# INTERNATIONAL URSIGRAM

# and

# WORLD DAYS SERVICE

# I.U.W.D.S.

# Synoptic Codes

# for

# Solar and Geophysical Data


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# Introduction

The International Ursigram and World Days Service (IUWDS) provides information rapidly to the world scientific community to assist in the planning, coordination and conduct of scientific work in disciplines affected by the sun-earth environment. The IUWDS is a joint service of the International Union of Radio Science (URSI), International Astronomical Union (IAU) and the International Union of Geodesy and Geophysics (IUGG) and a permanent service of the Federation of Astronomical and Geophysical Data Services (FAGS).

The IUWDS was formed in 1962 as a combination of the former International World Days Service, which had been initiated in 1959 to continue many aspects of the International Geophysical Year (IGY) World Days Program, and the former URSI Central Committee on Ursigrams which represented rapid data interchange activities first begun about 1930.

Two basic mechanisms have been selected to accomplish the program of the IUWDS. First, IUWDS prepares the International Geophysical Calendar each year. This calendar gives a list of "World Days" which scientists are encouraged to use for carrying out their experiments. Second, there is the International Ursigram Service for assisting those who need a specific state of solar activity, earth atmosphere or magnetosphere at the time of their experiment. Both programs are designed to be very flexible and can be easily adjusted to fit the needs of the scientific community.

In addition, on behalf of the Committee for Space Research (COSPAR), each month IUWDS summarizes the status of satellite orbits around the earth and of space probes in the interplanetary medium in the Spacewarn Bulletin. Future launches are announced, actual launches are reported, new satellites receive an international designation, decays in the earth atmosphere are predicted and announced, and finally series of satellites useful for international participation are listed. This bulletin is produced by the World Data Center-A for Rockets and Satellites.

### *Regional Warning Centers*

The International Ursigram Service operates through a number of Regional Warning Centers (RWC) scattered all around the world. Warning centers[1] are located in:

| | | | |
|---|---|---|---|
| Beijing, China | Paris, France | Prague, Czechoslovakia | Warsaw, Poland |
| Boulder, USA | New Delhi, India | Sydney, Australia | |
| Moscow, USSR | Ottawa, Canada | Tokyo, Japan | |

In its own geographic area, each RWC collects all the data and reports available concerning the state of the sun-earth environment. In some cases, these come from observatories operated directly by the Regional Warning Center. In many cases, they are gathered from regional scientific institutes and universities. The participating observing stations are listed in Appendix C.

### *Data Exchange*

The data accessible by IUWDS are very diverse and are highly regarded by the scientific community. The types of data include:

- spectroheliograms and filtergrams
- observations of magnetic field structures on the sun
- optical observations of sunspot regions
- observations of solar coronal holes by radio and infra-red techniques
- quiet sun emissions from radio to X-ray wavelengths
- reports of flares observed by a wide variety of methods
- solar X-ray data

[1]Complete descriptions of the RWCs are found in Appendix B.

- the flux of solar particles recorded by satellites, by riometers in the polar cap and by neutron monitors
- geomagnetic activity as measured by 3-hourly K indices and by reports of sudden storm commencements
- ionospheric data giving critical frequencies of the F and E layers
- cosmic ray data and reports of Forbush decreases

These data and reports (about 150 data sets from around 100 institutes or observatories) are coded according to the IUWDS code format (Chapters 1–7) and distributed daily on request to users and to other RWCs. Data exchange is generally via a daily, or more frequent, telex message. In addition, the data are exchanged via electronic mail, facsimile transmission, and electronic transfer of images. The daily schedule for the data interchange is listed in the subsections of Appendix B.

Information transmitted through the IUWDS network is analyzed by Regional Warning Centers which produce a number of "summary" reports and forecasts. The "Geoalert" (Chapter 1), a forecast of solar-geophysical conditions for the next few days, is a particularly important one of these reports. Each RWC prepares its own forecast ("Geoalert") and sends it to the World Warning Agency (WWA) in Boulder each day. The WWA then issues a Geoalert which is distributed worldwide each day at 0300 UT through the IUWDS network and through the WMO (World Meteorological Organization) network. Many RWCs also relay the WWA Geoalert to users within their own region.

The IUWDS network is also used for the prompt distribution of the preliminary values of the International Sunspot Number which is prepared monthly at the Royal Observatory of Belgium. In addition, IUWDS relays the geomagnetic "aa" indices which are computed each week at Meudon from two antipodal stations. IUWDS contributed to the production of these indices by supplying the Royal Observatory of Belgium and the "Institut de Physique du Globe" (Paris) with some of the raw data reports.

### *IUWDS Cooperation*

The IUWDS works very closely with other ICSU organizations involved in international cooperation in astronomical, geophysical, and space sciences. In fact, there is no sharp line between the IUWDS "program" and those arranged through other groups. The IUWDS attempts to respond to the needs of the scientific community whether these are expressed formally or informally. Thus IUWDS leaders participate in the work or meetings of the:

- International Union of Radio Science (URSI)
- International Astronomical Union (IAU)
- International Union of Geodesy and Geophysics (IUGG)—particularly IAGA and IAMAP
- Cosmic Ray Commission, International Union of Pure and Applied Physics (IUPAP)
- Committee for Space Research (COSPAR)
- Solar Terrestrial Energy Program (STEP)
- SCOSTEP
- CCIR
- World Meteorological Organization (WMO)

### *IUWDS and the STP World Data Centers*

There is no sharp line between IUWDS work and the activities of the STP World Data Centers. The data handled in the IUWDS-sponsored activities also go to the World Data Centers; the institutions involved are usually the same, and the flow of preliminary and definitive data is thereby coordinated. Finally, it should be noted that there is no real distinction between a large part of the IUWDS program and the SCOSTEP Program-Monitoring the Sun-Earth Environment (MONSEE); in this case also, the leadership and many of the participants are common to the two undertakings. In summary, the IUWDS attempts to provide a central service to the scientific and technical community in many aspects of what might be called "active" coordination of programs involving international cooperation in astronomical, geophysical, and space science.

### *IUWDS Solar Terrestrial Predictions Workshops*

An important function of IUWDS has been to organize a series of scientific workshops in the field of solar-terrestrial prediction. The first of this series was held in Boulder (1979), followed by meetings in Meudon (1986), Sydney (1989), and Ottawa (1992). Following each workshop, scientific papers have been collected into a "Proceedings." These publications have proven valuable to the international scientific community.

### *IUWDS Steering Committee*

The IUWDS Steering Committee comprises representatives of the interested International Council of Scientific Unions (ICSU), as well as some regional representatives and liaison with other interested organizations like the World Meteorological Organization (WMO). The Committee gives recognition to certain national institutions for playing international roles—Regional Warning Centers, Associate Regional Warning Centers, and the World Warning Agency. The Steering Committee meets almost every year and is responsible for the direction and management of the IUWDS service. It is also responsible for cooperation between Warning Centers. An annual report on IUWDS and its operations is produced each January. This report is published by FAGS and usually appears in the URSI Information Bulletin. Members of the IUWDS Steering Committee are:

- Dr. Richard Thompson (IUWDS Chairman)
- Mr. Gary Heckman (IUWDS Secretary, Secretary for Ursigrams)
- Ms. Helen Coffey (IAU Representative)
- Dr. E. A. Tandberg-Hanssen (FAGS Representative)
- Ms. Helen Coffey (IUGG Representative, Secretary for World Days)
- Dr. B. M. Reddy (URSI Representative)
- Mr. Joseph Hirman (RWC Boulder)
- Dr. Li Qibin (RWC China)
- Prof. Meiqing Gao (RWC China)
- Dr. S. I. Adviushin (RWC Moscow)
- Dr. A. D. Danilov (RWC Moscow)
- Dr. B. M. Reddy (RWC New Delhi)
- Dr. Richard Coles (RWC Ottawa)
- Dr. Pierre Lantos (RWC Paris)
- Mr. P. Triska (RWC Prague)
- Dr. D. Cole (RWC Sydney)
- Dr. K. Marubashi (RWC Tokyo)
- Dr. T. Ogawa (RWC Tokyo)
- Dr. Z. Klos (RWC Warsaw)
- Dr. J. Green (WDC–A Rockets and Satellites)

# Chapter One

## Alerts, Analysis, and Forecast Codes

Alerts, Analysis, and Forecast Codes are used by RWC's in their daily data interchange. The interchange of alerts, summary data and forecasts enables the RWC's to concentrate on data from their regions, and greatly reduce the quantity of data routinely interchanged among RWC's.

Code forms:

**UGEOA**

**UGEOE**

**UGEOI**

**UGEOR**

# UGEOA

*Content*:

Enables RWC's to send messages containing flare, magnetic, and proton event Advices (forecasts) to other RWC's and to general data users on an established schedule. The UGEOA code has a header containing the word GEOALERT. The PLAIN section is used for text information, for example, the WWA UGEOA may include special messages in the PLAIN section such as SIDC monthly sunspot values, SMM observing schedule, STRATWARM, *etc*.

The WWA UGEOA forecasts are based on RWC inputs (Advices). The WWA UGEOA message will also include the UGEOE, UGEOI, and UGEOR messages for the day. The UGEOA message schedule is:

SYD = 0000 UT
TOK = 0130 UT
WWA = 0330 UT
BEI = 0730 UT
MEU = 1230 UT
MOS = 1400 UT
BOU = 2200 UT

*Example*:

```
GEOALERT WWA059
UGEOA 85304  90228  0330/  2122/
12042  23041  31041
99999
PLAIN
text
BT
```

*Definition of symbols*:

*First Line—*

| GEOALERT | RWCDOY |
|---|---|

**GEOALERT** key word comes from **GEO**Alert Advices (forecasts)

| GEOALERT | RWCDOY | |
|---|---|---|

**RWC** = Three–letter RWC code
**DOY** = Julian day of year

*Second Line—*

| UGEOA | I I I I I | YMMDD | HHmm/ | GSMI/ |
|---|---|---|---|---|

**UGEOA** comes from **GEO**Alert Advices (forecasts)

| UGEOA | I I I I I | YMMDD | HHmm/ | GSMI/ |
|---|---|---|---|---|

**I I I I I** = station indicator (see lists in Appendix C)

## UGEOA—*Continued*

*Second Line—Contd.*

| UGEOA | I I I I I | **YMMDD** | HHmm/ | GSMI/ |
|---|---|---|---|---|

**Y** = last digit of year
**MM** = month of year, 01 = January, 02 = February, *etc.*
**DD** = UT day of month of issue

| UGEOA | I I I I I | YMMDD | **HHmm/** | GSMI/ |
|---|---|---|---|---|

**HHmm** = UT hour and minute of issue
/ = filler

| UGEOA | I I I I I | YMMDD | HHmm/ | **GSMI/** |
|---|---|---|---|---|

**G** = Ground-based solar data used in forecast
- 0 = none
- 1 = radio
- 2 = solar optical
- 3 = solar magnetic
- 4 = radio and solar opitcal (no solar magnetic)
- 5 = solar optical and solar magnetic (no radio)
- 6 = radio and solar magnetic (no solar optical)
- 9 = all

**S** = Space-based solar data used in forecast
- 0 = none
- 1 = solar x-rays
- 2 = energetic particles
- 3 = solar x-ray images
- 4 = solar x-rays and energetic particles (no solar x-ray images)
- 5 = energetic particles and solar x-ray images (no solar x-rays)
- 6 = solar x-rays and solar x-ray images (no energetic particles)
- 9 = all

**M** = Magnetic data used in forecast
- 0 = none
- 1 = spaced-based magnetometers
- 2 = ground-based magnetometers
- 3 = spaced-based and ground-based magnetometers

**I** = Ionospheric data used in forecast
- 0 = none
- 1 = ionosondes
- 2 = neutron monitors
- 3 = riometers
- 4 = ionosondes and neutron monitors (no riometers)
- 5 = neutron monitors and riometers (no ionosondes)
- 6 = ionosondes and riometers (no neutron monitors)
- 9 = all

/ = filler

## UGEOA—*Continued*

*Data Lines*

| | **1FIID** | **2FIID** | **3FIID** |
|---|---|---|---|

**1** = flare forecast (whole sun) for day **II**
**F** = forecast
- 0 = Quiet (< 50% probability of C-class flares)
- 1 = Eruptive (C-class flares expected, probability ≥ 50%)
- 2 = Active (M-class flares expected, probability ≥ 50%)
- 3 = Major flares expected (X-class flares expected, probability ≥ 50%)
- 4 = Proton flares expected (proton flares expected, probability ≥ 50%)
- 8 = Warning condition (activity levels expected to increase, but no numeric forecast given)
- / = No forecast

**II** = day of start of forecast period
**D** = duration (days)
- / = indefinite duration

| | **1FIID** | **2FIID** | **3FIID** |
|---|---|---|---|

**2** = magnetic forecast (local conditions) for day **II**
**F** = forecast
- 0 = Quiet
- 1 = Active conditions expected (A ≥ 20 or K = 4)
- 2 = Minor storm expected (A ≥ 30 or K = 5)
- 3 = Major magstorm expected (A ≥ 50 or K ≥ 6)
- 4 = Severe magstorm expected (A ≥ 100 or K ≥ 7)
- 8 = Warning condition (activity levels expected to increase, but no numeric forecast given)
- / = No forecast

**II** = day of start of forecast period
**D** = duration (days)
- / = indefinite duration

*Note: Geomagnetic events and indices (observed and predicted), are based on local not planetary conditions.*

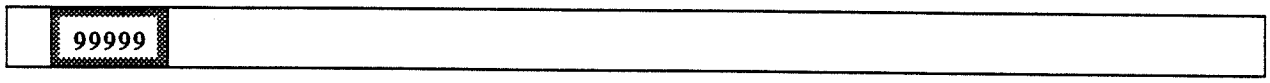
| | **1FIID** | **2FIID** | **3FIID** |
|---|---|---|---|

**3** = proton forecast for day **II**
**F** = forecast
- 0 = Quiet
- 1 = Proton event expected (10 pfu at > 10 MeV)
- 2 = Major proton event expected (100 pfu at > 100 MeV)
- 7 = Proton event in progress (> 10 MeV)
- 8 = Warning condition (activity levels expected to increase, but no numeric forecast given)
- / = No forecast

**II** = day of start of forecast period
**D** = duration (days)
- / = indefinite duration

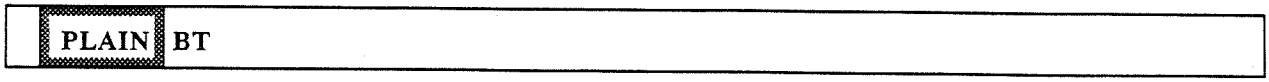
## UGEOA—*Continued*

*Last Data Line—*

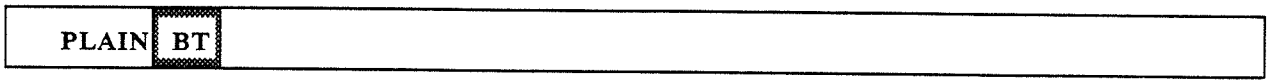



**99999** = end of data terminator; indicates that all coded data have been received

*Text Lines—*




**PLAIN** = Plain-language text information (rationale for forecasts; for example, Mag based on recurrence). Continue to include key words; for example, MAGALERT. . . followed by rationale.




**BT** = Break in transmission (end of message terminator)

*Note: / is to be used for data not available.*

# UGEOE

*Content*:

Enables RWC's to send messages containing summaries of significant solar events to other RWC's and to general data users. UGEOE is issued at 0330 UT from RWC BOU. RWC BOU criteria for significant solar events are:

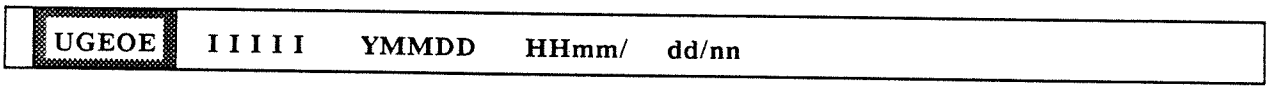
(a) Class M or greater x-ray burst
(b) Optical flare of importance 2B or greater
(c) Radio burst at 245 MHz (≥100 solar flux units above background)
(d) 10-cm Radio burst (100% above background)
(e) Type II or Type IV sweep-frequency burst

*Example*:

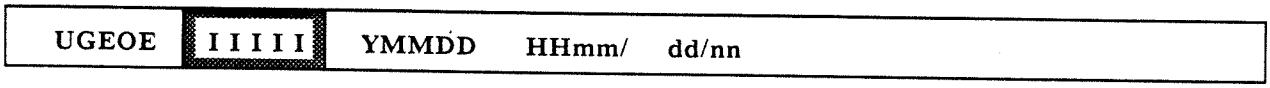
```
UGEOE 85304  90103  0330/  02/01
10111  1020/  10401  25622  12503  24504  32120  95290
99999
PLAIN
text
BT
```

*Definition of symbols*:

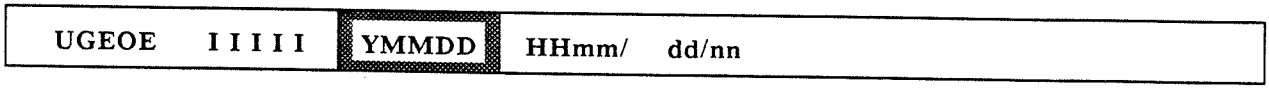
*First Line—*



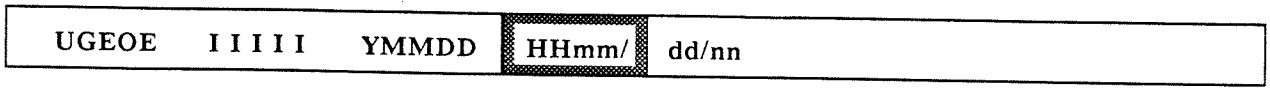

**UGEOE** comes from **GEO**Alert Event summary



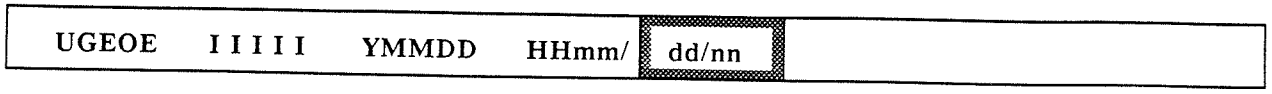

**IIIII** = station indicator (see lists in Appendix C)




**Y** = last digit of year
**MM** = month of year, 01 = January, 02 = February, *etc.*
**DD** = UT day of month of issue




**HHmm** = UT hour and minute of issue
/ = filler




**dd** = UT day of month of beginning of event
/ = filler
**nn** = number of significant solar events (lines) that follow

## UGEOE—*Continued*

*Data Lines—*

| **HHmmt** | **HHmm/** | **HHmmt** | **cddef** | **Tabpp** | **Fabpp** | **QXXYY** | **9RRRR** | *repeat this line for each solar event* |
|---|---|---|---|---|---|---|---|---|

**HHmm** = UT hour and minute of beginning of event for day **dd**
**t** = begin time qualifier
- 1 = exact start time of event
- 2 = first observation of event in progress at this time

*Note: The times are associated with the highest priority event according to the list on p. 1–6 in the following order: x-ray burst, optical flare, 245 MHz radio burst, 10-cm radio burst, Type II or Type IV sweep-frequency burst.*

| **HHmmt** | **HHmm/** | **HHmmt** | **cddef** | **Tabpp** | **Fabpp** | **QXXYY** | **9RRRR** | *repeat this line for each solar event* |
|---|---|---|---|---|---|---|---|---|

**HHmm** = UT hour and minute of maximum of event
**/** = filler

| **HHmmt** | **HHmm/** | **HHmmt** | **cddef** | **Tabpp** | **Fabpp** | **QXXYY** | **9RRRR** | *repeat this line for each solar event* |
|---|---|---|---|---|---|---|---|---|

**HHmm** = UT hour and minute of end of event
**t** = end time qualifier
- 1 = exact end time of event
- 2 = last observation of event in progress at this time

| **HHmmt** | **HHmm/** | **HHmmt** | **cddef** | **Tabpp** | **Fabpp** | **QXXYY** | **9RRRR** | *repeat this line for each solar event* |
|---|---|---|---|---|---|---|---|---|

**c** = indicates x-ray event class
- 0 = less than Class C solar event (flux $< 10^{-6}$ Wm$^{-2}$)
- 1 = Class C solar event ($10^{-6}$ Wm$^{-2}$ $\leq$ flux $< 10^{-5}$ Wm$^{-2}$)
- 2 = Class M solar event ($10^{-5}$ Wm$^{-2}$ $\leq$ flux $< 10^{-4}$ Wm$^{-2}$)
- 3 = Class X solar event ($10^{-4}$ Wm$^{-2}$ $\leq$ flux)
- 4 = Class X solar event ($10^{-3}$ Wm$^{-2}$ $\leq$ flux)
- 9 = no x-ray event observed

**dd** = x-ray intensity from 1.0 to 9.9 (report x-ray intensity $\geq$9.9 as 9.9)
- // = no x-ray event observed

**e** = optical flare importance based upon corrected area in square degrees
- 0 = subflare (s); area $\leq$ 2.0 square degrees
- 1 = importance 1; 2.1 square degrees $<$ area $\leq$ 5.1 square degrees
- 2 = importance 2; 5.2 square degrees $<$ area $\leq$ 12.4 square degrees
- 3 = importance 3; 12.5 square degrees $<$ area $\leq$ 24.7 square degrees
- 4 = importance 4; area $\geq$ 24.8 square degrees
- 9 = no optical flare observed

**f** = optical flare intensity
- 0 = faint
- 1 = normal
- 2 = bright
- 9 = unknown

## UGEOE—*Continued*

*Data Lines—Continued*

| HHmmt | HHmm/ | HHmmt | cddef | **Tabpp** | Fabpp | QXXYY | 9RRRR | { *repeat this line for each solar event* |
|---|---|---|---|---|---|---|---|---|

**T** = Indicates if a Type II sweep was observed and the importance of the Type II sweep
- 0 = no Type II sweep observed
- 1 = importance 1
- 2 = importance 2
- 3 = importance 3
- 9 = unknown

**ab** = Peak flux ($10^{-22}$ Wm$^{-2}$ Hz$^{-1}$) of radio burst at approximately 245 MHz, where **ab** = **a.b**

**pp** = Power of ten to apply to "**a.b**"

*Note:* "**abpp**" *reported as* "**2403**" *would equal* 2.4 x $10^{3}$ x $10^{-22}$ Wm$^{-2}$ Hz$^{-1}$

| HHmmt | HHmm/ | HHmmt | cddef | Tabpp | **Fabpp** | QXXYY | 9RRRR | { *repeat this line for each solar event* |
|---|---|---|---|---|---|---|---|---|

**F** = Indicates if a Type IV sweep was observed and the importance of the Type IV sweep
- 0 = no Type IV sweep observed
- 1 = importance 1
- 2 = importance 2
- 3 = importance 3
- 9 = unknown

**ab** = Peak flux ($10^{-22}$ Wm$^{-2}$ Hz$^{-1}$) of radio burst at 10-cm, where **ab** = **a.b**

**pp** = Power of ten to apply to "**a.b**"

*Note:* "**abpp**" *reported as* "**1704**" *would equal* 1.7 x $10^{4}$ x $10^{-22}$ Wm$^{-2}$ Hz$^{-1}$

| HHmmt | HHmm/ | HHmmt | cddef | Tabpp | Fabpp | **QXXYY** | 9RRRR | { *repeat this line for each solar event* |
|---|---|---|---|---|---|---|---|---|

**Q** = quadrant (heliographic coordinates) in which the event is observed
- 1 = NE (northeast)
- 2 = SE (southeast)
- 3 = SW (southwest)
- 4 = NW (northwest)

**XX** = distance to central meridian in degrees

**YY** = heliographic latitude in degrees

| HHmmt | HHmm/ | HHmmt | cddef | Tabpp | Fabpp | QXXYY | **9RRRR** | { *repeat this line for each solar event* |
|---|---|---|---|---|---|---|---|---|

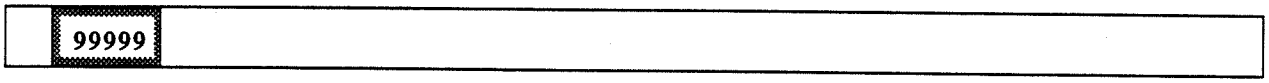
**9** = indicates that region number follows

**RRRR** = RWC region number

*Note:* / / / / *indicates no data available.*

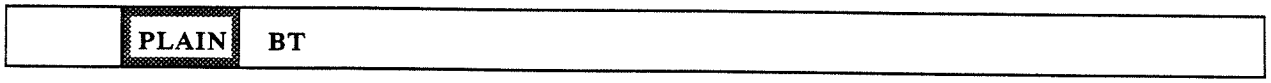
## UGEOE—*Continued*

*Last Data Line—*

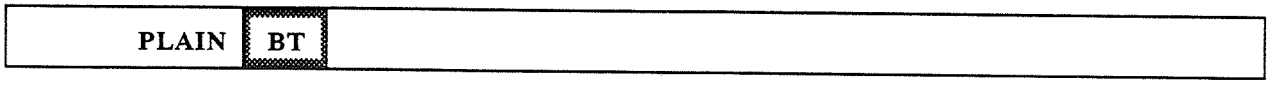



**99999** = end of data terminator; indicates that all data has been received

*Text Lines—*




**PLAIN** = Plain-language text information




**BT** = Break in transmission (end of message terminator)

*Note: / is to be used for data not available.*

# UGEOI

*Content*:

Enables RWC's to send messages containing summaries of daily indices. UGEOI is issued at 0330 UT from RWC BOU.

