Final: 09 December 2011

2012 International Geophysical Calendar

Cooperative programs pertaining to solar activity and the Earth's environment

Go to the ftp site for past calendars.

The International Geophysical Calendar contains information about:

- 2012 Solar Eclipses
- 2012 Meteor Showers

and recommended scientific programs for

- Airglow and Aurora Phenomena
- Atmospheric Electricity
- Geomagnetic Phenomena
- Ionospheric Phenomena
- Vertical Incidence sounding program
- Incoherent Scatter observation program
- Meteorology
- Global Atmosphere Watch (GAW)
- Solar Phenomena
- Climate and Weather of the Sun-Earth System (CAWSES)
- Space Research, Interplanetary Phenomena, Cosmic Rays, Aeronomy
- Meteor Showers

2012 FINAL Calendar -- PDF version

EXPLANATIONS

This Calendar continues the series begun for the IGY years 1957-58, and is issued annually to recommend dates for solar and geophysical observations, which cannot be carried out continuously. Thus, the amount of observational data in existence tends to be larger on Calendar days. The recommendations on data reduction and especially the flow of data to World Data Centers (WDCs) in many instances emphasize Calendar days. The Calendar is prepared by the International Space Environment Service (ISES) with the advice of spokesmen for the various scientific disciplines. For some programs, greater detail concerning recommendations appears from time to time published in IAGA News, IUGG Chronicle, URSI Information Bulletin and other scientific journals or newsletters.

The Calendar provides links to many international programs, giving an opportunity for scientists to become involved with data monitoring and research efforts. International

scientists are encouraged to contact the key people and join the worldwide community effort to understand the Sun-Earth environment.

The definitions of the designated days remain as described on previous Calendars. Universal Time (UT) is the standard time for all world days. Regular Geophysical Days (RGD) are each Wednesday. Regular World Days (RWD) are three consecutive days each month (always Tuesday, Wednesday and Thursday near the middle of the month). Priority Regular World Days (PRWD) are the RWD which fall on Wednesdays. Quarterly World Days (QWD) are one day each quarter and are the PRWD which fall in the World Geophysical Intervals (WGI). The WGI are fourteen consecutive days in each season, beginning on Monday of the selected month, and normally shift from year to year. In 2012 the WGI are March, June, September, and December.

The 2012 FINAL Calendar is available in PDF format.

2012 Solar Eclipses:

The year 2012 has one annular and one total eclipse.

a. **2012 May 20, an annular solar eclipse** begins at sunrise in Asia and ends at sunset in the United States. Annularity begins in southeast China, including Macau and Hong Kong, which has 3 m 52 s of annularity at a 10° altitude. It crosses northernmost Taiwan, including Taipei with 2 min 10 s of annularity, before crossing the Pacific Ocean. Partial phases range from northeast Indonesia, including Borneo and Celebes, and with the sun rising partially eclipsed in Bangladesh, Sikkim, Bhutan, Myanmar, Thailand, Cambodia, Vietnam, Laos, and China, where Beijing will have a 67° eclipse. Partial phases can also bee seen in eastern Kazakhstan, in Mongolia and in Siberia. In mid-Pacific, Honolulu, Hawaii, will have an 18° eclipse, and Anchorage, Alaska, will have a 68% eclipse. The path of annularity will hit the United States from south of Eureka, California, which will have about 95% coverage for 3 min 51 s, to slightly north of Grants Pass, Oregon, with similar coverage for 2 min 56 s. Annularity includes Cartson City, Nevada; St. George, Utah; Zion National Park in Utah,the Grand Canyon in Arizona; Canyon De Chelly National Monument; and Albuquerque, New Mexico; ending eastward of Lubbock, Texas. The Sun's diameter will be 90% covered in San Francisco; 85% covered in Los Angeles; 93% covered in Flagstaff, Arizona; and 90% covered in El Paso, Texas. To the north of the path of annularity, the Sun's diameter will be 70% covered in Calgary, Alberta, Canada; 78% covered in Bozeman, Montana; 61% covered in Winnipeg, Manitoba, Canada; and, at sunset, 67% covered in Minneapolis, Minnesota, 68% covered in Chicago. The eastern extent of the partial eclipses's visibility is in a line extending northeast from Pensacola, Florida; through Ashville, Tennessee; to Altoona, Pennsylvania; to Utica, NY. Buffalo will have close to a 60% eclipse at sunset; and Montreal about a 53% eclipse at sunset. Most of Mexico will also see sunset partial phases.

