



CAWSES News

Climate And Weather of the Sun-Earth System



Volume 1, Number 2

September 2004

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

It is indeed a great pleasure to greet all of you and report that CAWSES has been growing rapidly! I am delighted that we have been able to involve a large number of scientists from around the world to participate in the various Working Group activities under the different Themes. CAWSES, jointly with CPEA, conducted its first campaign and I earnestly solicit your participation in the data analysis and interpretation phase. In the following articles, Raju has provided you with an update on CAWSES activities and several of our Theme Chairs and colleagues have provided additional material on their Theme's activities. I hope you will agree with me that CAWSES, which is near the end of its first year of existence, is well on its way in generating global visibility and additional support for our colleagues through the exciting scope of its science and the eminence and dedication of the large number of scientists who have volunteered their efforts to this cause. I look forward to even greater interactions in the year ahead.

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Update on CAWSES activities since March 2004
D. Pallamraju

Since the publication of the first *CAWSES News* six months ago, the CAWSES program has accomplished many tasks. They include formation of focused Working Groups for all Themes in consultation with the respective Theme Co-chairs, successfully coordinating the first international CAWSES Space Weather and CPEA observational campaigns during March - April, 2004 in which over 40 institutions across the globe participated, organizing the first CAWSES Workshop at the CEDAR meeting in June 2004 at Santa Fe, NM, USA and the first CAWSES Science planning meeting on 17 July 2004 in Paris, France where over 30 scientists representing different Themes from various countries participated.

In the Science planning meeting, after a brief introduction by the CAWSES Chair, one of the CAWSES Co-Chairs from each Theme made presentations on his/her Theme's science agenda and proposed how it could interact with the research agenda of other Themes. These were followed by discussions on retrospective and future campaigns and future workshops. Many of these talks can be accessed from the CAWSES website at: <http://www.bu.edu/cawses>.

The international STP community has been very supportive of the CAWSES Program. Several countries such as India, Japan, and Germany have developed their national or regional programs. Further, the CAWSES – AOPR (Asia Oceania Pacific Rim) Office has been (continued on page 3)

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established in Taipei, Taiwan. We have been able to make inroads even into the Southern Hemisphere – as the Chair of the CAWSES program, Sunanda Basu, has been invited to give a keynote talk on CAWSES at the Australian Institute of Physics Meeting in Canberra in January 2005. She has also been invited to give hour-long plenary presentations at the IAGA Meeting in Toulouse in July, 2005 and at the URSI General Assembly in New Delhi in October, 2005. CAWSES Theme Co-Chairs Claus Froehlich and Franz-Josef Luebken delivered invited lectures on CAWSES activities during ICESTAR (Inter-hemispheric Conjugacy Effects in Solar-Terrestrial and Aeronomy Research) and SCAR (Scientific Committee for Antarctic Research) meetings that were held in April and July respectively. Claus Froehlich also delivered an interdisciplinary lecture on Solar Irradiance Variability at the COSPAR meeting in Paris. A proposal to the International Space Science Institute (ISSI) in Bern by Lesley Gray (Co-Chair of Theme 1) has been approved (see details below).

On a pleasant note, the CAWSES Program Administrator Lisa Vercauteren got married earlier this month and she is now Lisa Walsh. We wish her all the best in her married life.

Awards/Honors for SCOSTEP/CAWSES Scientists

Gordon Shepherd received the Alouette Award from the Canadian Aeronautics and Space Institute in 2004.

Louis J. Lanzerotti received the COSPAR William Nordberg Medal for the year 2004.

We congratulate them on their well-deserved recognition.

Future CAWSES Campaign

A radar 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. More details on this global campaign will be provided in the next *CAWSES News*. For further information on dates and schedules of the radar operations, please visit: http://people.ece.cornell.edu/wes/URSI_ISWG/2005WDschedule.htm.