*Example*:

```
UGEOI  85304  90103  0330/  02///
10112  21351  30302  41100  50400  62104  71203  80206  92501
99999
PLAIN
text
BT
```

*Definition of symbols*:

*First Line—*

| UGEOI | I I I I I | YMMDD | HHmm/ | dd / / / |
|---|---|---|---|---|

**UGEOI** comes from **GEO**Alert Daily **I**ndices

| UGEOI | I I I I I | YMMDD | HHmm/ | dd / / / |
|---|---|---|---|---|

**I I I I I** = station indicator (see lists in Appendix C)

| UGEOI | I I I I I | YMMDD | HHmm/ | dd / / / |
|---|---|---|---|---|

**Y** = last digit of year
**MM** = month of year, 01 = January, 02 = February, *etc.*
**DD** = UT day of month of issue

| UGEOI | I I I I I | YMMDD | HHmm/ | dd / / / |
|---|---|---|---|---|

**HHmm** = UT hour and minute of issue
/ = filler

| UGEOI | I I I I I | YMMDD | HHmm/ | dd / / / |
|---|---|---|---|---|

**dd** = UT day of month of data
/ / / = filler

## UGEOI—*Continued*

*Data Lines—*

| 1nnnn | 2CCCD | 3EEEF | 4GGGH | 5MMXX | 6abpp | 7abpp | 8SSNN | 9AAAA |
|---|---|---|---|---|---|---|---|---|

**1** = indicates that relative sunspot number for day **dd** follows
**nnnn** = sunspot number

| 1nnnn | 2CCCD | 3EEEF | 4GGGH | 5MMXX | 6abpp | 7abpp | 8SSNN | 9AAAA |
|---|---|---|---|---|---|---|---|---|

**2** = indicates that 10.7 cm radio flux for day **dd** follows
**CCC** = 10.7 cm radio flux
**D** = number of TENFLARES (solar radio-emission outbursts at 10 cm that are greater than 100% over background)

| 1nnnn | 2CCCD | 3EEEF | 4GGGH | 5MMXX | 6abpp | 7abpp | 8SSNN | 9AAAA |
|---|---|---|---|---|---|---|---|---|

**3** = indicates that Geomagnetic A-index and events observed locally for day **dd** follows
**EEE** = Geomagnetic A-index observed
**F** = important geomagnetic event observed and described as follows:
- 0 = no event
- 1 = end of geomagnetic storm
- 2 = storm in progress
- 6 = gradual storm commencement
- 7 = sudden storm commencement

*Note: Geomagnetic events and indices are based on local not planetary conditions.*

| 1nnnn | 2CCCD | 3EEEF | 4GGGH | 5MMXX | 6abpp | 7abpp | 8SSNN | 9AAAA |
|---|---|---|---|---|---|---|---|---|

**4** = indicates that cosmic ray intensity and events observed for day **dd** by Neutron Monitors follows
**GGG** = median level of cosmic ray intensity (where 1000 is the normal level)
if GGG > 500, then the median level = GGG
if GGG < 500, then the median level = GGG + 1000
**GGG** *reported as* **024** *would equal* **1024**
**GGG** *reported as* **892** *would equal* **892**
**H** = important cosmic-ray event observed and described as follows:
- 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 energetic solar particles (GLE)
- 6 = arrival of energetic solar particles (GLE) followed by Forbush decrease

| 1nnnn | 2CCCD | 3EEEF | 4GGGH | 5MMXX | 6abpp | 7abpp | 8SSNN | 9AAAA |
|---|---|---|---|---|---|---|---|---|

**5** = indicates that number of M and X flares for day **dd** follows
**MM** = number of M flares
**XX** = number of X flares

## UGEOI—*Continued*

*Data Lines—Continued*

| 1AAAA | 2CCCD | 3EEEF | 4GGGH | 5MMXX | **6abpp** | 7abpp | 8SSNN | 9AAAA |
|---|---|---|---|---|---|---|---|---|

**6** = indicates that x-ray background (.1-.8 nm) for day **dd** follows
**ab** = x-ray background (.1-.8 nm) in units of $Wm^{-2}$ where **ab** = **a.b**
**pp** = Power of ten to apply to "**a.b**"

*Note:* "**abpp**" *reported as "***2304***" would equal* 2.3 x $10^{-4}$ $Wm^{-2}$

| 1AAAA | 2CCCD | 3EEEF | 4GGGH | 5MMXX | 6abpp | **7abpp** | 8SSNN | 9AAAA |
|---|---|---|---|---|---|---|---|---|

**7** = indicates that particle fluence (> 10MeV) for day **dd** follows
**ab** = particle fluence (> 10MeV) in units of particles/$cm^2$-sr-day where **ab** = **a.b**
**pp** = Power of ten to apply to "**a.b**"

*Note:* "**abpp**" *reported as "***4607***" would equal* 4.6 x $10^7$ particles/$cm^2$-sr-day

| 1AAAA | 2CCCD | 3EEEF | 4GGGH | 5MMXX | 6abpp | 7abpp | **8SSNN** | 9AAAA |
|---|---|---|---|---|---|---|---|---|

**8** = indicates that number of spotted regions and new spot groups for day **dd** follows
**SS** = number of new spot groups
**NN** = number of spotted regions

| 1AAAA | 2CCCD | 3EEEF | 4GGGH | 5MMXX | 6abpp | 7abpp | 8SSNN | **9AAAA** |
|---|---|---|---|---|---|---|---|---|

**9** = indicates that total sunspot area for day **dd** follows
**AAAA** = total sunspot area in millionths of the solar hemisphere

*Last Data Line—*

| **99999** |
|---|

**99999** = end of data terminator; indicates that all data has been received

*Text Lines—*

| | **PLAIN** | **BT** |
|---|---|---|

**PLAIN** = Plain-language text information

| | PLAIN | **BT** |
|---|---|---|

**BT** = Break in transmission (end of message terminator)

*Note:* */ is to be used for data not available.*

# UGEOR

*Content*:

Enables RWC's to send messages containing sunspot region data and forecasts to other RWC's and to general data users. RWC's send UGEOR messages as needed. UGEOR is issued at 0330 UT from RWC BOU.

*Example*:

```
UGEOR  85304  90103  0330/  02/24  03101
12325  20501  31596  43211  50500  60025  43020  26210
99999
PLAIN
text
BT
```

*Definition of symbols*:

*First Line—*

| UGEOR | IIIII | YMMDD | HHmm/ | dd/hh | IIPnn |
|---|---|---|---|---|---|

**UGEOR** comes from **GEO**Alert **R**egion summary and forecasts

| UGEOR | IIIII | YMMDD | HHmm/ | dd/hh | IIPnn |
|---|---|---|---|---|---|

**IIIII** = station indicator (see lists in Appendix C)

| UGEOR | IIIII | YMMDD | HHmm/ | dd/hh | IIPnn |
|---|---|---|---|---|---|

**Y** = last digit of year
**MM** = month of year, 01 = January, 02 = February, *etc.*
**DD** = UT day of month of issue

| UGEOR | IIIII | YMMDD | HHmm/ | dd/hh | IIPnn |
|---|---|---|---|---|---|

**HHmm** = UT hour and minute of issue
/ = filler

| UGEOR | IIIII | YMMDD | HHmm/ | dd/hh | IIPnn |
|---|---|---|---|---|---|

**dd** = UT day of month of data and region location
/ = filler
**hh** = UT hour of region location

| UGEOR | IIIII | YMMDD | HHmm/ | dd/hh | IIPnn |
|---|---|---|---|---|---|

**II** = starting date of forecast
**P** = period (days) of forecast (usually 1 day)
**nn** = number of spotted regions
- 0 = no spotted regions (SPOTNIL)
- 1 = 1 region
- 2 = 2 regions, *etc.*

## UGEOR—*Continued*

*Data Lines—*

| 1RRRR | 2MMXX | 3SS12 | 4ZPCM | 5AAAA | 6SSSS | QXXYY | FCMXP | { *repeat this line for each spotted region* |
|---|---|---|---|---|---|---|---|---|

**1** = indicates that region number for day **dd** follows
**RRRR** = region number

| 1RRRR | 2MMXX | 3SS12 | 4ZPCM | 5AAAA | 6SSSS | QXXYY | FCMXP | { *repeat this line for each spotted region* |
|---|---|---|---|---|---|---|---|---|

**2** = indicates that number of x-ray flares for region RRRR for day **dd** follows
**MM** = number of class M flares
**XX** = number of class X flares

| 1RRRR | 2MMXX | 3SS12 | 4ZPCM | 5AAAA | 6SSSS | QXXYY | FCMXP | { *repeat this line for each spotted region* |
|---|---|---|---|---|---|---|---|---|

**3** = indicates that number of optical flares for region RRRR for day **dd** follows
**SS** = number of subflares
**1** = number of importance 1 flares
**2** = number of flares greater than importance 1

| 1RRRR | 2MMXX | 3SS12 | 4ZPCM | 5AAAA | 6SSSS | QXXYY | FCMXP | { *repeat this line for each spotted region* |
|---|---|---|---|---|---|---|---|---|

**4** = indicates that sunspot type for region RRRR for day **dd** follows
**Z** = Modified Zurich classification (see fig. 1–1)

| | |
|---|---|
| 1 = A | 5 = E |
| 2 = B | 6 = F |
| 3 = C | 7 = H |
| 4 = D | |

**P** = Penumbra of largest spot (see fig. 1–1)

0 = no penumbra (x)
1 = rudimentary (r)
2 = small symmetric (s) (north to south diameter $\leq$ 2.5°)
3 = small asymmetric (a) (north to south diameter $\leq$ 2.5°)
4 = large symmetric (h) (north to south diameter > 2.5°)
5 = large asymmetric (k) (north to south diameter > 2.5°)

**C** = Compactness of central spots

0 = single spot region, no compactness (x)
1 = open distribution (o)
2 = intermediate distribution (i)
3 = compact distribution (c)

**M** = Magnetic classification

1 = Alpha
2 = Beta
3 = Beta-Gamma
4 = Gamma
5 = Beta/Delta
6 = Beta-Gamma/Delta
7 = Gamma/Delta

| 1RRRR | 2MMXX | 3SS12 | 4ZPCM | 5AAAA | 6SSSS | QXXYY | FCMXP | { *repeat this line for each spotted region* |
|---|---|---|---|---|---|---|---|---|

**5** = indicates that sunspot area for region RRRR for day **dd** follows
**AAAA** = sunspot area in millionths of the solar hemisphere

## UGEOR—*Continued*

*Data Lines—Continued*

| 1RRRR | 2MMXX | 3SS12 | 4ZPCM | 5AAAA | **6SSSS** | QXXYY | FCMXP | { *repeat this line for each spotted region* |
|---|---|---|---|---|---|---|---|---|

**6** = indicates that total number of sunspots for region RRRR for day **dd** follows
**SSSS** = total number of sunspots

| 1RRRR | 2MMXX | 3SS12 | 4ZPCM | 5AAAA | 6SSSS | **QXXYY** | FCMXP | { *repeat this line for each spotted region* |
|---|---|---|---|---|---|---|---|---|

Coded location of region RRRR for day **dd** at hour **hh**:
**Q** = quadrant (heliographic coordinates) of the region
1 = NE (northeast) 3 = SW (southwest)
2 = SE (southeast) 4 = NW (northwest)
**XX** = distance to central meridian in degrees
**YY** = heliographic latitude in degrees

| 1RRRR | 2MMXX | 3SS12 | 4ZPCM | 5AAAA | 6SSSS | QXXYY | **FCMXP** | { *repeat this line for each spotted region* |
|---|---|---|---|---|---|---|---|---|

**F** = general forecast for region RRRR for day **II**
0 = Quiet (< 50% probability of C-class flares)
1 = Eruptive (C-Class flares expected, probability ≥ 50%)
2 = Active (M-class flares expected, probability ≥ 50%)
3 = Major (X-class flares expected, probability ≥ 50%)
4 = Proton (Proton flares expected, probability ≥ 50%)
/ = No general forecast available
**C** = probability of class C flares divided by ten
0 = 0-9% 5 = 50-59%
1 = 10-19% 6 = 60-69%
2 = 20-29% 7 = 70-79%
3 = 30-39% 8 = 80-89%
4 = 40-49% 9 = 90-99%
/ = No probability forecast available
**M** = probability of class M flares divided by ten (see list in C flares above)
**X** = probability of class X flares divided by ten (see list in C flares above)
**P** = probability of Proton flares divided by ten (see list in C flares above)

*Last Data Line—*

| **99999** |
|---|

**99999** = end of message terminator; indicates that entire message has been received

*Text Lines—*

| **PLAIN** | BT |
|---|---|

**PLAIN** = Plain-language text information

| PLAIN | **BT** |
|---|---|

**BT** = Break in transmission (end of message terminator)

*Note: / is to be used for data not available.*

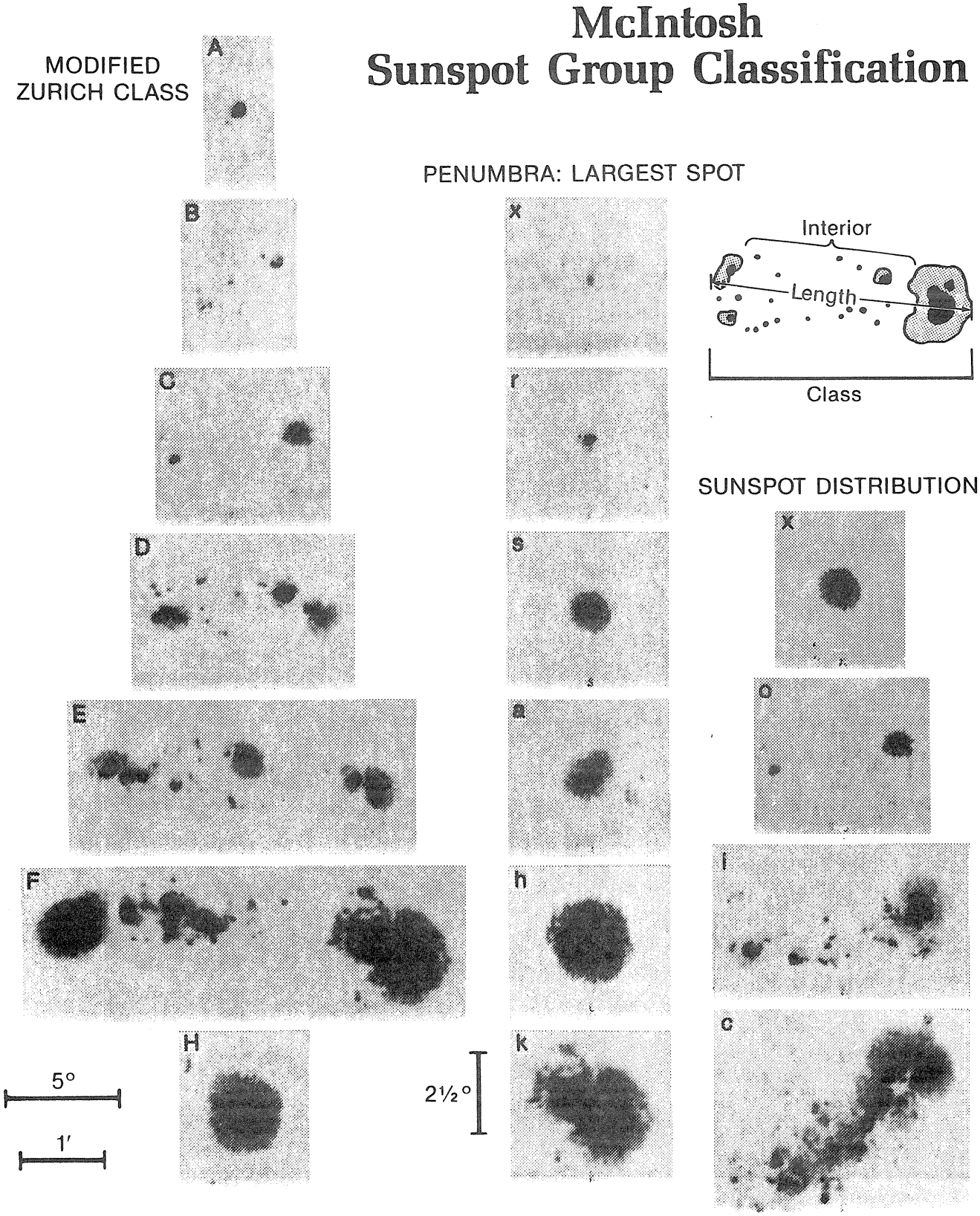



Figure 1-1.—Modified Zurich (McIntosh) Sunspot Classification.

# Chapter Two

## Optical Data Codes

Optical Data codes are used by observatories to report solar optical data; consisting generally of sunspots, plages, and flares.

Code forms:

**UFLAE**

**UPATP and UPATV**

**UPLAK**

**USSPI and USSPY**

**USSPS**

# UFLAE

*Content*:

Position, importance, time and duration of solar flares as reported by a single optical observatory. (Importance in conformance with the recommendations of IAU Commission 10 as of 1 January 1966.)

*Example*:

| UFLAE | 81202 | 80925 | 26818 | 27280 | 60028 | 30038 | 80055 |
|---|---|---|---|---|---|---|---|

*Definition of symbols*:

| **UFLAE** | I I I I I | YMMDD |
|---|---|---|

**UFLAE** comes from solar **FLArEs**

| UFLAE | **I I I I I** | YMMDD |
|---|---|---|

**I I I I I** = station indicator (see lists in Appendix C)

| UFLAE | I I I I I | **YMMDD** |
|---|---|---|

**Y** = last digit of year
**MM** = month of year, 01 = January, 02 = February, *etc.*
**DD** = UT day of month

| **QXXYY** | deAAA | aHHmm | bHHmm | [bHHmm] | cHHmm | { *repeat this line for each flare* |
|---|---|---|---|---|---|---|

Coded location of *each* non-quiet region:
**Q** = quadrant (heliographic coordinates) of the active region
1 = NE (northeast) 3 = SW (southwest)
2 = SE (southeast) 4 = NW (northwest)
**XX** = distance to central meridian in degrees
**YY** = heliographic latitude in degrees

| QXXYY | **deAAA** | aHHmm | bHHmm | [bHHmm] | cHHmm | { *repeat this line for each flare* |
|---|---|---|---|---|---|---|

**d** = flare importance based upon corrected area in square degrees
0 = subflare(s); area $\leq$ 2.0 square degrees
1 = importance 1; 2.1 square degrees $\leq$ area $\leq$ 5.1 square degrees
2 = importance 2; 5.2 square degrees $\leq$ area $\leq$ 12.4 square degrees
3 = importance 3; 12.5 square degrees $\leq$ area $\leq$ 24.7 square degrees
4 = importance 4; area $\geq$ 24.8 square degrees
**e** = flare intensity based upon relative evaluation
7 = faint
8 = normal
9 = bright
**AAA** = uncorrected flare area in millionths of solar disk

## UFLAE—*Continued*

| QXXYY | deAAA | **aHHmm** | bHHmm | [bHHmm] | cHHmm | { *repeat this line for each flare* |
|---|---|---|---|---|---|---|

**a** = start time qualifier
- 6 = start of flare
- 7 = first observation of flare in progress

**HHmm** = UT hour and minute of first observation of flare

| QXXYY | deAAA | aHHmm | **bHHmm** | [bHHmm] | cHHmm | { *repeat this line for each flare* |
|---|---|---|---|---|---|---|

**b** = observing quality indicator
- 1 = very poor
- 2 = poor
- 3 = fair
- 4 = good
- 5 = exceptional

**HHmm** = UT hour and minute of flare maximum (use / / / / if unknown)

*Note:* *Repeat group* **bHHmm** *for secondary maximums*

| QXXYY | deAAA | aHHmm | bHHmm | [bHHmm] | **cHHmm** | { *repeat this line for each flare* |
|---|---|---|---|---|---|---|

**c** = end time qualifier
- 8 = end of flare
- 9 = last observation of flare in progress

**HHmm** = UT hour and minute of end or last observation of flare

*Note:* *Repeat groups* **QXXYY deAAA aHHmm bHHmm cHHmm** *as required to describe flares observed*

*Note:* */ is to be used for data not available.*

## UPATP and UPATV

*Content*:

Solar flare survey intervals for Hα patrols, cinematographic only (P) or visual only (V). UPATP and UPATV are sent only if the flare observations have been reduced and are being reported in the same message, although there need not be flares observed during the patrol period.

*Example*:

| UPATP | 30508 | 11311 | 07310 |
|---|---|---|---|

and

| UPATV | 30508 | 12216 | 06208 |
|---|---|---|---|

*Definition of symbols*:

| UPATP | I I I I I | DDUaa | b b b c c | [b b b c c] |
|---|---|---|---|---|

**UPATP** comes from flare **PAT**rol hours, **P**hotographic

and

| UPATV | I I I I I | DDUaa | b b b c c | [b b b c c] |
|---|---|---|---|---|

**UPATV** comes from flare **PAT**rol hours, **V**isual

| UPATP | I I I I I | DDUaa | b b b c c | [b b b c c] |
|---|---|---|---|---|

**I I I I I** = station indicator (see lists in Appendix C)

| UPATP | I I I I I | DDUaa | b b b c c | [b b b c c] |
|---|---|---|---|---|

**DD** = UT day of observation
**U** = overall quality of observation

| | | | |
|---|---|---|---|
| 0 | = no data | 3 | = fair |
| 1 | = very poor | 4 | = good |
| 2 | = poor | 5 | = exceptional |

**aa** = check sum of all the following digits

| UPATP | I I I I I | DDUaa | b b b c c | [b b b c c] |
|---|---|---|---|---|

**bbb** = UT time of beginning of patrol period in hours and tenths of hours
**cc** = UT time of end of patrol period, in hours and tenths of hours, with tens digit suppressed

*Note:* *Repeat* **UPATP** *(or* **UPATV***)* **I I I I I DDUaa** *whenever the observing period covers two UT days. If ambiguity is possible when decoding, insert an extra group* **bbbcc**.

*Note:* */ is to be used for data not available.*

# UPLAK

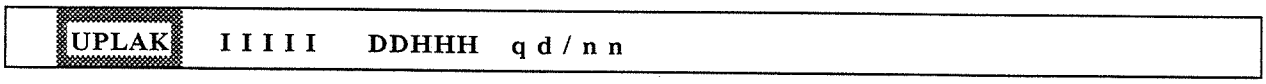
*Content*:

Area, importance, and intensity of calcium plages

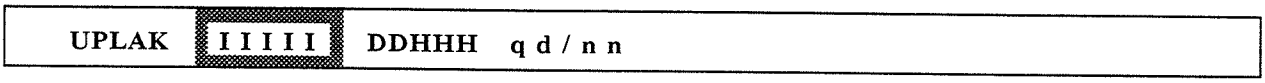
*Example*:

```
UPLAK 30508  12231   21/02
43211  13520  12443
43323  12040  09023
```

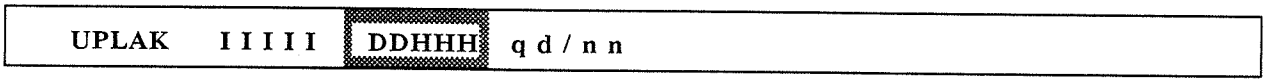
*Definition of symbols*:




**UPLAK** comes from **PLA**ges, code **K**




**I I I I I** = station indicator (see lists in Appendix C)




**DD** = UT day of observation
**HHH** = UT time of observation in hours and tenths of hours


**q** = quality of observation on a scale from 1 to 5
- 1 = very poor
- 2 = poor
- 3 = fair
- 4 = good
- 5 = exceptional

**d** = number of days since last message from this station
**/** = filler
**nn** = number of plages (three 5-digit groups each) for which information will follow

## UPLAK—*Continued*

| **eeefg** QXXYY iiijk | *repeat this line for each plage region* |
|---|---|

**eee** = serial number assigned by observatory

**f** = importance of plage region on a scale of 1 to 3 combined with information on the stage of evolution

- 1 = importance 1, increasing stage
- 2 = importance 2, increasing stage
- 3 = importance 3, increasing stage
- 4 = importance 1, stable
- 5 = importance 2, stable
- 6 = importance 3, stable
- 7 = importance 1, decreasing stage
- 8 = importance 2, decreasing stage
- 9 = importance 3, decreasing stage
- 0 = no evaluation given

**g** = age of the region

- 1 = born on disk
- 2 = born on invisible hemisphere, first disk transit
- 3 = second disk transit
- 4 = third disk transit
- 5 = fourth disk transit
- 6 = fifth disk transit
- 7 = sixth disk transit
- 8 = seventh disk transit
- 9 = eighth disk transit
- 0 = no evaluation given

| eeefg **QXXYY** iiijk | *repeat this line for each plage region* |
|---|---|

**Q** = quadrant (heliographic coordinates) containing the plage

- 1 = NE (northeast)
- 2 = SE (southeast)
- 3 = SW (southwest)
- 4 = NW (northwest)

**XX** = distance to central meridian in degrees

**YY** = heliographic latitude in degrees

| eeefg QXXYY **iiijk** | *repeat this line for each plage region* |
|---|---|

**iii** = area in millionths of the solar hemisphere, divided by 100

**j** = intensity

- 1 = faint
- 2 = 1.5
- 3 = 2
- 4 = 2.5
- 5 = 3
- 6 = 3.5
- 7 = 4
- 8 = 4.5
- 9 = 5 (very bright)

**k** = last digit of check sum of preceding 14 digits

*Note: / is to be used for data not available.*

# USSPI and USSPY

*Content*:

Code USSPI is used to describe sunspots classified by magnetic characteristics.
Code USSPY is used to describe sunspots classified by magnetic field gradient.
In these codes sunspot groups are classified into four different types: UNIPOLAR, BIPOLAR, CONFIGURATION, and MUTIPOLAR (or COMPLEX) region.
The two codes are identical, except that code USSPY has one 5-digit group added to the end of the CONFIGURATION description. The extra group is used to describe the intensity and strength of the magnetic field in gauss.

