CAWSES News

Climate And Weather of the Sun-Earth System

Volume 5, Number 1 Spring 2008

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

Susan Avery (savery@whoi.edu)

CAWSES continues to thrive as evidenced by the tremendous activity showcased in this newsletter. Highlights include a highly successful CAWSES Symposium held last October in Kyoto, Japan; the continued growth of the comics both in translations and new topics; and the many activities promoted and organized by the themes. I also want to draw your attention to the announcement at the end of this newsletter about the Sunanda and Santimay Basu Early Career Award.

As a follow-up to the Japan meeting discussion about CAWSES-II, a small group met at NCAR in January to finalize the topics and prepare a brochure. *CAWSES-II: Towards Solar Maximum* provides an opportunity for the community to study the entire rising phase of solar cycle 24 and for making comparisons with the previous and ongoing work in CAWSES during the declining phase of the solar cycle. A systems approach will be used to make progress on questions that require interdisciplinary research and international collaboration. In order to establish this systems approach, we are proposing to develop an International Virtual Institute that will provide the sustainable enabling infrastructure. Four scientific questions will form the basis for CAWSES-II: (1) What are the solar influences on Earth's climate? (2) How will geospace respond to an altered climate? (3) How does short-term solar variability affect the geospace environment? and (4) What is the geospace response to variable waves from the lower atmosphere? The final draft brochure and next steps were discussed at the SCOSTEP Bureau Meeting that was held in Vienna, Austria in April. We are trying to find a venue and date for having a CAWSES-II planning meeting and we will keep you posted.

I am pleased that Janet Kozyra has agreed to work with me on the development and implementation of CAWSES-II. We are currently pulling together a proposal to submit to the National Science Foundation to secure funding for the International Virtual Institute which will also include the project office.

As many of you know, Raju has taken a position in India at the Physical Research Laboratory. He will be stepping down as the CAWSES Science Coordinator/Secretary but will continue to play an important role in CAWSES and CAWSES-II through his work in India and the international community. All of us owe a great thank you to Raju who has done a magnificent job in producing the newsletters, keeping us coordinated, interfacing with all of the themes and countries, and helping to move us forward. He will be sorely missed as the Science Coordinator. I know that all of us look forward to working with him in his new position.

Progress of CAWSES activities since September 2007

D. Pallamraju (raju@prl.res.in)

The past six months have been amongst the busiest of periods of the first phase of the CAWSES program as there has been significant development on several fronts. In addition to progress in research in the individual Themes, the developments of CAWSES activities include execution of CAWSES observational campaigns, International CAWSES Symposium, and CAWSES science sessions in international meetings, discussions on CAWSES phase II science agenda, and, capacity building activity in terms of translation of six CAWSES comic books into at least 18 international languages! The CAWSES comics have really attracted the attention of many across the globe. Translation is currently going on

Inside this issue:

in Bulgarian, Chinese, Czech, Finnish, French, Hebrew, Hindi, Italian, Korean, Marathi, Nigerian (Hausa, Igbo, Yoruba, & Pidgin), Russian, Spanish, Swedish and Thai (with pending confirmation on Danish, Icelandic, and Greenlandic). Translation in some languages has been completed and they are in the process of being checked for oversight errors. As and when these comic books get ready, we will place them on the CAWSES website. Thanks to the work at Solar Terrestrial Environmental Laboratory (STEL), I am happy to announce the launching of two more new comic books entitled: 1) What are the Polar Regions? and 2) What is the Upper Atmosphere? These can be accessed from the CAWSES website at: http://www.bu.edu/cawses. So, in all now there are eight comic books on different topics of Solar to Terrestrial science topics.

Susan Avery presented the plan of science for CAWSES-II during her talk and during a town-hall meeting during the CAWSES Symposium in Kyoto, Japan in October 2007. Brigitte Schmieder presented the framework of CAWSES-II and the expectations from it in the Special Interest Group meeting on CAWSES during the National Space Science Symposium in Ooty, India during February 2008.

Among other articles, this issue consists of summary of the progress made in the first phase of CAWSES program under Theme 3. As you can see, substantial work has been carried out and it promises to form a solid base for building up of a sound edifice in the 2nd phase of the CAWSES program. You will also find the summary of discussions on the scientific direction that is planned for CAWSES-II and the SCOSTEP Bureau meeting held at Perugia, Italy. It is expected that in the next phase additional emphasis will be on the investigations of the linkages between various domains in the Sun–Earth connection research. I trust you will find this issue of *CAWSES News* informative.

In this year, I will be giving up my position as the CAWSES Science Coordinator/ Secretary. I would like to thank you all for your cooperation, enthusiasm, and responsiveness that you showed during the last five years! I thank both the CAWSES Chairs, Profs. Sunanda Basu and Susan Avery and all the CAWSES leadership spread all around the globe for their cooperation. It had been a pleasure working with all of you! I take this opportunity to thank the Directors of CSP, Boston University and Physical Research Laboratory, India (my present place of work) and the US NSF for their support of this activity. Thanks are also due to Mr. David Ellseworth, the CAWSES Program administrator, for his able assistance at the CAWSES office. It had been a rewarding experience for me to serve the CAWSES program, the science of which is so close to my heart! Lastly I would like to say that although I will be giving up my position, I will continue to be available for discussions on CAWSES science and for sharing my experience with the new leadership of CAWSES – II.

CAWSES Committee Members (March 2008)

Susan Avery, Chair	**savery@whoi.edu**
D. Pallamraju, Scientific Coordinator	**raju@prl.res.in**
D. Ellsworth, Program Administrator	dells@bu-ast.bu.edu

Theme 1: Solar Influence on Climate

M. Lockwood, Co-Chair	**mike.lockwood@rl.ac.uk**
L. Gray, Co-Chair	**lesley@met.rdg.ac.uk**

WG 1.1 Assessment of Evidence for the Solar Influence on Climate

J. Beer, WG 1.1 Leader	**beer@eawag.ch**
L. Hood	lon@lpl.arizona.edu
K. Labitzke	labitzke@strat01.met.fu-berlin.de
J. Lean	jlean@ssd5.nrl.navy.mil
A. Mangini	Augusto.Mangini@iup.uni-heidelberg.de
R. Narasimha	roddam@caos.iisc.ernet.in
G. North	g-north@tamu.edu
P. Stott	peter.stott@metoffice.com
G. Thuillier	gerard.thuillier@aerov.jussieu.fr
I. Usoskin	Ilya.Usoskin@oulu.fi
H. Weng	weng@lasg.iap.ac.cn
W. White	wbwhite@ucsd.edu

WG 1.2 Investigation of the Mechanisms for the Solar Influence on Climate:

