# CAWSES News

Climate And Weather of the Sun-Earth System

Volume 2, Number 1 March 2005


CAWSES is an international program sponsored by SCOSTEP (Scientific Committee on Solar-Terrestrial Physics) and has been established with the aim of significantly enhancing our understanding of the space environment and its impacts on life and society. The main functions of CAWSES are to help coordinate international activities in observations, modeling and theory crucial to achieving this understanding, to involve scientists in both developed and developing countries, and to provide educational opportunities for students at all levels.

## *Message from the Chair*


*Sunanda Basu*
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CAWSES is off to a very good start in its second year. The US National Science Foundation has decided to fund the CAWSES Office at Boston University for the period 2005 – 07 based on a peer-reviewed proposal submitted last October. This will allow the continuation of this office, which publishes *CAWSES News* and provides much needed support in interacting with all our members and implementing plans approved by the SCOSTEP Bureau and the Science Steering Group for CAWSES. We certainly do have much activity planned for the next six months. A one-day Workshop will be held on May 14, 2005 in Taipei in conjunction with the Eleventh International Symposium on Equatorial Aeronomy. Results of the first joint CAWSES and CPEA campaigns conducted during March – May 2004 will be discussed there. A CAWSES planning meeting will be held on July 23, 2005 in Toulouse in conjunction with the IAGA Meeting. We will use both these meetings to discuss promising science issues for international collaboration under the different themes and planning the next CAWSES experimental campaign slated for September 2005. The following article by Raju gives you more information. A few initial results from the first Campaign are included in this newsletter as are updates of various Theme activities and national programs. The most exciting news about national programs comes from our German colleagues who have been able to launch a significant national CAWSES effort involving 18 different institutions in Germany with funding for a large number of graduate students and post docs. We would like to encourage colleagues from other countries to approach their national funding agencies to support CAWSES-science in their respective countries and provide resources for training the next generation of researchers in Sun-Earth System science in your part of the world. Please let me know if the CAWSES SSG can help in any way. I personally look forward to meeting many of you at the CAWSES meetings in Taiwan and France.

***Inside this issue:***

## *Update on CAWSES activities since September 2004*

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We have entered the second year of the CAWSES program. Considering the voluntary nature of most of our efforts, it is encouraging to know that we have accomplished so much in so small a time. It is my pleasure to summarize them here.

As you will read below, the proposal by co-chairs and other members of Theme 1 to understand solar variability and links to climate has already been approved by the International Space Science Institute and we look forward to important results emanating from that meeting. Several focused working groups have been formed under Theme 2. They are listed in the section on CAWSES Members below. This issue provides some nice initial results on the measurements conducted during the first CAWSES Space Weather campaign last year. Theme 3 has developed several focused projects that will be coordinated by different members across the Theme 3 Working Groups, and thus, this signals a good beginning of interaction among disciplines within this Theme. At present brainstorming correspondence on different science aspects covered by each project is underway and it is expected that the projects will take a final shape in very near future. I believe that we will hear about their progress in the next *CAWSES News*. Working groups in Theme 4 have now advanced to the stage of defining their scope, mission, objectives and their working plan.

It was felt that the first CAWSES Science Planning meeting held in Paris during COSPAR last year was very useful in defining and planning the science strategy and its implementation by all the Themes. A similar one day Science Planning meeting will be held in Toulouse during IAGA to reassess the progress so far and to set timelines for the work to be carried out in the near future. Smaller meetings and workshops on various CAWSES topics will be held during the forthcoming International Symposium on Equatorial Aeronomy in Taipei, Taiwan, in May, the Solar Variability Workshop in Rome, in June, the International Association of Geomagnetism and Aeronomy General Assembly in Toulouse, France, in July and at the International Association of Meteorology and Atmospheric Sciences meeting in Beijing, China in August. These efforts will also eventually contribute to Capacity Building and Education by making it possible for some graduate students and post-doctoral fellows to attend these meetings.

As Sunanda Basu could not travel to Australia in January to participate in the 2005 Australian Institute of Physics Congress, Janet Kozyra gracefully agreed to deliver the CAWSES keynote address on her behalf. As you will see from the report below, CAWSES science provided the over-arching theme for this important meeting in the Southern hemisphere and it is anticipated that CAWSES science will be a major focus during the next Australian Institute of Physics Congress to be held in Brisbane, Queensland in 2006. Jan Sojka presented how CAWSES could contribute to IHY (International Heliophysical Year) in the IHY Science Planning meeting in February 2005. It is hoped that IHY can benefit from the resources and work that has been put in by the CAWSES community.

Focused science campaigns across the continents are essential to understand the problems that are global in nature. These also help in revitalizing the CAWSES community and in enhancing scientific cooperation and interactions. Several interesting results have been obtained during the first CAWSES Space Weather/CPEA (Coupling Processes in Equatorial Atmospheres) campaign last year, which have been presented at the CEDAR Workshop and AGU Fall Meeting last year in USA and some other results will be presented in the forthcoming CAWSES Space Weather and CPEA Workshops in Taiwan in May. Similar campaigns involving both Themes 2 and 3 are planned for this year as well. During September 2005, a one-month long campaign of space and ground-based measurements will be carried out during which all the incoherent scatter radars will be operated on a best effort basis. The CAWSES community can take advantage of this epoch to understand various space weather and atmospheric coupling issues at different latitudes. The Equatorial Atmosphere Radar in Indonesia is also expected to operate for CPEA studies. Hence, this month has been chosen to be the second CAWSES Space Weather/CPEA Campaign period. Experimental campaigns on Winter Polar Vortices and on the formation of Ice Layers in the summer season are being organized by Theme 3 scientists. As CAWSES science can grow only with the participation of the community at large, your participation is extremely important. You are encouraged to contact the relevant member of your working group to share your ideas and to sign up for your participation in these campaigns.