*Examples of USSPI codes*:

Unipolar:

```
USSPI   30508   12231   42042   51310
```

Bipolar:

```
USSPI   30508   12231   13035   62111   08611
```

Configuration:

```
USSPI   30508   12231   23010   01234
```

*Example of USSPY code:*

Configuration:

```
USSPY   30508   12231   23010   01234   12153
```

*Definition of symbols*:

```
USSPI   IIIII   DDHHG
```

**USSPI** comes from **Sun**SP**o**t**s**, code **I**

```
USSPY   IIIII   DDHHG
```

**USSPY** comes from **Sun**SP**o**t**s**, code **Y**

```
USSPI   IIIII   DDHHG
```

**IIIII** = station indicator (see lists in Appendix B)

```
USSPI   IIIII   DDHHG
```

**DD** = UT day of observation
**HH** = UT hour of observation
**G** = quality of the seeing
1 = very poor
2 = poor
3 = fair
4 = good
5 = exceptional

## USSPI—*Continued*

If basically *UNIPOLAR* use the following two codes:

| QXXXY | K a b c d | { *repeat this line for each UNIPOLAR sunspot group* |
|---|---|---|

**Q** = quadrant (heliographic coordinates) in which geometric center of sunspot group is located
- 1 = NE (northeast)
- 2 = SE (southeast)
- 3 = SW (southwest)
- 4 = NW (northwest)

**XX** = distance to central meridian in degrees

**YY** = heliographic latitude in degrees

| QXXXY | K a b c d | { *repeat this line for each UNIPOLAR sunspot group* |
|---|---|---|

**K** = key number
- 5 = isolated unipolar spot or large spot surrounded by small companions of opposite polarity (configurationB)

**a** = Zurich sunspot class
- 1 = A
- 8 = H
- 9 = J

**b** = diameter of the main spot umbra in degrees

**c** = magnetic polarity of the main spot
- 1 = north
- 2 = south
- 3 = doubtful because of its heliographic longitude)

**d** = configuration
- 0 = not any configuration; that is single spot or all tiny spots
- 1 = several tiny spots of opposite polarity at a distance (configuration B)
- 2 = configuration B suspected according to chromospheric data (dark filament surrounding the spot like an eyebrow)

## USSPI—*Continued*

If *BIPOLAR* use the following three codes:

| QXXXY | K a b b c | d d e f g | { *repeat this line for each BIPOLAR sunspot group* |
|---|---|---|---|

**Q** = quadrant (heliographic coordinates) of geometric center of bipolar group
- 1 = NE (northeast)
- 2 = SE (southeast)
- 3 = SW (southwest)
- 4 = NW (northwest)

**XX** = distance to central meridian in degrees

**YY** = heliographic latitude in degrees

| QXXXY | K a b b c | d d e f g | { *repeat this line for each BIPOLAR sunspot group* |
|---|---|---|---|

**K** = key number
- 6 = open bipolar (the shortest distance between the edges of the main spots is equal to or greater than the diameter of the largest spot)
- 7 = closed bipolar (simple classical bipolar group and the shortest distance between the closest main spots is less than the diameter of the largest spot in the group)

**a** = Zurich sunspot class
- 2 = B
- 3 = C
- 4 = D
- 5 = E
- 6 = F
- 7 = G

**b b** = longitude difference in degrees between exterior edges of the main spots

**c** = number of 5-digit blocks used to describe configuration, if any configuration exists, or X when this bipolar group is part of a multipolar region (see K = 8)

| QXXXY | K a b b c | d d e f g | { *repeat this line for each BIPOLAR sunspot group* |
|---|---|---|---|

**d d** = shortest distance in degrees between the interior edges of the closest spots of opposite polarities

**e** = diameter in degrees of the largest spot umbra

**f** = orientation of the inversion (neutral) line:
- 1 = the inversion line is roughly parallel (±30°) to a solar meridian and the two main spots are equivalent (Beta) or the leading spot is the larger (Beta P)
- 2 = the inversion line is roughly parallel (±30°) to a solar meridian but the following main spot is the larger (Beta F)
- 3 = the inversion line is tilted between 30° and 60° to the solar equator and the two main spots are equivalent, or the leading spot is the larger (Beta and Beta P)
- 4 = the inversion line is tilted between 30° and 60° to the solar equator but the following main spot is the larger (Beta F)
- 5 = the inversion line is roughly parallel (±30°) to the solar equator and the two main spots are equivalent, or the leading spot is the larger (Beta and Beta P)
- 6 = the inversion line is roughly parallel (±30°) to the solar equator but the following main spot is the larger (Beta F)

**g** = description of the polarities
- 1 = the polarities are normal in relation to the hemisphere and solar cycle
- 2 = the polarities are normal but with many tiny spots
- 3 = the polarities are reversed in relation to the hemisphere and solar cycle
- 4 = the polarities are reversed but with many tiny spots
- 5 = the two polarities are nearly at the same longitude (see f = 5 or 6)

## USSPI—*Continued*

If *CONFIGURATION* exists use the following two codes (USSPI) or three codes (USSPY):

*Note:* *CONFIGURATION exists if two spots or many more spots of opposite polarities are very near together (for example, the distance between the interior edges of the main spots is less than or equal to the diameter of the biggest spot). The best known is the Delta configuration, where two umbra of opposite polarities are in the same penumbra (these are used to estimate the position of the highest gradient of the longitudinal magnetic component).*

| QXXXY | K h i j k | { *repeat this line for each CONFIGURATION sunspot group* |
|---|---|---|

**Q** = quadrant (heliographic coordinates) of geometric center of an active configuration where
- 1 = NE (northeast)
- 2 = SE (southeast)
- 3 = SW (southwest)
- 4 = NW (northwest)

**XX** = distance to central meridian in degrees

**YY** = heliographic latitude in degrees

| QXXXY | K h i j k | { *repeat this line for each CONFIGURATION sunspot group* |
|---|---|---|

**K** = key number
- 0 = description of active configuration

**h** = type of configuration and orientation of the inversion line
- 1 = a spotted configuration and the inversion line is roughly parallel (±30°) to a solar meridian
- 2 = a spotted configuration and the inversion line is titled between 30° and 60° to the solar equator
- 3 = a spotted configuration and the inversion line is roughly parallel (±30°) to the solar equator
- 4 = a Delta configuration and the inversion line is roughly parallel (±30°) to a solar meridian
- 5 = a Delta configuration and the inversion line is tilted between 30° and 60° to the solar equator
- 6 = a Delta configuration and the inversion line is roughly (±30°) parallel to the solar equator

**i** = diameter in degrees of the west spot (the west umbra in a Delta configuration)

**j** = diameter in degrees of the east spot (the east umbra in a Delta configuration)

**k** = distance in degrees between the interior edges of the two polarities (the two umbrae in a Delta configuration). For two polarities nearly at the same longitude there is no special order to report the spot or umbra diameters.

Include the following group when using code USSPY:

| QXXXY K h i j k | l l m m n | { *repeat this line for each CONFIGURATION sunspot group* |
|---|---|---|

**l l** = intensity of north polarity field (gauss divided by 100)

**m m** = intensity of south polarity field (gauss divided by 100)

**n** = evaluation of the strength of the magnetic field gradient according to the following
- 1 = weak (**n** < 0.1 gauss/km)
- 2 = large (0.1 gauss/km ≤ **n** ≤ 0.5 gauss/km)
- 3 = very large (**n** > 0.5 gauss/m)

## USSPI—*Continued*

If *MULTIPOLAR or COMPLEX region* made up of several UNIPOLAR or BIPOLAR GROUPS, use the following two codes, followed by the appropriate UNIPOLAR, BIPOLAR or CONFIGURATION groups:

| | | |
|---|---|---|
| **QXXXY** | **K a a b b** | { *repeat this line for each MULTIPOLAR or COMPLEX sunspot group* |

**Q** = quadrant (heliographic coordinates) of geometric center of the region
- 1 = NE (northeast)
- 2 = SE (southeast)
- 3 = SW (southwest)
- 4 = NW (northwest)

**XX** = distance to central meridian in degrees
**YY** = heliographic latitude in degrees

| | | |
|---|---|---|
| QXXXY | **K a a b b** | { *repeat this line for each MULTIPOLAR or COMPLEX sunspot group* |

**K** = key number
- 8 = multipolar region which can be reported as comprising a set of unipolar and (or) bipolar groups and active configurations
- 9 = complex region

**a a** = longitude difference in degrees between exterior edges of the main spots
**b b** = latitude difference in degrees between exterior edges of the main spots

The above two groups are followed by the appropriate groups:

QXXXY **K a b c d** or QXXXY **K a b b c d d e f g** or QXXXY **K h i j k l l m m n**

| | |
|---|---|
| **QXXYY K a b c d** | as defined under *UNIPOLAR* (p. 2 - 6) |
| **QXXYY K a b b c d d e f g** | as defined under *BIPOLAR* (p. 2 - 7) |
| **QXXYY k h i j k l l m m n** | as defined under *CONFIGURATION* (p. 2 - 8) |

*Note: / is to be used for data not available.*

# USSPS

*Content*:

Code USSPS is used to describe sunspot groups.

*Example*:

| USSPS | 85303 | 24030 | 03432 | 91001 | 46631 | 0/101 | 95012 | 32515 | 31313 |
|---|---|---|---|---|---|---|---|---|---|

and

*Definition of symbols*:

| USSPS | I I I I I | DDHHH | a a a b c |
|---|---|---|---|

**USSPS** comes from **SunSPotS**

| USSPS | I I I I I | DDHHH | a a a b c |
|---|---|---|---|

**I I I I I** = station indicator (see lists in Appendix C)

| USSPS | I I I I I | DDHHH | a a a b c |
|---|---|---|---|

**DD** = UT day of observation
**HHH** = UT time of observation in hours and tenths of hour

| USSPS | I I I I I | DDHHH | a a a b c |
|---|---|---|---|

**a a a** = relative sunspot number
**b** = seeing quality
- 1 = very poor
- 2 = poor
- 3 = fair
- 4 = good
- 5 = exceptional

**c** = solar disk size used for measurement
- 1 = diameter of the solar disk less than 15 cm
- 2 = diameter of the solar disk between 15 and 30 cm
- 3 = diameter of the solar disk more than 30 cm
- 4 = individual sunspot groups at very high resolution

| d d AAA | QXXYY | f g h i i | { *repeat this line for each sunspot group* |
|---|---|---|---|

**d d** = serial number of sunspot group
**AAA** = area of sunspot group in tens of millionths of the solar hemisphere

| d d AAA | QXXYY | f g h i i | { *repeat this line for each sunspot group* |
|---|---|---|---|

**Q** = quadrant (heliographic coordinates) in geometric center of sunspot groups is located
- 1 = NE (northeast)
- 2 = SE (southeast)
- 3 = SW (southwest)
- 4 = NW (northwest)

**XX** = distance to central meridian in degrees
**YY** = heliographic latitude in degrees

## USSPS—*Continued*

| d d AAA QXXYY | **f g h i i** | { *repeat this line for each sunspot group* |
|---|---|---|

**f** = type of penumbra in the largest spot in group (see fig. 2–1)
- 0 = no penumbra (Zurich class A or B)
- 1 = rudimentary (r)
- 2 = small symmetric (s) north to south diameter $\leq$ 2.5°
- 3 = small asymmetric (a) north to south diameter $\leq$ 2.5°
- 4 = large symmetric (h) north to south diameter > 2.5°
- 5 = large asymmetric (k) north to south diameter > 2.5°

**g** = relative importance of the leading spot and density of the sunspot population
- 1 = leading spot largest and sunspot population density open
- 2 = following spot largest and sunspot population density open
- 3 = leading and following spots nearly same size and sunspot population density open
- 4 = leading spot largest and sunspot population density intermediate
- 5 = following spot largest and sunspot population density intermediate
- 6 = leading and following spot nearly same size and sunspot population density intermediate
- 7 = leading spot largest and sunspot population density compact
- 8 = following spot largest and sunspot population density compact
- 9 = leading and following spot nearly same size and sunspot population density compact

*Note:* **g** = / *(slant line) for unipolar spots of Zurich class A, H or J*

**h** = Zurich sunspot class (see fig. 2–1)
- 1 = A
- 2 = B
- 3 = C
- 4 = D
- 5 = E
- 6 = F
- 7 = G
- 8 = H
- 9 = J

*Note: Normally G will be encoded as an open E or F and J will be encoded as a small H.*

**i i** = number of spots in the group

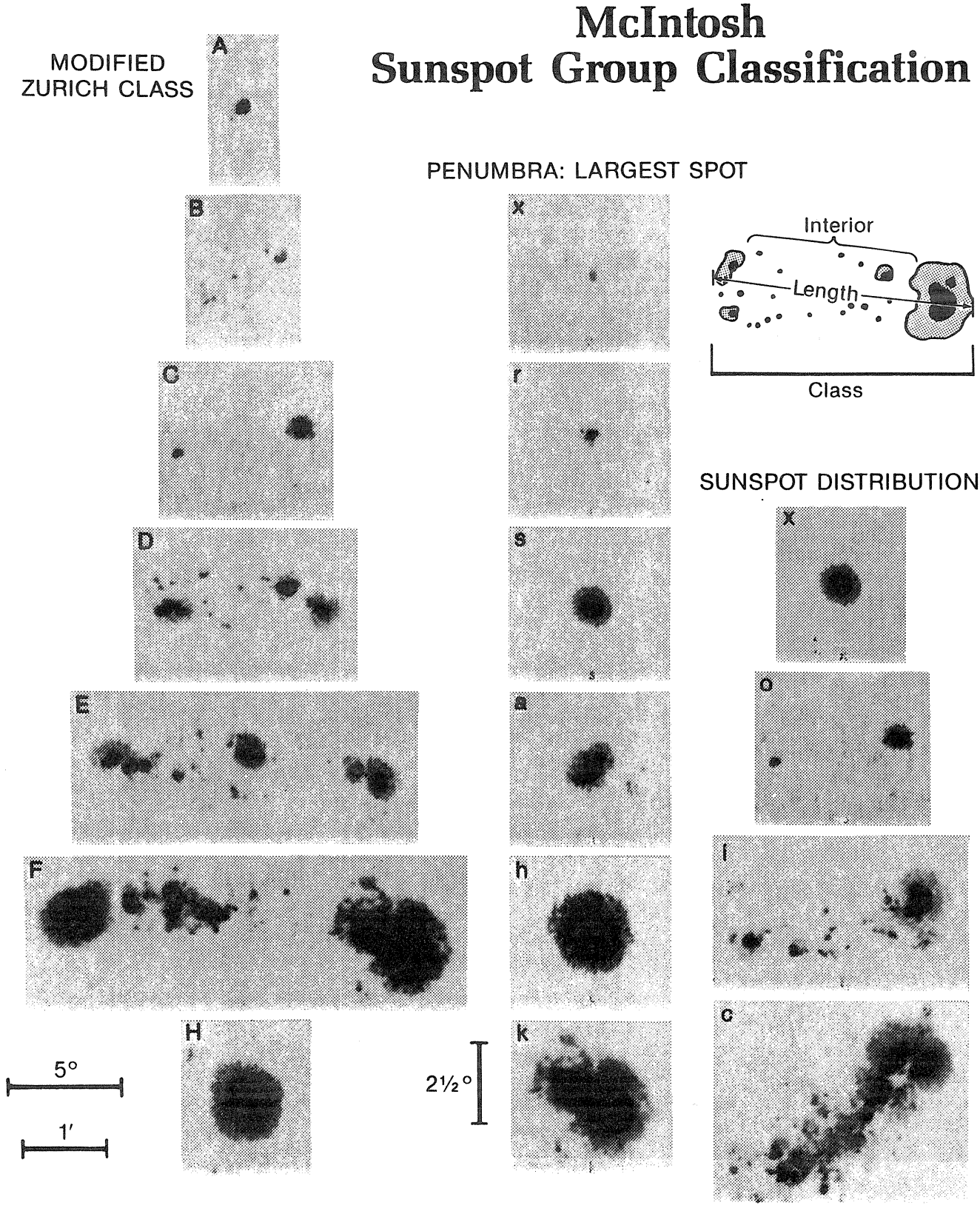



Figure 2-1.—Modified Zurich (McIntosh) Sunspot Classification.

# Chapter Three

## Radio Data Codes

Radio Data Codes are used by observatories to report solar radio data; radio bursts in discrete and sweep frequencies and quiet-sun levels in discrete radio frequencies.

Code forms:

**URALN**

**URANJ**

**URASP**

# URALN

*Content*:

Position measurements of solar radio sources or inferred coronal holes at a discrete frequency, possibly including intensity and flux.

This code is used to report location of either coronal condensations observed above 500 MHz (approximate); for example, the "slowly" varying component, generally a = 1 or a = 2 (see definition below); or noise storms observed below 500 MHz (approximate), where total power observation of noise storm on the same frequency is not available, generally a = 1 or a = 3 (see definition below).

When total power observation is available, URANJ should be used.

*Example*:

| URALN | 85304 | 90928 | 00692 | 02015 | 17100 | 27070 | 17010 | 18035 | 28090 |
|---|---|---|---|---|---|---|---|---|---|

*Definition of symbols*:

| URALN | I I I I I | YMMDD | FFFFF | HHTan |
|---|---|---|---|---|

**URALN** comes from **RA**dio noise **L**ocation, code **N**

| URALN | I I I I I | YMMDD | FFFFF | HHTan |
|---|---|---|---|---|

**I I I I I** = station indicator (see lists in Appendix C)

| URALN | I I I I I | YMMDD | FFFFF | HHTan |
|---|---|---|---|---|

**Y** = last digit of year
**MM** = month of year, 01 = January, 02 = February, *etc.*
**DD** = UT day of month

| URALN | I I I I I | YMMDD | FFFFF | HHTan |
|---|---|---|---|---|

**FFFFF** = frequency in MHz

| URALN | I I I I I | YMMDD | FFFFF | HHTan |
|---|---|---|---|---|

**HHT** = UT time nearest beginning of observation period in hours and tenths of hours
**a** = type of observation reported, where
- 1 = fan-beam, east-west scan using single group **d e f f f** for each source.
- 2 = detailed pencil-beam measurements in heliographic coordinates—two groups (**QXXYY b b b c c**) for each source.
- 3 = pencil-beam mapping on geocentric N-S-E-W grid; one group **Qxxyy** for each source

**n** = number of sources and (or) coronal holes reported

## URALN—*Continued*

If **a** = 1 (fan-beam, east-west scan) use the following two groups:

| **d e f f f** | **b b b c c** |
|---|---|

**d** = noise source or inferred coronal hole and importance, where
- 0 = noise source, importance 0 (least importance)
- 1 = noise source, importance 1
- 2 = noise source, importance 2
- 3 = noise source, importance 3 (greatest importance)
- 4 = inferred coronal hole, importance 1 (least importance)
- 5 = inferred coronal hole, importance 2
- 6 = inferred coronal hole, importance 3 (greatest importance)

**e** = location of noise source or deepest depression of inferred coronal hole east or west of scan center, where
- 7 = east
- 8 = west

**f f f** = distance of noise source or inferred coronal hole from scan center, in percent of photospheric radius

| **d e f f f** | **b b b c c** |
|---|---|

**b b b** = maximum intensity in tens of thousands of Kelvins (or, for sources at mm wavelengths, tens of Kelvins)

**c c** = flux enhancement from region in $10^{-22}$ $Wm^{-2}Hz^{-1}$

If **a** = 2 (detailed pencil-beam measurements in heliographic coordinates) use the following two groups:

| **Q X X Y Y** | **b b b c c** |
|---|---|

**Q** = quadrant (heliographic coordinates) containing the noise source, where
- 1 = NE (northeast)
- 2 = SE (southeast)
- 3 = SW (southwest)
- 4 = NW (northwest)

**XX** = distance to the central meridian in degrees (if above east or west limb, use 95)

**YY** = heliographic latitude in degrees

| **Q X X Y Y** | **b b b c c** |
|---|---|

**b b b** = maximum intensity in tens of thousands of Kelvins (or, for sources at mm wavelengths, tens of Kelvins)

**c c** = flux enhancement from region in $10^{-22}$ $Wm^{-2}Hz^{-1}$

If **a** = 3 (pencil-beam mapping on geocentric N-S-E-W grids) use the following group for each source:

| **Q x x y y** | [Q x x y y ... Q x x y y] |
|---|---|

**Q** = quadrant containing the noise source, where
- 1 = NE (northeast)
- 2 = SE (southeast)
- 3 = SW (southwest)
- 4 = NW (northwest)

**xx** = distance to east or west of N-S diameter in tenths of photospheric radius

**yy** = distance north or south of E-W diameter in tenths of photospheric radius

*Note: / is to be used for data not available.*

# URANJ

*Content*:

Single-frequency measurements of solar radio flux and events, with location of events if also measured at that frequency.

*Example*:

| URANJ | 85304 | 90928 | 01415 | 00060 | 14705 |
|---|---|---|---|---|---|

*Definition of symbols*:

| URANJ | I I I I I | YMMDD |
|---|---|---|

**URANJ** comes from **RA**dio **N**oise, code **J**

| URANJ | I I I I I | YMMDD |
|---|---|---|

**I I I I I** = station indicator (see lists in Appendix C)

| URANJ | I I I I I | YMMDD |
|---|---|---|

**Y** = last digit of year
**MM** = month of year, 01 = January, 02 = February, *etc.*
**DD** = day of month (UT)

| FFFFF | a a b b c (d d d e e) 9HHmm gHHmm h i i i i or k l l l l /HHmm (Qoppp) or (Qxxyy) |
|---|---|

**FFFFF** = frequency in MHz

*Note:* Repeat **URANJ I I I I I YMMJJ** for each frequency measured.

| FFFFF | a a b b c | (d d d e e) 9HHmm gHHmm h i i i i or k l l l l /HHmm (Qoppp) or (Qxxyy) |
|---|---|---|

**aa** = UT hour nearest beginning of observation period
**bb** = UT hour nearest end of observation period
**c** = number of significant events reported

| FFFFF a a b b c | d d d e e | 9HHmm gHHmm h i i i i or k l l l l /HHmm (Qoppp) or (Qxxyy) |
|---|---|---|

**ddd** = background flux in $10^{-22}$ $Wm^{-2}Hz^{-1}$, adjusted for burst effects if necessary. Divide flux by 10 if frequency greater than 20 GHz.
**ee** = nearest UT hour of flux measurement

*Note:* *Omit group* **dddee** *if these measurements are not made.*

| FFFFF a a b b c (d d d e e) | 9HHmm | gHHmm h i i i i or k l l l l /HHmm (Qoppp) or (Qxxyy) |
|---|---|---|

**9** = 9 indicates the begin time of an event report follows
**HHmm** = UT hour and minute of beginning of significant event (if in progress at beginning of observation period, use / / / /)

*Note:* For each new burst, start burst data with **9HHmm**

## URANJ—*Continued*

| FFFFF aabbc (dddee) 9HHmm **gHHmm** h i i i i or k l l l l /HHmm (Qoppp) or (Qxxyy) |
|---|

**g** = key to type of event where
- 1 = meter-wave noise storm
- 2 = rise in base level (usually meter-wave)
- 3 = meter-wave minor burst, or microwave simple burst
- 4 = group of bursts, of fluctuations
- 5 = meter-wave major burst, or microwave complex burst
- 6 = "plus" part of "major-plus" burst, or microwave post-burst increase

**HHmm** = UT hour and minute of end of event (if still in progress at end of observation period, use ////)

| FFFFF aabbc (dddee) 9HHmm gHHmm **h i i i i** or k l l l l /HHmm (Qoppp) or (Qxxyy) |
|---|

**h** = key to measurement of maximum flux of event in *flux units*, where
- 5 = actual measurement
- 6 = lower limit (due to receiver saturation, aerial mistracking, *etc.*)

**iiii** = peak flux of the event above pre-burst level, in $10^{-22}$ $Wm^{-2}Hz^{-1}$.

*Note:* *If the event is a noise storm, use the median flux; the time of maximum can then be replaced by ////. If peak flux is over 9999, replace by word FLUX and send flux as an extra 5-figure group immediately following* **h i i i i**.

OR

| FFFFF aabbc (dddee) 9HHmm gHHmm h i i i i or **k l l l l** /HHmm (Qoppp) or (Qxxyy) |
|---|

**k** = key to measurement of maximum flux in terms of *percent increase*, where
- 7 = actual measurement
- 8 = lower limit

**llll** = peak flux reported as percent increase over pre-burst level; for example, small bursts start from 0%, not 100%.

*Note:* *More than one significant maximum per burst can be reported by repeating from the* **h i i i i** *or* **k l l l l** *group. These are distinguished by their first digit 5, 6, 7 or 8, from the start of another burst which starts with a 9. One or more* **Qoppp** *or* **Qxxyy** *groups can be given with each flux maximum, to show the source position(s) contributing to that maximum. These are distinguished by the first digit being 0, 1, 2, 3, or 4. If necessary to show the motion of a moving source, later positions may be given at an arbitrary chosen time, not necessarily time of maximum flux.*

| FFFFF aabbc (dddee) 9HHmm gHHmm h i i i i or k l l l l **/HHmm** (Qoppp) or (Qxxyy) |
|---|

/ = filler

**HHmm** = UT hour and minute of maximum

**URANJ**—*Continued*

| FFFFF aabbc (dddee) fHHmm gHHmm h i i i i or k l l l l /HHmm Qoppp or (Qxxyy) |
|---|

**Q** = 0 to signify that fan-beam measurement of E-W location of burst source follows
**o** = location of burst source east or west of scan center, where
7 = east
8 = west
**ppp** = distance of burst source from scan center, in percent of photospheric radius

*Note: Omit group* **Qoppp** *if these measurements are not made.*

OR

| FFFFF aabbc (dddee) fHHmm gHHmm h i i i i or k l l l l /HHmm (Qoppp) or Qxxyy |
|---|

**Q** = quadrant containing the burst source, where
1 = NE (northeast) 3 = SW (southwest)
2 = SE (southeast) 4 = NW (northwest)
**xx** = distance to east or west of N-S diameter in tenths of photospheric radius
**yy** = distance north or south of E-W diameter in tenths of photospheric radius

*Note: Omit group* **Qxxyy** *if these measurements are not made.*

*Note: / is to be used for data not available.*

# URASP

*Content*:

Spectrographic measurements of solar radio events

*Example*:

| URASP | 85303 | 90928 | 06221 | 00072 | 22450 | 30236 | 10236 | 35500 | 30645 | 10645 |
|---|---|---|---|---|---|---|---|---|---|---|

*Definition of symbols*:

| URASP | I I I I I | YMMDD | FFGGH | a a b b c |
|---|---|---|---|---|

**URASP** comes from **RA**dio **SP**ectral event

| URASP | I I I I I | YMMDD | FFGGH | a a b b c |
|---|---|---|---|---|

**I I I I I** = station indicator (see lists in Appendix C)

| URASP | I I I I I | YMMDD | FFGGH | a a b b c |
|---|---|---|---|---|

**Y** = last digit of year
**MM** = month of year, 01 = January, 02 = February, *etc.*
**DD** = UT day of month

| URASP | I I I I I | YMMDD | FFGGH | a a b b c |
|---|---|---|---|---|

**FF** = lowest frequency of equipment (first two significant figures)
**GG** = highest frequency of equipment (first two significant figures)
**H** = frequency multiplication indicator, where

- 0 = indicates **FF** is to be multiplied by 1, **GG** by 1 to obtain frequencies in MHz
- 1 = indicates **FF** is to be multiplied by 1, **GG** by 10 to obtain frequencies in MHz.
- 2 = indicates **FF** is to be multiplied by 10, **GG** by 10 to obtain frequencies in MHz.
- 3 = indicates **FF** is to be multiplied by 1, **GG** by 100 to obtain frequencies in MHz
- 4 = indicates **FF** is to be multiplied by 10, **GG** by 100 to obtain frequencies in MHz
- 5 = indicates **FF** is to be multiplied by 100, **GG** by 100 to obtain frequencies in MHz

(If the report is based on real-time output which covers less than the full frequency range of the equipment, then give frequency range of real-time output.)

| URASP | I I I I I | YMMDD | FFGGH | a a b b c |
|---|---|---|---|---|

**a a** = UT hour nearest beginning of observation period
**b b** = UT hour nearest end of observation period
**c** = number of significant events reported

| f f g g h | dHHmm | eHHmm | { *repeat this line for each event* |
|---|---|---|---|

**f f** = lowest frequency of significant event
**g g** = highest frequency of significant event
**h** = frequency multiplication indicator for **f f** and **g g**, coded as for **H** above

## URASP—*Continued*

| f f g g h | **dHHmm** | eHHmm | { *repeat this line for each event* |
|---|---|---|---|

**d** = type of spectral activity, where
- 1 = type I storm = noise storm
- 2 = type II burst = slow-drift burst
- 3 = type III burst = fast-drift burst
- 4 = type IV = prolonged broad-band continuum, often preceded, at meter wavelengths, by a type II burst
- 5 = type V burst
- 6 = type III storm or dekametric continuum
- 7 = intermittent groups of type III bursts
- 8 = microwave burst of short (minutes) duration, usually of impulsive start
- 9 = continuum (except type IV and dekametric)
- / = unclassified activity

**HHmm** = UT hour and minute of start of event (if in progress at beginning of observation period use / / / /)

| f f g g h | dHHmm | **eHHmm** | { *repeat this line for each event* |
|---|---|---|---|

**e** = importance of event, if record timing is accurate to within 2 minutes:
- 1 = importance 1
- 2 = importance 2
- 3 = importance 3
- 7 = importance 1+
- 8 = importance 2+
- 9 = importance 3+

Otherwise, if record timing is not accurate to within 2 minutes:
- 4 = importance 1
- 5 = importance 2
- 6 = importance 3

**HHmm** = UT hour and minute of end of event (if event is still in progress at end of observation period, use / / / /).

*Note: / is to be used for data not available.*

# Chapter Four

## Satellite Data Codes

Satellite Data Codes are used by telemetry stations, forecast centers and others to encode solar geophysical data obtained from satellite-based sensors.