Report on progress under CAWSES Themes

Theme 1: Solar Influence on Climate

Co-Chairs: Michael Lockwood and Lesley Gray

The two prime goals of this Theme have been divided into two Working Groups: (1) Assessment of evidence for the Solar Influence on Climate and (2) Investigation of the mechanisms for Solar Influence on Climate. There are plans underway to review and or investigate the following inter-related goals, which will shed more light on different aspects of Solar Influence on Climate:

- updating of TSI (total solar irradiance) magnitudes, ozone and climate parameters for the latest solar cycle,
- understanding of what is required for long-term TSI reconstructions,
- analyses of the solar components of variability in a number of climate and ozone datasets,
- general circulation model simulations including coupled stratospheric chemistry,
- understanding of the 27-day solar rotation on stratospheric chemistry,
- new ideas on the link between solar influence on the tropical upper stratosphere and the polar lower stratosphere, including the link to the QBO (Quasi-Biennial Oscillations) in zonal stratospheric winds above the equator,
- understanding of how heating perturbations to the tropical lower stratosphere influence tropospheric climate, and
- understanding of the processes whereby ionization of the atmosphere by cosmic rays might influence cloud development.

Some of the above mentioned aspects were presented by Michael Lockwood during the CAWSES Science planning meeting and it can be accessed from: http://www.bu.edu/cawses/M_Lockwood_Theme1_CAWS_ES_July17_2004.ppt.

A proposal to the International Space Science Institute (ISSI) in Bern, Switzerland with Lesley Gray as the PI and a six-member team has been approved as an International Team proposal. This Team will meet in Bern from June 6-9, 2005 (and probably another time within the next six months) in conjunction with a larger Workshop Group on Solar Variability and Atmospheric Variations on Terrestrial Planets to work on review papers to critically assess the status of this rather controversial field.

Theme 2: Space Weather: Science and Applications

Co-Chairs: Janet Kozyra and Kazunari Shibata

The first CAWSES Space Weather campaign kicked off

with more than 40 international space and ground-based programs joining to observe the space environment from the Sun to the middle atmosphere. There were two components of the campaign: 1) a space weather interval from March 25 to April 6 and 2) an atmospheric coupling interval that spanned March and April 2004.

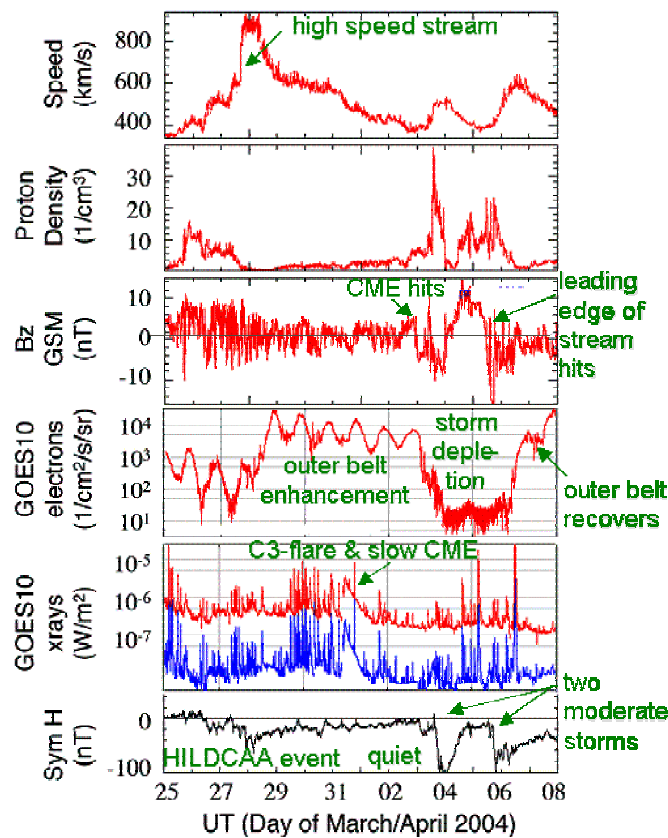


Figure 1 Solar activity during the first CAWSES Space Weather Campaign.

What Happened During the Campaign?

The CAWSES Space Weather Interval led off with a high-speed stream beginning on March 25 and peaking on March 27. Solar wind speed, proton density and IMF B_z are shown in panels 1-3 from the top in Figure 1. An enhancement of the outer belts late on March 28 followed the peak of the high-speed stream with some time delay (panel 4). A C3-class flare erupted on March 31 at 21:53 UT (observed by GOES 10 in panel 5) and a slow CME was observed moving toward Earth at 220 km/s by SOHO/LASCO. The CME took almost 3 days to hit the Earth on April 3 at 14:14 UT triggering a moderate magnetic storm (indicated in panel 6). A magnetically quiet interval (April 1 – 2) preceded the storm. The leading edge of a high-speed stream hit the Earth on April 5 triggering another moderate storm. The more modest Sym H values in the interval March 25 – 31 are associated with magnetic substorm activity triggered by fluctuating magnetic fields within the high-speed stream interval.