*"I am among those who think that science has great beauty. A scientist in his laboratory is not only a technician: he is also a child placed before natural phenomena which impress him like a fairy tale."*
**– Marie Curie** (French physicist, twice winner of the Nobel Prize, 1867-1934)

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WG 2.4 Continuous Solar Hα Observations

WG 2.5 Worldwide Space Weather Applications

WG 2.6 Models, Simulations and Data Assimilation

WG 2.7 Worldwide Coordinated Data Analysis

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## *Awards/Honors for SCOSTEP/CAWSES Scientists*

**Guy Brasseur** has been elected Fellow of the American Geophysical Union in 2005.

**Janet Kozyra** has been elected Fellow of the American Geophysical Union in 2005.

**Margaret Kivelson** is the recipient of the American Geophysical Union's J. A Fleming Medal for the year 2005. She is the first woman to win this medal.

**Archana Bhattacharyya** has been appointed the Director of the Indian Institute of Geomagnetism in Mumbai in January 2005. She is the first woman to be appointed Director of an Institute under the Department of Science & Technology in India.

We congratulate them on their well-deserved recognition.

*"May every young scientist remember... and not fail to keep his eyes open for the possibility that an irritating failure of his apparatus to give consistent results may once or twice in a lifetime conceal an important discovery."*
**- Patrick M. S. Blackett** (British physicist. Nobel Prize for Physics in 1948, 1897-1974)

## Report on progress under CAWSES Themes

### *Theme 1: Solar Influence on Climate*

**Progress on CAWSES Theme 1 activities**
*Report by Joanna D. Haigh*
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The International Space Science Institute (ISSI), Bern, Switzerland has approved a proposal made by Lesley Gray, Joanna Haigh, Jürg Beer, Ulrich Cubasch, Marv Geller and Mike Lockwood for support of a Team Building Activity in the area of the influence of solar variability on climate. The goals of the project are to review and assess current knowledge and understanding of (a) the observational evidence for impacts of solar variations on our climate and weather and (b) the mechanisms for transfer and amplification of solar variations by the atmosphere and, furthermore, to promote international communication and collaboration within this science discipline so as to enhance the rate of acquisition of knowledge and understanding. ISSI will provide financial support for team members to attend workshops and drafting meetings. The first team meeting will take place during the ISSI Workshop on "Solar Variability and Atmospheric Composition, Temperature, and Circulation Variations on Terrestrial Planets" to be held in Bern 6-10 June 2005.

CAWSES Theme 1 activities will also be discussed during the Scientific Assembly of the International Association of Meteorology and Atmospheric Sciences to be held in Beijing, China 2 – 11 August 2005 (http://www.iamas2005.com/). A special session on "Solar Activity and its Influences on the Earth's Weather and Climate" is being convened by Werner Schmutz, Joanna Haigh, Judit Pap and Hengyi Weng. Papers are invited on topics relating to the nature and consequences of changes in solar activity, total and spectral irradiance, and in the short and long-term influences of these changes on the Earth system and the linear and nonlinear processes through which these influences may occur. The deadline for submission of abstracts is 10 March.

### *Theme 2: Space Weather: Science and Applications*

**GPS TEC Maps During The First CAWSES Space Weather Campaign**
*Report by Anthea Coster*
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Dual-frequency data from more than 1000 ground-based GPS receivers have been used to reconstruct maps of the vertical TEC as a function of latitude and longitude for the 25 March – 6 April 2004 CAWSES campaign period. Combining these maps allows us to produce a time history of the global TEC distribution. By studying this time history we can observe the patterns of TEC behavior during both quiet and disturbed geomagnetic conditions. The data used to produce these maps came from both the International GPS Service (IGS) (http://igscb.jpl.nasa.gov/) and from the Continuously Operating Reference Stations (CORS) (http://www.ngs.noaa.gov/CORS/). The CORS network is coordinated by the U.S. National Geodetic Survey. The data were accessed via publicly available data archives on the World Wide Web ftp://cddisa.gsfc.nasa.gov/gps/ and http://sopac.ucsd.edu. The line-of-sight TEC values were converted to vertical TEC values using a simple mapping function, associated to an ionospheric pierce point latitude and longitude, and assuming a peak ionospheric height of 400 km. GPS satellite biases were obtained from the JPL IONEX files at ftp://cddisa.gsfc.nasa.gov/gps/. Receiver biases were estimated using an in-house estimation scheme. Both the receiver and satellite biases were removed from the data. The JASON and TOPEX TEC values, obtained from their on-board dual-frequency altimeter, were also plotted on these maps. The addition of this data has the advantage that it provides coverage over the ocean. Maps of TEC were prepared at 30-minute intervals for the entire CAWSES time period. The vertical TEC has been binned in 3° x 3° latitude/longitude bins and color-coded between 0 and 75 TEC units. No smoothing is used; the high level of detail is due primarily to the persistent well-organized connected structures and to the large quantity of data processed. Figure 1 shows the global TEC map produced for the 20:00 UT on 3 April 2004. Global TEC movies for the campaign period can be accessed from http://www.haystack.mit.edu/cgi-bin/millstone_documentation.cgi/AntheaCoster/CosterGPS_Movies. A faint Storm Enhanced Density structure, indicated as a faint plume of increased ionization, was seen growing out of the enhanced equatorial anomaly region starting in the Northeast US and moving in a north and westward direction into Canada. The geomagnetic index, $K_p$, was 5 at this time indicating a minor to moderate disturbance in the geomagnetic field.