Code forms:

**USXRA**

**USPRO**

**UTELC**

# USXRA

*Content*:

Solar x-ray events.

*Example*:

```
USXRA  90005  80712
06101  01525  01545  01630  12002  9abSp
```

*Definition of symbols*:

```
USXRA  IIIII  YMMDD
```

USXRA comes from Solar X-RAy events

```
USXRA  IIIII  YMMDD
```

**IIIII** = station indicator (see lists in Appendix C)

```
USXRA  IIIII  YMMDD
```

**Y** = last digit of year
**MM** = month of year, 01 = January, 02 = February, *etc.*
**DD** = UT day of month

```
SSENN  0HHmm  0HHmm  0HHmm  QabSp  9abSp
```

**SS** = satellite
06 = GOES-6
07 = GOES-7
08 = GOES-8
09 = GOES-9
**E** = energy range
1 = .1-.8 nm
**NN** = number of events

```
SSENN  0HHmm  0HHmm  0HHmm  QabSp  9abSp
```

**0** = indicates that the begin time of the event follows
**HHmm** = UT hour and minute of beginning of event

```
SSENN  0HHmm  0HHmm  0HHmm  QabSp  9abSp
```

**0** = indicates that the maximum time of the event follows
**HHmm** = UT hour and minute of maximum for event

```
SSENN  0HHmm  0HHmm  0HHmm  QabSp  9abSp
```

**0** = indicates that the end time of the event follows
**HHmm** = UT hour and minute of end time of event

## USXRA—*Continued*

| SSENN | 0HHmm | 0HHmm | 0HHmm | QabSp | 9abSp |
|---|---|---|---|---|---|

Maximum flux:

**Q** = qualifier
- 0 = uncertain data
- 1 = certain data

**ab** = x-ray flux in W m $^{-2}$ where **ab** = **a.b**

**S** = sign of the exponent to apply to **a.b**
- 0 = positive
- 9 = negative

**p** = power of ten to apply to **a.b**

*Note:* **abSp** *reported as* **4192** *would equal* 4.1 x $10^{-2}$ W $m^{-2}$

*Note:* */ is to be used for data not available.*

| SSENN | 0HHmm | 0HHmm | 0HHmm | QabSp | 9abSp |
|---|---|---|---|---|---|

Integrated flux (start thru end):

**9** = qualifier

**ab** x-ray integrated flux in J m $^{-2}$ where ab = a.b

**S** = sign of the exponent to apply to **a.b**
- 0 = positive
- 9 = negative

**p** = power of ten to apply to **a.b**

*Note:* **abSp** *reported as* **5692** *would equal* 5.6 x $10^{-2}$ J $m^{-2}$

*Note:* */ is to be used for data not available.*

# USPRO

*Content*:

Solar proton events.

*Example*:

```
USPRO  IIIII   YMMDD
SSEEE  DDHHM   DDHHM   DDHHM   9abcP   7abPP
```

*Definition of symbols*:

```
USPRO  IIIII   YMMDD
```

**USPRO** for satellite data (US) and PRO for protons.

```
USPRO  IIIII   YMMDD
```

**IIIII** = station indicator (20401 for Boulder)

```
USPRO  IIIII   YMMDD
```

Year, Month day of transmission

**Y** = last digit of year
**MM** = month of year, 01 = January, 02 = February, *etc.*
**DD** = UT day of month

```
SSEEE  DDHHM   DDHHM   DDHHM   9abcP   7abPP
```

**SS** = satellite identifier

| | | | |
|---|---|---|---|
| 06 = | GOES-6 | 08 = | GOES-8 |
| 07 = | GOES-7 | 09 = | GOES–9 |

**EEE** = energy range

010 = >10 MeV
100 = >100 MeV

```
SSEEE  DDHHM   DDHHM   DDHHM   9abcP   7abPP
```

**DD** = UT day
**HHM** = indicates hour and 10's of minutes of the appropriate begin time of the event

```
SSEEE  DDHHM   DDHHM   DDHHM   9abcP   7abPP
```

**DD** = UT day
**HHM** = indicates hour and 10's of minutes of the appropriate max time of the event

```
SSEEE  DDHHM   DDHHM   DDHHM   9abcP   7abPP
```

**DD** = UT day
**HHM** = indicates hour and 10's of minutes of the appropriate end time of the event

## USPRO—*Continued*

| SSEEE | DDHHM | DDHHM | DDHHM | 9abcP | 7abPP |
|---|---|---|---|---|---|

Maximum flux:

| | | |
|---|---|---|
| **9** | = | indicator |
| **abc** | = | Proton flux in pfu's expressed as a.bc<br>PFU = 1 particle $cm^{-2}$ $s^{-1}$ $sr^{-1}$ = 10 p $m^{-2}$ $s^{-1}$ $sr^{-1}$ |
| **P** | = | power of ten to raise **a.bc (always positive)** |

| SSEEE | DDHHM | DDHHM | DDHHM | 9abcP | 7abPP |
|---|---|---|---|---|---|

Integrated flux (start thru end):

| | | |
|---|---|---|
| **7** | = | indicator |
| **ab** | | integrated proton fluence expressed as a.b (particles $cm^{-2}$ $sr^{-1}$) |
| **PP** | = | power of ten to raise **a.b (always positive)** |

# UTELC

*Content*:

Total electron content.

*Example*:

| UTELC | 20401 | 80712 | 01525 | 51203 | 61304 |
|---|---|---|---|---|---|

*Definition of symbols*:

| UTELC | IIIII | YMMDD | OHHmm | Habpp | [Habpp | ...] |
|---|---|---|---|---|---|---|

**UTELC** comes from Total ELectron Content

| UTELC | IIIII | YMMDD | OHHmm | Habpp | [Habpp | ...] |
|---|---|---|---|---|---|---|

**I I I I I** = station indicator (see lists in Appendix C)

| UTELC | IIIII | YMMDD | OHHmm | Habpp | [Habpp | ...] |
|---|---|---|---|---|---|---|

**Y** = last digit of year
**MM** = month of year, 01 = January, 02 = February, *etc.*
**DD** = UT day of month

| UTELC | IIIII | YMMDD | OHHmm | Habpp | [Habpp | ...] |
|---|---|---|---|---|---|---|

**O** = indicates that the begin time of the observation follows
**HHmm** = UT hour and minute of beginning of observation

| UTELC | IIIII | YMMDD | OHHmm | Habpp | [Habpp | ...] |
|---|---|---|---|---|---|---|

**H** = last digit of UT hour

**ab** = total electron content in units of electrons/$m^2$ where **ab** = **a.b**

**pp** = power of ten to apply to **a.b**

*Note:* **abpp** *reported as* **1202** *would equal* $1.2 \times 10^2$ $Wm^{-2}$

*Note:* */ is to be used for data not available.*

# Chapter Five

## Ionospheric Data Codes

Ionospheric Data Codes are used to describe the state of the ionosphere through direct and indirect sensors.

Code forms:

**IONFM**

**UABSE**

**UFOFS, UFOFH, UMUFH, UFMNH, and UFESH**

**USIDS**

# IONFM

*Content*:

Hourly ionospheric data.

*Example*:

| IONFM | 33502 | 90111 | /1300 | 62129 | 03146 | 70130 | 01715 | 70030 | //716 |
|---|---|---|---|---|---|---|---|---|---|

*Definition of symbols*:

| IONFM | I I I I I | YMMDD | /HHmm | KFFMM | EEENN |
|---|---|---|---|---|---|

**IONFM** comes from **ION**ospheric data, **F**requency **M**easurements

| IONFM | I I I I I | YMMDD | /HHmm | KFFMM | EEENN |
|---|---|---|---|---|---|

**I I I I I** = station indicator (see lists in Appendix C)

| IONFM | I I I I I | YMMDD | /HHmm | KFFMM | EEENN |
|---|---|---|---|---|---|

**Y** = last digit of year
**MM** = month of year, 01 = January, 02 = February, *etc.*
**DD** = UT day of month

| IONFM | I I I I I | YMMDD | /HHmm | KFFMM | EEENN |
|---|---|---|---|---|---|

**/** = filler
**HHmm** = UT hour and minute of first data reported

| IONFM | I I I I I | YMMDD | /HHmm | KFFMM | EEENN |
|---|---|---|---|---|---|

**K** = double hour (UT) indicator
- 0 = 00 or 01, 20 or 21
- 1 = 02 or 03, 22 or 23
- 2 = 04 or 05
- 3 = 06 or 07
- 4 = 08 or 09
- 5 = 10 or 11
- 6 = 12 or 13
- 7 = 14 or 15
- 8 = 16 or 17
- 9 = 18 or 19

**FF** = $F_2$ critical frequency in tenths of MHz
**MM** = M-3000 maximum usable frequency in tenths of MHz

| IONFM | I I I I I | YMMDD | /HHmm | KFFMM | EEENN |
|---|---|---|---|---|---|

**EEE** = $E_s$ critical frequency in tenths of MHz
**NN** = Fmin frequency in tenths of MHz

*Note: / is to be used for data not available.*

# UABSE

*Content*:

Ionospheric absorption measurement by riometer technique or by ionospheric forward scatter or by VLF recordings.

*Example*:

```
UABSE  33501  05116
21200  91245  12/14
```

*Definition of symbols*:

```
UABSE  I I I I I  DDTHH
```

**UABSE** comes from ionospheric **ABS**orption, code **E**

```
UABSE  I I I I I  DDTHH
```

**I I I I I** = station indicator (see lists in Appendix C)

```
UABSE  I I I I I  DDTHH  aHHmm  9HHmm  (cc/HH)  or  (dddHH)
```

**DD** = UT day of observation
**T** = type of measurement
- 1 = riometer
- 2 = forward scatter
- 3 = VLF phase advance (rarely retardation which requires use of group **dddHH** instead of group **ccXHH**

**HH** = UT hour of message

```
UABSE  I I I I I  DDTHH  aHHmm  9HHmm  (cc/HH)  or  (dddHH)
```

**a** = type of phenomenon
- 1 = SCNA (sudden cosmic noise absorption)
  (if it is associated with a solar flare, it is normally reported by code USIDO)
- 2 = SPA (sudden phase anomaly)
  (if it is associated with a solar flare, it may be reported by code USIDO)
- 3 = Aurora—associated absorption
- 4 = PCA (polar cap absorption event) due to protons
- 5 = PCA (polar cap absorption event) due to relativistic electrons
- 6 = noise storm of solar radio emission superposed on absorption
- 7 = slowly varying ionospheric absorption—
  defines onset time of magnetospheric sub–storm at auroral zone stations near the midnight meridian (Eather and Jacka, Australia J. Physics *19*, 215, 1966).

**HHmm** = UT hour and minute of beginning of phenomenon

```
UABSE  I I I I I  DDTHH  aHHmm  9HHmm  (cc/HH)  or  (dddHH)
```

**9** = indicates time of maximum follows
**HHmm** = UT hour and minute of maximum of event

*Note: Omit group* **bHHmm** *if maximum time is not known*

## UABSE—*Continued*

If T = 1 or 2 in **DDTHH** use the following group:

| UABSE | I I I I I | DDTHH | aHHmm | 9HHmm | cc/HH | or | (dddHH) |
|---|---|---|---|---|---|---|---|

**cc** = number of decibels of maximum absorption before hour indicated by next **HH**
**/** = filler
**HH** = UT hour of end time of event
(if the event is still in progress at the time of the message, use / /)

If T = 3 in **DDTHH** use the following group:

| UABSE | I I I I I | DDTHH | aHHmm | 9HHmm | (cc/HH) | or | dddHH |
|---|---|---|---|---|---|---|---|

**d d d** = phase advance (rarely retardation) in degrees
**HH** = UT hour of end time of event
(if the event is still in progress at the time of the message, use / /)

*Note: / is to be used for data not available.*

# UFOFS, UFOFH, UMUFH, UFMNH , and UFESH

*Content*:

The data in the UFOFS, UFOFH, UFMNH, UFESH, and UMUFH codes include:

Critical frequencies of F2 region (foF2) as a function of time
Maximum and minimum values of foF2 and hour of occurrence
F-min frequencies for every 6 hours (first hours same as for first foF2 group)
Minimum o-layer component frequency
Critical frequency of sporatic E (foEs)

The codes are almost identical, except values are given for *6-hour intervals* in the UFOFS (xxxxS) code and for *1-hour intervals* in the UFOFH, UFMNH, UFESH, and UMUFH codes (xxxxH).

Also, the values are given for foF2 in the UFOFS and UFOFH codes and for M(3000)F2 in the UMUFH code (see **ffggh** group).

The UFESH code is used to report auroral sporadic E. It is the same as the UFOFH code, except the letter h in the group **fgggh** is defined as 6 = F, spread echoes for auroral sporadic E.

*Examples*:

```
UFOFS   34504   80924   /1800   9070/   0037/   3090/   6096/
```

```
UFOFH  22306   80924   /0000   0090/   1085/   2085/   3075/   4052/   5051/
6045/  7047/   8046/   9049/   0085/   1091/   2090/   3036/   4045/   5067/
6074/  7071/   8074/   9074/   0085/   1047/   2090/   3090/
```

```
UMUFH   34504   80924   /1800   9070/   0037/   3090/   6096/
```

*Definition of symbols*:

```
UFOFS   I I I I I   YMMDD   /HHmm
```

**UFOFS** comes from radio **FOF2**, code O (every Six hours, Universal time)

```
UFOFH   I I I I I   YMMDD   /HHmm
```

**UFOFH** comes from **FOF2**, code D (every **H**our, Universal time)

```
UMUFH   I I I I I   YMMDD   /HHmm
```

**UMUFH** comes from **M**aximum **U**sable **F**requency **F**actor (3000) F2, code D (every **H**our, UT time)

## UFOFS, UFOFH, UMUFH, UFMNH, and UFESH—*Continued*

| **UFMNH** | **I I I I I** | **YMMDD** | **/HHmm** |
|---|---|---|---|

**UFMNH** comes from **F**requency **M**i**N**imum (every **H**our, UT time) ???????

| **UFESH** | **I I I I I** | **YMMDD** | **/HHmm** |
|---|---|---|---|

**UFESH** comes from **F**requency **E**–Sporadic (every **H**our, UT time)

| **UFOFS** | **I I I I I** | **YMMDD** | **/HHmm** |
|---|---|---|---|

**I I I I I** = station indicator (see lists in Appendix C)

| **UFOFS** | **I I I I I** | **YMMDD** | **/HHmm** |
|---|---|---|---|

**Y** = last digit of year
**MM** = month of year, 01 = January, 02 = February, *etc.*
**DD** = UT day of month

| **UFOFS** | **I I I I I** | **YMMDD** | **/HHmm** |
|---|---|---|---|

/ = filler
**HHmm** = UT hour and minute of beginning of period

| **fgggh** | **[fgggh]** | **. . .** | **[fgggh]** | **MAXMI** | **HHppp** | **HHqqq** |
|---|---|---|---|---|---|---|

For the xxxxS codes, use the following time indicators:

**f** = even-hour indicator, give data for 6-hour intervals, beginning with the appropriate hour after the date:

| | | | |
|---|---|---|---|
| 0 | = 0000 hours | 6 | = 1200 |
| 3 | = 0600 | 9 | = 1800 |

For the xxxxH codes, use the following time indicators:

**f** = UT hour of data reported, beginning with the appropriate hour after the date

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 0 | = 0000 | 6 | = 0600 | 2 | = 1200 | 8 | = 1800 |
| 1 | = 0100 | 7 | = 0700 | 3 | = 1300 | 9 | = 1900 |
| 2 | = 0200 | 8 | = 0800 | 4 | = 1400 | 0 | = 2000 |
| 3 | = 0300 | 9 | = 0900 | 5 | = 1500 | 1 | = 2100 |
| 4 | = 0400 | 0 | = 1000 | 6 | = 1600 | 2 | = 2200 |
| 5 | = 0500 | 1 | = 1100 | 7 | = 1700 | 3 | = 2300 |

## UFOFS, UFOFH, UMUFH, UFMNH, and UFESH—*Continued*

**ggg** = value of foF2 (in tenths of MHz) for UFOFS and UFOFH
(report as 000 if symbols only are applicable)

= value of M(3000)F2 (in hundredths) for UMUFH
(report as 000 if symbols only are applicable

= minimum value (in tenths of MHz) of the o-layer component frequency (UFMNH)
(report as 000 if symbols only are applicable)

= value of foEs (in tenths of MHz) for UFESH
(report as 000 if symbols only are applicable)

**h** = descriptive letter symbol (see Piggott and Rawer, *URSI Handbook of Ionogram Interpretation and Reduction,* 1961, for full information)

- X = none (use / in teletype messages)
- 1 = A, blanketing sporadic E
- 2 = B, complete absorption
- 3 = C, equipment trouble
- 4 = D, frequency higher than equipment limit
- 5 = E, frequency lower than equipment limit
- 6 = F, spread echoes
- 7 = G, foF2 $\leq$ foF1 (report foF1 in group **ggg** above)
- 8 = I or T, interpolated or smoothed value
- 9 = R, measurement influenced by, or impossible because of attenuation in the vicinity of a critical frequency
- 0 = any other

For code UFESH:

6 = F, spread echoes for auroral sproadic E

| fgggh | [fgggh] | . . . | [fgggh] | **MAXMI** | HHppp | HHqqq |
|---|---|---|---|---|---|---|

**MAXMI** = key word, indicating the following groups given **MAX**imum and **MI**nimum foF2 during 24-hour period reported

| fgggh | [fgggh] | . . . | [fgggh] | MAXMI | **HHppp** | HHqqq |
|---|---|---|---|---|---|---|

**HH** = nearest hour of maximum value
**ppp** = maximum value of foF2 in 24-hour period reported, in tenths of MHz

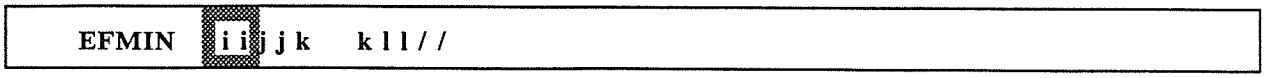
| fgggh | [fgggh] | . . . | [fgggh] | MAXMI | HHppp | **HHqqq** |
|---|---|---|---|---|---|---|

**HH** = nearest hour of minimum value
**qqq** = minimum value of foF2 in 24-hour period reported, in tenths of MHz

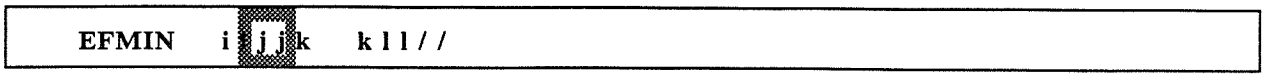
| **EFMIN** | i i j j k | k l l / / |
|---|---|---|

**EFMIN** = key word, indicating f-MIN data to follow

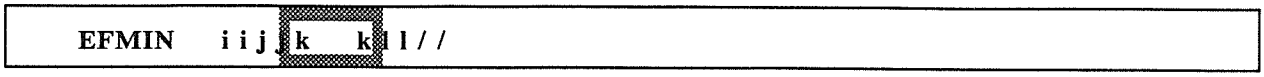
## UFOFS, UFOFH, UMUFH, UFMNH, and UFESH—*Continued*




**i i** = f-min in tenths of MHz for time of first **fgggh** group above

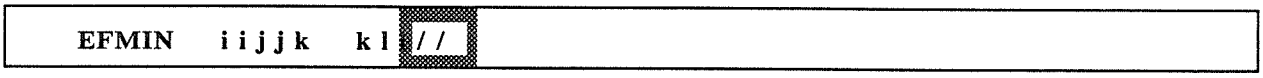



**j j** = f-min in tenths of MHz for 6 hours later than **i i**




**k k** = f-min in tenths of MHz for 12 hours later than **i i**


**l l** = f-min in tenths of MHz for 18 hours later than **i i**




/ / = filler

*Notes: 1. In* **i i j j k k l l / /** *groups, "99" will signify f-min ≥ 9.9 MHz*

*2. If a symbol is to be used for f-min, encode as follows:*

*X1 = A* *X3 = C*
*X2 = B* *X5 = E*
*(The X's should be / in teletype messages)*

*Note: / is to be used for data not available.*

# USIDS

*Content*:

Type of ionospheric phenomena observed, and importance with appropriate times.

*Example*:

```
USIDS   10101   80314
11520   11540   31600
```

*Definition of symbols*:

```
USIDS   IIIII   YMMDD
```

**USIDS** comes from radio Sudden Ionospheric Disturbance, code S

```
USIDS   IIIII   YMMDD
```

**IIIII** = station indicator (see lists in Appendix C)

```
USIDS   IIIII   YMMDD
```

**Y** = last digit of year
**MM** = month of year, 01 = January, 02 = February, *etc.*
**DD** = UT day of month

```
aHHmm   cHHmm   dHHmm        { repeat this line for each type of phenomena reported
```

**a** = type of phenomena
- 0 = sudden frequency deviation (SFD)
- 1 = short wave fade-out with sudden drop out (typical S-SWF)
- 2 = short wave fade-out with slow drop out - 5 to 15 minutes with gradual recovery (slow S-SWF)
- 3 = short wave fade-out with fade irregular in drop out and recovery (G-SWF)
- 4 = sudden enhancement of atmospherics (SEA)
- 5 = sudden phase anomaly-phase advance (SPA)
- 6 = sudden cosmic noise absorption (SCNA)
- 7 = sudden enhancement of signal .15 to 200 KHz (SES)
- 8 = sudden phase anomaly-phase retardation (SPA)

*Note: To report SPA by degrees, use code UABSE.*

**HHmm** = UT hour and minute of beginning of phenomena

```
aHHmm   cHHmm   dHHmm        { repeat this line for each type of phenomena reported
```

**c** = importance of phenomena

| | | | |
|---|---|---|---|
| 0 | = importance 1- | 7 | = importance 1+ |
| 1 | = importance 1 | 8 | = importance 2+ |
| 2 | = importance 2 | 9 | = importance 3+ |
| 3 | = importance 3 | | |

**HHmm** = UT hour and minute of maximum of phenomena

## USIDS—*Continued*

| aHHmm | cHHmm | dHHmm | { *repeat this line for each type of phenomena reported* |
|---|---|---|---|

**d** = recording definitiveness and time qualifier

| | | |
|---|---|---|
| 0 = definite<br>1 = reasonable<br>2 = fair<br>3 = questionable | } | time accuracy *is* within 2 minutes |
| 5 = definite<br>6 = reasonable<br>7 = fair<br>8 = questionable | } | time accuracy *is not* within 2 minutes |

**HHmm** = UT hour and minute of end time of phenomena

*Note: / is to be used for data not available.*

# Chapter Six

## Geophysical Data Codes

Geophysical Data Codes are used to report geomagnetic, auroral, and cosmic-ray data derived from ground-based sensors.

Code forms:

**SOLMF**

**UCOHO**

**UCOSE**

**UMAGF**

# SOLMF

*Content*:

Observed value of the solar mean field from Stanford (RWC Boulder).

*Example*:

| SOLMF 18403 80601 00039 |
|---|

*Definition of symbols*:

*First Line—*

| SOLMF IIIII YMMDD QMMMM |
|---|

**SOLMF** comes from **SOL**ar **M**ean **F**ield

| SOLMF IIIII YMMDD QMMMM |
|---|

**IIIII** = station indicator (see lists in Appendix C)

| SOLMF IIIII YMMDD QMMMM |
|---|

**Y** = last digit of year
**MM** = month of year, 01 = January, 02 = February, *etc.*
**DD** = UT day of month

| SOLMF IIIII YMMDD QMMMM |
|---|

**Q** = polarity or explanation for no data
- 0 = positive value
- 1 = equipment problems
- 2 = weather problems
- 9 = negative value

**MMMM** = measured value of solar mean field in micro-Teslas

*Note:* for solar mean field of 20 report as **0020**

*Note:* */ is to be used for data not available.*

# UCOHO

*Content*: Coronal hole data.