More initial results from the campaign can be accessed from:

http://www.bu.edu/cawses/Theme_2_Updates.html.

What's Next in the Campaign?

The plan is to provide a clearinghouse at <http://www.bu.edu/cawses> for observations, theory, modeling and data assimilation associated with the first CAWSES campaign. To make this as useful as possible, campaign participants are asked to provide: (i) A high level summary of observations focusing on interesting new features and new science questions that they raise, (ii) Links to summary plots & digital data where applicable, and (iii) New science issues to provide a focus for the worldwide campaign analysis.

CAWSES Worldwide Maps. The following worldwide maps are under construction for the CAWSES campaign: (a) Global maps of ULF wave parameters and (b) Assimilative global ionospheric profiles from the GAIM model at Utah State University (courtesy of Jan Sojka).

The worldwide analysis of new science issues raised by the observations will be carried out in two modes:

Virtual poster sessions & message boards: We are developing the capability for workshop participants to upload presentations, easily access other presentations and communicate through e-mail or message boards. This was done for the April 2002 Sun-Earth Connections workshop at Applied Physics Laboratory at John Hopkins University and was simple and successful.

Face-to-face presentations at international and national meetings: In addition to scheduling appropriate sessions at international scientific meetings, we plan to enlist the help of national CAWSES or related programs to increase the number of workshops where collaborative research will take place. A list of relevant national and international meetings will be available on the CAWSES website at Boston University.

A CAWSES Space Weather Workshop, with special emphasis on solar studies was held during September 11 – 12, 2004 in Beijing, China in conjunction with the IAU Symposium on Coronal and Stellar Mass Ejections. The Workshop was Co-Chaired by K. Shibata and N. Gopalswamy (see the report on the workshop below).

Theme 3: Atmospheric Coupling Processes

Co-Chairs: Franz-Josef Lübken and Joan Alexander

The first science planning meeting of all working groups of Theme 3 took place in Paris on July 22, 2004 during the COSPAR Meeting. A total of 23 scientists attended this meeting. Several suggestions for scientific topics and

specific projects were presented, supplemented by inputs via e-mails from those who could not be present at that meeting. As agreed upon during the meeting and in discussions thereafter, certain "projects" will be identified within the next few months. These projects will serve to coordinate experimental and modelling efforts concentrating on specific projects. Obviously, there will always be an overlap between various projects within Theme 3 and also with science issues of other Themes. We hope to have a detailed description ready by the end of the year, which will include a specification of the scientific topic of the project, observations and modelling efforts envisaged, the time line, and a list of scientists who would be responsible for coordinating the activities. The final version of the project description will then be made available at the CAWSES website and also distributed to the community through the CAWSES distribution list available at the CAWSES Office. If you would like to be informed about the activities in Theme 3 please contact the CAWSES Office with a request to add your name to the distribution list.

During the meeting in Paris it was also agreed that we should aim for a separate Theme 3 workshop in 2005, which would be held before or after a large international symposium. We shall also propose CAWSES related sessions and Theme 3 meetings in conjunction with international symposia. The next chance for such a get-together is during the AGU Meeting in San Francisco in December 2004.

Coupling Processes in the Equatorial Atmosphere (CPEA) campaign was held for two months during March – April 2004 under the leadership of S. Fukao, University of Kyoto, Japan. (More information on CPEA can be obtained from: <http://www.kurasc.kyoto-u.ac.jp/cpea/>). Several radars operated during this campaign. These include the Equatorial Atmosphere Radar located on the geographic equator in Indonesia in a region of very strong convection, the MU radar in Kyoto, Japan, the MST radar located at Gadanki, and the VHF radar at Trivandrum in the Indian sector and radars at Jicamarca and Piura in the American sector (See report by M. Yamamoto below).

Theme 4: Space Climatology

Co-Chairs: Claus Fröhlich and Jan Sojka

Several noteworthy actions have taken place under WG 4.1 (Total Solar Irradiance). They are:

Workshop on Solar Irradiance Variability was organized by WG 4.1 by Judit Pap and Gerrard Thuillier during the COSPAR Meeting in Paris, France, in July 2004.