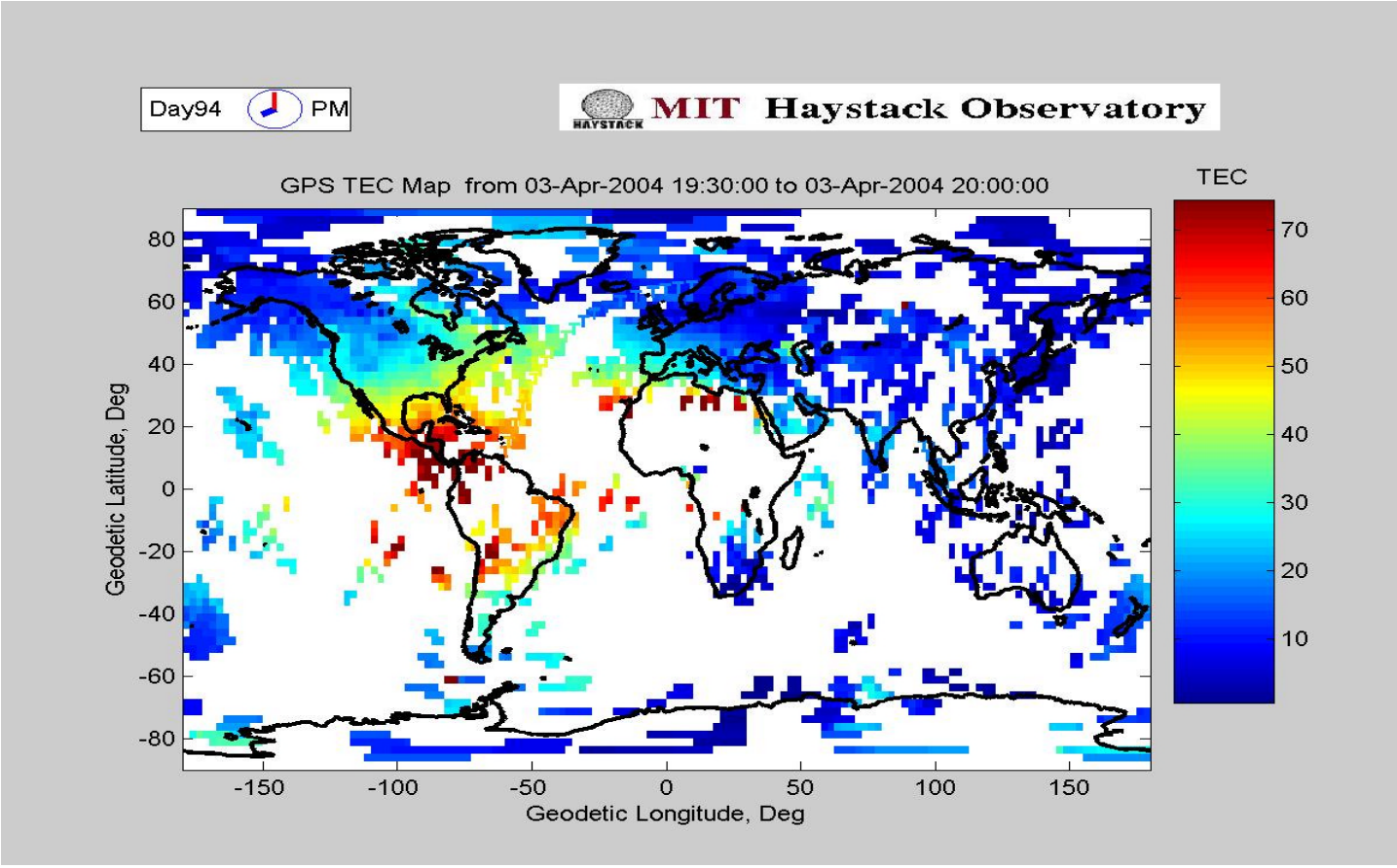


**Figure 1 Global GPS TEC map produced for 3 April 2004 19:30-20:00 during a moderately disturbed geomagnetic storm.**

***GAIM Results During the First CAWSES Space Weather Campaign***

*Report by Jan Sojka*
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The first CAWSES Campaign provided the USU GAIM (Utah State University Global Assimilated Ionospheric Measurements) ionospheric data assimilators an opportunity to explore the potential of global weather mapping of the ionosphere. *Sojka et al*. [2004] presented aspects of these simulations at the CEDAR (Coupling, Energetics, Dynamics of Atmospheric Regions) and Fall AGU (American Geophysical Union) meetings. From a CAWSES perspective these assimilation results are global maps of the ionosphere electron density from 90 km to 1600 km and from –60 to +60 geographic latitude obtained at an interval of every 15 minutes. The power of these maps is that they provide information on whether the electron density variations are *local*, *regional*, or *global*. This is particularly beneficial when scientific investigations are being *conducted locally* and inferences need to be made on a regional or even global scale.