*Example*:

```
UCOHO 21304 80629 1630/ 2//01
20221 12104 12504 13020 21121 21216 12510 125// 99999
PLAIN
text
BT
```

*Definition of symbols*:

*First Line—*

UCOHO I I I I I YMMDD HHmm/ T / / nn

**UCOHO** comes from **CO**ronal **HO**le,

UCOHO I I I I I YMMDD HHmm/ T / / nn

**I I I I I** = station indicator (see lists in Appendix C)

UCOHO I I I I I YMMDD HHmm/ T / / nn

**Y** = last digit of year
**MM** = month of year, 01 = January, 02 = February, *etc.*
**DD** = UT day of month of observation

UCOHO I I I I I YMMDD HHmm/ T / / nn

**HHmm** = UT hour and minute nearest beginning of observation
**/** = filler

UCOHO I I I I I YMMDD HHmm/ T / / nn

**T** = type of measurement
- 1 = 530.3 nm (FE XIV green line)
- 2 = 1083 nm (Helium)
- 3 = radio scan
- 4 = x-ray image
- 5 = EUV

**nn** = number of coronal holes reported

*Data lines—*

| TNNcP | AAAnn | QXXYY | [QXXYY] | ..... | [QXXYY] | c c c / / | { repeat this line for each coronal hole |
|---|---|---|---|---|---|---|---|

**T** = type
- 1 = polar north (use // in the next section for the serial number)
- 2 = polar north extension
- 3 = polar south (use // in the next section for the serial number)
- 4 = polar south extension
- 5 = isolated
- 9 = unknown (for example from E-W drift radio scan data)

**NN** = serial number of the coronal hole (use // for polar north or polar south)

**q** = certainty of the existence of the coronal hole
- 1 = uncertain
- 2 = poor
- 3 = fair
- 4 = good

**P** = polarity
- 1 = positive
- 2 = negative
- 3 = not determined

| TNNcP | AAAnn | QXXYY | [QXXYY] | ..... | [QXXYY] | c c c / / | { repeat this line for each coronal hole |
|---|---|---|---|---|---|---|---|

**AAA** = area in thousandths of solar hemisphere

**nn** = number of boundary points reported (no more than 20 points, minimum number of points is four, must include maximum east longitude, west longitude, north latitude, and south latitude for each hole)

| TNNcP | AAAnn | QXXYY | [QXXYY] | ..... | [QXXYY] | c c c / / | { repeat this line for each coronal hole |
|---|---|---|---|---|---|---|---|

**Q** = heliographic coordinates of selected boundary points (must include maximum east longitude, west longitude, north latitude, and south latitude for each hole)
- 1 = NE (northeast)
- 2 = SE (southeast)
- 3 = SW (southwest)
- 4 = NW (northwest)

**XX** = distance to central meridian in degrees

**YY** = heliographic latitude in degrees

| TNNcP | AAAnn | QXXYY | [QXXYY] | ..... | [QXXYY] | c c c / / | { repeat this line for each coronal hole |
|---|---|---|---|---|---|---|---|

**c c c** = Carrington longitude of the center of the coronal hole

**/ /** = filler

*Last Data Line—*

| 99999 |
|---|

**99999** = end of data terminator; indicates that all coded data has been received

*Text Lines—*

| PLAIN | BT |
|---|---|

**PLAIN** = Plain language text information

| PLAIN | BT |
|---|---|

**BT** = Break in transmission (end of message terminator)

*Note: / is to be used for data not available.*

# UCOSE

*Content*:

Bi-hourly flux values of cosmic rays, daily variations and special events.

*Example*:

```
UCOSE 44406 25102 68154 31048 33046 35046 37046 39042
41042 43042 45046 47048 49046 51052 53054
```

*Definition of symbols*:

*First Line—*

**UCOSE** I I I I I DDTHH a b c c c HHddd [HHddd] ..... [HHddd] { *repeat this group for each hour*

**UCOSE** comes from **COS**mic rays, code **E**

UCOSE **I I I I I** DDTHH a b c c c HHddd [HHddd] ..... [HHddd] { *repeat this group for each hour*

**I I I I I** = station indicator (see lists in Appendix C)

UCOSE I I I I I **DDTHH** a b c c c HHddd [HHddd] ..... [HHddd] { *repeat this group for each hour*

**DD** = UT day of first period for which flux values are given

**T** = type of apparatus
- 0 = neutron monitor (IGY-Simpson type)
- 1 = high counting rate neutron monitor (IQSY-type)
- 2 = meson monitor (IGY-type)
- 3 = meson monitor (IQSY type)
- 4 = telescope, no shielding
- 5 = ionization chamber

**HH** = UT hour of message (normally in the UT day following the date of **DD**)

UCOSE I I I I I DDTHH **a b c c c** HHddd [HHddd] ..... [HHddd] { *repeat this group for each hour*

**a** = type of variation during the day
- 0 = normal daily variation
- 1 = beginning of a pre-decrease
- 2 = pre-decrease
- 3 = commencement of a Forbush decrease
- 4 = Forbush decrease
- 5 = recurrent activity
- 6 = increase
- 7 = after-effect of increase
- 8 = daily variation of large amplitude
- 9 = daily variation of anomalous phase

**b** = sign of daily variation (below or above arbitrary level)
- 7 = negative
- 8 = zero
- 9 = positive

**c c c** = average deviation expressed in steps of thousandths of an arbitrary mean level

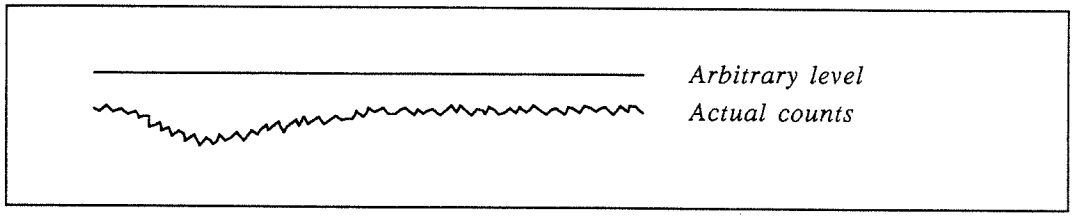
## UCOSE—*Continued*

| UCOSE | I I I I I | DDTHH | a b c c c | HHddd | [HHddd] | ..... | [HHddd] | { *repeat this group for each hour* |
|---|---|---|---|---|---|---|---|---|

**HH** = UT hour indicator; deviation of flux from the normal value following with **ddd** refers to the interval **HH**-1 to **HH** + 1 hours; if the deviation is positive, 30 is added to the hour to obtain **HH**

**ddd** = deviation of cosmic ray flux from level expressed by steps of thousandths of an arbitrary mean count

*Note: The arbitrary level is selected so that the deviations can be specified by three digits. The arbitrary level is always chosen higher than the actual level (see example below).*




*Note: / is to be used for data not available.*

# UMAGF

*Content*:

Geomagnetic Ak index (allows for 3-digit value)
Geomagnetic K-indices for the period reported
Geomagnetic disturbances with time of occurrence
Time and value of minimum H-component (optional)

*Example*:

```
UMAGF   18403   21207   1300/
 11125   1/151   25896   37766   51407   20671
```

*Definition of symbols*:

*First Line—*

```
UMAGF  I I I I I   YMMDD HHmm/
```

**UMAGF** comes from **MAG**netic activity, code **F**

```
UMAGF  I I I I I   YMMDD HHmm/
```

**I I I I I** = station indicator (see lists in Appendix C)

```
UMAGF  I I I I I  YMMDD HHmm/
```

**Y** = last digit of year
**MM** = month of year, 01 = January, 02 = February, etc.
**DD** = UT day of month

```
UMAGF  I I I I I  YMMDD  HHmm/
```

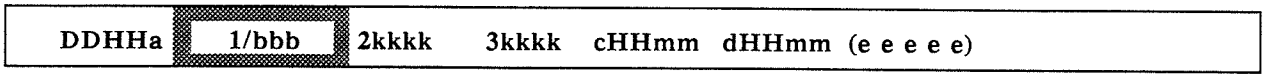
**HHmm** = UT time in hour and minute
**/** = filler

*Second Line—*

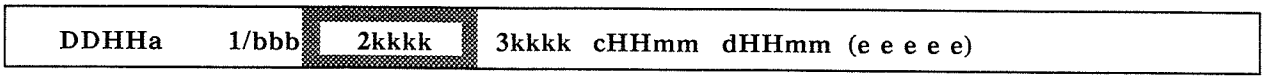
```
DDHHa   1/bbb   2kkkk   3kkkk   cHHmm   dHHmm   (e e e e e)
```

**DD** = UT day of beginning 24-hour period reported
**HH** = UT hour of beginning 24-hour period reported
**a** = last digit of check sum of the Ak (bbb) and the 8 Ks.

## UMAGF—*Continued*




**1** = indicator for Ak index
**bbb** = Ak index for UT date If Ak is not available, use ///

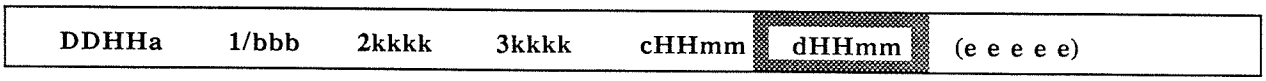



**2** = indicator Ak index
**kkkk** = first 4 K index


**3** = indicator for last 4 K indices
**kkkk** = last 4 K index

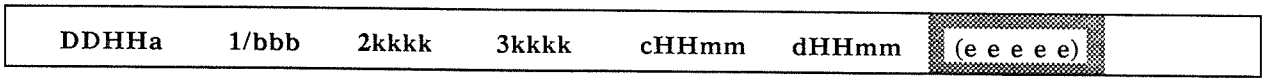

**c** = indicator telling the time reported in HHmm is
1 = storm end
2 = bay (psc)
3 = typical crochet
4 = provisional figures
6 = gradual storm beginning
7 = sudden storm beginning
8 = very marked sudden storm beginning
9 = sudden impulse

**HHmm** = UT hour and minute of phenomenon indicated by **c.**
If **c**=4, **HHmm** is used for reporting up to four additional K indices (3-hour periods) following the 24-hour interval reported by the **2** and **3** groups.




**d** 5 = signifies the following time refers to absolute value of minimum reached on the horizontal component
**HHmm** = UT hour and minute of minimum

Note: Omit **dHHMM** group if data not available




**e e e e e** = intensity of minimum expressed in nT

*Note: Omit group* **e e e e e** *if these measurements are not made.*

*Note: / is to be used for data not available.*

# Chapter Seven

## Regional and Specialized Codes

Regional and Specialized Codes are more nearly associated with an RWC than with a type of solar geophysical information.

Code forms:

**RWC Boulder Codes:**

**AFRED**
**TENCM**

**RWC Moscow Codes:**

**FORECAST**

**RWC Tokyo Codes:**

**RATEF**

**Other RWC Codes:**

**UPROP**
**UFILA**

## AFRED (RWC Boulder)

*Content*:

Predicted value of A-index for Fredericksburg, Virginia, for each of the next three days (RWC Boulder).

*Example*:

| AFRED 02523 02224 02025 |
|---|

*Definition of symbols*:

| AFRED a a a DD a a a DD a a a DD |
|---|

**AFRED** comes from **A**-index for **FRED**ericksburg, Virginia.

| AFRED a a a DD a a a J J a a a DD |
|---|

**a a a** = predicted A-index for Fredericksburg, Virginia
**DD** = UT day for predicted **a a a**

*Note: / is to be used for data not available.*

## TENCM (RWC Boulder)

*Content*:

Predicted Ottawa 10.7 cm flux for each of the next three days (RWC Boulder).

*Example*:

| |
|---|
| TENCM 15412 15013 14514 |

*Definition of symbols*:

| |
|---|
| TENCM a a a DD a a a DD a a a DD |

**TENCM** comes from **TEN-CM** flux (10-cm flux)

| |
|---|
| TENCM a a a DD a a a DD a a a DD |

**a a a** = predicted value of Ottawa 10-cm flux
**DD** = UT day for predicted **a a a**

*Note: / is to be used for data not available.*

# FORECAST (RWC Moscow)

*Content*:

Five-day forecast of ionospheric and geomagnetic conditions expressed by quality figures for Moscow.

*Example*:

```
FORECAST 34504 26310 IONFO 00110 0////
FORECAST 34504 26310 MAGFO 00110 0////
FORECAST 38401 26310 IONFO 01000 0////
FORECAST 36401 26310 MAGFO 01000 0////
```

*Definition of symbols*:

| | | |
|---|---|---|
| | **FORECAST** | **I I I I I  DDJJm** |

**FORECAST** of ionospheric and geomagnetic conditions

| | | |
|---|---|---|
| **FORECAST** | **I I I I I** | **DDJJm** |

**I I I I I** = station indicator (see lists in Appendix C)

| | | |
|---|---|---|
| **FORECAST  I I I I I** | **DDJJm** | |

**DD** = UT day of beginning of the 5-day period to which the forecast refers
**JJ** = UT day of the end of the 5-day period to which the forecast refers
**m** = last digit of month of year (1 = January, 2 = February . . . 0 = October, 1 = November)

| | | |
|---|---|---|
| | **ION / /** | **a a a a a  (a / / / /)** |

**ION / /** = comes from **ION**ospheric conditions

| | | |
|---|---|---|
| **ION / /** | **a a a a a** | **(a / / / /)** |

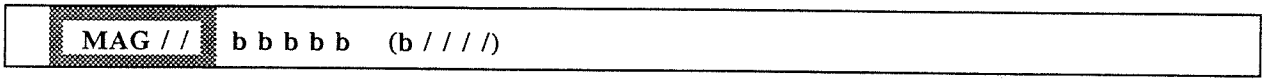
**a a a a a** = expected ionospheric conditions expressed by quality figures for corresponding date. The 6th quality figure refers to 31st day of a month.

| | | | |
|---|---|---|---|
| 0 | = | quiet | $\lvert\Delta foF2\rvert \leq \pm 20\%$ |
| 1 | = | minor negative disturbance: | $20\% < \lvert\Delta foFs\rvert < 25\%$ |
| 2 | = | moderate negative disturbance: | $25\% < \lvert\Delta foF2\rvert < 35\%$ |
| 3 | = | major negative disturbance: | $\lvert\Delta foF2\rvert > 35\%$ |
| 4 | = | minor positive disturbance: | $20\% < \lvert\Delta foF2\rvert < 25\%$ |
| 5 | = | moderate positive disturbance: | $25\% < \lvert\Delta foF2\rvert < 35\%$ |
| 6 | = | major positive disturbance: | $\Delta foF2 > 35\%$ |

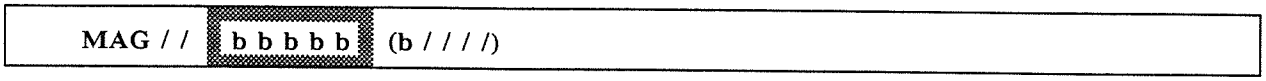
| | | |
|---|---|---|
| **ION / /  a a a a a** | **(a / / / /)** | |

**a / / / /** = expected ionospheric conditions expressed by quality figure (see above) for the 31st day of a month, otherwise omit this group.

## FORECAST—*Continued*

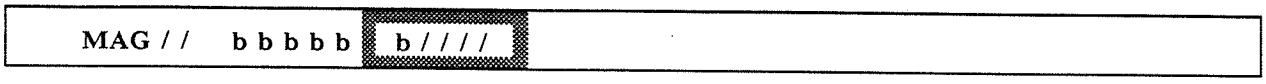



**MAG / /** = comes from **MAG**netic conditions




**b b b b b** = expected geomagnetic conditions expressed by quality figures for corresponding date. The 6th quality figure refers to 31st day of a month (A-index for Moscow)

| | | | |
|---|---|---|---|
| 0 | = | quiet | (A < 15) |
| 1 | = | minor disturbance | (15 < A ≤ 25) |
| 2 | = | moderate disturbance | (25 < A ≤ 80) |
| 3 | = | major disturbance | (A > 80) |




**b / / / /** = expected geomagnetic conditions expressed by quality figure (see above) for the 31st day of a month, otherwise omit this group.

*Note: / is to be used for data not available.*

# RATEF (RWC Tokyo)

*Content*:

Seven-day forecast of Radio Telecommunications, issued every Friday and Tuesday (by Hiraiso).

*Example*:

```
RATEF  05/11  22313  14/02  11021
```

*Definition of symbols*:

```
RATEF  DD / J J  a a a a a  a a / b b  b b b b b
```

**RATEF** comes from **RA**dio **TE**lecommunications **F**orecast for combination of circuits

```
RATEF  DD / J J  a a a a a  a a / b b  b b b b b
```

**DD** = UT day of beginning of the 7-day period to which forecast applies
/ = filler
**J J** = UT day of ending of the 7-day period to which forecast applies

```
RATEF  DD / J J  a a a a a  a a / b b  b b b b b
```

**aaaaaaa** = forecast quality figures for each day of the 7-day period
- 1 = very poor
- 2 = poor
- 3 = slightly poor
- 4 = good
- 5 = very good

/ = filler

```
RATEF  DD / J J  a a a a a  a a / b b  b b b b b
```

**bbbbbbb** = possibility of SWF for each day of the 7-day period
- 0 = nothing
- 1 = slight possibility
- 2 = high possibility

*Note: / is to be used for data not available.*

# UPROP

*Content*:

Radio propagation indices for certain radio circuits, monitored at the observatory.

*Example*:

```
UPROP   31526   80730   06/50
05735   03652   02534
99999
PLAIN
text
BT
```

*Definition of symbols*:

*First Line—*

| UPROP | I I I I I | YMMDD | HH / z z |
|---|---|---|---|

**UPROP** comes from radio **PROP**agation

| UPROP | I I I I I | YMMDD | HH / z z |
|---|---|---|---|

**I I I I I** = station indicator (see lists in Appendix C)

| UPROP | I I I I I | YMMDD | HH / z z |
|---|---|---|---|

**Y** = last digit of year
**MM** = month of year, 01 = January, 02 = February, etc.
**DD** = UT day of month of observation

| UPROP | I I I I I | YMMDD | HH / z z |
|---|---|---|---|

**HH** = UT hour of the start of the 24-hour period for which the Propagation Index is calculated
**/** = filler
**z z** = last two digits of check sum of all the following digits

## UPROP—*Continued*

*Data Lines—*

| a a b b c | [a a b b c] ... |
|---|---|

**a a** = circuit monitored
- 01 = Tokyo, Japan
- 02 = New York, USA
- 03 = Tehran, Iran
- 04 = Oslo, Norway
- 05 = Bracknell, England
- 06 = Canberra, Australia
- 07 = Johannesburg, South Africa
- 08 = Rome, Italy
- 09 = Moscow, USSR
- 10 = Fort Collins, Colorado, USA
- 11 = Melbourne, Australia

**b b** = Propagation Index from 0.1 - 9.9, where 6.0 = normal.
Conditions are "normal" (index 6.0) if they correspond to the average of the preceding 27 days (1 sun rotation) Scale of Propagation Index.
- 0.1 - 1.0 = very poor
- 1.1 - 3.0 = poor
- 3.1 - 5.0 = fair
- 5.1 - 7.0 = normal
- 7.1 - 9.0 = good
- 9.1 - 9.9 = very good

**c** = Number of frequencies that are used to calculate the Propagation Index.

*Note: The Melbourne circuit consists of five frequencies that transmit for the world-wide CCIR HF field strength measuring campaign.*

*Last Data Line—*

| 99999 | |
|---|---|

**99999** = end of data terminator – indicates that all coded data has been received

| PLAIN | BT |
|---|---|

**PLAIN** = Plain language text information

| PLAIN | BT |
|---|---|

**BT** = Break in transmission (end of message terminator)

# UFILA

*Content*:

Code for reporting the position, orientation, and magnitude of a filament which has disappeared. A "filament" consists of one or more dark sections which appear to lie along one magnetic inversion line. The properties of only one filament disappearance can be encoded in a single UFILA code.

*Example*:

```
UFILA 30508
80721  14361   80722  14251   42345  12212   43050  99999
```

*Definition of symbols*:

**UFILA** I I I I I

**UFILA** comes from disappearing **FILA**ment

UFILA **I I I I I**

**I I I I I** = station indicator (see lists in Appendix C)

**YMMDD** HHmmq YMMDD HHmmn QXXYY aaaed QXXYY [QXXYY aaaed QXXYY]... 99999

UT date of last observation prior to disappearance:

**Y** = last digit of year
**MM** = month of year, 01 = January, 02 = February, *etc.*
**DD** = UT day of month

YMMDD **HHmmq** YMMDD HHmmn QXXYY aaaed QXXYY [QXXYY aaaed QXXYY]... 99999

UT time of last observation prior to disappearance and character of disappearance:

**HH** = UT hour
**mm** = UT minute
**q** = general character of disappearance
- 1 = slow disappearance, taking more than a half hour
- 2 = rapid disappearance, taking less than a half hour
- / = character of disappearance not determined

YMMDD HHmmq **YMMDD** HHmmn QXXYY aaaed QXXYY [QXXYY aaaed QXXYY]... 99999

UT date of first observation after disappearance:

**Y** = last digit of year
**MM** = month of year, 01 = January, 02 = February, *etc.*
**DD** = UT day of month

YMMDD HHmmq YMMDD **HHmmn** QXXYY aaaed QXXYY [QXXYY aaaed QXXYY]... 99999

UT time of first observation after disappearance and number of filament segments:

**HH** = UT hour
**mm** = UT minute
**n** = number of filament segments encoded

## UFILA—*Continued*

| YMMDD HHmmq YMMDD HHmmn QXXYY aaaed QXXYY [QXXYY aaaed QXXYY]... 99999 |
|---|

Coordinates (at the time of last observation) of one end of the filament or filament segment:

**Q** = heliographic coordinates of the point (use )
- 1 = NE (northeast)
- 2 = SE (southeast)
- 3 = SW (southwest)
- 4 = NW (northwest)
- (use / / / / / if coordinates cannot be determined)

**XX** = distance to central meridian in degrees (longitude)

**YY** = heliographic latitude in degree

*Note:* Use / / / / / *if coordinates cannot be determined.*

*The location and orientation of a filament is described by specifying two or more positions along the filaments. The first position, described above, corresponds to one endpoint. Subsequent positions, described below, refer to points of inflection where the gross orientation of the filament changes markedly. Between two consecutive points, the filament should lie approximately along a great circle arc. The final position refers to the other endpoint.*

| YMMDD HHmmq YMMDD HHmmn QXXYY aaaed QXXYY [QXXYY aaaed QXXYY]... 99999 |
|---|

Descriptive data on filament segment:

**aaa** = reduction in the uncorrected area of the envelope containing the dark matter in the filament segment (in heliographic square degrees at disk center) replaced by /// if undetermined for any reason

**e** = extent to which the filament segment has disappeared
- 0 = no disappearance
- 1 = incomplete disappearance with section of filament segment remaining
- 2 = faint trace of entire filament segment remains
- 3 = complete disappearance
- / = not determined or not relevant

**d** = darkness of filament segment
- 1 = faint
- 2 = normal
- 3 = dark
- / = not determined or not relevant

*Note: The interval between two consecutive positions is called a "filament segment" and its characteristics are described above. The filament need not appear continuous, in the form of dark absorbing material, over the entire segment. Filament material is nearly always irregular in shape and density, which complicates the measurement of its area. Measurement of the area of a segment is made by first constructing an envelope which loosely encloses the dark matter of the filament segment. The area indicated in the code should be the reduction in the area of this envelope between the last time the filament was observed prior to disappearance and the time of the first observation after disappearance.*

## UFILA—*Continued*

| YMMDD HHmmq YMMDD HHmmn QXXYY aaaed QXXYY [QXXYY aaaed QXXYY]... 99999 |
|---|

Coordinates of the other end of the filament or filament segment:

**Q** = heliographic coordinates of the point

1 = NE (northeast) 3 = SW (southwest)

2 = SE (southeast) 4 = NW (northwest)

**XX** = distance to central meridian in degrees (longitude)

**YY** = heliographic latitude in degrees

*Note:* Use / / / / / *if coordinates cannot be determined.*

*If a filament extends from the disk to beyond the limb, then one endpoint will correspond to a disk position and the other endpoint will correspond to a limb position. If the filament lies entirely beyond the limb (prominence), only two positions indicating the limb extent of the prominence should be given. In these cases the area may include measurements made of material both on the disk and above the limb.*

| YMMDD HHmmq YMMDD HHmmn QXXYY aaaed QXXYY [QXXYY aaaed QXXYY]... 99999 |
|---|

**99999** = end of message terminator; indicates that entire message has been received

*Note:* */ is to be used for data not available.*

# Appendix A

## Standard Code Format

The procedure for adding new IUWDS codes is described below and an example of the Standard Code Format is shown on the next page.

When a new code is proposed, Boulder and the RWC which proposed the code will work together to design the format. When the format is worked out it will be distributed to all RWCs for suggestions. After all the ideas are considered a final format will again be distributed to the RWCs along with the date it will be implemented. New codes will always be implemented on either April 1 or October 1.

# Uxxxx

*First Line—*

| **Uxxxx** | I I I I I | YMMDD | HHmmt | (qqqnn) |
|---|---|---|---|---|

**Uxxxx** comes from xxxx

| Uxxxx | **I I I I I** | YMMDD | HHmmt | (qqqnn) |
|---|---|---|---|---|

**I I I I I** = station indicator (see lists in Appendix D)

| Uxxxx | I I I I I | **YMMDD** | HHmmt | (qqqnn) |
|---|---|---|---|---|

**Y** = last digit of year
**MM** = month of year, 01 = January, 02 = February, etc.
**DD** = UT day of month

| Uxxxx | I I I I I | YMMDD | **HHmmt** | (qqqnn) |
|---|---|---|---|---|

**HHmm** = UT in hour and minute
**t** = time qualifier

*This 5–digit group is optional and may be omitted—*

| Uxxxx | I I I I I | YMMDD | HHmmt | **(qqqnn)** |
|---|---|---|---|---|

**qqq** data information qualifiers (if not necessary use / / /)
**nn** = checksum, for example it could be the number of 5–digit groups, events, or lines of data that follow prior to the **99999** line

*Second and following lines contain data in five–digit groups and have fixed format—*

| DATAA | DATAB | DATAC | DATAD | ..... |
|---|---|---|---|---|

*Listed below are letters which are always defined in a certain way in the codes—*

**HHT** = UT time in hours and tenths of hours
**JJ** = last day (UT) of a defined period

Coded location of regions, etc.

**Q** = quadrant (heliographic coordinates) of the region
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

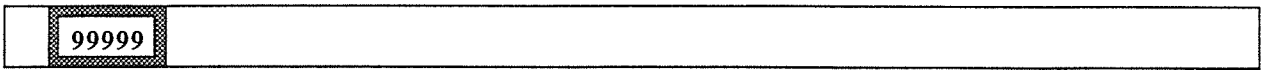
**AAAA** = sunspot area in millionths of solar hemisphere

OR

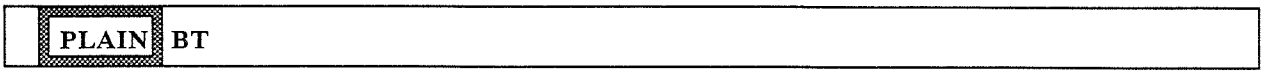
**AAA** = sunspot area in millionths of solar hemisphere

**ab** = flux, *etc.* where **ab** = **a.b**
**pp** = Power of ten to apply to **a.b**

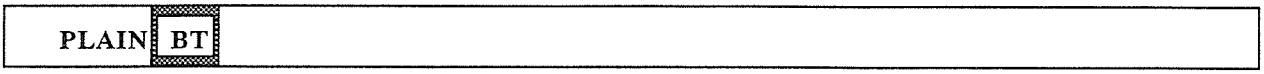
*Last Data Line—*




**99999** = end of data terminator – indicates that all coded data has been received




**PLAIN** = Plain language text information




**BT** = Break in transmission (end of message terminator)

*Note: / is to be used for data not available.*

# Appendix B

## Regional Warning Centers

This section concerns the major specifics of the Regional Warning Centers (RWC's). All of the real-time data available at each RWC, as well as a description of their major products is included. It also includes information concerning the person in charge, address, operating organization, telephone and telex numbers, and broadcasts that are issued from the center.