- Map of annular solar eclipse May 20, 2012.
- Interactive Google map of annular solar eclipse May 20, 2012.

b. **2012 Nov 13/14, total solar eclipse,** magnitude 1.050, 04m02s max duration, eclipse visible in Australia, NZ, s Pacific, s S. America (total: n Australia, s Pacific). The 2012 November 13/14 total solar eclipse will be visible as total only in northwestern Australia on November 13, local time, within an hour of sunrise. Annularity begins at sunrise in Arnhem Land, east of Darwin. In Queensland, the centerline goes south of Port Douglas. Totality will be visible from Innesfall along the coast through Cairns and Port Douglas, and north about halfway to Cooktown. Totality will last 2 min 5 s at its centerline, crossing Oak Beach; it will last 2 min 0 s at Cairns and 2 min 3 s at Port Douglas. The path of totality then extends over the Pacific Ocean, not including any other land. All of Australia will see partial phases, ranging from 40% at sunrise in Perth, Western Australia, to 69% coverage of the Sun's diameter in Sydney. Christchurch, New Zealand, will have 68% coverage, and all of New Zealand will have a similar partial eclipse. Partial phases will also be seen at sunset, weather permitting, from most of Chile and western Argentina. The sun will set about 80° eclipsed at Santiago, Chile. The partial phases will end just west of Lima, Peru; San Juan, Peru, and the Paracas National Reserve are just within the western edge of partial-phase visibility.

- Map of total solar eclipse November 13/14, 2012.
- Interactive Google map of total solar eclipse November 13/14, 2012.

Information from Jay M. Pasachoff, Williams College (Williamstown, Massachusetts), Chair, International Astronomical Union's Working Group on Eclipses, based on information and maps provided by Fred Espenak and Xavier Jubier.

- **Eclipse References:**
  - Fred Espenak, Fifty Year Canon of Solar Eclipses: 1986-2035, NASA Reference Publication 1178 Revised, July 1987.
  - Leon Golub and Jay M. Pasachoff, The Solar Corona, Cambridge University Press, 1998.
  - Jay M. Pasachoff and Alex Filippenko, The Cosmos: Astronomy in the New Millennium, Brooks/Cole Publishers, 2002, 2004 and 2006.
  - Leon Golub and Jay M. Pasachoff,Nearest Star: The Exciting Science of Our Sun, Harvard University Press, 2001.
  - Jay M. Pasachoff, The Complete Idiot's Guide to the Sun, Alpha Books, 2003.

2012 Meteor Showers

(Dates selected from the International Meteor Organization Shower Calendar 2012. Peak times provided by A. McBeath.):