This first CAWSES-GAIM assimilation covers the period of day 80 through 110 of 2004. The data sets used for this study included those from 162 GPS stations, 16 ionosondes and 2 DMSP satellites. These data streams have been assimilated using a Gauss Markov version of a Kalman assimilation model [*Schunk et al*., 2004]. The physics and covariance matrices are both based upon the Ionospheric Forecast Model (IFM) developed by the Space Environment Corporation [Schunk et al., 1997].

Movies showing the variations in the global ionospheric total electron content, the $N_mF_2$, and altitude slices of $n_e$ for different days can be viewed at the web site http://gaim.cass.usu.edu/~sojka/cawses_movies.html. The altitude slices are at 250, 300, 400, 500, and 600 km, which emphasize the variations in the ionosphere beginning from the bottomside through the peak into the topside. During the entire 30-day period "weather" is always apparent and as a result the assimilation provides a new perspective on the meaning of monthly median climatology.

References

Schunk, R. W., J. J. Sojka, J. V. Eccles, (1997), Expanded capabilities for the ionospheric forecast model, *Rep. AFRL-VS-HA-TR-98-0001*, 1-142.

Schunk, R. W., et al., (2004), Global assimilation of ionospheric measurements (GAIM), *Radio Sci., 39*, RS1S02, doi:10.1029/2002RS002794.

Sojka, J. J., R. W. Schunk, L. Scherliess, and D. C. Thompson, (2004), Assimilated low latitude ionosphere variability during the first CAWSES space weather campaign, Eos Trans. AGU, 85(47), Fall Meet. Suppl., Abstract SA31B-02.

## *Theme 3: Atmospheric Coupling Processes*

**The 2005 campaign on ice layers in the summer mesosphere**

*Coordinators: Franz-Josef Lübken, Ulf-Peter Hoppe, and Scott Bailey*
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### Introduction

Within CAWSES several Themes have been identified, one of which is Atmospheric Coupling Processes (Theme 3). During the last months we have defined various projects within Theme 3, one of which is entitled `Solar influence on minor constituents and layers at the extra-tropical summer mesopause'. Within this project we will organize a Campaign on ice layers in summer 2005.

This will be a coordinated effort to measure as many parameters as possible within the upper atmosphere at middle and polar latitudes related to the existence of ice particles in the mesopause region. Observations which are relevant to this topic, such as temperatures, water vapor, noctilucent clouds (NLC), polar mesosphere clouds (PMC), and polar mesosphere summer echoes (PMSE) are highly welcome.

### Science Objectives and Activities

The aim of this coordinated effort is to study the morphology of ice layers and to investigate the background conditions for their formation in addition to related phenomena at mid- and polar latitudes. Various layers exist in the mesopause region, which owe their existence to the very low temperatures at these altitudes and to the presence of trace gases, in particular water vapor. The characteristics of these layers are very sensitive to temperature, dynamics, and to water vapor. They are therefore best suited to indicate long-term and solar-induced changes in the upper atmosphere. Indeed, variations on decadal time scales of different layer parameters have been reported. However, the physical and photo-chemical processes involved are not understood. This campaign proposes to study the formation of these layers and their feedback effect on trace gas concentrations.

### Measurements and modelling:

It is planned to coordinate as many as possible ground-based, rocket-borne, and satellite-based observations relevant to the objectives listed above. In particular, this concerns investigation of ice layer detection by lidars (NLC), radars (PMSE) and satellites (PMC), trace gas measurements from satellites and from ground-based instruments, temperature observations, and in-situ measurements of plasma by rockets.

We also like to stimulate modelling efforts, from micro-physical modelling of ice particle generation to GCM models of the thermal, dynamical, and compositional structure of the upper atmosphere.

**How to participate ?**

If you intend to participate (that is what we hope) please send the specifications of your observations or your model efforts to the coordinators by April 30, 2005 (email addresses given above). For measurements, please specify:

- parameter being measured and approximate accuracy
- time period covered in 2005 and sampling time
- altitude range and height resolution
- location of instrument (or latitude/longitude range for satellite borne instruments)

**Progress on Investigations of Polar Vortices**
*Coordinator: Alan Manson*
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"Atmospheric Wave Influences upon the Winter Polar Vortices (0-100 km) from Observations and Modeling: radiationally unexpected phenomena such as SSW (sudden stratospheric warmings), mesospheric thermal inversions, equinoctial transitions, "Ozone Holes", and the winter anomaly (D-region ionization) will be investigated for CAWSES winters beginning in 2004/5". This is a project in CAWSES Theme 3.