Publication of “Solar Variability and its Effects on Climate”, Edited by Judit Pap and Peter Fox, AGU Monograph Series, 2004 (Outcome of SCOSTEP/ISCS Meetings).

Similarly, Working Group 4.4 (Climatological Variations of the Ionosphere and Upper Atmosphere) led by Martin Jarvis and John Emmert has been quite active. It is completing its definitions for scope and mission objectives, and is also setting up interactions with the other CAWSES Themes and their Working Groups. A succinct interpretation of the WG 4.4 title would be as follows. *Climatological variations refer to changes in the mean state of a system including long-term trends. The mean state is defined within a given parameter space. For the purposes of WG 4.4, 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.* Specific as this definition is, it still leaves a large overlap between other CAWSES themes and working groups as well as other ongoing international research efforts. The leadership of WG 4.4 will be working closely and initiating liaisons with such overlapping interests. This WG is addressing the important issue of identifying key data sets for analytical focus, establishing their quality, promoting their longevity, and if necessary creating documentation of these efforts. The Theme 4 leadership is eagerly awaiting the initial selection of specific “observations” by WG 4.4. The working report on this activity can be obtained from: http://www.bu.edu/cawses/Theme_4_Updates.html.

Furthermore, CAWSES will be sponsoring a joint IAGA and ICMA Symposium "Long-term trends in the upper atmosphere" during the IAGA Assembly in Toulouse in July 2005.

Capacity Building and Education

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

The CAWSES – AOPR (Asia Oceania and Pacific Rim) Office has been established in Taipei, in July 2004. The director of the CAWSES-AOPR Office is Dr. Lou C. Lee. He is currently the Director of National Applied Research Laboratories and also serves as the Chairman of the National Committee for SCOSTEP of the Republic of China. This Office will also support activities of the AOPR Center in Simulation and Modeling of the Sun-Earth System. The Center will fuse together the simulation and modeling activities in different institutions in Taiwan into a coherent effort to interact with other centers in the AOPR region. It will serve as a training center for young scientists through mini-workshops, particularly in the

South Asian region. The first such mini-workshop will take place during the summer of 2005. Furthermore, CAWSES-AOPR will be organizing a one-day workshop on CAWSES science on May 14, 2005 during the International Symposium on Equatorial Aeronomy ISEA-11 to be held in Taiwan. The deadline for abstracts is Jan 31, 2005. Please visit <http://csrsddc.csr.ncu.edu.tw/isea-11.html> for further details.

Contributions from the CAWSES community

Geomagnetic Conjugate Observations of Medium-Scale Traveling Ionospheric Disturbance (MSTID): A research topic under CPEA.

Report by M. Yamamoto

CPEA is a six-year project (2001-2006) under the grant-in-aid for scientific research of priority areas funded by the Japanese Ministry of Education, Culture, Sports, Science and Technology (MEXT). CPEA studies dynamical coupling processes in the equatorial atmosphere from the troposphere to the ionosphere. For that purpose we conduct various observations centered around the Equatorial Atmosphere Radar (EAR) in Indonesia. Here we show a very interesting result from the CPEA-related observations (Otsuka *et al.*, 2004). We conducted geomagnetic conjugate observations of 630-nm airglow at Sata, Japan, and Darwin, Australia, with two all-sky CCD imagers. The airglow perturbations caused by MSTIDs were simultaneously observed at both sites at around midnight of August 9, 2002 (Figure 2). The observed MSTID structures were mirrored in the northern and southern hemispheres connected by geomagnetic field lines. This result suggests that polarization electric field (E_p) plays an important role in the generation of MSTIDs. E_p maps along B and moves the F -region plasma upward or downward by $E \times B$ drifts, causing plasma density perturbations with structures mirrored in the northern and southern hemispheres. This electromagnetic coupling process between the ionosphere of both the hemispheres is associated with the equatorial atmosphere at very high altitude. Perturbations in the upper equatorial atmosphere may affect the higher-latitude atmosphere/ ionosphere through this process, too. In the CPEA project we will continue studies of such coupling processes by means of the EAR, airglow imagers, and other related instruments.

Reference

Otsuka, Y., K. Shiokawa, T. Ogawa, and P. Wilkinson (2004), Geomagnetic conjugate observations of medium-scale traveling ionospheric disturbances at midlatitude using all-sky airglow imagers, *Geophys. Res. Lett.*, 31, L15803, doi:10.1029/2004GL020262.