U. Cubasch, WG 1.2 Leader	**cubasch@zedat.fu-berlin.de**
M. Baldwin	mark@nwra.com
R. Bradley	rbradley@geo.umass.edu
R. Garcia	rgarcia@acd.ucar.edu
G. Harrison	r.g.Harrison@rdg.ac.uk
C. Jackman	jackman@assess.gsfc.nasa.gov
K. Kodera	kodera@mri-jma.go.jp
J. Egil Kristjansson	jegil@geo.uio.no
U. Langematz	langematz@strat01.met.fu-berlin.de
D. Rind	drind@giss.nasa.gov

Theme 2: Space Weather: Science and Applications

J. Kozyra, Co-Chair	**jukozyra@engin.umich.edu**
K. Shibata, Co-Chair	**shibata@kwasan.kyoto-u.ac.jp**
S. Basu	basu@ppd.nrl.navy.mil
W. Gonzalez	gonzalez@dye.inpe.br
A. Petrukovich	apetruko@iki.rssi.ru
R. Schwenn	schwenn@linmpi.mpg.de
R. Sridharan	r_sridharan@vssc.org
X. Feng	fengx@spaceweather.ac.cn

WG 2.1 Enhanced Resolution GPS TEC Maps:

A. Coster, WG2.1 Co-Leader	**ajc@haystack.mit.edu**
M.Hernandez-Pajares Co-Leader	**manuel@mat.upc.es**
E. de Paula	eurico@dae.inpe.br
C. Mitchell	c.n.mitchell@bath.ac.uk
C. Valladares	valladar@bc.edu

WG 2.2 CAWSES/IAGA/GEM Magnetospheric Observations:

I. Mann, WG 2.2 Leader	**imann@space.ualberta.ca**
M. Engebretson	engebret@augsburg.edu
J. Love	jlove@usgs.gov
M. Moldwin	mmoldwin@ucla.edu
A. Viljanen	ari.viljanen@fmi.fi
K. Yumoto	yumoto@geo.kyushu-u.ac.jp
E. Zesta	zesta@atmos.ucla.edu

WG 2.3 Solar Sources of Geoeffective Disturbances:

N. Gopalswamy, WG 2.3 Leader	**gopals@fugee.gsfc.nasa.gov**
B. Jackson	vjackson@ucsd.edu
S. T. Wu	wus@cspar.uah.edu

WG 2.4 Continuous Hα Imaging Network (CHAIN)

H.Kurokawa,WG2.4Leader	**kurokawa@kwasan.kyoto-u.ac.jp**

WG 2.5 Space Weather Applications

WG 2.6 Models, Simulations and Data Assimilation

S. T. Wu, WG 2.6 Leader	**wus@cspar.uah.edu**

WG 2.7 Coordinated Data Analysis

Theme 3: Atmospheric Coupling Processes

F-J. Luebken, Co-Chair	**luebken@iap-kborn.de**
J. Alexander, Co-Chair	**alexand@cora.nwra.com**

WG 3.1 Dynamical coupling and its role in the energy and momentum budget of the middle atmosphere:

M.Mlynczak,WG3.1Co-Leader	**m.g.mlynczak@larc.nasa.gov**
W. Ward, WG 3.1 Co-Leader	**wward@unb.ca**
D. Fritts	dave@colorado-research.com
N. Gavrilov	gavrilov@pobox.spbu.ru
S. Gurubaran	gurubara@iig.iigm.res.in
M. Hagan	hagan@ncar.ucar.edu
A. Manson	alan.manson@usask.ca
D. Pancheva	eesdvp@bath.ac.uk
K. Sato	kaoru@nipr.ac.jp
K. Shiokawa	shiokawa@stelab.nagoya-u.ac.jp
H. Takahashi	hisao@laser.inpe.br
R. Vincent	robert.vincent@adelaide.edu.au
F. Yi	yf@email.whu.edu.cn

WG 3.2 Coupling via photochemical effects on particles and minor constituents in the upper atmosphere: solar/terrestrial influences and their role in climate:

M. Dameris, WG 3.2 Leader	**martin.dameris@dlr.de**
S. Bailey	scott.bailey@gi.alaska.edu
U. Hoppe	uph@ffi.no
C. Jackman	charles.h.jackman@nasa.gov
M. Lopez-Puertas	puertas@iaa.es
D. Marsh	marsh@ucar.edu
J. Russell III	james.russell@hamptonu.edu
D. Siskind	siskind@uap2.nrl.navy.mil

WG 3.3 Coupling by electrodynamics including ionospheric/magnetospheric processes:

G. Lu, WG 3.3 Co-Leader	**ganglu@ucar.edu**
M. Yamamoto, WG 3.3 Co-Leader	**yamamoto@kurasc.kyoto-u.ac.jp**
I. Batista	inez@dae.inpe.br
A. Bhattacharyya	archana@iigs.iigm.res.in
J. Chau	jchau@jro.igp.gob.pe
S. Cummer	cummer@ee.duke.edu
P. Dyson	p.dyson@latrobe.edu.au
M. Fullekrug	fuellekr@geophysik.uni-frankfurt.de
R. Tsunoda	tsunoda@sri.com

Theme 4: Space Climatology

C. Fröhlich, Co-Chair	**cfrohlich@pmodwrc.ch**
J. Sojka, Co-Chair	**fasojka@gaim.cass.usu.edu**

WG 4.1 Solar Irradiance Variability:

G. Thuillier, WG 4.1 Co-Leader	**gerard.thuillier@aerov.jussieu.fr**
J. Pap, WG 4.1 Co-Leader	**papj@marta.gsfc.nasa.gov**
P. Fox, WG 4.1 Coordinator	**pfox@ucar.edu**

WG 4.2 Heliosphere Near-Earth:

L. Svalgaard,WG 4.2 Leader	**agu@leif.org**

WG 4.3 Radiation Belt Climatology:

T. Obara, WG 4.3 Leader	**t.obara@nict.go.jp**
S. Bourdarie	sebastien.bourdarie@onecert.fr
S. Fung	shing.fung@gsfc.nasa.gov
D. Heynderickx	D.Heynderickx@oma.be
H. Matsumoto	matsumoto.haruhisa@jaxa.jp
Y. Miyoshi	miyoshi@stelab.nagoya-u.ac.jp
M. Panasyuk	panasyuk@sinp.msu.su

WG 4.4 Climatological Variations of the Ionosphere and Upper Atmosphere:

M. Jarvis, WG 4.4 Co-Leader	**m.jarvis@bas.ac.uk**
J. Emmert, WG 4.4 Co-Leader	**emmert@uap2.nrl.navy.mil**
R. Akmaev	Rashid.Akmaev@noaa.gov
G. Beig	beig@tropmet.res.in
G. Burns	gary.burns@aad.gov.au
J. Chau	jchau@jro.igp.gob.pe
A. Danilov	geophys@sovamsu.sovusa.com
R. Niciejewski	niciejew@umich.edu
H. Rishbeth, Special Consultant	hr@phys.soton.ac.uk

T. Ulich thomas.ulich@sgo.fi

Liaison of WG 4.4 with IAGA/ICMA
J. Lastovicka jla@ufa.cas.cz

Capacity Building and Education
R. Vincent robert.vincent@adelaide.edu
B. Schmieder brigitte.schmieder@obspm.fr
G. Lu ganglu@ucar.edu

CAWSES / SCOSTEP community mourns the loss of:

Pembroke J. Hart, 79, a retired geophysicist at the National Academy of Sciences, died on Feb. 6 in Arlington County, USA. In 1958, Dr. Hart became a staff officer at the National Academy of Sciences and helped coordinate programs associated with that year's International Geophysical Year, which led to decades of scientific projects. He also participated in research programs to study the Earth's mantle and crust and was active in such scientific efforts as the International Geodynamics Project and the International Lithosphere Program. In 1963, a geographical feature in Antarctica -- the Hart Hills -- was named in his honor. He received the 2006 Edward A. Flinn III Award of the American Geophysical Union.

Awards/Honors of SCOSTEP/CAWSES Scientists:

- **Susan Avery** has been named the President and Director of the Woods Hole Oceanographic institute.
- **Jan Sojka** has been elected President-elect for the SPA section of AGU
- **Larissa Goncharenko** has been elected the Secretary of the SPA section of AGU.

We congratulate them on their well-deserved recognition.

Proceedings of the SCOSTEP Bureau meeting in Perugia, Italy

Submitted by Gang Lu (ganglu@ucar.edu)

The Bureau members and the CAWSES Chair Susan Avery met on 28 October 2007, following the International CAWSES Symposium in Kyoto, Japan. The complete meeting minutes can be found at the SCOSTEP website http://www.scostep.ucar.edu/. A brief summary of the Bureau meeting is provided below:

1. Review of CAWSES-I

One of the major CAWSES education and public outreach activities is the development and publication of a series of comic books that address several CAWSES scientific topics. The project is collaboration between the Solar-Terrestrial Environment Laboratory at Nagoya University and SCOSTEP/CAWSES over the past 3 years under the supervision and overall guidance of Prof. Kamide and the technical support of Ms. Noda. The success of the comic books is beyond all expectations, and it is fully anticipated that the value of the comic books will continue to grow as they are being translated into many international languages. Another important CAWSES achievement is the first Sun-Earth Connection Virtual Conference led by Janet Kozyra, one of the co-chairs of Theme 2. Other than these two there are other success stories of CAWSES-I: such as the CAWSES program facilitating Germany, Japan, and India to obtain substantial funding to support STP researches in their respective countries, which brings together the solar and geoscience communities through joint CAWSES workshops.

Some lessons have been learned from CAWSES-I as well. Although the current 4-theme structure of the CAWSES-I program seems to work out fine, some reorganization and restructuring will be needed in CAWSES-II. For example, there is some level of overlap between Theme 1 and Theme 4 in terms of scientific objectives, which may have led to some confusion as to which theme should take up the leading role in organizing certain scientific activities. During the past 3 years, some Themes have been more active in carrying out a variety of CAWSES related activities than the others. It appears that the activity level of each CAWSES theme depends, to a large extent, on the level of enthusiasm of the respective theme leaders. Passionate theme leaders are therefore crucial to the success of the CAWSES program.

2. CAWSES-II Updates

Susan Avery presented a draft proposal for CAWSES-II to the Bureau members. The main distinction of CAWSES-II from CAWSES-I will be an emphasis on the Sun and the Earth as a coupled system. But she also pointed out that we should take what is still valid from CAWSES-I and build on it. Some new science topics, such as paleoclimatology and comparative planetary study, may be added to CAWSES-II. Avery proposed a new concept for CAWSES-II, which is, to form the CAWSES International Virtual Institute (or Headquarters) that will lead and coordinate efforts in various CAWSES projects, ranging from research activities to data service, resource management, capacity building, and cyber infrastructures.

The Bureau members attending the meeting reached a general consensus to endorse the draft proposal presented by Susan Avery. Other suggestions by the Bureau members included: collaboration with the existing (or those that are under development) virtual observatories, such as those supported by eGY and IHY; collaboration with the NSF-sponsored Digital Library for Earth System Education (DLESE) program for Capacity Building and EPO; collaboration with IHY regarding its initiatives in Africa and continuing this type of effort

through the CAWSES program, for example, utilizing the IHY-UN support to establish an African CAWSES regional office; working with other US-based STP communities, such as SHINE, GEM, CEDAR, and LWS, to attract their involvement in the CAWSES program.

3. Final Decision on STP-12

The proposals by Germany and Hungary to host the STP-12 symposium were both excellent, and it was a very difficult decision for the Bureau to select one among them. After carefully assessing the possible financial risks and a greater potential for a successful meeting, the Bureau accepted the German proposal to host the STP-12 in Berlin in 2010. The Bureau urged the German organizers to form a scientific organizing committee as soon as possible, which should consist of representatives from both solar and geoscience communities.

4. New Scientific Discipline Representatives

SCOSTEP currently has 36 Scientific Discipline Representatives (SDRs). Among them, 16 SDRs appointed in 1999 will finish their term in 2007. A semi-final list of 22 SDR candidates was discussed at the Bureau meeting. The appointment letters were sent to all new SDR candidates before the end of the year, and all have accepted the position which becomes effective in 2008.

5. SCOSTEP Co-sponsorship Procedures and Policy/ guidelines for translating comic books

The Bureau passed two general guidelines concerning the SCOSTEP sponsorship: (1) All sponsored meetings should show an acknowledgment of the SCOSTEP/CAWSES sponsorship with or without the financial support, and the sponsored meetings should incorporate the SCOSTEP and CAWSES logos as appropriate in their meeting advertisements, and (2) The SCOSTEP/CAWSES financial support should go to the meeting organizers and not to individuals.