a. **Meteor outbursts** are unusual showers (often of short duration) from the crossing of relatively recent comet ejecta. Dates are for the year 2012.
    - No predicted events.
b. **Regular meteor showers:** The dates (based on UT in year 2012) for regular meteor showers are:
    - Dec 28-Jan 12, peak Jan 04 07h20m UT (Quadrantids);
    - Apr 16-Apr 25, peak Apr 22 05h25m UT (Lyrids);
    - Apr 19-May 28, peak May 05 19h00m UT (Eta Aquariids);
    - May 22-Jul 02, peak Jun 07 05h UT (Daytime Arietids);
    - May 20-Jul 05, peak Jun 09 05h UT (Daytime Zeta Perseids);
    - Jun 05-Jul 17, peak Jun 28 04h UT (Daytime Beta Taurids);
    - Jul 12-Aug 23, peak Jul 29/30 (Southern Delta Aquariids);
    - Jul 17-Aug 24, peak Aug 12 12h00m to 14h30m UT (Perseids);
    - Sep 09-Oct 09, peak Sep 27 04h UT (Daytime Sextantids);
    - Oct 02-Nov 07, peak Oct 21 (Orionids);
    - Nov 06-Nov 30, peak Nov 17 09h35m UT (Leonids);
    - Dec 07-Dec 17, peak Dec 13 07h00m - Dec 14 04h15m UT (Geminids);
    - Dec 17-Dec 26, peak Dec 22 03h00m UT (Ursids).

Meteor Shower Websites:

- Shower activity near-real time reports -- International Meteor Organization
- Meteor shower activity forecast from your own location -- Peter Jenniskens
- Shower names and data -- IAU Meteor Data Center
- Announcements and reports of meteor outbursts -- Minor Planet Center
- Shower outburst activity forecast -- Institut de Mecanique celeste et de calcul des ephemerides

References:

- Peter Jenniskens, Meteor showers and their parent comets. Cambridge University Press, 2006, 790 pp.

Real Time Space Weather and Earth Effects

The occurrence of **unusual solar or geophysical conditions** is announced or forecast by ISES through various types of geophysical **"Alerts"** (which are widely distributed via the internet on a current schedule). Stratospheric warmings (STRATWARM) were also designated for many years. The meteorological telecommunications network coordinated by the World Meteorological Organization (WMO) carries these worldwide Alerts once daily soon after 0400 UT. For definitions of Alerts see ISES "Synoptic Codes for Solar and Geophysical Data", March 1990 and its amendments. For many years Retrospective World Intervals were selected and announced by MONSEE (Monitoring of the Sun-Earth Environment) and elsewhere to provide additional analyzed data for particular events studied in the ICSU Scientific Committee on Solar-Terrestrial Physics (SCOSTEP) programs.

Final: 09 December 2011

RECOMMENDED SCIENTIFIC PROGRAMS (FINAL EDITION)

(The following material was reviewed in 2011 by spokesmen of IAU, IAGA, WMO and URSI as suitable for coordinated geophysical programs in 2012.)

Airglow and Aurora Phenomena.

Airglow and auroral observatories operate with their full capacity around the New Moon periods. However, for progress in understanding the mechanism of many phenomena, such as low latitude aurora, the coordinated use of all available techniques, optical and radio, from the ground and in space is required. Thus, for the airglow and aurora 7-day periods on the Calendar, ionosonde, incoherent scatter, special satellite or balloon observations, etc., are especially encouraged. Periods of approximately one weeks' duration centered on the New Moon are proposed for high resolution of ionospheric, auroral and magnetospheric observations at high latitudes during northern winter.

Atmospheric Electricity.

Non-continuous measurements and data reduction for continuous measurements of atmospheric electric current density, field, conductivities, space charges, ion number densities, ionosphere potentials, condensation nuclei, etc.; both at ground as well as with radiosondes, aircraft, rockets; should be done with first priority on the RGD each Wednesday, beginning on 4 January 2012 at 0000 UT, 11 January at 0600 UT, 18 January at 1200 UT, 25 January at 1800 UT, etc. (beginning hour shifts six hours each week, but is always on Wednesday). Minimum program is at the same time on PRWD beginning with 18 January at 1200 UT. Data reduction for continuous measurements should be extended, if possible, to cover at least the full RGD including, in addition, at least 6 hours prior to indicated beginning time. Measurements prohibited by bad weather should be done 24 hours later. Results on sferics and ELF are wanted with first priority for the same hours, short-period measurements centered around minutes 35-50 of the hours indicated. Priority Weeks are the weeks that contain a PRWD; minimum priority weeks are the ones with a QWD. The World Data Centre for Atmospheric Electricity, 7 Karbysheva, St. Petersburg 194018, USSR, is the collection point for data and information on measurements.