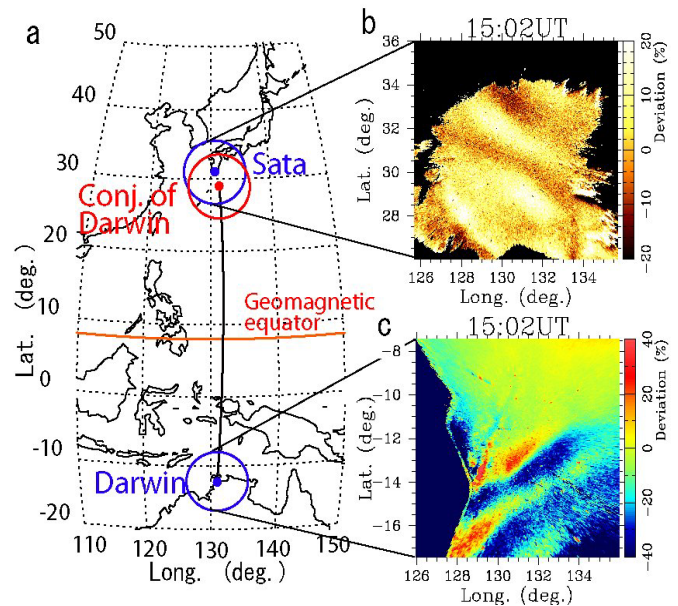


Figure 2 (a) Map showing the locations of observational sites and coverage of the airglow imagers (radius of 500 km). One site is located at Sata (31.0N, 130.7E), Japan and the other site at Darwin (12.4S, 131.0E), Australia. The geomagnetic field line connecting between Darwin and its conjugate point is shown by black curve. Red circle shows conjugate area connected by the geomagnetic field lines to the observational coverage of the Darwin imager. (b and c) Two-dimensional maps of 630-nm airglow intensity observed at (b) Sata and (c) Darwin at 1502 UT (2402 LT) on August 9, 2002. The observed all-sky images are converted to geographical coordinates assuming that the emission layer exists at an altitude of 250 km. Color levels in each image show percentage of the airglow intensity derivations from 1 hour average to the background.

Conference on Sun-Earth Connection: Multiscale Coupling in Sun-Earth Processes, 9-13 February 2004, Hawaii, USA.

Report by A. T. Y. Lui and Y. Kamide

The goal of this conference was to provide a forum to discuss and exchange knowledge and ideas on recent observational and theoretical results on multiscale coupling in the Sun-Earth processes. The motivation of this conference stemmed from the recognition that strong evidence exists between various space-plasma regions in the Sun-Earth system (that are traditionally investigated separately) and the multiscale nature of several phenomena occurring in such a coupled system. Recent progress and significant public interest gained in linking the entire chain of space disturbances from “sun to mud” testify to the usefulness of this system-wide approach. These developments have led to a new perspective in space plasma dynamics of examining the system as a whole

within the Sun-Earth Connection framework. Emerging from this new perspective is a new approach, which is based on the concepts developed in modern statistical mechanics to address the physical processes governing the evolution of out-of-equilibrium and complex systems on the techniques to investigate the multiscale phenomena prevalent in nature.

Presentations given in this meeting showed a diversity of space phenomena exhibiting scale free characteristics, intermittency, and non-Gaussian distributions of probability density function of fluctuations in the physical parameters of the sun, solar wind, magnetosphere, ionosphere, and thermosphere. These characteristics underscore the usefulness in cross-disciplinary exchange on theoretical work, simulation results, and data analysis techniques needed to unravel the underlying physical processes. They also lend themselves to a possible unified description and prediction for space disturbances.

Participants came from 14 countries in Asia, North America, and Europe. A total of 79 presentations were made in this conference, covering both traditional and new innovative approaches to treat Sun-Earth Connection phenomena and their multiscale coupling based on observations, simulations, and theoretical considerations. These presentations were sorted into seven sessions: multiscale features in complexity dynamics, space storms, magnetospheric substorms, present and future multiscale space missions, turbulence and magnetic reconnection, modeling and coupling of space phenomena, and nonlinear processes in various space phenomena.