We will study the **polar vortices (0-100 km) using both observations and models during the winters;** each hemisphere's winter will become a Campaign, beginning in 2004/5 with the northern hemisphere. Observations of Planetary Wave (PW), Tidal and Gravity Wave (GW) characteristics (spectra, wave-numbers, and couplings) and interactions with the mean flow will be required. PWs in the lower middle atmosphere (MA) have a powerful role in establishing the initial characteristics of the lower part of the vortex, and also play a crucial role later in the instability and the breakdown of the vortex. GWs determine the characteristics of the upper part of the vortex and the associated warm winter mesopause and poleward meridional flow. However, both GW and PW are considered to be involved throughout the middle atmosphere's vortex, and their relative roles have yet to be determined in time and space. Longitudinal tidal structures and related changes in GW fluxes require study.

Collaborations with the other Projects (under Theme 3) dealing with Noctilucent Clouds, Polar Mesospheric Summer Echoes, and Polar Mesospheric Clouds, global ozone distribution, tidal characterization, GW and turbulence, and coupling processes in the equatorial atmosphere, will ensure that the dominant processes and their interactions are treated synergistically. Finally, solar influences upon the dynamics will be assessed. The historically interesting "Winter Anomaly" (of radio wave absorption and associated electron densities), will also be revisited using electron density data from some of the radar systems.

Global data are required from the lower atmosphere and throughout the middle atmosphere: up to about 50 km, so the 'MetO' products (U.K. Meteorological Office GCM with data-assimilation; in the upper MA winds/ temperatures/ 'intensities' from radars, opticals and satellites e.g. TIMED, Odin-OSIRIS. Sophisticated GCMs (or wave-specific models), will be run with 'realistic' tropospheres e.g. TIME-GCM, Canadian CMAM.

Co-coordinators are associated with the radars, optical facilities, and models. Scott Palo is the facilitator for the Southern Hemisphere Campaigns. Collaborations with the other CAWSES Themes will also be developed to obtain full benefit of the CAWSES program.

## *Theme 4: Space Climatology*

**Progress on Radiation Belt Climatology (WG 4.3)**
*Report by T. Obara*
*(t.obara@nict.go.jp)*

**Scope:**
'Climatological variations of the radiation belt' refers to changes on long-time scales; i.e. over a solar cycle variation. As it is well known, the radiation belt varies during magnetic storms. Since the characteristics of magnetic storms has a dependence on the solar cycle, the radiation belt itself changes accordingly. The purpose of this working group (WG 4.3), the ***Radiation Belt Climatology*** is to clarify the long-term variation of the

radiation belt together with understanding the basic physics of these variations. Important climatologically varying parameters include particle fluxes of each species at a given location as functions of solar and solar wind activities, day of year and magnetosphere energy input (typically represented by indices such as *Kp* and *Dst*). The specific work of this group is to make a long-term radiation belt database by compiling data from Europe, Russia, Japan and United States and to consider next generation radiation belt models.

**Mission:**

- Synergize and clarify our knowledge of the climatology and extremes of the radiation belt.
- Promote making of a long-term database over 40 years for the purpose of scientific understanding and applications.
- Make next generation radiation belt models based on the knowledge of the long-term behavior.

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**Progress on Climatological Variations of the Ionosphere and Upper Atmosphere (WG 4.4)**

*Report by John Emmert*
*(emmert@uap2.nrl.navy.mil)*

**Scope:**

"Climatological variations" refer to changes in the mean state (climatology, defined within a given parameter space) of a system on time scales longer than those represented by the parameter space. Time scales explicitly represented by climatological parameter spaces are typically less than 1 year (i.e., up to seasonal effects).

For the purposes of this working group, the upper atmosphere is the region between the stratopause (~50 km) and 1500 km. The ionosphere is defined as the ionized portion of the atmosphere within this region.

**Mission:**

The mission of the working group is to synergize, clarify, and advance our knowledge of climatology and trends in the ionosphere and upper atmosphere, by promoting the collection, availability, quality control, and analysis of long-term data.

**Objectives:**

- Focus the scientific activities of the community on key climatological issues.
- Promote the preservation and dissemination of long-term data sets.
- Advocate for new measurements to fill gaps in the climatological record, and for continued collection of data from existing instruments.
- Assess and document the quality of long-term data sets.
- Establish a set of standardized procedures for producing climatologies and calculating long-term trends, in order to promote meaningful comparison of results from different data sets.

**Dictionary of terms**

**Climatology.** The mean state of a system within a given parameter space. The system consists of components (such as density) and the *a priori* parameters on which the values of the components depend (such as latitude). "Mean" implies an average over a certain time period, usually longer than one year. However, the parameters can vary over much shorter time periods. For example, the Kp index might be used to describe the average response of the system to geomagnetic storms; although this index changes every three hours, a given value is repeated many times over the course of several years, permitting an average state corresponding to those conditions to be computed. The key element of a climatology is repeatability.

**Climatological component.** A dependent variable in a climatology. In the upper atmosphere and ionosphere, the most relevant and commonly studied climatological components (roughly corresponding to the zeroth through second moments of a particle distribution) are $n_x$ (number density), $v_x$ (bulk velocity), and $T_x$ (temperature), where x stands for the various neutral and ionized species. In practice, what are measured are derivatives (not necessarily in the mathematical sense) of these quantities, such as $\rho$ (total mass density) or $hmF_2$ (the height of peak electron density). Also, the short-term variability (on a specified time-scale) around the mean can also be treated as a climatological component.

