

# CAWSES Space Weather Campaign

The first CAWSES (Climate And Weather of the Sun Earth System) Space Weather campaign will be running in association with the campaign of CPEA (Coupling Processes in Equatorial Atmosphere) and the ISR World Days from March 29 to April 3, 2004. The focus of the ISR world days campaign will be the coupling between the high- and low-latitude ionospheres. The focus of the CPEA campaign (which runs through March-April 2004) is on the coupling from the troposphere up through the thermosphere in a strong convective region over Indonesia.

During the ISR World Days Interval, CAWSES will draw together and expand these efforts by coordinating collaborating satellite and ground-based programs to produce a sun-to-Earth data set which dips down into the lower atmosphere.

The CAWSES campaign will also serve as the first testbed for a collaborative CAWSES/GEM/IAGA effort to combine international magnetometer chains to produce global maps of ULF wave index and magnetospheric density.

During the CPEA campaign interval, CAWSES will support the goal of understanding atmosphere coupling in the equatorial region by providing a global context for local equatorial-region observations. But CAWSES will expand beyond this to produce a characterization of the middle atmosphere during equinox conditions that embeds the detailed view of equatorial coupling supplied by CPEA.

CAWSES will pursue international collaborations to create global maps of middle atmosphere quantities (i.e., gravity waves, neutral winds, etc.) depending on the coverage by available observing sites.

CAWSES will enable a world-wide analysis campaign following the observation intervals.

- **ISR World Days Campaign** (contact: Chaosong Huang <cshuang@haystack.mit.edu>)
  - [http://www.haystack.edu/schedules/worlddays\\_2004.html](http://www.haystack.edu/schedules/worlddays_2004.html)
  - All the incoherent scatter radars worldwide will participate, including Sonderstrom, EISCAT, Svalbard, Millstone Hill, Arecibo, Jicamarca, Irkutsk (Russia), and Kharkov (Ukraine)
  - Measure ionospheric electron density, ion velocity, electron temperature, ion temperature, and electric fields over the F-region. Neutral winds can be derived
  - Focus: to investigate global ionospheric disturbances during magnetic storms and substorms. In particular, how significantly magnetic storms and substorms affect the middle- and low-latitude ionospheric electron density and TEC, how effectively magnetospheric substorm electric fields penetrate to the low-latitude ionosphere, and how the ionospheric electron density and TEC disturbances vary with longitude and latitude
- **First CAWSES/GEM/IAGA World Magnetometer Maps** (contact: Ian Mann <imann@space.ualberta.ca>)
  - Space weather global data products derived from collaborating ground-based magnetometer arrays
    - First data product will be ULF wave power distribution maps.
    - Testbed arrays: IMAGE (Ari Viljanen), MACCS (Mark Engebretson), CANOPUS (Ian Mann), USGS (Jeff Love), MEASURE (Mark Moldwin), SAMBA (Eftyhia Zesta), 210 MM (Kiyohumi Yumoto).
    - Extend to include other arrays and stations
    - Extend to create other magnetometer data products based on the time-series data. Working toward development of new ULF wave indices and eventually ULF magnetospheric density maps
  - hosted on the Space Sciences Data Portal (SSDP) being developed at the University of Alberta (PI:Robert Rankin)
- **Solar Observations Web Page hosted at NASA GSFC** (contact: Nat Gopalswamy <gopals@fugee.gsfc.nasa.gov>)
  - Link on the CDAW website at <http://cdaw.gsfc.nasa.gov>
  - List solar data sources for the CAWSES campaign
  - Link to the data in a usable form for campaign participants
  - Data Sources: IPS, ISOON, H-alpha, TRACE, SOHO, Metric Radio, Microwave, etc.
- **SOHO** (scientific contact: Joe Gurman <gurman@gsfc.nasa.gov>)
  - SOHO will be in a telemetry "keyhole" between March 20 and April 4. Telemetry will be reduced to ~60%. LASCO coverage of coronal mass ejections will probably still be quite good. EIT data will be unavailable.
- **RHESSI** (contact: Robert Lin <rlin@ssl.berkeley.edu>)
  - Able to supply information on solar flare emissions and particle acceleration
- **Big Bear Solar Observatory** (contact: Vasyi Yurchyshyn <vayur@bbso.njit.edu>)
  - 1 min time cadence full disk Halpha images (at BBSO from 1500 to 0000 UT)
  - 1 min time cadence full disk H alpha images from our Global H alpha Network
  - 1 min time cadence hi resolution measurements of the solar magnetic field
- **SMEI** Contacts: Dave Webb ( [David.Webb@hanscom.af.mil](mailto:David.Webb@hanscom.af.mil)), Bernie Jackson <bvjackson@ucsd.edu>
  - Try to ensure that SMEI is operating in its normal, all-sky mode during the March-April timeframe.
  - Especially monitor operations during the March 29-April 3 CPEA time period
  - View entire sky beyond ~20 deg from the sun
  - Can see CME's and should be able to detect corotating structures
- **ACE** (contact: Thomas Zurbuchen <thomasz@umich.edu>)
  - Rapidly analyze and provide level 2 digital files of the upstream solar wind conditions
  - Provide link to analyzed data on the ACE home page