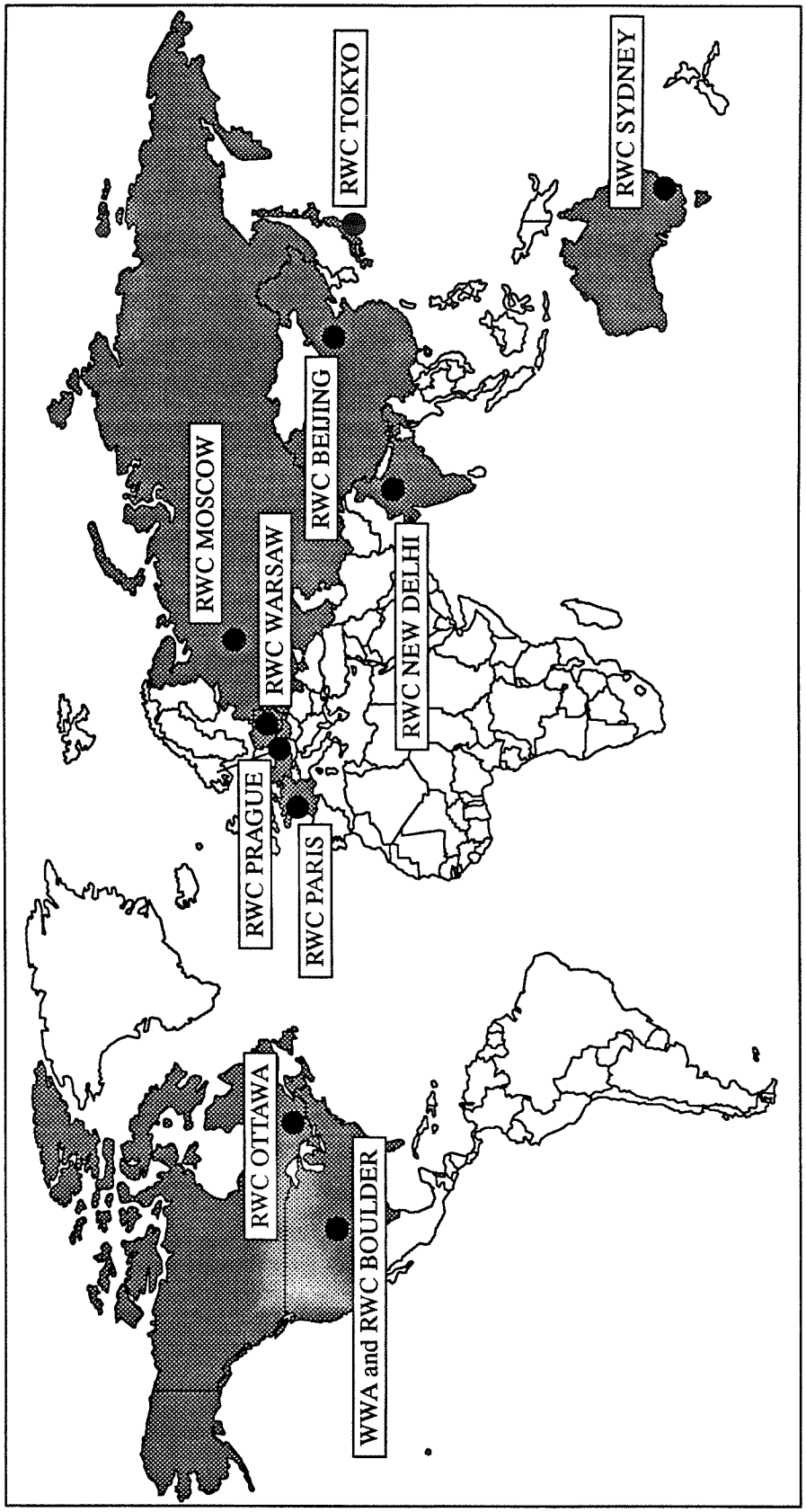



Figure B–1. International Ursigram and World Days Service (I.U.W.D.S.) Regional Warning Centers

# Chinese Regional Warning Center

## RWC BEIJING

**Supervisory**
Dr. Li Qibin

**Mail address**
Beijing Astronomical Observatory
Chinese Academy of Sciences
Beijing 100080
Beijing, China

**Telephone**
2551968

**Telefax**
281261

**Telex**
22040 (BAOAS CN)

**Cable**
9053

**Electronic mail**
INTERNET: bmabao@ica.beijing.canet.cn

**Operating organization**
Beijing Astronomical Observatory

**Operating hours**
8 hours/day 5 days/week

**Outgoing messages**

Data: Solar (optical and radio), ionospheric, cosmic ray, geomagnetic

Products: UGEOA, UGEOE, UGEOI, UFOFH and UCOSE, UMAGF

**Observatory data collected at Beijing RWC**

Solar (optical):
Huairou (Beijing), Purple Mountain (Nanjing)
Shahe (Beijing), Yunnan (Kunming)

Solar (radio):
Shahe (Beijing), Purple Mountain (Nanjing)
Yunnan (Kunming)

Solar cosmic ray (UCOSE):
Center for Space Science and Applied Research (Beijing)

Geomagnetic (UMAGF):
Beijing Geomagnetic Observational Centre

Ionospheric (UFOFH):
Beijing, Chongqing, Guangzhou, Manzhouli

**Data transmitted from RWC's *to* Beijing**

| Time UT | Frequency of issue | From |
|---|---|---|
| 0030 | Daily | Boulder |
| 0200 | Daily | Boulder |
| 0235 | Daily | Boulder |
| 0330 | Daily | Boulder |
| 2200 | Daily | Boulder |

**Data transmitted to RWC's *from* Beijing**

| Time UT | Frequency of issue | to |
|---|---|---|
| 0600 | M–F | Boulder |

# Western Hemisphere Regional Warning Center

## WORLD WARNING AGENCY (WWA)
## and
## RWC BOULDER

**Supervisory**
Gary Heckman
Forecast Center: Joseph W. Hirman
Communications Center: Kurt Carran

**Mail address**
Space Environment Services Center
NOAA, R/E/SE
325 Broadway, Radio Building
Boulder, Colorado 80302-3328
USA

**Telephone**
303–497–3171

**Telefax**
303–497–3137

**Telex**
888776 (NOAA BLDR)

**U.S. military teletype**
RUWTGPA

**Cable**
NOAA BLDR, Boulder, Colorado

**Electronic mail address**
INTERNET: sesc@sel.bldrdoc.gov
SPAN: selvax::sesc

**Public Bulletin Board System**
303–497–5000 (300, 1200 or 2400 baud)

**Operating organization**
National Oceanic and Atmospheric Administration
U.S. Department of Commerce

**Operating hours**
Forecast Center and Communications Center:
24 hours/day, 7 days/week

**Outgoing messages**
Data:
URSIGRAM Solar and geophysical data (issued daily at 0105UT)

Products (issued daily):
Solar Region Summary (0030UT),
Anchorage Advisory Report (0040 UT),
Solar Coronal Disturbance Report (0200),
Solar and Geophysical Activity Summary (0235 UT),
Geoalert WWA (0330 UT),
Geoalert RWC (2145 UT),
Joint USAF/NOAA Report of Solar and Geophysical Activity (2200 UT)

Products (issued weekly):
Preliminary Report and Forecast of Solar Geophysical Data
27-day outlook (10.7 cm flux, $K_p$, and $A_p$)

**Services**
Public Bulletin Board System (303-497-5000)
Satellite Broadcast
Space Enviroment Laboratory Data Acquisition and Display System (SDII)
Space Environment Laboratory Solar Imaging System (SELSIS)

**Observatory data collected at RWC Boulder (WWA)**

Solar (optical):
Boulder, Culgoora, Holloman, Kitt Peak, Learmonth, Mt. Wilson, Palehua, Ramey, San Vito

Solar (radio):
Boulder, Culgoora, Learmonth, Penticton, Palehua, Sagamore Hill, San Vito

Solar cosmic ray:
Anchorage, Thule

X–ray and particle:
GOES, NOAA (spacecraft)

Ionospheric:
Argentia, Boulder, Bermuda, Cape Canaveral, Dyess, Eielson, Eglin, Ft. Churchill, Goosebay, Hawaii, Korea, Manila, Nicosia, Ottawa, Resolute Bay, Shemya, Taiwan, Vandenberg AFB, Wallops Island

## RWC BOULDER—*Continued*

Geomagnetic:
Anchorage, Arctic Village, Baker Lake, Boulder, Cambridge Bay, Cape Parry, College, Fort Churchill, Fort Yukon, Fredericksburg, Fresno, Glenea, GOES, Honolulu, Inuvik, Meanook, Narssarssuaq, Newport, Ottawa, Point Barrow, Poste de la Baleine, Resolute Bay, Sachs Harbor, St Johns, San Juan, Sitka, Talkeetna, Tucson, Victoria, Yellowknife

**Data transmitted from RWC's *to* Boulder**

| Time UT | Frequency of issue | From |
|---|---|---|
| 0130 | Daily | Moscow, Sydney, Tokyo |
| 0600 | Daily | Moscow, Sydney, Tokyo |
| 0900 | Daily | Sydney |
| 1100 | Daily | Darmstadt[2] |
| 1400 | Daily | Moscow, Meudon[1] |
| 1600 | Daily | Moscow |

[1]data is not transmitted on Sunday.
[2]data is not transmitted on Saturday or Sunday.

**Data transmitted to RWC's *from* Boulder**

| Time UT | Frequency of issue | To |
|---|---|---|
| 0030 | Daily | Beijing, Moscow, New Delhi |
| 0105 | Daily | Moscow |
| 0200 | Daily | Beijing, Moscow, New Delhi |
| 0235 | Daily | Beijing, Moscow, New Delhi |
| 0330 | Daily | GEOALERT WWA<br>Beijing, Moscow, New Delhi |
| 2200 | Daily | Beijing, Moscow, New Delhi |

Note: URSIGRAM solar and geophysical data and all products issued by WWA Boulder are available on our SELVAX computer. The account name is SEL with no password required. Files may be downloaded at your convenience.

**GEOALERT broadcasts**

Content: Penticton 10.7 cm solar flux, Boulder A-index, Boulder 3-hourly K-index, current solar and geophysical data summaries and forecasts.

Methods of transmission:

**WWV**
Voice message every hour at 18 minutes past the hour at 2.5, 5, 10, 15, and 20 MHz. Message is changed every 3 hours at 0000, 0300, 0600, 0900, 1200, 1500, 1800, and 2100 UT.

**WWVH**
Voice message every hour at 45 minutes past the hour at 2.5, 5, 10, and 15 MHz. Message is changed every 3 hours at 0000, 0300, 0600, 0900, 1200, 1500, 1800, and 2100 UT.

**24-hour answering service** 303-497-3235 (recorded message which is changed every 3 hours at 0000, 0300, 0600, 0900, 1200, 1500, 1800, and 2100 UT.)

# Eurasian Regional Warning Center

## RWC MOSCOW

**Supervisory**
Dr. S. I. Avdiushin
Forecast Center : S. G. Frolov

**Mail address**
Institute of Applied Geophysics
Rostinskay 9
Moscow 129226
RUSSIA

**Telex**
411914 (ZEMLA SU)

**Electronic Mail address**
INTERNET: geophys@sovamsu.sovusa.com

**Operating organization**
Federal Service on the Hydrometerorology and Environment of the Russian Federation
RUSSIA

**Operating hours**
24 hours/day, 7 days/week

**Outgoing messages**

Data:
URSIGRAM Solar and geophysical data
(Issued daily at 0600, 0730, 0900, 1200, 1345UT)

Forecasts:
Solar activity and geophysical disturbances in GEOSOL at 1600UT;
Ionspheric disturbances in URSIGRAM for National Centers

**Observatory data collected at Moscow RWC**

Solar (optical):
Abastumani, Alma-Alta, Irkutsk, Kislovodsk Tashkent, Ussurisk.

Solar (radio): Abastumani, Dushanbe, Irkutsk, Kislovodsk, Moscow, Nijni Novgorod (Gorky).

Ionospheric:
Daily reports - Darmstadt, Juliusruh, Pruhonice
Hourly reports - Ashgabat, Archangelsk, Cape Schmidt, Dixon, Ekaterinburg, Khabarovsk, Kaliningrad, Magadan, Moscow, Murmansk, Novosibirsk, Petropavlovisk, Preobrajeniya, Podkamennaya Tungusca, Rostov-na-donu, Salekhard, St. Peterburg, Tashkent, Tomsk, Uelen.

Ionospheric (SID):
Kuhlungsborn, Norddeih, Panska Vec

Geomagnetic:
Archangelsk, Dixon, Ekaterinburg, Kalingrad, Khabarovsk, Krenkel, Moscow, Murmansk, Magadan, Novosibirsk, Petropavlovsk, Preobrajeniya, Podkamennaya Tungusca, St. Peterburg, Tiksi, Uelen.

**Data transmitted from RWC's *to* Moscow**

| Time UT | Frequency of issue | From |
|---|---|---|
| 0030 | Daily | Boulder |
| 0105 | Daily | Boulder |
| 0200 | Daily | Boulder |
| 0235 | Daily | Boulder |
| 0330 | Daily | Boulder |
| 0800 | Darmstadt, Paris, Sydney, Tokyo, occasionally from India* | |
| 1200 | Daily | Praga* |
| 1500 | Daily | Paris* |
| 2200 | Daily | Boulder |

* Data is not transmitted on Saturday or Sunday

**Data transmitted to RWC's *from* Moscow**

| Time UT | Frequency of issue | To |
|---|---|---|
| 0600 | Daily | Boulder |
| 0730 | Daily | Beijing |
| 0900 | Daily | Boulder, Budapest, Darmstadt, India, Havana, Praga, Paris, Sydney, Tokyo, Warsaw, National Centers and Subcenters, |
| 1200 | Daily | Boulder |
| 1345 | Daily | Boulder, Budapest, Darmstadt, India, Havana, Praga, Paris, Sydney, Sofia, Tokyo, National Centers and Subcenters, |

## RWC MOSCOW—*Continued*

**URSIGRAM broadcasts**

Moscow (three times a day)
Content: current data summaries and forecasts

| Time of Transmission (UT) | Call sign | Frequency kHz |
|---|---|---|
| 0440 – 0510 | RYeM–4 | 10275[1] |
| | | 3937.5[2] |
| | | 4565 |
| | | 5780 |
| | | 6980 |
| 1030 – 1100 | RYeM–4 | 5380 |
| | | 7450 |
| | | 9145 |
| | | 13360 |
| 2230 – 2300 | RYeM–4 | 3937.5 |
| | | 4395 |
| | | 5780 |
| | | 6980 |

[1]broadcast from March 1 to September 30
[2]broadcast from October 1 to February 28

# India Regional Warning Center

## RWC NEW DELHI

**Supervisory**
Dr. B. M. Reddy
Immediate Charge: Dr. D. R. Lakshmi

**Mail address**
c/o National Physical Laboratory
Dr. K. S. Krishman Rd.
New Delhi 110012, India

**Telephone**
5721436, 5726570

**Telefax**
91115752678

**Telex**
3177384 (RSD IN)
3177099 (NPL IN)

**Electronic Mail address**
INTERNET: npl@csird.ernet.in

**AUTODIN**
via RUEHND

**Telegraph**
NATPHYLAB

**Operating organization**
National Physical Laboratory

**Operating hours**
0330 – 1145 UT (Monday – Friday)

**Outgoing messages**

Data:
Geoalert Messages are sent from RWC Tokyo by R.T.T. Multiplex Systems to Delhi via Bombay (teleprinter line from Bombay to Delhi) at about 1100 hours I.S.T. Delhi foF2 and SID data is added to this and a consolidated message goes out daily (see URSIGRAM broadcasts).

**Observatory data collected at New Delhi RWC**

Solar:
Kodaikanal

Ionospheric (SID):
Delhi

**Data transmitted from RWC's *to* New Delhi**

| Time UT | Frequency of issue | From |
|---|---|---|
| 0000 | Daily | Moscow, Sydney |
| 0030 | Daily | Boulder |
| 0100 | Daily | Sydney |
| 0200 | Daily | Boulder |
| 0235 | Daily | Boulder |
| 0330 | Daily | Boulder |
| 0600 | Daily | Moscow, Sydney |
| 1100 | Daily | Tokyo |
| 1200 | Daily | Moscow, Sydney |
| 1800 | Daily | Moscow, Sydney |
| 2200 | Daily | Boulder |
| after sunset | Daily | Culgoora |

**Data transmitted to RWC's *from* New Delhi**

Weekly report of 6 hourly values of foF2 are sent to Ionospheric Prediction Section, Institute for Telecommunications Sciences, Boulder, Colorado USA and exchanged with RWC Sydney and Moscow (by Telex) on every Tuesday.

# Canadian Associate Regional Warning Center

## RWC OTTAWA

**Supervisory**
Dr. Richard Coles
Forecast Center: Dr. J. Hruska
Dr. K. L. Lam

**Mail address**
Geophysics Division
Geological Survey of Canada
1 Observatory Crescent
Ottawa Canada K1A OY3

**Telephone**
613–837–3527
613–837–4241
613–837–3033

**24–hour answering service**
613–992–1299 (recorded message)

**Telefax**
613–824–9803

**Telex**
0534822 (CNSC OTT)
0533117 (EMAR)

**Electronic Mail address**
INTERNET: hruska@geolab.emr.ca

**Public Bulletin Board System**
613–992–3135 (1200 baud)

**Operating organization**
Geological Survey of Canada

**Operating hours**
1200–2100 UT (Monday–Friday)

**Observatory data collected at Ottawa RWC**

Geomagnetic:
Baker Lake, Cambridge Bay, Churchill, Fort Glanlee, Meanook, Mould Bay, Ottawa, Poste–de–la–Baleine, Resolute Bay, St. John's, Victoria, Yellowknife

Ionospheric (UFOFH):
Beijing, Chongqing, Guangzhou, Manzhoulo

**Data transmitted from RWC's *to* Ottawa**

| Time UT | Frequency of issue | From |
|---|---|---|
| none | | |

Data:
URSIGRAM Solar and geophysical data (issued daily at 1000 UT; except Saturdays, Sundays, and Holidays)

# Western Europe Regional Warning Center

## RWC PARIS

**Supervisory**
Dr. Pierre Lantos
Immediate Charge: Mme. J. Gapihan, Mme. G. Michet

**Mail address**
Ursigrammes, DASOP
Observatoire de Paris
92195 Meudon, Principal Cedex
France

**Electronic mail address**
INTERNET: previ@mesiob.obspm.circe.fr (130.84.200.4)
SPAN: mesiob::previ

**Telephone**
14507 7770 (or 7771)

**Telefax**
14507 7959

**Telex**
631812 (FCMEU X 631812)

**Cable**
TX 631812 FCMEU MEUDON FRANCE

**Operating organization**
Jointly:
Observatoire de Paris
92195 Meudon, France, and
C.N.E.T., Lannion B
BP 40 22301 Lannion Cedex, France

**Operating hours**
0730 – 1630 UT (Monday–Friday)
Summer 0630 – 1530 UT (Monday–Friday)
Closed Saturdays, Sundays and international holidays.

**Outgoing messages**

Data:
URSIGRAM Solar and geophysical data

Forecasts:
Geoalert – Solar activity and geophysical disturbances

Products:
Provisional Aa indices and Summary of solar and geophysical data and disturbances (issued weekly).

**Observatory data collected at Paris RWC**

Solar:
Catania, Meudon, Nancay, Tortosa,Yunnan Obs.

Solar Cosmic Ray:
Iles Kerguelen

Ionospheric:
Daily reports – Iles Kerguelen, Nijmegen (SID's), Poitiers, Juliusruh[4], Nordeich[4]
Weekly reports – Iles Kerguelen, Terre Adelie

Geomagnetic:
Chambon la Foret, Iles Kerguelen, Tamanrasset, Tortosa, Wingst[4]

**Data transmitted from RWC's *to* Paris**

| Time UT | Frequency of issue | From |
|---|---|---|
| 0700 | Daily | occasionally from Sydney |
| 0800 | Daily | Tokyo |
| 0900 | Daily | Moscow |
| 0900 | Daily[1] | Warsaw |
| 1100 | Daily[1] | Darmstadt, Praha |
| 1400 | Daily | Moscow |

[1]data is not transmitted on Saturday, Sunday, and holidays

**Data transmitted to RWC's *from* Paris**

| Time UT | Frequency of issue | To |
|---|---|---|
| 0800 | Daily[2] | Relay of Tokyo message to Moscow, Warsaw |
| 1000 | Daily | Relay of Darmstadt Ursigram to Praha, Warsaw, Moscow |
| 1400[3] | Daily[2] | Boulder, Moscow,Praha, Sydney, Tokyo, Warsaw |

[2]data is not transmitted on Saturdays, Sundays and international holidays.
[3]1300 UT in the summer
[4] via Darmstadt

# Czechoslovakia Associate Regional Warning Center

## RWC PRAGUE

**Supervisory**
Dr. F. Blahak
Immediate Charge: Dr. J. Boska

**Mail address**
Czech Academy of Sciences
Geophysical Institute
Bocni II
141 31 Praha 4
Czechoslovakia

**Telephone**
(42–2) 762548

**Telefax**
(42–2) 762528

**Telex**
121546 IONP C

**Electronic Mail address**
BITNET: ion@cspgig11.bitnet

**Operating organization**
Geophysical Institute of the Czech
Academy of Sciences

**Operating hours**
0600 – 1400 UT (Monday – Friday) Summer
0700 – 1500 UT (Monday – Friday) Winter

**Outgoing messages**

**Observatory data collected at Prague RWC**

Ionospheric:
Juliusruh (UFOFH, UMUFH)
Kuhlungsborn (SID)
Pruhonice (UFOFH)
Panska Ves (SID)

**Data transmitted to RWC's *from* Prague**

| Time UT | Frequency of issue | To |
|---|---|---|
| 1000 | Daily | Darmstadt, Paris, Warsaw |

**Data transmitted from RWC's *to* Prague**

| Time UT | Frequency of issue | From |
|---|---|---|
| 0700 | Daily | Darmstadt, Moscow |
| 1200 | Daily | Darmstadt |
| 1400 | Daily | Paris |

# Australia and Antarctica Regional Warning Center

## RWC SYDNEY

**Supervisory**
Mr. Geoff Robinson
Immediate Charge: Garth Patterson
Data Coordination: Richard Thompson

**Mail address**
IUWDS Regional Warning Centre,
IPS Radio and Space Services
P.O. Box 5606
West Chatswood, N.S.W. 2057
Australia

**Location**
Level 4
15 Help Street
Chatswood, N.S.W. 2067

**Telephone**
(61) (2) 414–8000 (switchboard)
(61) (2) 414–8329 (warning center)
(61) (2) 414–8325 (Richard Thompson)
(61) (2) 414–8335 (David Cole)
(61) (2) 414–8339 (Phil Wilkinson)
(61) (67) 959211 (Culgoora Observatory)
(61) (99) 491471 (Learmonth Solar Observatory)
(61) (2) 414–8307 (Geoff Robinson)
(61) (2) 414–8326 (Garth Ptterson)

**Telefax**
(61) (2) 414–8331 or (61) (2) 414–8340
(61) (67) 959266 (Culgoora Solar Observatory)
(61) (99) 491605 (Learmonth Solar Observatory)

**Telex**
20663 (IPSO AA20663)
66996 (IPSOLAR) Culgoora Solar Observatory
99241 (IPSOLM) Learmonth Solar Observatory

**Electronic mail address (INTERNET):**

| | |
|---|---|
| Warning centre | rwc@ips.oz.au |
| Culgoora | culgoora@ips.oz.au |
| Richard Thompson | richard@ips.oz.au |
| Garth Patterson | garth@ips.oz.au |
| Geoff Robinson | geoff@ips.oz.au |

**Operating organization**
IPS Radio and Space Services
Department of Arts and Administrative Services

**Operating hours**
2230 – 0600 UT (and later as required; closed from 0200 UT on Saturdays, Sundays, and Holidays)

**Outgoing messages**

Data:
URSIGRAM Solar and geophysical data (issued daily at 0000 UT and after sunset, occasionally at 0600 UT, and following major events)

Forecasts:
Daily forecast in 0000UT URSIGRAM and in service products.

Products:
Disturbance Warnings—Forecasts of significant events
Disturbance Alerts—Confirmations of significant disturbances
Daily Propagation Report—Summary of daily activity
Recorder Telephone Message—Condensed propagation report
Weekly Propagation Report—Summary of weekly activity
Weekly Geophysical Report—Summary of weekly magnetic activity
Monthly Solar–Geophysical Summary—Monthly summary of events and indices

**Observatory data collected at Sydney RWC**

Solar (optical):
Culgoora, Learmonth

Solar (Radio– fixed frequency):
Culgoora, Learmonth

Ionospheric (six–hourly data):
Davis, Macquarie Island, Mawson, Mundaring, Norfolk Island.

Ionospheric (hourly data):
Camden (Sydney), Townsville, Hobart, Canberra, Vanimo.

Ionospheric (fadeouts):
Culgoora, Camden

Geomagnetic (UMAGF):
Culgoora, Learmonth

## RWC SYDNEY—*Continued*

**Data transmitted from RWC's *to* Sydney**

| Time UT | Frequency of issue | From |
|---|---|---|
| 0100 | Daily | Beijing |
| 0630 | Daily | Tokyo |
| 0900 | Daily | Moscow |
| 1400 | Daily | Moscow |
| 1500 | Daily[1] | Meudon |

[1]data is not transmitted on Sunday

**Data transmitted from RWC's *from* Sydney**

| Time UT | Frequency of issue | To |
|---|---|---|
| 0000 | Daily | Boulder, Delhi, Tokyo, Moscow, Beijing, Czech Republic, Meudon |
| 0300 | Daily | Boulder, Delhi, Tokyo, Moscow, Beijing, Czech Republic, Meudon |
| 0700-0900 | Daily (direct from Culgoora Observatory) | Boulder, Delhi, Tokyo |
| 0700-0900 | (after sunset) Daily | Boulder, Delhi, Tokyo, Moscow, Beijing, Czech Republic, Meudon |

**URSIGRAM broadcasts**

Message Content: Solar Geophysical Reports

Method of transmission:

**24–hour answering service** (61) (2)414–8330 (recorded message—Condensed propagation report.)

# Western Pacific Regional Warning Center

## RWC TOKYO

**Supervisory**
Dr. K. Marubashi
Forecast Center (Hiraiso): Dr. T. Ogawa
Immediate Charge (Hiraiso): Dr. T. Kikuchi

**Mail address**
**Dr. K. Marubashi**
Radio Science Division
Communications Research Laboratory
4-2-1, Nukuikita-machi, Koganie-shi
Tokyo 184, Japan

Forecast Center
Hiraiso Solar Terrestrial Research Center
Communications Research Laboratory
3601 Isozaki, Nakaminato-shi
Ibarski 311-12, Japan

**Telephone**
81-423-27-7259 (Dr. K. Marubashi)
81-292-65-7121 (Forecast Center)

**Telefax**
81-423-27-6677 (Dr. K. Marubashi)
81-292-65-7209 (Forecast Center)

**Telex**
2832611 (DEMPA J) (Dr. K. Marubashi)
3632125 (CRLHI J) (Forecast Center)

**Cable**
DEMPA KOKUBUNJI TOKYO

**Electronic mail address**
SPAN nssdca:psi%crlhi::kmarubashi
or ssl::psi%crlhi::ogawa

**Operating organization**
Communications Research Laboratory
Ministry of Post and Telecommunications

**Operating hours**
Forecast Center:
2330 - 1300 UT 7 days/week

**Outgoing messages**

Data:
URSIGRAM Solar and geophysical data (issued daily at 0730 UT)

Forecasts:
Solar activity and geophysical disturbance in the GEOALERT TOK message (issued daily at 0100 UT)

Radio Telecommunications Forecast for the coming 7-day period in the RATEF code issued every Friday and Tuesday.