Geomagnetic Phenomena.

It has always been a leading principle for geomagnetic observatories that operations should be as continuous as possible and the great majority of stations undertake the same program without regard to the Calendar.

Stations equipped for making magnetic observations, but which cannot carry out such observations and reductions on a continuous schedule are encouraged to carry out such work at least on RWD (and during times of MAGSTORM Alert).

Ionospheric Phenomena.

Special attention is continuing on particular events that cannot be forecast in advance with reasonable certainty. These will be identified by Retrospective World Intervals. The importance of obtaining full observational coverage is therefore stressed even if it is only possible to analyze the detailed data for the chosen events. In the case of vertical incidence sounding, the need to obtain quarter-hourly ionograms at as many stations as possible is particularly stressed and takes priority over recommendation (a) below when both are not practical.

For the **vertical incidence (VI) sounding program,** the summary recommendations are:

a. All stations should make soundings on the hour and every quarter hour;
b. On RWDs, ionogram soundings should be made at least every quarter hour and preferably every five minutes or more frequently, particularly at high latitudes;
c. All stations are encouraged to make f-plots on RWDs; f-plots should be made for high latitude stations, and for so-called "representative" stations at lower latitudes for all days (i.e., including RWDs and WGIs) (Continuous records of ionospheric parameters are acceptable in place of f-plots at temperate and low latitude stations);
d. Copies of all ionogram scaled parameters, in digital form if possible, be sent to WDCs;
e. Stations in the eclipse zone and its conjugate area should take continuous observations on solar eclipse days and special observations on adjacent days. See also recommendations under Airglow and Aurora Phenomena.

For the 2012 **incoherent scatter observation program**, every effort should be made to obtain measurements at least on the Incoherent Scatter Coordinated Observation Days, and intensive series should be attempted whenever possible in WGIs, on Dark Moon Geophysical Days (DMGD) or the Airglow and Aurora Periods. The need for collateral VI observations with not more than quarter-hourly spacing at least during all observation periods is stressed.

Special programs include:

- **Strat-Warming** Dynamics and Temperature of the Lower Thermosphere During Sudden Stratospheric Warming -- Key objectives are: To measure neutral wind (zonal and meridional components) and electron and ion temperatures in the lower thermosphere before and during sudden stratospheric warming. To compare variations in temperature and winds to average variations observed by ISRs during the winter. To compare variations in temperatures and winds to mesospheric response as given by MF and meteor radars and lidars. To extend studies of stratospheric warming effects to the lower thermosphere and investigate possible coupling with the ionosphere. To examine the mechanisms responsible for variations in lower thermospheric dynamics and temperatures and investigate to what degree they can be related to sudden stratospheric warming. Observation

length is a 10 day interval beginning in the period January 15-February 15. The decision to start will be based on predictions of stratospheric warming by Larisa Goncharenko. In the case of no SSW event, the World Day will fall back to a 5 day run at the end of the alert period, February 7-12. (L. Goncharenko -- lpg@haystack.mit.edu).

- **Synoptic** These synoptic experiments are intended to emphasize wide coverage of the F-region, with some augmented coverage of the topside or E-region to fill in areas of the data bases that have relatively little data. (J. Sojka -- sojka@cc.usu.edu).

- AO -- Arecibo Observatory;
- JRO -- Jicamarca Radio Observatory.

Special programs: Dr. Ingemar Haggstrom, EISCAT, Box 812, SE-98128 Kiruna, Sweden; tel: +46 98079155;Fax: +46 98079159; e-mail ingemar@eiscat.se; URSI Working Group G.5. See the 2012 Incoherent Scatter Coordinated Observation Days (URSI-ISWG) webpage for complete 2012 definitions.