- **Cluster** (contact: Philippe Escoubet <Philippe.Escoubet@esa.int>)
  - Apogee in front of dayside magnetopause
  - About half- time in the upstream solar wind
  - Crosses the South and North cusp/magnetopause, the auroral region on nightside, the radiation belts and the plasmasphere.
  - View surface waves on the magnetopause
- **Double-Star** (contacts: Philippe Escoubet, Philippe Escoubet@esa.int; Prof. Z.-X. Liu, liu@center.cssar.ac.cn)
- **Geotail** (Contact: Don Fairfield <Donald.H.Fairfield@nasa.gov>) - **NOT CONFIRMED**
  - inner magnetosphere current disruption region
  - solar wind upstream of bow shock
- **Polar** (contact: John Sigwarth <john-sigwarth@uiowa.edu>)
  - Polar perigee at the near-equatorial magnetopause,
  - Science focus: cusp, pressure pulses, triggered aurora, conjugate ovals, dayside O/N2
- **GOES magnetic field** (contacts: Howard Singer <howard.singer@noaa.gov>, Brian Fraser <Brian.Fraser@newcastle.edu.au>)
  - Magnetic field observations at geo orbit
  - ULF wave signatures
- **NOAA/POES** (Contact: David S Evans <David.S.Evans@noaa.gov>)
  - Operational data from NOAA-15, -16, 17
  - auroral protons and electrons, ring current and radiation belts, solar particle events
- **Iridium magnetic field measurements** (contact: Brian Anderson <Brian.Anderson@jhuapl.edu>)
  - Maps of FACs, magnetic perturbations and poynting flux where data quality is sufficient
- **Radiation belt particles**
  - **SAMPEX** (Contact: Daniel Baker <daniel.baker@lasp.colorado.edu>)
  - **GOES particles** (Contact: Terry Onsager <Terry.Onsager@noaa.gov>)
  - **HEO** (Contact: Joseph Fennell <Joseph.F.Fennell@aero.org>): Electrons >130 keV to >3 MeV; Limited proton coverage at E> 80 keV.
  - **GPS and LANL SOPA: NOT CONFIRMED**
- **IMAGE** (in Earth eclipse for much of the campaign - many instruments will have to be shut down.)
  - magnetospheric density profiles - RPI (Contact: Bodo Reinisch, Paul Song <paul.song@uml.edu>). Run as long as possible.
  - ring current populations, substorm populations, outflows (ENA Imager Contacts: HENA, Don Mitchell <Donald.G.Mitchell@jhuapl.edu>; MENA, Craig Pollock <craig.pollock@swri.org>; LENA Tom Moore <Thomas.E.Moore@gsfc.nasa.gov>)
  - plasmaspheric dynamics (Contact: Bill Sandel <sandel@arizona.edu>)
  - Auroral emissions: Partial coverage by WIC due to shut down for sun protection, more complete coverage by SI-12 and SI-13 possible (Contact: Harald Frey <hfrey@ssl.berkeley.edu>)
- **LANL GEO plasma** (contact: Michelle Thomsen <mthomsen@lanl.gov>)
  - satellites at 8, 69, 103, 195, and 322 East Geographic Longitude
  - Routine observations of plasmaspheric drainage plumes, near-Earth plasmasheet
- **DMSP and ROCSAT** (Contact: Rod Heelis <heelis@utdallas.edu>)
  - charged particle drift, composition and temperature
  - data sets will provide equatorial mid-latitude and high latitude data distributed in latitude, longitude, and LT