The Bureau also approved the following terms prepared by Dr. D. Pallamraju with regard to the translation of comic books into other languages:

(1) One will translate or arrange to translate the comic books in a way to convey the true meaning and spirit of the wordings as close to the original as possible.
(2) One will not modify the credits that presently exist in the comic books.
(3) In principle, the text should be written within the balloon of the comics. Only onomatopoeia, such as “Whoosh!” and “Boing!” can be put on the figure(s).
(4) The translated version of the comics should be sent to the CAWSES office for approval before public distribution.
(5) CAWSES (or SCOSTEP) office may send the translated comics for a review to check for oversight or errors in the translation before approval. One will agree to incorporate the comments that are made in good faith.
(6) The translation should be carried out promptly and should be completed in a reasonable period (not exceeding three months).
(7) The translated comic books will be placed on the SCOSTEP and CAWSES websites.
(8) The comic books should not be distributed for commercial purposes.
(9) One will translate faithfully the acknowledgments on the back cover to the Solar-Terrestrial Environment Laboratory of Nagoya University and to SCOSTEP/CAWSES, as well as the information on the original author, but may include additional text or page(s) to acknowledge the personnel and funding sources that support the translations.

Progress on the first phase of CAWSES Theme 3 “Atmospheric Coupling Processes”

Submitted by J. Alexander (**alexand@cora.nwra.com**) *and F-J. Luebken* (**luebken@iap-kborn.de**)

1. Scientific Focus

The scientific topic of Theme 3 is to study coupling processes from the ground to the thermosphere and their connection to solar input and anthropogenic changes. Some spectacular examples have demonstrated recently that coupling can take place between very remote places in the atmosphere, both from above to below and vice versa. This can lead to a significant redistribution of energy input into the system and cause effects that are far away from the location of the prime effect. Climate and the response of the atmosphere to solar input can only be understood when coupling mechanisms are considered. This requires a proper understanding of the physical and chemical processes involved.

Coupling processes include dynamics, radiation, electrodynamics and the transport of photochemical active constituents, and they are studied via observations, theory, and modelling. When Theme 3 was first formed, the activities were organized into three working groups with broad themes: dynamics, photochemistry, and electrodynamics. A set of projects with more focused goals was also proposed, and these turned out to be more effective than working groups, mostly because of the enthusiasm of individuals who promoted and lead them. Eight projects were initiated and in the following we summarize the activities and the most important results of these projects.

2. Scientific and programmatic aspects of projects:

2.1 Atmospheric Wave Interactions with the Winter Polar Vortices (0-100km)

Coordinator: Alan Manson

The focus of this project is to study dynamical processes and the interactions of tides, planetary waves, gravity waves, and turbulence with each other and with the background flow, concentrating on the polar vortex. These processes are poorly understood and can lead to unexpected phenomena (e. g., sudden stratospheric warmings), which often have global implications. The project has studied the polar vortices using observations and models during campaigns that took place in each winter since 2004/05. Measurements include middle atmosphere winds and temperatures from radars, meteorological analyses for stratospheric winds and temperatures from UKMO, and ground-based optical airglow systems. The impact of the polar vortex on ozone distribution was also studied. Both well-established and new techniques were applied at middle and polar latitudes. Papers for the first three Campaigns of the CAWSES "Vortex" project have been published or are in preparation. These studies also serve as background for the developing research within the PEARL laboratory of the "Canadian Network for the Detection of Atmospheric Change" at Eureka 80oN, Ellesmere Island (www.CANDAC.ca).

2.2 A global observing campaign to characterize tides and their influence from the troposphere to the thermosphere
Coordinator: William Ward

The main idea behind this project is to use, for the first time, the entire range of observational capabilities to measure tides, thereby minimizing the limitations of any one method. This project started by coordinating observations from radars, lidars, airglow and microwave instruments, and satellite measurements to obtain a nearly complete picture of tides. The first tidal campaign took place from Sep. 1 to Oct. 31, 2005 to coincide with the "World Month" campaign undertaken by the Incoherent Scatter Radar community. The focus was on determining the consistency of tidal signatures observed by various means. Three more campaigns took place in 2007/2008, in the periods Mar. 1 – Apr. 30, Jun. 1 – Aug. 15, and Dec. 1 – Feb. 15, 2008. This project includes substantial modelling efforts to better understand sources and signatures of migrating and non-migrating tides, including their effects on the mean circulation, energy budget and trace gas distribution. A workshop on tides took place during Aug. 27-30, 2007 in Fredericton, New Brunswick, Canada. Several planning meetings were organized in conjunction with EGU and AGU symposia. In the future the project will focus on the interpretation of the measurements obtained so far, and on further campaigns dedicated to specific aspects of tides. Results from the first campaign show good comparisons between model, satellite observations and ground based radar observations. The Tides Project has created a web-based data archive for the campaign activities accessible through the project website: http://www.unb.ca/fredericton/science/physics/CAWSES_GTC/

2.3 2.3 Gravity waves and turbulence
Coordinators: Dave Fritts, Nikolei Gavrilov

The activities in this project concentrated on the lower thermosphere region at equatorial latitudes, which is also relevant to the CPEA project (see below). The studies focus on the potential role of gravity waves in creating instabilities in the F region ("spread F") and plasma bubbles extending to higher altitudes. It is suggested that gravity waves arising from deep tropical convection can lead to substantial perturbations at the bottomside F layer and can play a substantial role in plasma instabilities. Two campaigns took place at equatorial latitudes during Oct. – Nov. 2005 to study the ionospheric F region. Radars, digisondes, and airglow instruments were employed at a number of Brazilian sites. TIMED/GUVI measurements were used for large-scale correlative data. Participation included scientists from several US and Brazilian universities and research organizations. A series of workshops took place for planning the campaigns and scientific analysis of the measurements.

2.4 Solar influence on minor constituents and layers at the extra-tropical summer mesopause
Coordinators: Franz-Josef Lübken, Ulf-Peter Hoppe, Scott Bailey

At middle and polar latitudes ice layers exist in the mesopause region, which owe their existence primarily to very low temperatures. These layers are known as, noctilucent clouds (NLC) and polar mesosphere summer echoes (PMSE). The characteristics of these layers (e.g., occurrence frequency, height, brightness etc.) are very sensitive to background conditions and are therefore best suited to indicate long-term and solar-induced changes in the upper atmosphere. This project studied the characteristics of these layers, such as their formation, morphology, long term change, and sensitivity with respect to the variations caused by solar forcing and anthropogenic greenhouse gas increase. Observations from lidars, radars, satellites, and rockets were employed. Coordinated measurements took place in two campaigns in the summers of 2005 (northern hemisphere) and 2005/06 (southern hemisphere) that allowed unprecedented insight into physical processes related to the ice layers. A workshop was held in Kühlungsborn, Germany, in the spring of 2006.