For the ionospheric drift or wind measurement by the various radio techniques, observations are recommended to be concentrated on the weeks including RWDs.

For travelling ionosphere disturbances, propose special periods for coordinated measurements of gravity waves induced by magnetospheric activity, probably on selected PRWDs and RWDs.

For the ionospheric absorption program half-hourly observations are made at least on all RWDs and half-hourly tabulations sent to WDCs. Observations should be continuous on solar eclipse days for stations in the eclipse zone and in its conjugate area. Special efforts should be made to obtain daily absorption measurements at temperate latitude stations during the period of Absorption Winter Anomaly, particularly on days of abnormally high or abnormally low absorption (approximately October-March, Northern Hemisphere; April-September, Southern Hemisphere).

For back-scatter and forward scatter programs, observations should be made and analyzed at least on all RWDs.

For synoptic observations of mesospheric (D region) electron densities, several groups have agreed on using the RGD for the hours around noon.

For ELF noise measurements involving the earth-ionosphere cavity resonances any special effort should be concentrated during WGIs.

It is recommended that more intensive observations in all programs be considered on days of unusual meteor activity.

Meteorology.

Particular efforts should be made to carry out an intensified program on the RGD -- each Wednesday, UT. A desirable goal would be the scheduling of meteorological rocketsondes, ozone sondes and radiometer sondes on these days, together with maximum-altitude rawinsonde ascents at both 0000 and 1200 UT.

During **WGI and STRATWARM Alert Intervals,** intensified programs are also desirable, preferably by the implementation of RGD-type programs (see above) on Mondays and Fridays, as well as on Wednesdays.

Global Atmosphere Watch (GAW).

The World Meteorological Organization (WMO) Global Atmosphere Watch (GAW) integrates many monitoring and research activities involving measurement of atmospheric composition, and serves as an early warning system to detect further changes in atmospheric concentrations of greenhouse gases, changes in the ozone layer and in the long range transport of pollutants, including acidity and toxicity of rain as well as of atmospheric burden of aerosols (dirt and dust particles). Contact WMO, 7 bis avenue de la Paix, P.O. Box 2300, CH-1211 Geneva 2, Switzerland or wmo[at]wmo.int.

Solar Phenomena.

Observatories making specialized studies of solar phenomena, particularly using new or complex techniques, such that continuous observation or reporting is impractical, are requested to make special efforts to provide to WDCs data for solar eclipse days, RWDs and during PROTON/FLARE ALERTS. The attention of those recording solar noise spectra, solar magnetic fields and doing specialized optical studies is particularly drawn to this recommendation.

CAWSES (Climate and Weather of the Sun-Earth System).

Program within the SCOSTEP (Scientific Committee on Solar-Terrestrial Physics): 2004-2008. Its focus is to mobilize the community to fully utilize past, present, and future data; and to produce improvements in space weather forecasting, the design of space- and Earth-based technological systems, and understanding the role of solar-terrestrial influences on Global Change. Contact is Susan Avery (susan.avery@colorado.edu), Chair of CAWSES Science Steering Group. Program theme areas are:

- Solar Influence on Climate -- M. Lockwood and L. Gray (UK);
- Space Weather: Science and Applications -- J. Kozyra (USA) and K. Shibata (Japan);
- Atmospheric Coupling Processes -- F. Luebken (Germany) and J. Alexander (USA);
- Space Climatology -- C. Frolich (Switzerland) and J. Sojka (USA); and

- Capacity Building and Education -- M.A. Geller (USA), S.-T. Wu (USA), and J. H. Allen (USA).
- See the CAWSES website for more information.

ILWS (International Living With a Star) International effort to stimulate, strengthen, and coordinate space research to understand the governing processes of the connected Sun-Earth System as an integrated entity. Contact info@ilwsonline.org.