- **DMSP Particles & Fields** (Contact: Fred Rich, [Frederick.Rich@hanscom.af.mil](mailto:Frederick.Rich@hanscom.af.mil))
  - Thermal plasma data, precipitating particle data, fluxgate magnetometer data
- **FAST:** (Contact: Cynthia Cattell <cattell@belka.space.umn.edu>)
  - pre-noon/dusk (~20 MLT).
  - Taking data to low latitudes (~ 50 deg ILAT).
  - Magnetometer data to help with the field-aligned current/ULF wave physics
  - High-resolution particle measurements 10's eV to 10's keV
- **Fabrey-Perot Interferometers in Northern Scandinavia** Contact: Anasuya Aruliah <a.aruliah@ucl.ac.uk>
  - FPIs observing the 630nm emission at Kiruna, Sweden; Sodankyla, Finland and Longyearbyen, Svalbard
  - Also operating a narrow field of view spectrograph platform, observing several wavelengths, but looking in particular at proton aurora. Context is provided by co-located video camera, and absolute calibration by co-located photometers.
  - Observations at night pending clear weather during the campaign
- **TIMED** (Contact: Sam Yee <Sam.Yee@jhuapl.edu>)
  - 10 - 22 LT plane
  - Lower thermosphere and mesosphere observations of chemically active species, neutral temp, particle inputs, neutral composition, auroral emissions, etc. Also solar EUV, XUV emissions
  - Will support the ISR World Days Campaign as well as CPEA
  - Will limit operations that disrupt observations during the entire March-April time interval of the campaign.
- **IPS Ionosonde Network in Australia** (contact: Phil Wilkinson <phil@ips.gov.au>)
  - 5 min cadence ionograms
- **SuperDARN radar network** (contact: Ray Greenwald <Ray.Greenwald@jhuapl.edu>)
  - website at APL will provide the convection patterns and cross polar cap potential as the campaign evolves
- **JPL TEC Maps** (contact: Tony Mannucci <Tony.Mannucci@jpl.nasa.gov>)
  - Data from ground and space-borne GPS receivers
- **TEC generated from IGS RINEX data** Contact: Ruth Bamford (McCrea) <R.A.Bamford@rl.ac.uk>
  - supported under the European COST271
  - European maps at <http://ionosphere.rcru.rl.ac.uk/index.htm>
  - World maps can be produced
- **UK Ionosonde facilities** (contact: Sarah James <sarah@wdcc1d.stp.rl.ac.uk>)
  - at Chilton, UK and Port Stanley, Falkland Islands
  - 5 min cadence ionograms
  - available online via the World Data Centre for STP, Chilton website at <http://www.wdc.rl.ac.uk/> and it will also be included in Center for Atmospheric Research, Lowell's DIDBase
- **Ionospheric scintillations & TEC Network** (Contact: Cesar Valladares <valladar@maill.bc.edu>)
  - GPS scintillation data, GPS-derived TEC data
  - Chain of GPS receivers located in the American 70 deg longitude sector
- **MACCS magnetometer chain** Contacts: Jeff Hughes [hughes@bu.edu](mailto:hughes@bu.edu) ; Mark Engebretson [engebret@augsborg.edu](mailto:engebret@augsborg.edu)
  - Operate as normal during CAWSES