Regarding scientific results related to CAWSES, the evidence for long term trends and solar cycle effects is increasing. Still, some observations are not consistent with the overall picture and are not yet fully understood. A spectacular coupling event was observed in NH summer 2002 when increased planetary wave activity in the SH caused significant effects in the NH mesosphere, including a warming around

the mesopause and a reduction of PMSE. Models have been able to explain these observations qualitatively by feedback mechanisms between planetary waves, gravity waves, and their effect on global circulation. Our understanding of some basic physical processes on PMSE or inter-hemispheric differences has improved substantially in the last years thanks to major progress in experimental capabilities and sophisticated modelling. For example, first continuous observations of temperatures, PMSE, and NLC at mesopause altitude at Spitsbergen have general implications for the upper atmosphere regarding water vapour, turbulence, and the energy budget. A new satellite called Aeronomy of Ice in the Mesosphere (AIM) is specifically dedicated to the study of ice layers and their role in understanding climate effects in the upper atmosphere. AIM was launched on Apr 25, 2007, and brings unprecedented detail about the global distribution of ice clouds. There are several science topics that need to be investigated in the future, e.g., feedback mechanisms of ice layer variations on trace gas distribution and the thermal and dynamical state of the upper atmosphere.

2.5 Energy budget of the thermosphere and its link to the Sun and climate (Formerly: Ozone - how well do we really understand it?)
Coordinator: Marty Mlynczak

The activities in this project concentrated on the scientific analysis of measurements from the SABER instrument on the NASA TIMED satellite, in particular, the infrared emissions from NO and CO_2 . Infrared cooling impacts the influence of the Sun on the energy balance and climate of the thermosphere. NO acts as a "natural thermostat" in the thermosphere during geomagnetic storms since the increased energy input leads to an enhancement of NO, which in turn boosts cooling by infrared emission. SABER measurements showed a general decline of infrared emission caused by decreasing solar activity, but also tremendous day-to-day variability. A nine-day variability is found in the NO and CO_2 emission, which is attributed to the recurrence of coronal holes on the Sun that are spaced approximately 120 degrees apart in solar longitude. Consequently, the 27-day solar rotation period brings one of the coronal hole features "in view" of the Earth every 9 days. These results demonstrate a link between the processes in the solar corona and the heat budget and climate of the thermosphere. The data are important for understanding natural variability and long-term climate change in the thermosphere due to increasing CO_2 abundances. It is planned to convene a topical workshop to bring together observers and modellers to work on SABER data from this energy balance perspective.

2.6 Coupling processes in the equatorial atmosphere (CPEA)
Coordinators: M. Yamamotu, H. Takahashi, S. Gurubaran, and S. Fukao

The Equatorial Atmosphere Radar (EAR) was established in March 2001 on the equator in Sumatra Island, Indonesia. The location was selected in the western Pacific region known as the center of intense atmospheric motions and global atmospheric changes. Soon after the beginning of the EAR observations, "Coupling Processes in the Equatorial Atmosphere (CPEA)" was started as a six-year project (2001-2007) 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 accumulated many instruments in the EAR site and surrounding areas in Indonesia. CPEA has also participated as one of the CAWSES Theme 3 projects. The CPEA activities specific to the CAWSES project were a series of joint observational campaigns and organization of international symposia and a workshop.

The international observational campaigns were conducted in Mar-May 2004 (CPEA-I) and Nov. – Dec., 2005 (CPEA-II). Observations included several radars, lidars, airglow instruments, balloon-borne measurements, and meteorological instruments. Scientific results include Kelvin wave breaking effects on the tropopause region, observational evidence of wave generation by convection, observations of the space-time evolution of plasma bubbles and their relationship to waves in the lower atmosphere, and inter-hemispheric coupling of the ionosphere via processes related to plasma bubbles and travelling ionospheric disturbances [Fukao, 2006]. The two international CPEA symposia were held in Kyoto, Japan in 2002 and 2007. The CAWSES CPEA Workshop was held in May 2005 during the ISEA-11 meeting in Taipei Taiwan. These meetings were successful in bringing researchers from all over the world together to discuss topics related to CAWSES. Two special issues also highlight these results, which are published in *J. Meteorol. Soc. of Japan* in 2006 and in the process in *Earth, Planets and Space*.

Reference: S. Fukao, Coupling Processes in the Equatorial Atmosphere (CPEA): A Project Overview, *J. Meteor. Soc. Japan*, 84A, 1-18, 2006.

2.7 Understanding Atmospheric Coupling Processes through Numerical Modeling
Coordinators: Gang Lu, Maura Hagan, Art Richmond

Major progress has been achieved through models of atmospheric coupling processes developed at research centers around the world. These models have lead to important recent discoveries including (a) demonstration of the relationship between diurnal tidal variations forced by tropical deep

convection and the global morphology of the ionospheric equatorial ionization anomaly, (b) solar wind driven magnetospheric disturbances that produce penetration of electric fields and disturbances in the equatorial ionosphere, and (c) non-linear interaction of these penetration electric fields with ionospheric dynamo electric fields. These examples highlight the ability of these models to describe very complex processes in coupling across vastly differing atmospheric zones from the troposphere to the edge of space. The Theme 3 Numerical Modeling project participants contributed directly to the CAWSES campaign of Sep 2005 with numerical simulations of ionospheric and thermospheric disturbances associated with the geomagnetic storm observed on 10 Sep 2005. During the event, radars at Millstone Hill and Arecibo observed a dayside positive storm phase via enhanced electron density in the F region with an unusual vertical profile shape. Simulations with the Thermosphere-Ionosphere Electrodynamics General Circulation Model (TIEGCM) reproduced the observed electron density profiles, and identified the shape as associated with specific patterns in vertical ion drift. The model also identified the primary cause of the positive storm response as enhanced meridional neutral wind rather than the penetration magnetospheric electric field.

2.8 Electrodynamic Coupling effects in the equatorial and low-latitude ionosphere

Coordinators: Archana Bhattacharayya, Art Richmond, Hermann Lühr

Some exciting results have been obtained under this project. They include: 1. Experimental confirmation by CHAMP magnetic field measurements of the electromagnetic nature of equatorial plasma bubbles (EPBs), which was earlier suggested in model studies to be also associated with the coupling of equatorial F region to conjugate ionospheric E regions and, 2. In a statistical study of the effect of solar wind-magnetosphere-ionosphere coupling on the generation of EPBs it was found that such generation is most likely to occur around midnight in all seasons. Without CAWSES coordinated multi-technique campaigns, which are essential for the study of coupling between atmosphere-ionosphere and between different regions of the ionosphere, would not have happened. Several plans are being made for the next phase of CAWSES: e.g., 1. CHAMP irregularity measurements shall be compared with those from C/NOFS, 2. Ground-based multi-technique (scintillation, radar, ionosonde, GPS) observations in the Indian region shall be combined with the data from satellite observations such as CHAMP, DMSP, TIMED GUVI, to study the role of ambient conditions in the evolution of spatial structure in EPBs.