**Climatological parameter.** An independent variable in a climatology. Important geophysical parameters include latitude, longitude, height, solar and magnetic local times, day of year, solar EUV irradiance (typically represented by the $F_{10.7}$ proxy), and magnetospheric energy input (typically represented by indices such as *Kp* and *Dst*).

**Ionosphere.** For the purpose of this working group, the ionized portion of the *upper atmosphere*.

**Trend.** The time-dependent change of a climatology. While absolute time might be included in the parameter space of climatology, it is not a repeatable quantity, and therefore holds a special status. Non-repeatable states of a system can occur for three reasons:
There is a monotonic evolution of the system.

There are periodic changes in the system occurring on time scales greater than the span of the data.
There is a sudden and rapid shift in mean state.

**Upper Atmosphere.** For the purpose of this working group (WG 4.4), the region between the stratopause (~50 km) and 1500 km.

### *Capacity Building and Education*

*Co-Chairs: Marvin Geller, S.-T. Wu, and Joe Allen*

SCOSTEP/CAWSES support is being extended to several workshops and focused meetings being conducted in conjunction with major international meetings this year. This support will partially fund the attendance of some students and post-doctoral fellows. These meetings include International Symposium on Equatorial Aeronomy/CAWSES Space Weather and CPEA Workshops in Taiwan, in May, Solar Variability Workshop in Rome in June, IAGA scientific sessions on "Low latitude atmosphere - ionosphere - magnetosphere coupling, dynamics and energetics (including small scale coupling)" and "Long-term trends in the upper atmosphere" to be held in Toulouse in July.

## Contributions from the CAWSES community

### *German Science Foundation establishes a priority programme on CAWSES*

*Report by Franz-Josef Lübken*
*(luebken@iap-kborn.de)*

The German science foundation (Deutsche Forschungsgemeinschaft, DFG) has announced a priority program for CAWSES in July 2004. Most topics of the international CAWSES program are covered. Several institutions submitted proposals in the framework of this program. A review panel meeting took place in Walberberg (close to Cologne) and 24 proposals were accepted. A total of 18 different institutions all over Germany are now involved in CAWSES related projects. Nine post doctoral fellows and 30 PhD positions are funded within the priority program and approximately 3 Million Euros per year are available. In the first round these projects will run for 2 years. Two more successive periods with 2 years each are planned, i.e., the program runs for 6 years from 2005 to 2011. Although the German priority program on CAWSES funds activities at German institutions only, international collaboration is strongly encouraged.

### *Workshop on Solar Variability and Space Weather*

*Report by Judit Pap*
*(papj@marta.gsfc.nasa.gov)*

WG1 of Theme 4, in collaboration with Theme 2, had a special session (Solar Variability and Space Weather) during the AGU 2004 Fall Session in San Francisco. The conveners were: Judit Pap, Peter Fox and Nat Gopalswamy. We had 33 papers, 6 of them oral talks. During this AGU session we discussed various issues of solar irradiance models, both empirical and theoretical; and the various aspects of solar magnetic activity leading to eruptive events. Data archival issues related to the Solar Virtual Observatory were discussed in detail. During this AGU session the approval of the French PICARD mission was announced. PICARD will be launched in 2008, concurrently with the NASA Solar Dynamics Observatory (SDO) Mission, and it will carry a 2K x 2K imager obtaining solar images at 5 different wavelengths to measure the solar diameter, two radiometers, and three Sun Photometers. The main objective of the PICARD mission is to determine whether and to what degree the solar diameter changes and what is the relationship between the diameter and luminosity changes, which is a critical parameter for theoretical solar models. Developing theoretical solar models, instead of the currently used empirical models, is a critical task (1) for stellar physics and (2) for predicting solar variability changes and their effect on climate.

The next meeting, related to WG1 of Theme 4, "Solar Variability and Climate" will take place in Rome, during June 27-July 2, 2005, which will include general talks on both solar physics and climate. During this meeting we will have a special CAWSES session. The aim of this forthcoming CAWSES session will be to incorporate the results presented during the main body of the Rome meeting into WG1's agenda and prepare a working document for the CAWSES management and the community. Specifically, that CAWSES session will address important issues, like the possible secular change in total irradiance over the last three decades and its implication on climate, role of solar variability in climate change, solar feature recognition, and most of all to establish the best data products and their archive for community use.

### *The ICESTAR program of SCAR and CAWSES*

*Report by Maurizio Candidi*
*(candidi@ifsi.rm.cnr.it)*

SCAR, the Scientific Committee for Antarctic Research (http://www.scar.org), of ICSU (the International Council of Scientific Unions), in its meetings in July 2004, the Open Science Conference, and in its Delegates' meeting in October 2004, has discussed and approved five Scientific Research Programmes, which it will support and coordinate during the five year cycle, 2005-2009. These scientific programmes are those that SCAR will conduct through the International Polar Year. One of these programmes is ICESTAR: Interhemispheric Conjugacy in Effects in Solar-Terrestrial and Aeronomy Research, (http://www.scar.org/researchgroups/physicalscience/ICESTAR28nov04.pdf).