- **UARS** (Contact: Charles Jackman <jackman@assess.gsfc.nasa.gov>)
  - Very low power situation during ISR world days. It is possible that there will be some measurements by SOLSTICE and SUSIM, but very little else
  - After April 2, the possibility exists to have SOLSTICE, SUSIM, HALOE, and possibly HRDI on with PEM during the daytime part of the orbit.
  - Longer term data set possible for equinox campaign: HALOE is scheduled to make measurements March 1-7 and 16-26. The schedule for April will soon be available.
  - HALOE data is available after it is processed at [http://haloedata.larc.nasa.gov/Haloe/noframe\\_home.html](http://haloedata.larc.nasa.gov/Haloe/noframe_home.html)
- **Coupling Processes in the Equatorial Atmosphere (CPEA) campaign** (contact: Prof Shoichiro Fukao <fukao@kurasc.kyoto-u.ac.jp>)
  - Download brochure at [http://people.ece.cornell.edu/wes/URSI\\_ISWG/CPEA-panf.pdf](http://people.ece.cornell.edu/wes/URSI_ISWG/CPEA-panf.pdf)
  - Runs March and April 2004 in Indonesia
  - Observe coupling processes in the neutral atmosphere from troposphere to thermosphere in a region of strong turbulence.
  - One focus is on the characterization of gravity waves over Indonesia by CPEA from April 10 - May 10, 2004
    - CPEA observations will be placed into the global context by the CAWSES atmospheric observations.
      - Note: The CAWSES objective is to characterize the middle atmosphere using global sets of ground-based observations and satellite data during the equinox interval.
      - It supports and broadens the CPEA objectives
      - CAWSES provides a testbed for producing global maps of important geophysical quantities (i.e., gravity waves, neutral winds, etc.) using international collections of ground-based observations combined with satellite data.
- **Indian Institute of Geomagnetism (IIG) Contact: Dr. S. Gurubaran <gurubara@vsnl.com>: Equatorial Station at Tirunelveli**
  - Partial reflection MF Radar. Continuously operated. Measurements at 80-98 km
  - Digital fluxgate magnetometer that along with Alibag system provides EEJ strength at high temporal resolution (Contact: S. Alex; salex@iigs.iigm.res.in)
  - VHF spaced-receiver and GPS instruments are also operated here that can provide a variety of information on the equatorial ionospheric irregularities (contact: A. Bhattacharyya; archana@iigs.iigm.res.in)
- **Mesospheric Gravity Wave & Temperature Measurements** (Contact: Mike Taylor <mtaylor@cc.usu.edu>)
  - During the new moon period in March (13-28) and April (11-27)
  - All-sky, multi-wavelength gravity wave imager, located at Bear Lake Observatory, UT (41.6 N, 111.6 W). Sequential measures of the NIR OH, O<sub>2</sub>(0,1) band emissions, and the OI (557.7 nm), OI (630.0 nm) and Na (589.2 nm) line emissions
  - Medium field (75 deg) Mesospheric Temperature Mapper for OH(6,2) and O<sub>2</sub>(0,1) band emission intensity and rotational temperatures at 3-min resolution and ~2 K precision. Located at Maui, Hawaii (20.8 N, 156 W)
- **Indian Institute of Astrophysics, Solar-Terrestrial Physics Facilities at Kodaikanal** Contact: J. H. Sastri <jhs@iiap.res.in>
  - campaign mode now till April 6, 2004
  - ionosonde, HF Doppler radar and digital magnetometer

- **Brazilian Ionosondes** (Contact: Dr. Paulo Fagundes, [fagundes@univap.br](mailto:fagundes@univap.br))
  - 3 digital ionosondes (CADIIs)
  - 3 multi-spectral all-sky imaging systems
  - Operational during the proposed period (March 29 to April 03, 2004)
  - Spread from equator to low-latitudes
- **Consorzio “Area di Ricerca in Astrogeofisica”, L’Aquila** (Italy). Person to contact: U. Villante ([umberto.villante@aquila.infn.it](mailto:umberto.villante@aquila.infn.it))
  - **SEGMA Magnetometer Array**. Person to contact: M. Vellante ([massimo.vellante@aquila.infn.it](mailto:massimo.vellante@aquila.infn.it))
  - **ULF wave magnetic measurements** at Panagyurishte (Bulgaria). Person to contact: M. Vellante ([massimo.vellante@aquila.infn.it](mailto:massimo.vellante@aquila.infn.it))
  - **ULF wave magnetic measurements** at Ottana (Italy). Person to contact: P. Palangio ([palangio@ingv.it](mailto:palangio@ingv.it))
  - **ULF wave magnetic measurements** at Terra Nova Bay (Antarctica).
    - measurements will be available only after the next summer campaign (December 2004).
    - Person to contact: M. De Lauretis ([marcello.delauretis@aquila.infn.it](mailto:marcello.delauretis@aquila.infn.it))
  - **Absolute magnetic field measurements** at the Geomagnetic Observatory of L’Aquila (Italy). Person to contact: P. Palangio ([palangio@ingv.it](mailto:palangio@ingv.it))
  - **Absolute magnetic field measurements** at the Geomagnetic Observatory of Castello Tesino (Italy). Person to contact: A. De Santis ([desantis@ingv.it](mailto:desantis@ingv.it))
  - **Vertical ionospheric sounding** at Rome (Italy) and Gibilmanna (Sicily, Italy). Person to contact: B. Zolesi ([zolesi@ingv.it](mailto:zolesi@ingv.it))
  - **Oblique ionospheric sounding** between Rome and London. Person to contact: B. Zolesi ([zolesi@ingv.it](mailto:zolesi@ingv.it))
- **“Istituto di Fisica dello Spazio Interplanetario” (IFSI), of the Italian CNR (National Research Council)**
  - Kerguelen SuperDARN radar.
  - run by IFSI in cooperation with CNRS, Orleans.
  - radar is crossed with the Japanese radar in Syowa, and provides the vector flow velocity pattern of the ionospheric plasma.
  - radars operate continuously
  - Contacts are provided in the SuperDARN web page <http://superdarn.jhuapl.edu/info.html>
- **PSPT (Precision Solar Photometric Telescope) at the Rome Astronomical Observatory**
  - During the first CAWSES campaign “triplets” of CaII K line (393.3 nm, bw 0.25 nm), blue continuum (409.2 nm, bw 0.25 nm) and red continuum (607.1 nm, bw 0.5 nm). images of the solar disk will be acquired within few minutes each hour, during the whole day, weather permitting.
  - The images calibrated for instrumental effects will be available through the OAR web-page at <http://www.mporzio.astro.it/solare>
- **Department of Space Radio Physics at the Kharkiv V. Karazin National University** (Contact: Prof. Oleg F. Tyrnov, [Oleg.F.Tyrnov@univer.kharkov.ua](mailto:Oleg.F.Tyrnov@univer.kharkov.ua))
  - magnetometer, the MF radar, the HF radar, and navigation satellite radio beacon receivers (49° 38'N, 36° 20')
  - described at <http://www.radiophys.univer.kharkov.ua/space/>
- **SCINDA: Scintillation Network Decision Aid** (Contact: Keith Groves, [keith.groves@hanscom.af.mil](mailto:keith.groves@hanscom.af.mil))
  - Raw scintillation data from the network will be obtained