3. Other developments and common activities with Theme 2

- AGU Session on Exploring the global response of the Sun-H-M-I-A system (convened by J. Kozyra and D. Pallamraju)
- IAGA Session on Low latitude A-I-M coupling, dynamics and energetics (convened by M. A. Abdu)
- A month-long incoherent scatter radar campaign in Sep 2005 and Apr 2006.
- Space Weather Campaign in Sep 2005
- 2005 campaign on ice layers near the summer mesopause
- Joint ICESTAR/CAWSES coordinated effort on the Jan 2005 solar flare effects

Priority programme of the German Science Foundation is running for 6 years involving approximately 30 institutes in Germany with around 120 scientists and 70-100 Ph.D. students. The total funding is approximately 17-20 Million US-Dollars. The continuation of Germany's membership in EISCAT is also funded through this priority programme. National workshops have also been organized (with international guests) every second year. The German foundation also organized CAWSES related sessions during the EGU general assembly in Vienna (in 2006, 2007 and 2008).

Development in the CAWSES-India Program

Report on CAWSES-Space Weather campaign during Mar-Apr 2006

Submitted by T. K. Pant (tarun_kumar@vssc.gov.in)

Under Theme 2 of CAWSES-India program, three main scientific problems were identified for focused study through a countrywide multi-instrument multi-institution observational campaign during Mar-Apr 2006. These problems were (a) investigation of the evolution of magnetic field structures on the sun and solar wind disturbances, (b) investigation of the day-to-day variability of equatorial and low latitude thermosphere-ionosphere system with an emphasis on the generation and development of equatorial spread F, and, (c) investigation of solar and interplanetary origin of geomagnetic activity and related magnetospheric-ionospheric-thermospheric (MIT) effects. The solar observations from the Ooty Radio telescope during this period revealed interaction regions caused by coronal holes. While the two-dimensional images of solar corona at 115 MHz (about 0.2 Rs above the disk) obtained using radioheliograph at Gauribidanur investigated the kinematics of CMEs/flares close to the Sun, observations on these flares were also made using (i) 6" Spar Telescope for small field high resolution observations, and (ii) GONG full disk telescope (magnetograms and Dopplergrams) at Udaipur. The terrestrial measurements were carried out using ground-based MST and HF radars and GPS receivers, daytime airglow photometer and other complementary instruments like the ionosondes and the magnetometers. Some of the important observations which indicated

the possibility of a connection between the solar processes and the processes in the terrestrial upper atmosphere were: (a) the optically measured daytime mesopause temperature showed a prominent decrease in the afternoon hours during the main phases of the geomagnetic storms, (b) Quasi 2- and 5-day oscillations appear to be modulating not only the mesopause temperature indicating the presence of planetary waves therein, but also the strength and extent of large scale process like the equatorial ionization anomaly. Further, while the instabilities in the post evening ionosphere were observed on 8 nights by the MST radar, scintillations in the VHF range were observed on about 30 nights. In view of these results and the CAWSES Theme 2 brainstorming session which was held at the Space Physics Laboratory (SPL), VSSC in Dec 2007, it was agreed that the main emphasis of the second phase of CAWSES Theme 2 campaign in Feb – Apr 2008 will be on the investigation of the nature of processes that play a key role in vertically coupling the various atmospheric domains, especially the coupling of thermosphere-ionosphere with its neighboring regions. These processes include both the sources: i) those with the origin in the lower atmosphere (troposphere and stratosphere), and ii) those in the magnetosphere and beyond.

Highlights of Theme 3 activities of CAWSES-India

Submitted by S.Gurubaran (gurubara@iigs.iigm.res.in)

A national CAWSES program sponsored by the Indian Space Research Organization (ISRO) has been pursued in India. The Theme 3 of CAWSES-India focuses on scientific activities related to tropical tropopause dynamics, stratosphere-troposphere exchange (STE) processes, middle atmospheric dynamics and electrodynamical processes within the near-space environment. Seven projects are being carried out under this Theme. An experimental campaign on middle atmospheric tides has been successfully conducted during Feb-Apr 2006. The experiments conducted under the ISRO's Midde Atmospheric Dynamics program contributed database to this tidal campaign study. Research was carried out under the following areas: (1) Characterization of atmospheric boundary layer processes and identification of their links to the tropical tropopause variations during intense convection, (2) Characterization of cirrus clouds within the tropical tropopause layer and the energetics associated with the cirrus formation, (3) Influence of monsoon associated mesoscale convective systems on the tropical tropopause region, (4) Large-scale variation and trends in observed Convective Available Potential Energy over a few low latitude sites, (5) Role of STE on tropospheric and stratospheric ozone in relation with tropopause variation over the Asian region, (6) Links between the upper mesospheric tidal wind fields and deep tropical convection, and (7) Evolution of Equatorial Spread F irregularities under different ambient conditions. With regard to theme 3 of CAWSES, the CAWSES national program offered a unique opportunity for various scientific groups to interact and generate a scientific platform that could be used to launch future CAWSES related activities.

Theme 4 activities of CAWSES-India

Submitted by R. Dabas (rajdabas@mail.nplindia.org)

Under the Theme 4 of the CAWSES-India program following activities, as approved by the National Science Committee, are in progress by different groups in the country. These are: 1) Studies on low latitude space climatology with ground based Ionosphere – Thermosphere measurements, 2) Climatology and modeling of the F region over Indian equatorial and low-latitudes based on data from ionosonde network, 3) Study of Sun-Earth interactions using VHF scintillations, 4) An integrated approach for the investigation of the equatorial ionosphere thermosphere system using different ground based experimental techniques at the magnetic equatorial location, 5) Analysis & modeling of the Indian ionospheric electron content, 6) Space Climatology of upper ionosphere using VHF scintillation and VLF Whistler mode, 7) Ionospheric modeling for short and long term predictions of F-region parameters over Indian zone, 8) Space Weather impact on equatorial and low latitude F-region ionosphere over India, and 9) Equatorial and low latitude spread F irregularity characteristics over the Indian region and their prediction possibilities. In addition to the above projects, one of the important contributions of the NPL/ISRO program has been the digitization of ionosonde data from a network of Indian stations obtained during the past 20 - 40 years!