This program, as stated in its summary, will establish a forum and working groups to provide a portal on the World Wide Web to all Antarctic geospace data and metadata, and tools for extracting and reducing these data into value-added products, similar to those available or being developed in other areas of SCAR science. Antarctica offers a privileged position to remotely sense the vast region of geospace because the Earth's magnetic field focuses the effects of geospace into the polar regions and Antarctica has a land mass on which to base instruments at high latitudes. Yet Antarctica has been under-exploited relative to the Arctic. However, recently there has been a substantial investment by a number of countries in sophisticated instrumentation providing a grid of instruments over much of the Southern Polar Region. Further instruments are to be installed in the near future that will provide a coverage that is equal to and in some cases better than that in the Northern Polar Region. Hence, now the capability exists to investigate conjugate relationships at an unprecedented level of detail.

ICESTAR is designed to exploit this capability. The main aim of the programme will be to enhance visibility, accessibility, and usability of the Antarctic geospace data to enable whole-system geospace research, which will include interhemispheric, ground-space studies, and new cross-disciplinary research such as teleconnections between the upper and lower levels of the atmosphere.

ICESTAR will have four working groups that will specifically focus on:

1. Quantifying and understanding the similarities and differences between the Northern and Southern polar upper atmospheres under the varying influence of the solar electromagnetic radiation and of the solar wind.
2. Quantifying the effects on the polar ionosphere and atmosphere of the magnetospheric electromagnetic fields and plasma populations, from the radiation belts to the tail plasma.
3. Quantifying the atmospheric consequences of the global electric circuit and further understanding the electric circuit in the middle atmosphere as guided by the electric fields generated at the solar wind–magnetosphere interface.
4. Creating a data portal that will integrate all of the polar datasets and modeling results. This data portal will enable the research to be conducted by the other working groups.

This programme has been proposed in accordance with the SCAR Strategic Plan, which states that:

SCAR should support its solar-terrestrial research program in partnership with IASC (International Arctic Science Committee) and others, to create a framework for improved coordination of research, long-term scientific monitoring, and operational programs throughout the next solar cycle. Strong links should be maintained with ICSU's Scientific Committee on Solar-Terrestrial Physics (SCOSTEP), and especially with the overarching program CAWSES (Climate and Weather of the Sun Earth System), to facilitate the achievement of excellence by SCAR's solar-terrestrial physics program.

It is the feeling of the ICESTAR Steering Committee that ICESTAR and CAWSES offer many very interesting opportunities for integration and collaboration. Such coordinated operation of the two programs might be defined by the CAWSES Science Steering Group, and the ICESTAR Steering Committee.

To remain updated on the development of ICESTAR please visit the new ICESTAR website: http://www.siena.edu/physics/ICESTAR/

***Australian Institute of Physics (AIP) Congress, 31 January - 4 February 2005, Canberra, Australia.***

*Report by Iver Cairns (University of Sydney) (cairns@physics.usyd.edu.au)*

During the AIP Congress CAWSES was the primary focus of 5 oral sessions and 1 poster session on solar terrestrial and space physics (STSP). Many of the Australian CAWSES and STSP communities attended, as did approximately 10 international scientists. In the meeting 6 invited Keynote and 14 contributed oral talks and 55 posters were given. Over half the contributed talks were given by research students and post-doctoral fellows. The CAWSES program chair, Sunanda Basu, authored the

opening presentation, a Keynote review of the goals and purview of CAWSES, that was presented by Janet Kozyra. After talks on Earth's neutral atmosphere and the importance of ozone, Janet's Keynote reviewed CAWSES programs on magnetospheric physics and coupling to the ionosphere and atmosphere. The second session focused on Space Weather effects inside Earth's magnetosphere, with presentations on "Sun to mud" prediction, transient ionospheric convection, and magnetic reconnection that finished with Wendell Horton's Keynote talk on magnetic substorms and relativistic electron injection into the magnetosphere. The third CAWSES session addressed solar flares, coronal mass ejections, radio emissions, energetic particle acceleration, and proton aurora, anchored by Hilary Cane's Keynote and theories for shock-driven radio emissions. Chris Chaston's Keynote presentation on particle acceleration in Earth's auroral regions, was followed by FedSat observations on auroral current systems and theoretical work on wave generation and beam propagation. The final CAWSES session focused on the neutral atmosphere and magnetospheric physics, starting with a Keynote review by Mark Conde on winds in the neutral thermosphere. It continued with tomographic reconstruction of the plasmasphere using GPS and FedSat data, the radiation dose on airplanes, and field-aligned current systems. Meanwhile, the STSP poster session covered the entire gamut of CAWSES, from lightning to cosmic rays, with a strong emphasis on plasma physics. It included presenters from Australian and overseas Universities, the Australian Antarctic Division (AAD), Defense Science and Technology Organization (DSTO), Ionospheric Prediction Service (IPS), and US Air Force. Invited posters on the interests, research foci, and personnel of Australia's primary STSP sites were also given. More details can be obtained from the Congress website http://www.aipcongress2005.anu.edu.au/index.php. The STSP group anticipates that CAWSES will be a major focus of its program for the 2006 AIP Congress, to be held in Brisbane, Queensland.