**Observatory data collected at Tokyo RWC**

Solar (optical):
Hiraiso, Mitaka, Mt. Norikura

Solar (radio):
Hiraiso, Toyokawa

Solar Cosmic Ray:
Tokyo

Particle:
GMS (spacecraft)

Ionospheric (SID):
Hiraiso

Ionospheric (UFOFS):
Kokubunji, Okinawa, Wakkanai, Yamagawa

Geomagnetic:
Hiraiso, Kakioka

HF Field Strength:
Hiraiso

Stratospheric Warming alert:
Tokyo

**Data transmitted from RWC's *to* Tokyo**

| Time UT | Frequency of issue | From |
|---|---|---|
| 0230 | Daily | Sydney |
| 1000 | Daily | Moscow, Sydney |
| 1400 | Daily | Meudon |
| 1500 | Daily | Moscow |

**Data transmitted to RWC's *from* Tokyo**

| Time UT | Frequency of issue | To |
|---|---|---|
| 0130 | Daily | Boulder |
| 0600 | Daily | Meudon, Sydney |

## RWC TOKYO—*Continued*

**URSIGRAM broadcasts**

| Transmitting Station | Call sign | Frequency kHz | Class | Power kW | Time of Emission |
|---|---|---|---|---|---|
| Tokyo | JJD | 10,415 | A1 | 5 | 0800[1] |
| Tokyo | JJD2 | 15,950 | A1 | 5 | 0800[1] |

[1]Non-directional Antenna

Method of transmission:
The message begins with the word "URSIGRAM" and the text of the message is repeated twice. Broadcasting takes the following form:

1. The following are sent repeatedly five times beginning at the time of the above schedule:

VVV VVV VVV DE JJD/JJD2 JJD/JJD2 JJD/JJD2

2. Immediately after the end of the above signals, the signals and information below are sent:

CQ CQ CQ DE JJD/JJD2 JJD/JJD2 JJD/JJD2
URSIGRAM = Text of message AR RPT
= Text of message
AR VA DE JJD/JJD2

Ionospheric (UFOF):
Delhi, Kodaikanal

Geomagnetic:
Alibag, Hyderabad, Kodaikanal

Ionospheric propagation conditions:
Moscow

**URSIGRAM broadcasts**

Transmitted through NPL Standard Time & Frequency Service (ATA) on 5, 10, and 15 MHz daily at 0930 UT.

The message is also put on R.T.T. broadcast (by IMD) at 1805 UT. R.T.T. frequencies used are 19, 12, 7, and 3 MHz.

**Outgoing messages**

Data:
Forecasts of Geomagnetic Activity for up to 3 days in advance (issued daily)

Alerts:
Issued when major geomagnetic disturbance is expected

Products:
Forecasts of Geomagnetic Activity for three zones in Canada for up to 27 days in advance (issued three times a week)
Review of Geomagnetic Activity for previous 27 days (issued three times a week)

# Warsaw Regional Warning Center

## RWC WARSAW

**Supervisory**
Dr. Z. Klos
Immediate Charge: Mrs. I. Stanislawska, Mr. K. Stasiewicz

**Mail address**
Helio–Geophysical Prediction Service
Polish Academy of Sciences
Space Research Center
Bartycka 18A
00–716 Warsaw
Poland

**Telephone**
403 766

**Telefax**
121273

**Telex**
825670 (CBK PL)

**Electronic Mail address**
INTERNET: cbk@cbk.waw.pl
or cbk@chopin.cbk.waw.pl
BITNET: cbkpan@plearn.bitnet

**Operating organization**
Polish Academy of Sciences,
Space Research Center

**Operating hours**
0700 – 1400 UT (Monday–Friday),
0700 – 1200 UT (Saturday),
(closed Sundays and Holidays)

**Outgoing messages**

Data:
URSIGRAM Solar, ionospheric, and geophysical data (issued daily at 0900 UT, except Sundays and Holidays)

**Observatory data collected at Warsaw ARWC**

Solar (radio):
Torun

Ionospheric:
Belsk, Miedzeszyn

Geomagnetic:
Belsk

**Data transmitted from RWC's *to* Warsaw**

| Time UT | Frequency of issue | From |
|---|---|---|
| 0900 | Daily | Sydney, Tokyo, Boulder (via Meudon) |
| 1200 | Daily | Prague |
| 1230 | Daily | Boulder, Darmstadt (via Prague) |
| 1400 | Daily | Meudon |

**Data transmitted to RWC's *from* Warsaw**

| Time UT | Frequency of issue | To |
|---|---|---|
| 0900 | Daily | Meudon, Moscow, Prague |

Data is also received by broadcast from Moscow at 0500, 1100 and 2300 UT (see p. B–6).

# Appendix C

## Listings

The following section consists of two listings of IUWDS stations, listed numerically by station indicator and also listed alphabetically by station name. The Station number (I I I I I) is assigned by the IUWDS Secretariat using the following guidelines:

The indicator group "I I I I I" is assigned as follows in order "abcde."

a = octant of the world

| | | | | |
|---|---|---|---|---|
| 1 | = | 0 – 100° | west, | northern hemisphere |
| 2 | = | 100 – 180° | west, | northern hemisphere |
| 3 | = | 0 – 100° | east, | northern hemisphere |
| 4 | = | 100 – 180° | east, | northern hemisphere |
| 5 | = | 0 – 100° | west, | southern hemisphere |
| 6 | = | 100 – 180° | west, | southern hemisphere |
| 7 | = | 0 – 100° | east, | southern hemisphere |
| 8 | = | 100 – 180° | east, | southern hemisphere |

b = tens position of longitude

if a = 1, 3, 5, or 7

| | | | | | |
|---|---|---|---|---|---|
| 0 | = | 0 – 5° | 5 | = | 46 – 55° |
| 1 | = | 6 – 15° | 6 | = | 56 – 65° |
| 2 | = | 16 – 25° | 7 | = | 66 – 75° |
| 3 | = | 26 – 35° | 8 | = | 76 – 85° |
| 4 | = | 36 – 45° | 9 | = | 86 – 99° |

if a = 2, 4, 6, or 8

| | | | | | |
|---|---|---|---|---|---|
| 0 | = | 100 – 105° | 5 | = | 146 – 155° |
| 1 | = | 106 – 115° | 6 | = | 156 – 165° |
| 2 | = | 116 – 125° | 7 | = | 166 – 175° |
| 3 | = | 126 – 135° | 8 | = | 176 – 185° |
| 4 | = | 136 – 145° | 9 | = | 186 – 199° |

c = tens position of latitude

| | | | | | |
|---|---|---|---|---|---|
| 0 | = | 0 – 5° | 5 | = | 46 – 55° |
| 1 | = | 6 – 15° | 6 | = | 56 – 65° |
| 2 | = | 16 – 25° | 7 | = | 66 – 75° |
| 3 | = | 26 – 35° | 8 | = | 76 – 85° |
| 4 | = | 36 – 45° | 9 | = | 86 – 90° |

dd = station number within position "abc" (arbitrarily assigned by IUWDS)

| | | | |
|---|---|---|---|
| For example: | Boulder, Colo. NOAA | N40 W105 | becomes 20401 |
| | Boulder, Colo. University of Colo. | N40 W105 | becomes 20402 |

# NUMERICAL LISTING OF IUWDS STATIONS

1. *Description:*

The stations listed in this section have been assigned IUWDS station indicators and contribute data to the IUWDS data interchange.

*Table 1.—Numerical Listing of IUWDS Stations*

| Station Indicator | Geographical Location | | Location | | Sensors[1] |
|---|---|---|---|---|---|
| | City, State | Country | °Lat | °Long | |
| 10101 | Ouagadougou | Upper Volta | N12 | W02 | I |
| 10401 | Bordeaux | France | N45 | W01 | R |
| 10402 | Aires/Adour | France | N44 | W00 | G |
| 10501 | Abinger | United Kingdom | N54 | W02 | G |
| 10502 | Herstmonceux | United Kingdom | N51 | W00 | O |
| 10503 | Jodrell Bank | United Kingdom | N53 | W02 | R |
| 10504 | Slough | United Kingdom | N51 | W01 | I |
| 10505 | Lannion | France | N48 | W03 | I |
| 10506 | Upper Heyford | United Kingdom | N51 | W01 | G |
| 10507 | Hartland | United Kingdom | N51 | W04 | G |
| 10508 | Eskdalemur | United Kingdom | N55 | W03 | G |
| 10601 | Lerwick | United Kingdom | N60 | W001 | G |
| 11301 | Averoes | Morocco | N33 | W08 | G |
| 11302 | Tiouine | Morocco | N30 | W07 | G |
| 12101 | Dakar | Senegal | N15 | W17 | G, I |
| 12601 | Reykjavik | Iceland | N64 | W21 | G |
| 14601 | Narssarssuaq | Greenland | N61 | W45 | G |
| 15101 | Paramaribo | Suriname | N06 | W55 | I, R |
| 15501 | St. John's, Newfoundland | Canada | N47 | W52 | G, I |
| 15502 | Argentia | Canada | N48 | W53 | I |
| 16101 | Trinidad | West Indies | N10 | W61 | I |
| 16301 | Bermuda | Bermuda | N32 | W64 | I |
| 16501 | Goose Bay, Labrador | Canada | N53 | W60 | G, I |
| 17201 | Ramey Air Force Base | Puerto Rico | N18 | W67 | O |
| 17202 | San Juan | Puerto Rico | N18 | W66 | G |
| 17401 | Sagamore Hill, Massachusetts | United States of America | N42 | W70 | R, I |
| 17402 | Wallops Island, Virginia | United States of America | N37 | W75 | I |
| 17403 | Prospect, Massachusetts | United States of America | N42 | W71 | R |
| 17501 | Loring Air Force Base, Maine | United States of America | N47 | W68 | G |
| 17801 | Thule | Greenland | N76 | W68 | G, I |
| 18201 | Jamaica | West Indies | N18 | W76 | I |
| 18301 | Cape Kennedy, Florida | United States of America | N28 | W80 | I |
| 18401 | NASA, Washington, D.C. | United States of America | N38 | W77 | I |
| 18402 | ERL, Washington, D.C. | United States of America | N38 | W77 | S |
| 18403 | Fredericksburg, Virginia | United States of America | N38 | W77 | G |
| 18404 | McMath-Hulbert, Pontiac, Michigan | United States of America | N42 | W83 | I, O |
| 18405 | Ottawa | Canada | N45 | W76 | G |
| 18406 | Ottawa NRC | Canada | N45 | W76 | R, I |
| 18407 | Ottawa CRC | Canada | N45 | W76 | I |
| 18408 | Pennsylvania State University, University Park, Penn. | United States of America | N41 | W78 | R |

*Table 1.—Numerical Listing of IUWDS Stations—Continued*

| Station Indicator | Geographical Location | | Location | | Sensors[1] |
|---|---|---|---|---|---|
| | City, State | Country | °Lat | °Long | |
| 18501 | Deep River, Ontario | Canada | N46 | W77 | G |
| 18502 | Great Whale | Canada | N55 | W77 | I |
| 18503 | Poste de la Baleine | Canada | N55 | W77 | G |
| 19301 | Huntsville, Alabama | United States of America | N35 | W87 | O |
| 19302 | Dyess Air Force Base, Texas | United States of America | N32 | W99 | I |
| 19303 | Eglin Air Force Base, Florida | United States of America | N30 | W86 | I |
| 19304 | Bay St Louis, Louisiana | United States of America | N30 | W90 | G |
| 19501 | Aberdeen, South Dakota | United States of America | N45 | W98 | S |
| 19502 | Winnipeg/Kenora | Canada | N50 | W94 | I |
| 19503 | Glenlea | Canada | N49 | W97 | G |
| 19601 | Churchill | Canada | N58 | W94 | I |
| 19602 | Baker Lake | Canada | N64 | W96 | G |
| 19701 | Resolute Bay | Canada | N74 | W94 | I |
| 20301 | Fort Davis, Texas | United States of America | N31 | W101 | R |
| 20302 | Del Rio, Texas | United States of America | N30 | W101 | G |
| 20401 | NOAA, Boulder, Colorado | United States of America | N40 | W105 | G, I, O |
| 20402 | University of Colorado, Boulder, Colorado | United States of America | N40 | W105 | R, I |
| 20701 | Cambridge Bay | Canada | N69 | W105 | G |
| 21301 | Sacramento Peak, New Mexico | United States of America | N32 | W105 | O |
| 21302 | Tucson, Arizona | United States of America | N32 | W110 | G |
| 21303 | White Sands, New Mexico | United States of America | N32 | W107 | I |
| 21304 | Kitt Peak, Arizona | United States of America | N32 | W111 | O |
| 21305 | Holloman Air Force Base, Alamogordo, New Mexico | United States of America | N33 | W106 | O |
| 21401 | Climax, Colorado | United States of America | N39 | W106 | G, O |
| 21501 | Saskatoon | Canada | N52 | W106 | G |
| 21502 | Meanook | Canada | N54 | W113 | G |
| 21601 | Yellowknife | Canada | N62 | W114 | G |
| 22301 | La Posta, California | United States of America | N33 | W118 | I, R |
| 22302 | Lockheed, Burbank, California | United States of America | N34 | W118 | O |
| 22303 | Aerospace, California | United States of America | N31 | W118 | O, R |
| 22304 | Mt. Wilson, California | United States of America | N31 | W118 | O |
| 22305 | Port Arguello, California | United States of America | N34 | W120 | I |
| 22306 | Vandenberg, Air Force Base, California | United States of America | N34 | W120 | I |
| 22307 | Univ. of California, San Diego, California | United States of America | N33 | W116 | IPS |
| 22401 | Palo Alto, California | United States of America | N37 | W122 | G |
| 22402 | Fresno, California | United States of America | N37 | W119 | G |
| 22501 | Penticton, British Columbia | Canada | N49 | W120 | R |
| 22502 | Newport, Washington | United States of America | N48 | W117 | G |
| 22503 | Victoria | Canada | N49 | W123 | G |
| 22701 | Cape Parry | Canada | N70 | W125 | G, I |
| 22702 | Sachs Harbor | Canada | N72 | W125 | G, I |
| 22801 | Mould Bay | Canada | N76 | W119 | G, I |
| 23601 | Sitka, Alaska | United States of America | N57 | W135 | G |
| 23701 | Inuvik | Canada | N68 | W133 | G, I |
| 24701 | Arctic Village, Alaska | United States of America | N68 | W145 | G |

*Table 1.—Numerical Listing of IUWDS Stations—Continued*

| Station Indicator | Geographical Location | | Location | | Sensors[1] |
|---|---|---|---|---|---|
| | City, State | Country | °Lat | °Long | |
| 25601 | Anchorage, Alaska | United States of America | N61 | W150 | G, I |
| 25602 | College, Alaska | United States of America | N64 | W147 | G, I |
| 25603 | Fort Yukon, Alaska | United States of America | N66 | W147 | G, I |
| 25604 | Eielson Air Force Base, Alaska | United States of America | N64 | W147 | I |
| 25605 | Talkeetna, Alaska | United States of America | N63 | W150 | G, I |
| 26201 | Honolulu, Hawaii | United States of America | N21 | W158 | G |
| 26202 | Maui Haleakala, Hawaii | United States of America | N20 | W157 | O |
| 26203 | Maui, Hawaii | United States of America | N20 | W157 | I |
| 26204 | Palehua, Hawaii | United States of America | N21 | W158 | O, R |
| 26205 | Keakawapu Beach, Hawaii | United States of America | N20 | W156 | I |
| 26701 | Point Barrow, Alaska | United States of America | N71 | W157 | G |
| 28501 | Adak, Alaska | United States of America | N52 | W177 | I |
| 28701 | Cape Schmidt | Russia | N69 | W179 | I |
| 30201 | Tamanrasset | Algeria | N22 | E05 | G, I |
| 30401 | Pic-du-Midi | France | N43 | E00 | G, O |
| 30402 | Tortosa | Spain | N41 | E00 | G, I, O |
| 30502 | Toulouse | France | N44 | E02 | S |
| 30503 | Chambon-la-Foret | France | N48 | E02 | G |
| 30504 | DeBilt | Netherlands | N52 | E05 | I |
| 30505 | Dourbes | Belgium | N50 | E05 | G |
| 30506 | Garchy | France | N47 | E03 | G |
| 30507 | Kootwijk | Netherlands | N52 | E06 | I |
| 30508 | Meudon | France | N49 | E02 | O |
| 30509 | Nancay | France | N47 | E02 | R |
| 30510 | Nera | Netherlands | N52 | E05 | I |
| 30511 | Poitiers | France | N46 | E00 | I |
| 30512 | Uccle | Belgium | N50 | E04 | O |
| 30513 | Nijmejen | Netherlands | N52 | E06 | I |
| 31401 | Anacapri-G | Italy | N40 | E14 | O |
| 31402 | Anacapri-S | Italy | N40 | E14 | O |
| 31403 | Arcetri | Italy | N43 | E11 | O, S |
| 31404 | Bologna | Italy | N44 | E11 | G, R |
| 31405 | Catania | Italy | N37 | E15 | O |
| 31406 | Rome | Italy | N42 | E12 | I, O |
| 31501 | Arosa | Switzerland | N46 | E09 | O |
| 31502 | Berlin-Adlershof | Germany, Federal Republic of | N53 | E14 | R |
| 31503 | Breisach | Germany, Federal Republic of | N48 | E07 | I |
| 31504 | Darmstadt | Germany, Federal Republic of | N50 | E09 | I |
| 31506 | Juliusruh/Rugen | Germany, Federal Republic of | N54 | E13 | I |
| 31507 | Kanzelhohe | Germany, Federal Republic of | N46 | E14 | O |
| 31508 | Kiel | Germany, Federal Republic of | N54 | E10 | G, R |
| 31509 | Kranzbach | Germany, Federal Republic of | N48 | E11 | G |
| 31510 | Kuhlungsborn | Germany, Federal Republic of | N54 | E12 | I |
| 31511 | Lindau | Germany, Federal Republic of | N51 | E10 | I |
| 31512 | Ljubljana | Yugoslavia | N46 | E15 | O |
| 31513 | Locarno | Switzerland | N46 | E09 | O |
| 31514 | Luchow | Germany, Federal Republic of | N53 | E11 | I |
| 31515 | Neustrelitz | German Democratic Republic | N53 | E13 | I |
| 31516 | Ondrejov | Czechoslovakia | N50 | E15 | O, R |
| 31517 | Panska Ves | Czechoslovakia | N51 | E15 | I |

*Table 1.—Numerical Listing of IUWDS Stations—Continued*

| Station Indicator | Geographical Location | | Location | | Sensors[1] |
|---|---|---|---|---|---|
| | City, State | Country | °Lat | °Long | |
| 31518 | Predigstuhl | Germany, Federal Republic of | N47 | E12 | G |
| 31519 | Pruhonice | Czechoslovakia | N50 | E14 | G |
| 31520 | Tremsdorf | Germany, Federal Republic of | N52 | E13 | R |
| 31522 | Wendelstein | Germany, Federal Republic of | N47 | E12 | O |
| 31523 | Wingst | Germany, Federal Republic of | N54 | E09 | G |
| 31524 | Witteveen | Netherlands | N53 | E07 | G |
| 31525 | Zurich | Switzerland | N47 | E08 | O |
| 31526 | Norddeich | Germany, Federal Republic of | N54 | E07 | I |
| 31601 | Alborg | Denmark | N56 | E10 | I |
| 31801 | Spitzbergen | Norway | N78 | E15 | I |
| 31802 | Hornsund-Svalbard | Norway | N77 | E15 | G |
| 32001 | Bangui | Central African Republic | N04 | E19 | G |
| 32402 | Belgrade | Yugoslavia | N45 | E20 | O |
| 32403 | Thessalonika | Greece | N41 | E23 | O |
| 32404 | San Vito | Italy | N41 | E18 | I, O, R |
| 32501 | Budapest | Hungary | N47 | E19 | I |
| 32502 | Lomnicki Stit | Czechoslovakia | N49 | E20 | G |
| 32503 | Skalnate Pleso | Czechoslovakia | N49 | E20 | O |
| 32505 | Belsk | Poland | N52 | E21 | G |
| 32506 | Torun | Poland | N53 | E19 | G |
| 32507 | Warsaw | Poland | N52, | E21 | I |
| 32601 | Emmaboda | Sweden | N60 | E17 | I |
| 32602 | Enkoping | Sweden | N60 | E17 | G, I |
| 32603 | Lycksele | Sweden | N65 | E19 | I |
| 32604 | Nurmijarvi | Finland | N61 | E25 | G, I |
| 32605 | Stockholm | Sweden | N59 | E18 | I, O |
| 32606 | Uppsala | Sweden | N60 | E18 | I |
| 32701 | Andenes | Norway | N69 | E16 | G |
| 32702 | Kiruna | Sweden | N68 | E20 | I |
| 32703 | Tromso | Norway | N70 | E19 | G |
| 33301 | Helwan | Egypt | N30 | E31 | G |
| 33302 | Nicosia | Cyprus | N35 | E33 | I |
| 33401 | Bucharest | Romania | N44 | E26 | O |
| 33603 | St. Peterburg | Russia | N60 | E32 | I, G |
| 33701 | Ivalo | Finland | N69 | E27 | G |
| 33702 | Murmansk | Russia | N68 | E33 | I, G |
| 33703 | Sodankyla | Finland | N67 | E27 | I |
| 34101 | Djibouti | Djibouti | N12 | E43 | I |
| 34401 | Abastumani | Georgian | N41 | E43 | O, R |
| 34402 | Kislovodsk | Russia | N43 | E42 | O, R |

*Table 1.—Numerical Listing of IUWDS Stations—Continued*

| Station Indicator | Geographical Location | | Location | | Sensors[1] |
|---|---|---|---|---|---|
| | City, State | Country | °Lat | °Long | |
| 34503 | Moscow | Russia | N55 | E37 | G, I, O, R |
| 34601 | Archangelsk | Russia | N46 | E40 | G |
| 34602 | Nijni Novgorod | Russia | N56 | E44 | I |
| 36401 | Ashgabat | Turkmenstan | N37 | E58 | I |
| 36602 | Ekaterinburg | Russia | N56 | E61 | G, I |
| 36801 | Krenkel Polar Station | Franz Joseph Island | N80 | E58 | G, I |
| 37201 | Ahmedabad | India | N23 | E73 | I |
| 37301 | Udaipur | India | N24 | E73 | O |
| 37401 | Tashkent | Uzbekistan | N41 | E70 | O |
| 37701 | Salekhard | Russia | N66 | E66 | I |
| 38101 | Kodaikanal | India | N10 | E77 | O, I, G |
| 38102 | Thumba | India | N09 | E77 | I |
| 38201 | Hyderabad | India | N17 | E78 | O |
| 38301 | New Delhi | India | N28 | E77 | I |
| 38401 | Alma Ata | Kazakhstan | N43 | E77 | I |
| 38501 | Novosibirsk | Russia | N55 | E82 | I |
| 38601 | Tomsk | Russia | N56 | E85 | I |
| 38701 | Dixon | Russia | N74 | E81 | G, I |
| 39601 | Podkamennaya Tunguska | Russia | N61 | E90 | G |
| 40501 | Irkutsk | Russia | N52 | E104 | G, I, O |
| 40801 | Cape Chelyuskin | Russia | N77 | E104 | G |
| 41206 | Guangzhou | Peoples Republic of China | N23 | E113 | I |
| 41301 | Wuchang | Peoples Republic of China | N30 | E114 | I |
| 41305 | Chongqing | Peoples Republic of China | N29 | E106 | I |
| 42101 | Manila | Philippines | N14 | E121 | I, O, R |
| 42102 | Quezon City | Philippines | N14 | E121 | I, O, R |
| 42201 | Baguio | Philippines | N16 | E120 | O |
| 42202 | Taipei | Taiwan | N25 | E121 | G, I, O |
| 42203 | Taoyvan | Taiwan | N25 | E121 | I |
| 42301 | Nanking | Peoples Republic of China | N29 | E116 | O |
| 42401 | Huairou, Beijing | Peoples Republic of China | N40 | E117 | O |
| 42402 | Shahe, Beijing | Peoples Republic of China | N40 | E116 | O, R |
| 42403 | Beijing | Peoples Republic of China | N40 | E116 | G |
| 42404 | Beijing | Peoples Republic of China | N40 | E116 | I |
| 42503 | Manzhouli | Peoples Republic of China | N49 | E117 | I |
| 43301 | Okinawa | Japan | N26 | E128 | I |
| 43302 | Yamagawa | Japan | N31 | E130 | I |
| 43401 | Ussurisk | Russia | N43 | E132 | O |
| 43402 | Seoul | Korea | N38 | E127 | I |
| 43403 | Ussurisk | Russia | N43 | E132 | R |

*Table 1.—Numerical Listing of IUWDS Stations—Continued*

| Station Indicator | Geographical Location | | Location | | Sensors[1] |
|---|---|---|---|---|---|
| | City, State | Country | °Lat | °Long | |
| 43404 | Osan AB | Korea | N37 | E127 | I |
| 43501 | Khabarovsk | Russia | N48 | E135 | G, I |
| 43701 | Tiksi Bay | Russia | N71 | E129 | G |
| 44301 | Toyokawa | Japan | N35 | E137 | R |
| 44401 | Hiraiso | Japan | N36 | E141 | R |
| 44402 | Kakioka | Japan | N36 | E140 | G |
| 44403 | Kokubunji | Japan | N36 | E139 | I |
| 44404 | Mitaka | Japan | N36 | E140 | O |
| 44405 | Mt. Norikura TAO | Japan | N36 | E138 | O |
| 44406 | Tokyo | Japan | N36 | E140 | I |
| 44408 | Wakkanai | Japan | N45 | E141 | I |
| 44409 | Akita | Japan | N39 | E140 | I |
| 45601 | Magadan | Russia | N60 | E151 | G, I |
| 46501 | Petropavlousk | Russia | N52 | E158 | I |
| 47501 | Shemya, Alaska | United States of America | N52 | E174 | I |
| 54201 | Vassouras | Brazil | S22 | W43 | G |
| 56301 | Buenos Aires | Argentina | S35 | W58 | G, R |
| 56302 | San Miguel | Argentina | S34 | W58 | O |
| 56303 | Tucuman | Argentina | S26 | W65 | I |
| 56501 | Port Stanley | Falkland Islands | S52 | W58 | I |
| 56601 | King George Island | Antarctica | S62 | W58 | G |
| 57101 | Huancayo | Peru | S12 | W75 | G, I,O |
| 62801 | Byrd Station | Antarctica | S79 | W120 | G, I |
| 65201 | Tahiti | Polynesia | S18 | W150 | I |
| 66201 | Rarotonga | Cook Islands | S21 | W159 | I |
| 70901 | South Pole | Antarctica | S90 | E00 | I |
| 72301 | Capetown | South Africa | S34 | E18 | I, O |
| 72701 | Roi Baudouin | Antarctica | S70 | E24 | I |
| 73001 | Lwiro | Congo | S02 | E28 | I, R |
| 73301 | Potchefstrom | South Africa | S27 | E27 | G |
| 73302 | Johannesburg | South Africa | S26 | E28 | I |
| 74701 | Syowa Station | Antarctica | S69 | E40 | I |
| 75201 | Tanarive | Madagascar | S20 | E48 | I |
| 76701 | Mawson | Antarctica | S68 | E63 | I |
| 77501 | Kerguelen Island | French Austral and Antarctic Territories | S49 | E70 | G, I |
| 78701 | Davis | Antarctica | S69 | E78 | I, R |
| 81202 | Learmonth | Australia | S21 | E115 | G, O, R |
| 81701 | Casey | Antarctica | S66 | E111 | I |
| 81801 | Vostok | Antarctica | S78 | E105 | G |
| 82301 | Gnangara | Australia | S23 | E116 | G |
| 82302 | Mundaring | Australia | S32 | E116 | I, G |
| 83101 | Darwin | Australia | S12 | E131 | I |
| 84001 | Vanimo | Papua New Guinea | S03 | E141 | I |
| 84701 | Terre Adelie | Antarctica | S66 | E141 | G, I |
| 85101 | Port Moresby | Papua New Guinea | S09 | E147 | I |

*Table 1.—Numerical Listing of IUWDS Stations—Continued*

| Station Indicator | Geographical Location | | Location | | Sensors[1] |
|---|---|---|---|---|---|
| | City, State | Country | °Lat | °Long | |
| 85201 | Townsville | Australia | S19 | E147 | I |
| 85301 | Brisbane | Australia | S27 | E153 | I |
| 85302 | Canberra | Australia | S35 | E149 | I, G |
| 85303 | Culgoora | Australia | S30 | E149 | I, O, R |
| 85304 | Sydney (Fleurs) | Australia | S34 | E151 | I, O, R |
| 85305 | Camden | Australia | S34 | E151 | I |
| 85401 | Hobart | Australia | S43 | E147 | I |
| 86501 | Macquarie Island | Australia | S54 | E159 | I |
| 87301 | Norfolk Island | Australia | S29 | E168 | I |
| 87401 | Wellington | New Zealand | S41 | E175 | O |
| 87402 | Christchurch | New Zealand | S43 | E172 | I |
| 87801 | McMurdo | Antarctica | S77 | E166 | I |
| 87802 | Scott Base | Antarctica | S77 | E166 | I |
| 88301 | Raoul Island | Kermadec Island | S29 | E178 | I |
| 90006 | GOES-6, NOAA | United States of America | N00 | W135 | S |
| 90007 | GOES-7, NOAA | United States of America | N00 | W75 | S |
| 91012 | NOAA-12, NOAA | United States of America | Polar | | S |

[1] G = Geomagnetic, I = Ionospheric, O = Optical, R = Radio, S = Satellite.