Reports from the CAWSES community

ISSI Workshops in 2005-2006 on Sun-Earth connection (THEME II)

Submitted by Consuelo Cid (consuelo.cid@uah.es) *and Brigitte Schmieder* (Brigitte.Schmieder@obspm.fr)

The 'Stages of Sun-Earth connection' program arose with a proposal to the International Space Science Institute located in Bern, Switzerland in 2005. Twelve participants from eight institutions from five countries (Spain, Argentina, Belgium, France and Germany) joined their knowledge in the fields of solar, interplanetary and magnetospheric physics to accomplish the task of understanding all the stages of space weather. The proposal of the team was to analyze individual events at different stages and not to make a statistical study. We thought that this approach lets us improve our knowledge of Sun-Earth connection. Every member provided the best of his/her expertise in analyzing solar images, interplanetary magnetic fields, energetic particles, geomagnetic indices or theoretical approaches of the events selected. We participated in three meetings at ISSI in Sep. 2005, May

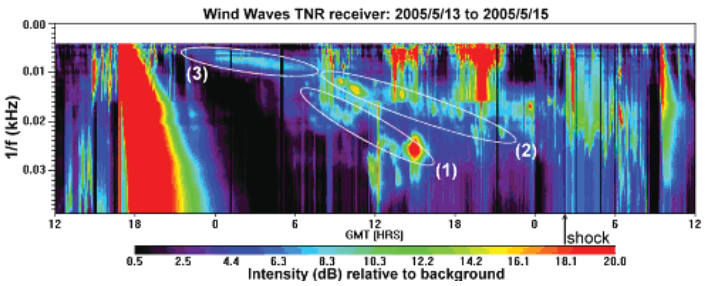

Figure 1: Dynamic spectral radio emission (WAVES/TNR) between May 13 and May 15 UT where three type II emissions are identified corresponding to two interplanetary shock entities.

2006, and Nov. 2006 to try and join all the work that we have done in our institutions, and now our results are starting to see the light. 'Magnetic clouds seen at different locations in the Heliosphere' (Rodriguez et. al., 2008, Ann. Geophys., 25, 1-17) is the first of the results from the team. Magnetic clouds are huge magnetic structures and survive until several AU away from the Sun. It is accepted that its local topology could be modelled as a cylindrical flux rope, but the global topology is still unknown. In this paper we analyzed two magnetic clouds, which were observed not only at 1 AU by ACE spacecraft, but also by Ulysses spacecraft. In Jan. 2005, when one of the clouds was observed, the location of Ulysses was 72º N, and then, it provided a good opportunity to study the global topology and evolution from the solar topology. This evolution is also analyzed in the event of Nov. 2001, when Ulysses was close to the ecliptic plane, but at a radial distance of 5.3 AU. The next of our results on the May 2000 event will be appearing in JGR (Dasso et. al., 2008). Two CMEs, well observed at 1 AU, show that their original structures were preserved and survived while evolving in the interplanetary medium. These CMEs developed one of the most intense geomagnetic storm of this solar cycle (Dst =-263 nT). Also three halo CMEs with very different geomagnetic response have been studied by the team and the manuscript is under preparation.

Post CAWSES-Kyoto Thoughts and Futures of the Theme 3 Project: "Atmospheric Wave Interactions with the Winter Polar Vortices (0-100km)"

Submitted by Alan Manson (alan.manson@usask.ca)

This CAWSES Theme 3 WG 3.1 project is closely tied, in a scientific collaborative sense, with a major Atmospheric Sciences initiative in Canada: Canadian Network for the Detection of Atmospheric Change (www.CANDAC.ca). Begun as a dream in 2002, and under the extraordinary leadership of Prof James Drummond, the PIs forming the Scientific Steering Committee have acquired significant funds for the acquisition and installation of multiple observational systems at Eureka 80°N, Ellesmere Island such as: spectrometers, lidars, imagers, and radars. Studies extend from ground to 100km, with these Themes: Troposphere Transport and Air Quality; the Radiative Environment [Clouds, Aerosols and Diamond Dust]; Middle Atmosphere Chemistry; Waves And Coupling Processes [WACP, 0-100km].

The first winter with all systems operating is 2007/8, which happens also to be the first season for the IPY program. Our SKiYMET radar has operated since February 2006. PEARL (expand) is one of the International Arctic Systems for Observing the Atmosphere, which includes several locations that are well known to CAWSES community: e.g. Barrow, Alaska (71° N); Ny-Alesund (Svalbard), Norway (79° N) and Summit, Greenland (72° N). So now to the connection between PEARL at Eureka and our "….Polar Vortex…" CAWSES Project. The dominant atmospheric structure in the Arctic is the winter polar vortex. Its characterization and evolution each winter is a function of the propagation of stationary and propagating planetary waves from lower heights and latitudes, the resulting Brewer-Dobson circulation, the phases of ENSO and the QBO, fluxes of gravity waves from everywhere, the stratospheric/mesospheric disturbances of each year, and hence finally the solar activity/cycle. Understanding of the atmosphere processes over Eureka [0-100km] therefore requires knowledge/characterization of the vortex, since Eureka may be outside, on the edge, or inside the vortex during any given winter. The least well understood parts of the vortices are the tops and bottoms, with their crucial interactions with the tropopause and mesopause regions. The scientific questions for WACP-CANDAC therefore involve all of those hemispheric and global phenomena/issues. It is our SCOSTEP heritage that engages us with both CANDAC-PEARL and CAWSES simultaneously.

This perspective brings to light a significant gap in the range of phenomena and their altitudes currently being studied within CAWSES-I; with the exception of the "….Vortex….." project. Based upon 'Kyoto', very little attention is being given to the observation/study of atmospheric processes between the tropopause region and the lower mesosphere. These are crucial for the understanding of the polar vortices and related global processes. These are the structures through which the atmosphere from surface to 100km is linked by dynamical, chemical and thermal processes. Consistent with this imperative, concept studies are now underway for a major Canadian Space Agency (CSA) mission: Atmospheric Processes of Climate and its Change, APOCC. The CSA is also a partner in the CANDAC and the Canadian Middle Atmosphere Model activities. We expect to be active in this vortex-theme throughout CAWSES-II, and welcome/need the involvement of other participants, either independently or collaboratively. The program that is powerfully engaged with all the aspects of the middle atmosphere coupling is, of course SPARC. Several SPARC members are our colleagues and collaborators in CANDAC-PEARL science. A joint

meeting between SPARC and CAWSES communities would also be stimulating, synergistic and desirable.