- **International Digisonde Users Group.** Contact: Bodo Reinisch [bodo\\_reinisch@uml.edu](mailto:bodo_reinisch@uml.edu)
  - 1 ionogram every 5 minutes,
  - calibrated drift operation run 2-4 drift cases following each ionogram.
  - data archived in DIDBase.
- **HIRISE (High Resolution Imaging Echelle Spectrograph)**  
Contact: "D. Pallamraju" <raju@cawses.bu.edu>
  - operating from Boston (42.2N, 71.W, mag lat. 48.3)
  - daytime red line (630.0nm) emission measurements
- **Network of Mesospheric Radars** (Contact: Scott Palo <palo@colorado.edu>)
  - Radars run quasi-continuously. Will try to minimize radar downtime for maintenance in the March-April 2004 time frame.
  - List of ~ 35 network radars spanning high to low latitudes at <http://sisko.colorado.edu/TIMED/> .  
Follow links --> Data: Ground-based Radars --> Sites
- **Atmospheric facility at Gadanki, India** (Contact: D. Narayana Rao <dnrao\_2001@rediffmail.com> )
  - MST Radar, Raleigh Lidar, Lower atmospheric radar, GPS receiver, GPS Sonde and some of the meteorological parameters at ground level
- **Space Physics Laboratory, VSSC, Trivendrum** (Contact: R. Sridharan at [r\\_sridharan@vssc.org](mailto:r_sridharan@vssc.org))
  - HF Radar, Magnetometer, and Optical photometers will be operating.
- **C'NOFS team** (contact: Odile de La Beaujardiere <Odile.delaBeaujardiere@hanscom.af.mil>)
  - analysis of pre-C'NOFS equatorial data set

- **UPOS\_GSE Geoeffectiveness of Solar Events** (contact: Charles Deehr [cdeehr@gi.alaska.edu](mailto:cdeehr@gi.alaska.edu))
  - Calculates 4-day and 28-day predictions of solar wind density, velocity, pressure and magnetic field to 2 and 10 AU every hour at <http://gse.gi.alaska.edu/recent/>
  - "Fearless Forecast" provides email notification of predicted shock arrival times. Subscribe at: <http://www.gi.alaska.edu/mailman/listinfo/gse-ff>.
- **LF wind measurements at Collm (52N, 15E)** (Contact: Christoph Jacobi: [jacobi@rz.uni-leipzig.de](mailto:jacobi@rz.uni-leipzig.de) )
  - Horizontal E-region drift at 85-105 km and LF reflection height at oblique incidence at 177 KHz
  - data coverage is approx 12 h for heights and 16 h for winds (both nighttime), resolution is 30 min

## IMPORTANT WEB SITES;

- Ground-Based Coronal Hole Images:  
[http://mlso.hao.ucar.edu/cgi-bin/mlso\\_acoshome.cgi](http://mlso.hao.ucar.edu/cgi-bin/mlso_acoshome.cgi)
- Ground-Based Coronal Mass Ejection Images:  
[http://mlso.hao.ucar.edu/cgi-bin/mlso\\_homepage.cgi](http://mlso.hao.ucar.edu/cgi-bin/mlso_homepage.cgi)
- Active Region Monitor:  
<http://beauty.nascom.nasa.gov/arm/latest/>