# ALPHABETICAL LISTING OF IUWDS STATIONS

1. *Description:*

The stations listed in this section have been assigned IUWDS station indicators and contribute data to the IUWDS data interchange.

*Table 2.—Alphabetical Listing of IUWDS Stations*

| Station Indicator | Geographical Location | | Location | | Sensors[1] |
|---|---|---|---|---|---|
| | City, State | Country | °Lat | °Long | |
| 34401 | Abastumani | Georgian | N41 | E43 | O, R |
| 19501 | Aberdeen, South Dakota | United States of America | N45 | W98 | S |
| 10501 | Abinger | United Kingdom | N54 | W02 | G |
| 28501 | Adak, Alaska | United States of America | N52 | W177 | I |
| 22303 | Aerospace, California | United States of America | N31 | W118 | O, R |
| 37201 | Ahmedabad | India | N23 | E73 | I |
| 10402 | Aires/Adour | France | N44 | W00 | G |
| 44409 | Akita | Japan | N39 | E140 | I |
| 31601 | Alborg | Denmark | N56 | E10 | I |
| 38401 | Alma Ata | Kazakhstan | N43 | E77 | I |
| 31401 | Anacapri–G | Italy | N40 | E14 | O |
| 31402 | Anacapri–S | Italy | N40 | E14 | O |
| 25601 | Anchorage, Alaska | United States of America | N61 | W150 | G, I |
| 32701 | Andenes | Norway | N69 | E16 | G |
| 31403 | Arcetri | Italy | N43 | E11 | O, S |
| 34601 | Archangelsk | Russia | N46 | E40 | G, I |
| 24701 | Arctic Village, Alaska | United States of America | N68 | W145 | G |
| 15502 | Argentia | Canada | N48 | W53 | I |
| 31501 | Arosa | Switzerland | N46 | E09 | O |
| 36401 | Ashgabat | Turkmenistan | N37 | E58 | I |
| 11301 | Averoes | Morocco | N33 | W08 | G |
| 42201 | Baguio | Philippines | N16 | E120 | O |
| 19602 | Baker Lake | Canada | N64 | W96 | G |
| 32001 | Bangui | Central African Republic | N04 | E19 | G |
| 19304 | Bay St. Louis, Louisiana | United States of America | N30 | W90 | G |
| 42404 | Beijing | Peoples Republic of China | N40 | E116 | I |
| 42403 | Beijing | Peoples Republic of China | N40 | E116 | G |
| 32402 | Belgrade | Yugoslavia | N45 | E20 | O |
| 32505 | Belsk | Poland | N52 | E21 | G |
| 31502 | Berlin–Adlershof | Germany, Federal Republic of | N53 | E14 | R |
| 16301 | Bermuda | Bermuda | N32 | W64 | I |
| 31404 | Bologna | Italy | N44 | E11 | G, R |
| 10401 | Bordeaux | France | N45 | W01 | R |
| 31503 | Breisach | Germany, Federal Republic of | N48 | E07 | I |
| 85301 | Brisbane | Australia | S27 | E153 | I |
| 33401 | Bucharest | Romania | N44 | E26 | O |
| 32501 | Budapest | Hungary | N47 | E19 | I |
| 56301 | Buenos Aires | Argentina | S35 | W58 | G, R |
| 62801 | Byrd Station | Antarctica | S79 | W120 | G, I |
| 20701 | Cambridge Bay | Canada | N69 | W105 | G |

*Table 2.—Alphabetical Listing of IUWDS Stations—Continued*

| Station Indicator | Geographical Location | | Location | | Sensors[1] |
|---|---|---|---|---|---|
| | City, State | Country | °Lat | °Long | |
| 85305 | Camden | Australia | S34 | E151 | I |
| 85302 | Canberra | Australia | S35 | E149 | I, G |
| 40801 | Cape Chelyuskin | Russia | N77 | E104 | G |
| 18301 | Cape Kennedy, Florida | United States of America | N28 | W80 | I |
| 22701 | Cape Parry | Canada | N70 | W125 | G, I |
| 28701 | Cape Schmidt | Russia | N69 | W179 | I |
| 72301 | Capetown | South Africa | S34 | E18 | I, O |
| 81701 | Casey | Australia | S66 | E111 | I |
| 31405 | Catania | Italy | N37 | E15 | O |
| 30503 | Chambon-la-Foret | France | N48 | E02 | G |
| 41305 | Chongqing | Peoples Republic of China | N29 | E106 | I |
| 87402 | Christchurch | New Zealand | S43 | E172 | I |
| 19601 | Churchill | Canada | N58 | W94 | I |
| 21401 | Climax, Colorado | United States of America | N39 | W106 | G, O |
| 25602 | College, Alaska | United States of America | N64 | W147 | G, I |
| 85303 | Culgoora | Australia | S30 | E149 | I, O, R |
| 12101 | Dakar | Senegal | N15 | W17 | G, I |
| 31504 | Darmstadt | Germany, Federal Republic of | N50 | E09 | I |
| 83101 | Darwin | Australia | S12 | E131 | I |
| 78701 | Davis | Antarctica | S69 | E78 | I, R |
| 30504 | DeBilt | Netherlands | N52 | E05 | I |
| 18501 | Deep River, Ontario | Canada | N46 | W77 | G |
| 20302 | Del Rio, Texas | United States of America | N30 | W101 | G |
| 38701 | Dixon | Russia | N74 | E81 | G, I |
| 34101 | Djibouti | Djibouti | N12 | E43 | I |
| 30505 | Dourbes | Belgium | N50 | E05 | G |
| 19302 | Dyess Air Force Base, Texas | United States of America | N32 | W99 | I |
| 18402 | ERL, Washington, D.C. | United States of America | N38 | W77 | S |
| 19303 | Eglin Air Force Base, Florida | United States of America | N30 | W86 | I |
| 25604 | Eielson Air Force Base, Alaska | United States of America | N64 | W147 | I |
| 36602 | Ekaterinburg | Russia | N56 | E61 | G, I |
| 32601 | Emmaboda | Sweden | N60 | E17 | I |
| 32602 | Enkoping | Sweden | N60 | E17 | G, I |
| 10508 | Eskdalemur | United Kingdom | N55 | W03 | G |
| 20301 | Fort Davis, Texas | United States of America | N31 | W101 | R |
| 25603 | Fort Yukon, Alaska | United States of America | N66 | W147 | G, I |
| 18403 | Fredericksburg, Virginia | United States of America | N38 | W77 | G |
| 22402 | Fresno, California | United States of America | N37 | W119 | G |
| 90005 | GOES-5, NOAA | United States of America | N00 | W75 | S |
| 90006 | GOES-6, NOAA | United States of America | N00 | W135 | S |
| 90007 | GOES-7, NOAA | United States of America | N00 | W75 | S |
| 30506 | Garchy | France | N47 | E03 | G |
| 19503 | Glenlea | Canada | N49 | W97 | G |
| 82301 | Gnangara | Australia | S23 | E116 | G |
| 16501 | Goose Bay, Labrador | Canada | N53 | W60 | G, I |
| 18502 | Great Whale | Canada | N55 | W77 | I |
| 41206 | Guangzhou | Peoples Republic of China | N23 | E113 | I |
| 10507 | Hartland | United Kingdom | N51 | W04 | G |
| 33301 | Helwan | Egypt | N30 | E31 | G |
| 10502 | Herstmonceux | United Kingdom | N51 | W00 | O |

*Table 2.—Alphabetical Listing of IUWDS Stations—Continued*

| Station Indicator | Geographical Location | | Location | | Sensors[1] |
|---|---|---|---|---|---|
| | City, State | Country | °Lat | °Long | |
| 44401 | Hiraiso | Japan | N36 | E141 | R |
| 85401 | Hobart | Australia | S43 | E147 | I |
| 21305 | Holloman Air Force Base, Alamogordo, New Mexico | United States of America | N33 | W106 | O |
| 26201 | Honolulu, Hawaii | United States of America | N21 | W158 | G |
| 31802 | Hornsund–Svalbard | Norway | N77 | E15 | G |
| 42401 | Huairou, Beijing | Peoples Republic of China | N40 | E117 | O |
| 57101 | Huancayo | Peru | S12 | W75 | G, I, O |
| 19301 | Huntsville, Alabama | United States of America | N35 | W87 | O |
| 38201 | Hyderabad | India | N17 | E78 | O |
| 23701 | Inuvik | Canada | N68 | W133 | G, I |
| 40501 | Irkutsk | Russia | N52 | E104 | G, I, O |
| 33701 | Ivalo | Finland | N69 | E27 | G |
| 18201 | Jamaica | West Indies | N18 | W76 | I |
| 10503 | Jodrell Bank | United Kingdom | N53 | W02 | R |
| 73302 | Johannesburg | South Africa | S26 | E28 | I |
| 31506 | Juliusruh/Rugen | Germany, Federal Republic of | N54 | E13 | I |
| 44402 | Kakioka | Japan | N36 | E140 | G |
| 31507 | Kanzelhohe | Germany, Federal Republic of | N46 | E14 | O |
| 26205 | Keakawapu Beach, Hawaii | United States of America | N20 | W156 | I |
| 77501 | Kerguelen Island | French Austral and Antarctic Territories | S49 | E70 | G, I |
| 43501 | Khabarovsk | Russia | N48 | E135 | G, I |
| 31508 | Kiel | Germany, Federal Republic of | N54 | E10 | G, R |
| 56601 | King George Island | Antarctica | S62 | W58 | G |
| 32702 | Kiruna | Sweden | N68 | E20 | I |
| 34402 | Kislovodsk | Russia | N43 | E42 | O, R |
| 21304 | Kitt Peak, Arizona | United States of America | N32 | W111 | O |
| 38101 | Kodaikanal | India | N10 | E77 | O, I, G |
| 44403 | Kokubunji | Japan | N36 | E139 | I |
| 30507 | Kootwijk | Netherlands | N52 | E06 | I |
| 31509 | Kranzbach | Germany, Federal Republic of | N48 | E11 | G |
| 36801 | Krenkel Polar Station | Franz Joseph Island | N80 | E58 | G, I |
| 31510 | Kuhlungsborn | Germany, Federal Republic of | N54 | E12 | I |
| 22301 | La Posta, California | United States of America | N33 | W118 | I, R |
| 10505 | Lannion | France | N48 | W03 | I |
| 81202 | Learmonth | Australia | S21 | E115 | G, O, R |
| 10601 | Lerwick | United Kingdom | N60 | W001 | G |
| 31511 | Lindau | Germany, Federal Republic of | N51 | E10 | I |
| 31512 | Ljubljana | Yugoslavia | N46 | E15 | O |
| 31513 | Locarno | Switzerland | N46 | E09 | O |
| 22302 | Lockheed, Burbank, California | United States of America | N34 | W118 | O |
| 32502 | Lomnicki Stit | Czechoslovakia | N49 | E20 | G |
| 17501 | Loring Air Force Base, Maine | United States of America | N47 | W68 | G |
| 31514 | Luchow | Germany, Federal Republic of | N53 | E11 | I |
| 73001 | Lwiro | Congo | S02 | E28 | I, R |

*Table 2.—Alphabetical Listing of IUWDS Stations—Continued*

| Station Indicator | Geographical Location | | Location | | Sensors[1] |
|---|---|---|---|---|---|
| | City, State | Country | °Lat | °Long | |
| 32603 | Lycksele | Sweden | N65 | E19 | I |
| 86501 | Macquarie Island | Australia | S54 | E159 | I |
| 45601 | Magadan | Russia | N60 | E151 | G, I |
| 42101 | Manila | Philippines | N14 | E121 | I, O, R |
| 42503 | Manzhouli | Peoples Republic of China | N49 | E117 | I |
| 26202 | Maui Haleakala, Hawaii | United States of America | N20 | W157 | O |
| 26203 | Maui, Hawaii | United States of America | N20 | W157 | I |
| 76701 | Mawson | Antarctica | S68 | E63 | I |
| 18404 | McMath–Hulbert, Pontiac, Michigan | United States of America | N42 | W83 | I, O |
| 87801 | McMurdo | Antarctica | S77 | E166 | I |
| 21502 | Meanook | Canada | N54 | W113 | G |
| 30508 | Meudon | France | N49 | E02 | O |
| 44404 | Mitaka | Japan | N36 | E140 | O |
| 34503 | Moscow | Russia | N55 | E37 | G, I, O, R |
| 22801 | Mould Bay | Canada | N76 | W119 | G, I |
| 44405 | Mt. Norikura TAO | Japan | N36 | E138 | O |
| 22304 | Mt. Wilson, California | United States of America | N31 | W118 | O |
| 82302 | Mundaring | Australia | S32 | E116 | I, G |
| 33702 | Murmansk | Russia | N68 | E33 | I, G |
| 18401 | NASA, Washington, D.C. | United States of America | N38 | W77 | I |
| 20401 | NOAA, Boulder, Colorado | United States of America | N40 | W105 | G, I, O |
| 91012 | NOAA–12, NOAA | United States of America | Polar | | S |
| 30509 | Nancay | France | N47 | E02 | R |
| 42301 | Nanking | Peoples Republic of China | N29 | E116 | O |
| 14601 | Narssarssuaq | Greenland | N61 | W45 | G |
| 30510 | Nera | Netherlands | N52 | E05 | I |
| 31515 | Neustrelitz | German Democratic Republic | N53 | E13 | I |
| 38301 | New Delhi | India | N28 | E77 | I |
| 22502 | Newport, Washington | United States of America | N48 | W117 | M |
| 33302 | Nicosia | Cyprus | N35 | E33 | I |
| 30513 | Nijmejen | Netherlands | N52 | E06 | I |
| 34602 | Nijni Norvgorod | Russia | N56 | E44 | I, R |
| 31526 | Norddeich | Germany, Federal Republic of | N54 | E07 | I |
| 87301 | Norfolk Island | Australia | S29 | E168 | I |
| 38501 | Novosibirsk | Russia | N55 | E82 | I |
| 32604 | Nurmijarvi | Finland | N61 | E25 | G, I |
| 43301 | Okinawa | Japan | N26 | E128 | I |
| 31516 | Ondrejov | Czechoslovakia | N50 | E15 | O, R |
| 43404 | Osan AB | Korea | N37 | E127 | I |
| 18407 | Ottawa CRC | Canada | N45 | W76 | I |
| 18406 | Ottawa NRC | Canada | N45 | W76 | R, I |
| 18405 | Ottawa | Canada | N45 | W76 | G |
| 10101 | Ouagadougou | Upper Volta | N12 | W02 | I |
| 26204 | Palehua, Hawaii | United States of America | N21 | W158 | O, R |
| 22401 | Palo Alto, California | United States of America | N37 | W122 | G |

*Table 2.—Alphabetical Listing of IUWDS Stations—Continued*

| Station Indicator | Geographical Location | | Location | | Sensors[1] |
|---|---|---|---|---|---|
| | City, State | Country | °Lat | °Long | |
| 31517 | Panska Ves | Czechoslovakia | N51 | E15 | I |
| 15101 | Paramaribo | Suriname | N06 | W55 | I, R |
| 18408 | Pennsylvania State University, University Park, Penn. | United States of America | N41 | W78 | R |
| 22501 | Penticton, British Columbia | Canada | N49 | W120 | R |
| 46501 | Petropavlovsk | Russia | N53 | E158 | I |
| 30401 | Pic-du-Midi | France | N43 | E00 | G, O |
| 39601 | Podkamennaya Tunguska | Russia | N61 | E90 | G |
| 26701 | Point Barrow, Alaska | United States of America | N71 | W157 | G |
| 30511 | Poitiers | France | N46 | E00 | I |
| 22305 | Port Arguello, California | United States of America | N34 | W120 | I |
| 85101 | Port Moresby | Papua New Guinea | S09 | E147 | I |
| 56501 | Port Stanley | Falkland Islands | S52 | W58 | I |
| 18503 | Post de le Baleine | Canada | N55 | W77 | G |
| 73301 | Potchefstrom | South Africa | S27 | E27 | G |
| 31518 | Predigstuhl | Germany, Federal Republic of | N47 | E12 | G |
| 17403 | Prospect, Massachusetts | United States of America | N42 | W71 | R |
| 31519 | Pruhonice | Czechoslovakia | N50 | E14 | G |
| 42102 | Quezon City | Philippines | N14 | E121 | I, O, R |
| 17201 | Ramey Air Force Base | Puerto Rico | N18 | W67 | O |
| 88301 | Raoul Island | Kermadec Island | S29 | E178 | I |
| 66201 | Rarotonga | Cook Islands | S21 | W159 | I |
| 19701 | Resolute Bay | Canada | N74 | W94 | I |
| 12601 | Reykjavik | Iceland | N64 | W21 | G |
| 72701 | Roi Baudouin | Antarctica | S70 | E24 | I |
| 31406 | Rome | Italy | N42 | E12 | I, O |
| 22702 | Sachs Harbor | Canada | N72 | W125 | G, I |
| 21301 | Sacramento Peak, New Mexico | United States of America | N32 | W105 | O |
| 17401 | Sagamore Hill, Massachusetts | United States of America | N42 | W70 | R, I |
| 37701 | Salekhard | Russia | N66 | E66 | I |
| 17202 | San Juan | Puerto Rico | N18 | W66 | G |
| 56302 | San Miguel | Argentina | S34 | W58 | O |
| 32404 | San Vito | Italy | N41 | E18 | I, O, R |
| 21501 | Saskatoon | Canada | N52 | W106 | G |
| 87802 | Scott Base | Antarctica | S77 | E166 | I |
| 43402 | Seoul | Korea | N38 | E127 | I |
| 42402 | Shahe, Beijing | Peoples Republic of China | N40 | E116 | O, R |
| 47501 | Shemya, Alaska | United States of America | N52 | E174 | I |
| 23601 | Sitka, Alaska | United States of America | N57 | W135 | G |
| 32503 | Skalnate Pleso | Czechoslovakia | N49 | E20 | O |
| 10504 | Slough | United Kingdom | N51 | W01 | I |
| 33703 | Sodankyla | Finland | N67 | E27 | I |
| 70901 | South Pole | Antarctica | S90 | E00 | I |
| 31801 | Spitzbergen | Norway | N78 | E15 | I |
| 15501 | St. John's, Newfoundland | Canada | N47 | W52 | G, I |
| 33603 | St. Peterburg | Russia | N60 | E32 | G |

*Table 2.—Alphabetical Listing of IUWDS Stations—Continued*

| Station Indicator | Geographical Location | | Location | | Sensors[1] |
|---|---|---|---|---|---|
| | City, State | Country | °Lat | °Long | |
| 32605 | Stockholm | Sweden | N59 | E18 | I, O |
| 36601 | Sverdlovsk | Russia | N56 | E61 | I |
| 85304 | Sydney (Fleurs) | Australia | S34 | E151 | I, O, R |
| 74701 | Syowa Station | Antarctica | S69 | E40 | I |
| 65201 | Tahiti | Polynesia | S18 | W150 | I |
| 42202 | Taipei | Taiwan | N25 | E121 | G, I, O |
| 25605 | Talkeetna, Alaska | United States of America | N63 | W150 | G, I |
| 30201 | Tamanrasset | Algeria | N22 | E05 | G, I |
| 75201 | Tanarive | Madagascar | S20 | E48 | I |
| 42203 | Taoyvan | Taiwan | N25 | E121 | I |
| 37401 | Tashkent | Uzbekistan | N41 | E70 | O |
| 84701 | Terre Adelie | Antarctica | S66 | E141 | G, I |
| 32403 | Thessalonika | Greece | N41 | E23 | O |
| 17801 | Thule | Greenland | N76 | W68 | G, I |
| 38102 | Thumba | India | N09 | E77 | I |
| 43701 | Tiksi Bay | Russia | N71 | E129 | G |
| 11302 | Tiouine | Morocco | N30 | W07 | G |
| 44406 | Tokyo | Japan | N36 | E140 | I |
| 38601 | Tomsk | Russia | N56 | E85 | I |
| 30402 | Tortosa | Spain | N41 | E00 | G, I, O |
| 32506 | Torun | Poland | N53 | E19 | G |
| 30502 | Toulouse | France | N44 | E02 | S |
| 85201 | Townsville | Australia | S19 | E147 | I |
| 44301 | Toyokawa | Japan | N35 | E137 | R |
| 31520 | Tremsdorf | Germany, Federal Republic of | N52 | E13 | R |
| 16101 | Trinidad | West Indies | N10 | W61 | I |
| 32703 | Tromso | Norway | N70 | E19 | G |
| 21302 | Tucson, Arizona | United States of America | N32 | W110 | G |
| 56303 | Tucuman | Argentina | S26 | W65 | I |
| 30512 | Uccle | Belgium | N50 | E04 | O |
| 37301 | Udaipur | India | N24 | E73 | O |
| 20601 | Yellowknife | Canada | N62 | W114 | G |
| 22307 | Univ. of California, San Diego, California | United States of America | N33 | W116 | IPS |
| 20402 | University of Colorado, Boulder, Colorado | United States of America | N40 | W105 | R, I |
| 10506 | Upper Heyford | United Kingdom | N51 | W01 | G |
| 32606 | Uppsala | Sweden | N60 | E18 | I |
| 43401 | Ussurisk | Russia | N43 | E132 | O |
| 22306 | Vandenberg, Air Force Base, California | United States of America | N34 | W120 | I |
| 84001 | Vanimo | Papua New Guinea | S03 | E141 | I |
| 54201 | Vassouras | Brazil | S22 | W43 | G |
| 22503 | Victoria | Canada | N49 | W123 | G |
| 81801 | Vostok | Antarctica | S78 | E105 | G |
| 44408 | Wakkanai | Japan | N45 | E141 | I |
| 17402 | Wallops Island, Virginia | United States of America | N37 | W75 | I |
| 32507 | Warsaw | Poland | N52 | E21 | I |
| 87401 | Wellington | New Zealand | S41 | E175 | O |
| 31522 | Wendelstein | Germany, Federal Republic of | N47 | E12 | O |
| 21303 | White Sands, New Mexico | United States of America | N32 | W107 | I |
| 31523 | Wingst | Germany, Federal Republic of | N54 | E09 | G |
| 19502 | Winnipeg/Kenora | Canada | N50 | W94 | I |

*Table 2.—Alphabetical Listing of IUWDS Stations—Continued*

| Station Indicator | Geographical Location | | Location | | Sensors[1] |
|---|---|---|---|---|---|
| | City, State | Country | °Lat | °Long | |
| 31524 | Witteveen | Netherlands | N53 | E07 | G |
| 41301 | Wuchang | Peoples Republic of China | N30 | E114 | I |
| 43302 | Yamagawa | Japan | N31 | E130 | I |
| 31525 | Zurich | Switzerland | N47 | E08 | O |

[1] G = Geomagnetic, I = Ionospheric, O = Optical, R = Radio, S = Satellite.

# A



# C



# F



# G



# I



# O



# R

## S



## T



## U