Status of the AIM mission

Submitted by Scott Bailey (baileys@vt.edu)

The Aeronomy of Ice in the Mesosphere (AIM) has completed observations of one full northern and most of one southern season of Polar Mesospheric Clouds (PMCs). The AIM mission was launched from Vandenberg Air Force Base in California on April 25, 2007 becoming the first satellite mission dedicated to the study of PMCs. AIM carries three instruments specifically selected because of their ability to provide key measurements needed to address the AIM goal which is to determine why these clouds form and vary. The instrument payload includes a nadir imager, a solar occultation instrument, and an in-situ cosmic dust detector. Early science results from the first northern and southern hemisphere seasons show a highly variable cloud morphology, larger cloud brightnesses and more detailed structure than previous space-based instruments because of AIM's much finer spatial resolution, and the first direct observation of the layer of small ice particles believed to be the cause of the summertime radar echoes. Additionally, complex features were observed that are reminiscent of tropospheric weather phenomena. The first results from AIM are currently being submitted to a special issue of the Journal of Atmospheric and Solar Terrestrial Physics on Layered Phenomenon of the Mesopause Region (Richard Collins, Editor). A special session of the Spring AGU in Ft. Lauderdale May 27-30 entitled "AIM and other Contributions to Understanding the Formation and Evolution of NLCs/PMCs" will also be held (Conveners James M. Russell III and Scott M. Bailey). It is expected that the science from the AIM mission will be of interest to the CAWSES community.

5th IAGA/ICMA/CAWSES Workshop "Long-Term Changes and Trends in the Atmosphere"

Submitted by J. Lastovicka, and J.T. Emmert (jla@ufa.cas.cz)

The workshop is focused on long-term changes and trends in the mesosphere, thermosphere and ionosphere but changes/trends in the stratosphere and troposphere will also be covered. It will be held at the Arctic and Antarctic Research Institute (AARI) in St. Petersburg, Russia during September 8-13, 2008. A special issue in a journal with papers from this workshop is planned. Chairman of the LOC Oleg Troshichev (olegtro@aari.nw.ru) can provide you with additional information about St. Petersburg arrangements. St. Petersburg has direct air connection with many European towns and with a couple of towns out of Europe; it is not necessary to fly through Moscow. Many people claim that it is the most beautiful town in Russia with many historical monuments. Previous workshops were held at Pune, India (1999); Prague, Czech Republic (2001); Sozopol, Bulgaria (2004); and Sodankyla, Finland (2006).

Web site of the Workhop: http://www.onlinereg.ru/trends
Abstract deadline: 15 April 2008; Accommodation booking deadline: 1 August 2008
Registration fee: €175 before 1 May, €225 after 1 May, accompanying persons €50.
Program Committee: J. Lastovicka (Chairman, jla@ufa.cas.cz), G. Beig, J. T. Emmert, M. Jarvis, O. Troshichev.

International School on Atmospheric Radars (ISAR-NCU 2008) during Oct 6 – 18, 2008

Submitted by J. Roettger (roettger@mps.mpg.de)

The international school lecture series and workshop ISAR-NCU 2008 will be held at the National Central University (NCU), Chung-Li, Taiwan ROC during on 6 - 18 October 2008. This school bases on earlier ISARs and is intended to be for graduate and Ph.D. students and young postdoctoral research scientists having background or profound interest in atmosphere and ionosphere science, data processing and remote sensing (passive) and radar (active) methods as well as in atmospheric and ionospheric modelling. In particular, methods for applying FormoSat3/COSMIC, MST and incoherent scatter radars data will be addressed.

The ISAR-NCU 2008 is co-directed by Jürgen Röttger and Lung-Chi Tsai, supported by a Scientific Organization Committee including C.H. Liu, S. Fukao, F. Chao and H.C. Yeh. The local organization is by the Center of Space and Remote Sensing Research, the Institute of Space Science and the College of Earth Science of the National Central University. Sponsors of this school will be the National Central University and the National Science Council of Taiwan ROC as well as the Academia Sinica ROC, SCOSTEP/CAWSES and URSI.

The activity will include a one day workshop, tutorial lectures, intensive training and computer laboratory work. During the latter the participants, supervised by the lecturers, will analyze and interpret data obtained by different sounding and radar techniques. Some introduction will also be given to modelling and simulations. Lecturers will be from the National Central University and the international community of atmosphere and ionosphere research using ground-based radio methods.

Graduate or Ph. D. students and postdoctoral scientists from third-world countries, particularly from South-East Asia, are encouraged to apply. Although the main purpose of this school is to help researchers and students from developing countries through this program of training activities within

a framework of international cooperation, participants from developed countries are also welcome to attend. The school will be conducted in English and participants must have a good working knowledge of that language. As a rule, travel and subsistence expenses of the participants are borne by the home institution. However, limited funds are available for some participants from, and working in, developing countries, to be selected by the organizers. As scarcity of funds allows travel to be granted only in some particular cases, but every effort should be made by candidates to secure support for their fares (or at least half fare) from their home country. The total number of participants in the school is limited. Applications need to be received by 30 June 2008 at: National Central University, ISAR - NCU 2008, Chung-Li, Taiwan (R.O.C.) (http://isarncu.ncu.edu.tw)

Announcements from the CAWSES Office

D. Pallamraju (raju@prl.res.in)

CAWSES announces the release of two more comic books

We are happy to announce that two more CAWSES comic books: 1) What are the Polar Regions? and 2) What is the Upper Atmosphere? have been released. These are available at the CAWSES website for download.

Call for Nominations for "The Sunanda and Santimay Basu Early Career Award in Sun-Earth Systems Science

The Sunanda and Santimay Basu Early Career Award, given by the Space Physics and Aeronomy Section of the AGU, honors an individual scientist from a developing nation for making outstanding contributions to research in Sun-Earth Systems Science that further the understanding of both plasma physical processes and their applications for the benefit of society. The award is open to scientists who are within 7 years of having received a Ph.D. and who live and work in developing countries. Consideration is to be given to candidates who have overcome obstacles in attaining their research objectives. The CAWSES members would remember that Prof. Sunanda Basu was the founding Chair of the CAWSES Science Steering Group.

The recipient will be invited by the Space Physics and Aeronomy Section to present a paper at the AGU Fall Meeting. Travel funds will be provided. Please check the Web site for application procedures. www.agu.org/inside/sectaward-nom.html Deadline 1 June 2008.

Non-Profit
U.S. Postage
PAID
Boston, MA
Permit No. 1839

CAWSES News
Center for Space Physics
CAWSES, Boston University
725 Commonwealth Avenue
Boston MA, 02215

D. Pallamraju, Scientific Coordinator,
Editor, *CAWSES News*
(raju@prl.res.in)
D. Ellsworth, Program Administrator,
(dells@bu-ast.bu.edu)
Tel: +011-617-353-5990
Fax: +011-617-353-6463

CAWSES News is also available on the web at: http://www.bu.edu/cawses
CAWSES International Coordination office at B.U. is supported by US NSF