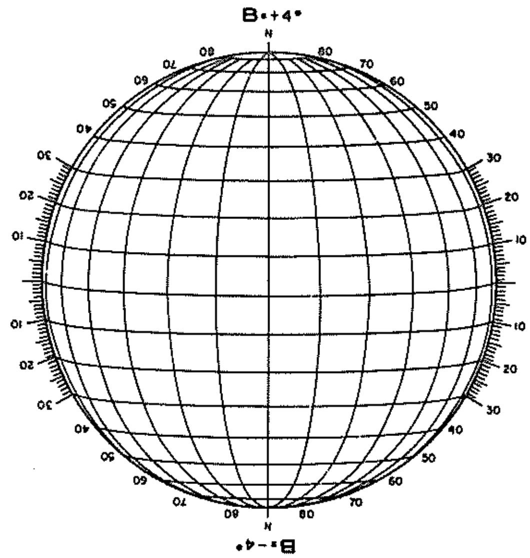
Dec 20 - Dec 27
May 17 - May 24

June 28 - July 6
Nov 10 - Nov 17



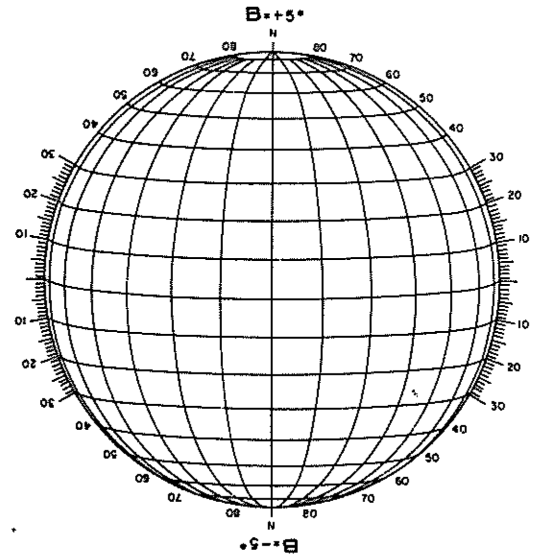
Dec 28 - Jan 4
May 8 - May 16

July 7 – July 16
Oct 31 – Nov 9



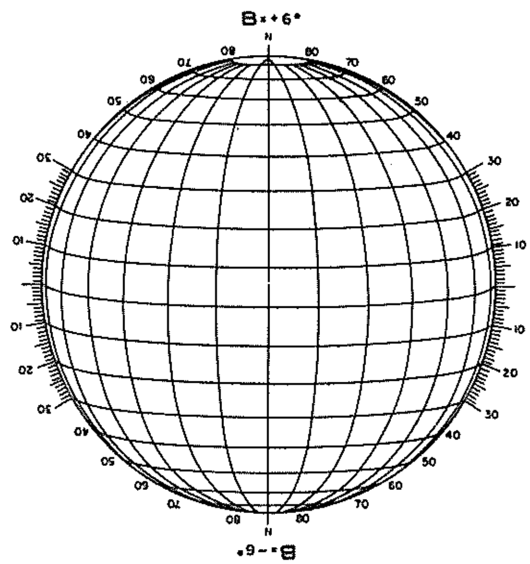
Apr 28 - May 7
Jan 5 - Jan 14

July 17 – July 27
Oct 20 – Oct 30



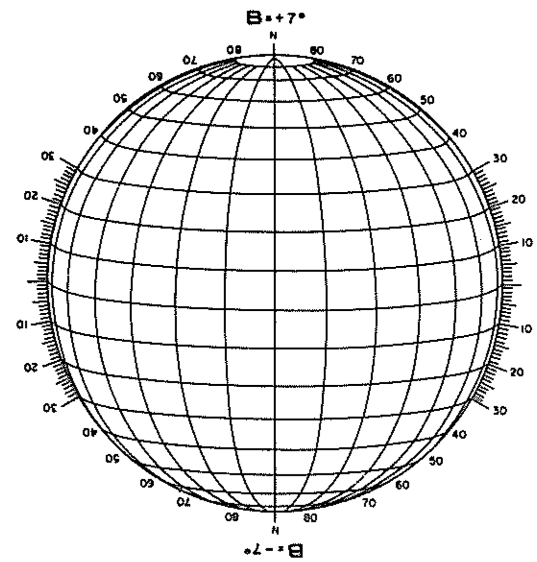
Apr 17 - Apr 27
Jan 15 - Jan 24

July 28 – Aug 12
Oct 5 – Oct 19



Apr 2 - Apr 16
Jan 25 - Feb 8

Aug 13 – Oct 4



Feb 9 - Apr 1

WORLD DATA CENTER A

FOR

SOLAR-TERRESTRIAL PHYSICS

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

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