Papers presented at this Conference will be published in the form of a Proceedings Handbook from Elsevier.

CAWSES Symposium for Space Weather Study in Japan, 18 – 19 March 2004, Fukuoka, Japan
Report by Kiyohumi Yumoto

The CAWSES symposium for space weather study was held at the Space Environment Research Center (SERC), Kyushu University. This symposium focused on new and established techniques to study the couplings of complex and composite systems from the solar surface to the Earth's surface. The goals of CAWSES Themes 2 and 3 in Japan are to construct Space Weather Stations (for observations) and Modeling Stations (for simulation/empirical modeling) during the period of the international CAWSES program (2004-2008).

CAWSES Space Weather meeting, 11 – 12 September, 2004, Beijing, China

Report by Kazunari Shibata

A CAWSES Space Weather meeting was held in conjunction with the IAU symposium on Coronal Mass Ejections. A total of 25 participants attended from 9 countries.

Several interesting presentations were made. They include: the solar sources of geoeffective disturbances by N. Gopalswamy, review of the present status of space weather research in Europe by B. Schmieder, a review on the study of the pre-flare state, which is considered the most important element for space weather predictions by J. Wang, an overview of investigations on solar-interplanetary geomagnetic storm connection (SIGMA) by X. Feng and solar activity prediction on photospheric magnetic field as well as present status of space weather research in China by H. Wang among others. Some of the talks can be viewed at the following link: http://www.kwasan.kyoto-u.ac.jp/~shibata/cawses_beijing_2004/index.html.

Towards the end of the meeting, there was a discussion on the possible international collaborations under the scope of CAWSES and there was unanimity among participants that the Solar and Heliospheric physicists should be actively involved with Space Weather studies, which is an important CAWSES Theme.

German Science Foundation establishes a priority programme on CAWSES

Report by Franz-Josef Lübken

On July 16, 2004, the German science foundation DFG (Deutsche Forschungsgemeinschaft), has announced a new priority program (Schwerpunktprogramm, SPP) for CAWSES. The leader of this SPP is Prof. Franz-Josef Lübken from the Leibniz-Institute of Atmospheric Research in Kühlungsborn, Germany. Priority programmes of the DFG provide funds to German institutions for a dedicated scientific topic for a period of approximately 6 years. The selection process amongst the various proposals for SPP is highly competitive. It is likely that the decision within DFG for the selection of the CAWSES SPP was because of its identification as an international SCOSTEP program. It is expected that approximately 20-25 German research institutions will participate in this new initiative. The deadline for submission of individual proposals within the new SPP is October 22, 2004. A workshop with a presentation of all proposals will take place in Cologne during 24-26 January 2005. Proposals will be selected after a peer review and funding will probably begin in the

spring of 2005. Details on the CAWSES SPP are available from the following web site:

http://www.dfg.de/aktuelles_presse/information_fuer_die_wissenschaft/schwerpunktprogramme/

COST 724

Report by Jean Lilensten

COST is an intergovernmental framework for European Cooperation in the field of Scientific and Technical Research. COST 724 is an action entitled, "Developing the scientific basis for monitoring, modeling and predicting Space Weather", which was created in 2003 and so far 23 countries and 3 international institutions are participating in it. In this short period of time, the COST 724 action website <http://cost724.obs.ujf-grenoble.fr> has been made operational. The scientific activities started on the basis of sharing methods, data or codes. Along with ESA, COST 271 and E-STAR, we will be organizing the First European Space Weather Week, ESTEC at Noordwijk

during 29 November – 3 December 2004 with a dedicated refereed journal issue. We hope this meeting will be an annual event. We will also be organizing a dedicated session at EGU, Vienna 2005. Our group is supported by several EU or INTAS (International Association for the promotion of cooperation with scientists from the New Independent States of the former Soviet Union) projects related to Space Weather.

Early announcement of STP-11 meeting in Rio de Janeiro, Brazil

The SCOSTEP's 11th Quadrennial Solar Terrestrial Physics Symposium on "Sun, Space Physics and Climate" will be held at Hotel Gloria Convention Center in Rio de Janeiro, Brazil during 6 – 10 March 2006. Please check the website: <http://www.abc.org.br/scostep2006/> for details and updates.



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

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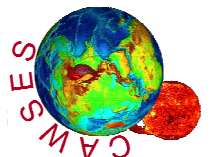
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