***CAWSES-CHINA: Space Weather Symposium***

*Report by Fengsi Wei*
(*fswei@spaceweather.ac.cn*)

CAWSES – CHINA's Theme 2 (Space Weather: Science and Applications) is being coordinated by Professor Fengsi Wei, and now with two more members: Professor Xueshang Feng and Dr. Jian Wu devoted to science and application topics.

In 2004, a space weather conference was held at Wuyishan, Fujian, China, (as a first meeting of CAWSES – Space Weather Theme of China) in which 160 Chinese scientists from around the world participated (http://www.spaceweather.ac.cn). This conference also happens to be China's fifth Space Weather Symposium that started in 1997.

Two new space exploration projects are in the planning stage: one is Space Wind and Storm Exploration – SWISE proposed by Professor Liu Zhengxing and the other is Space Weather Explorer – Kuafu mission (L1 + polar orbit) project proposed by Professor Tu Chuanyi.

The World Chinese Space Weather Conference will be held at Macao, November 21 – 25 2005. This conference (http://www.spaceweather.ac.cn) is sponsored by Macao Committee of Science and Technology and National Natural Science Foundation of China.

*"I have little patience with scientists who take a board of wood, look for its thinnest part, and drill a great number of holes where drilling is easy."*
**- Albert Einstein** (German born American physicist, winner of Nobel Prize for Physics in 1921. 1879-1955)

**Important Announcements from the CAWSES Office**
*D. Pallamraju*

***1) CAWSES Mini-Workshops on Saturday May 14, 2005 in Taiwan***

We are planning to have two CAWSES Mini-workshops on May 14, 2005 in conjunction with the 11th International Symposium on Equatorial Aeronomy in Taipei, Taiwan on Theme 2 and Theme 3 science. We expect that in these workshops there will be discussions on the results obtained during the first joint CAWSES Space Weather and CPEA campaigns conducted during March-May, 2004. On May 13, 2005 we have reserved a two-hour time period in the evening (1730 to 1930 LT) to discuss the progress of the CAWSES program in different countries. This will also provide a good opportunity to interact with people who are involved with CAWSES science in different parts of the world and members of the SCOSTEP Bureau, which is concurrently meeting in Taipei on May 9-10. Hope you will be able to take advantage of all these meetings and contribute to the progress of CAWSES.

***2) 2nd CAWSES Science Planning meeting during IAGA in Toulouse, July 05***

The 2nd CAWSES Science Planning meeting will be held on Saturday July 23, 2005 from 9 AM – 4 PM at the Congress Center in Toulouse. The CAWSES SSG, all the Theme members, and country representatives are invited to attend. Please let us know if you plan to attend. This day-long meeting will provide an assessment of progress thus far and the direction for the near future. There will also be a CAWSES Theme 3 meeting on Wednesday July 20, 2005. The Agenda and specific location in the Congress Center are being finalized. Please consult our Webpage.

### 3) CAWSES Campaign in September 2005

A joint ground and space-based campaign has been planned for the entire month of September 2005, during which many incoherent scatter radars will be operating on a "best effort" basis. We hope that the CAWSES community will take advantage of this huge effort by participating in large numbers in a variety of observations in order to understand various global scientific issues related to Themes 2 and 3. For further information on dates and schedules of the radar operations, please visit:

http://people.ece.cornell.edu/wes/URSI_ISWG/2005WDschedule.htm. Much more information about plans and organization will be available after the ISEA and IAGA Meetings and will be made available on the CAWSES webpage.

### 4) IAGA Association Lecture on CAWSES at Toulouse

Sunanda Basu has been invited to deliver an Association Lecture on "Climate and Weather of the Sun-Earth System: SCOSTEP's New Interdisciplinary Research Program (CAWSES)". This one-hour lecture will be delivered in the main auditorium of the Toulouse Convention Center at 8:30 AM on Wednesday, July 27, 2005. We consider this to be a fine recognition of the large amount of effort being put into the program by our colleagues throughout the world and hope you can attend the lecture.

### 5) STP-11 Meeting in Rio de Janeiro, March 6-10, 2006

Planning continues for STP-11 meeting to be held in Rio during March 6 – 10, 2006. Keynote speakers will include G. Brasseur, C. de Jager, T. Killeen and A. Nishida. A public lecture will be presented by J. G. Roederer. Several tutorial speakers have been invited and more information will be available shortly. Please stay tuned for updates on this meeting (http://www.abc.org.br/scostep2006/).



*CAWSES News* is also available on the web at: *http://www.bu.edu/cawses*

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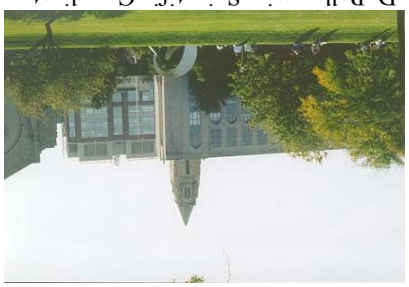

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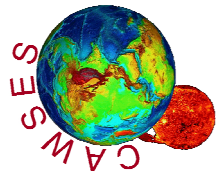


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