ISWI (International Space Weather Initiative) -- a program of international cooperation to advance space weather science by a combination of instrument deployment, analysis and interpretation of space weather data from the deployed instruments in conjunction with space data, and communicate the results to the public and students. ISWI is a follow-up activity to the successful IHY 2007, but focusing exclusively on space weather. The goal of the ISWI is to develop the scientific insight necessary to understand the science, and to reconstruct and forecast near-Earth space weather. This includes instrumentation, data analysis, modeling, education, training, and public outreach. Contact J. Davila at Joseph.M.Davila@nasa.gov.

Space Research, Interplanetary Phenomena, Cosmic Rays, Aeronomy.

Experimenters should take into account that observational efforts in other disciplines tend to be intensified on the days marked on the Calendar, and schedule balloon and rocket experiments accordingly if there are no other geophysical reasons for choice. In particular it is desirable to make rocket measurements of ionospheric characteristics on the same day at as many locations as possible; where feasible, experimenters should endeavor to launch rockets to monitor at least normal conditions on the Quarterly World Days (QWDs) or on RWDs, since these are also days when there will be maximum support from ground observations. Also, special efforts should be made to assure recording of telemetry on QWDs and Airglow and Aurora Periods of experiments on satellites and of experiments on spacecraft in orbit around the Sun.

Meteor showers.

Of particular interest are both predicted and unexpected showers from the encounter with recent dust ejecta of comets (meteor outbursts). The period of activity, level of activity, and magnitude distributions need to be determined in order to provide ground truth for comet dust ejection and meteoroid stream dynamics models. Individual orbits of meteoroids can also provide insight into the ejection circumstances. If a new (1-2 hour duration) shower is observed due to the crossing of the 1-revolution dust trail of a (yet unknown) Earth threatening long-period comet, observers should pay particular attention to a correct determination of the radiant and time of peak activity in order to facilitate predictions of future encounters. Observations of meteor outbursts should be reported to the I.A.U. Minor Planet Center (mpc@cfa.harvard.edu) and International Meteor Organization (visual@imo.net). The activity curve, mean orbit, and particle size distribution of minor annual showers need to be characterised in order to understand their relationship to the dormant comets among near-Earth objects. Annual shower

observations should be reported to national meteor organizations, or directly to the International Meteor Organization. Meteoroid orbits are collected by the IAU Meteor Data Center.

The International Space Environment Service (ISES) is a permanent scientific service of the International Union of Radio Science (URSI), with the participation of the International Astronomical Union and the International Union Geodesy and Geophysics. ISES adheres to the Federation of Astronomical and Geophysical Data Analysis Services (FAGS) of the International Council of Scientific Unions (ICSU). ISES coordinates the international aspects of the world days program and rapid data interchange.

This Calendar for 2012 has been drawn up by R. Fiori and H.E. Coffey, of the ISES Steering Committee, in association with spokesmen for the various scientific disciplines in SCOSTEP, IAGA and URSI and other ICSU organizations. Similar Calendars are issued annually beginning with the IGY, 1957-58, and are published in various widely available scientific publications. PDF versions of the past calendars are available online.

Published for the International Council of Scientific Unions and with financial assistance of UNESCO for many years.

Copies are available upon request to ISES Chairman, Dr. David Boteler, Geomagnetic Laboratory, Natural Resources Canada, 2617 Anderson Road, Ottawa, Ontario, Canada, K1A 0E7, FAX (613)824-9803, e-mail dboteler at NRCan.gc.ca, or ISES Secretary for World Days, Ms. Robyn Fiori, Geomagnetic Laboratory, Natural Resources Canada, 2617 Anderson Road, Ottawa, Ontario, Canada, K1A 0E7, FAX (613)824-9803, e-mail rfiori at NRCan.gc.ca. Beginning with the 2008 Calendar, all calendars are available only in digital form.

The website for the International Geophysical Calendar, including recent versions, can be fount at the here.