



CAWSES News

Climate And Weather of the Sun-Earth System



Volume 4, Number 2

September 2007

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 (susan.avery@colorado.edu)

The continued engagement of the international CAWSES community is reflected in the exciting activities described in this edition of the CAWSES newsletter. Many colleagues have worked hard to coordinate these activities and the scientific results are really beginning to showcase the success of CAWSES. In addition the newly formed comics that Raju discusses in his editorial are an exciting capacity building result.

During the IUGG meeting in Perugia, Italy the SCOSTEP Bureau along with some of the CAWSES theme leaders had a strategic planning meeting to develop the framework for the follow-on to the CAWSES program. I would like to thank the theme and project leaders for their excellent input into this strategic process by providing a summary of research highlights conducted through CAWSES as well as an assessment of what has worked and what has not worked. The framework of the new plan, tentatively being called CAWSES II: The Next Step Forward, builds upon the successes and lessons learned from the first 3 years of CAWSES. CAWSES plays a unique and important role for the sun-earth system science community in providing the structure in which progress on scientific issues that cannot be done without international collaboration is made possible. Strategies for this enabling role include:

- International collaboration in integrating observations from various ground-based, in-situ, and satellite-based systems to provide a global-view of the sun-earth system.
- Engagement of researchers across the disciplines to attack Sun-to-Earth science issues in a way that fund-

ing agencies & universities tend to discourage by their structures.

- Use of international collaboration and interdisciplinary efforts for capacity building and graduate student education worldwide.
- Scientific strategy and framework that provides focus for the development of support in member nations.

It is strongly encouraged that CAWSES II remains true to this role. While it has been difficult to shift the scientific culture to the international and interdisciplinary role, notable success has been achieved in these first 3 years which provides encouragement to continue. In particular CAWSES has:

- Contributed to the generation of a significant amount of support for Sun-Earth system science in several countries, namely Germany, Japan, India, and Taiwan.
- Contributed to the awareness around the world on the necessity to view the Sun-Earth system as a single entity.
- Enabled face-to-face meetings of experts working in different areas of Sun-Earth system science which has lead to a better appreciation of the issues involved with the sun-earth coupling. Such understanding has lead to observational campaigns and conferences with focused science goals.
- Invigorated the world-wide community through several ground-based and space-based observational campaigns.
- Helped create several data resources and archives for space weather and atmospheric research.
- Trained hundreds of students through summer schools and workshops.

(continued on page 2 ...)

Inside this issue:

<i>Message from the Chair</i>	1
<i>Developments in CAWSES activities Since March 2007</i>	2
<i>Summary of 2007 SCOSTEP Bureau and General Council Meetings in Perugia, Italy</i>	2
<i>CAWSES Committee Members (September 2007)</i>	4
<i>Progress Under CAWSES Themes</i>	6
<i>Theme 3: Atmospheric Coupling Processes</i>	6
<i>Spectacular Mountain Wave Events Observed by HIRDLS</i>	6
<i>Report on the Second CAWSES Global Tidal Campaign Workshop held during August 27 – 30, 2007</i>	7

Theme 4: Space Climatology.....	8
“Floors” in IMF, EUV, and therefore in TSI.....	8
Progress on “Long term trends” Study (WG 4.4).....	10
Capacity Building and Education.....	10
Announcement: 3rd Capacity Building workshop by CAWSES – AOPR.....	10
Reports from the CAWSES Community.....	10
Significant longer-term periodicities in the proxy record of the Indian monsoon rainfall.....	10
Second phase of CAWSES Priority Programme in Germany Supports use of EISCAT.....	11
Announcements from the CAWSES office.....	11
Fourth CAWSES Global Tidal Campaign in December 1 – January 31, 2008.....	11
Sun-Earth Connection Virtual Conference Series: Session 2.....	11

(... continued from page 1)

- Supported young scientists to participate in various international conferences.
- Created a new and innovative way of scientific interactions through the conception and organization of the virtual conference, worthy of emulation by other communities.
- Contributed to publications of several refereed publications of CAWSES science, including a couple of special issues related to results from the CAWSES workshops on (1) space weather modeling, and (2) space weather and atmospheric coupling.
- Contributed to the publication of books (solar irradiance, solar variability and planetary climates)

I am completing a draft of CAWSES-II ideas and hope to circulate that draft to the theme leaders soon. During the upcoming CAWSES symposium in Kyoto, Japan I will present the ideas for CAWSES II and hope that many of you will attend a community forum during that symposium to provide additional input.

Developments in CAWSES activities Since March 2007

D. Pallamraju (raju@cawses.bu.edu)

Buoyed by the progress of the CAWSES program in the past three and a half years, discussions and planning for the next phase of the 5-years of CAWSES program have begun in right earnest. A meeting was held on July 2, 2007 in Perugia, Italy in conjunction with the IUGG Assembly, where some of the CAWSES Theme co-chairs and SCOSTEP Bureau members gathered to kick start the process. This meeting assessed the progress of the CAWSES program thus far and discussed the future course of action to be taken after the end of the initial duration of CAWSES program in mid-2008. There was a unanimous and overwhelming “yes” for renewing the international flavor and umbrella that the CAWSES program continues to provide. The global appeal of CAWSES science has assisted in bringing in significant

resources for CAWSES science in France, Germany, India, Japan and Taiwan. There has been support in the US as well on various CAWSES science issues, although not under that heading. Building upon the progress so far it was decided to tentatively call the next phase “CAWSES-II: The Next Step Forward”. The plan entails more interactions through virtual conferences, virtual meetings of graduate students, and possible internet tutorials on CAWSES science, in addition to the observational campaigns and focused workshops. Please stay tuned for more details on this development in the near future.

Some of the activities in the near future include the International CAWSES Symposium in Kyoto Japan in October, the 4th CAWSES Global Tidal campaign from December 1, 2007 to January 31, 2008 and the 2nd CAWSES virtual conference in January 2008. Research papers that resulted from the International CAWSES Space Weather Modeling workshop held in Japan last year are under refereeing process and will form a special journal issue on “Space Weather Modeling: Status and Prospects” in *Journal of Geophysical Research – Space Physics*. Other special issues are in the planning stages. You will see in this issue that there are some excellent new science results and reports on recently held workshops.

As a capacity building effort, in collaboration with STEL, Japan, we (CAWSES/SCOSTEP) have come up with six comic books on various research areas of the Sun-Earth system. These are: i) What is the aurora?! ii) What is the Geomagnetic Field?! iii) What is the Ozone Hole?! iv) What is the Solar Wind?! v) What is Global Warming?!, and vi) What are Cosmic Rays?!. You can access them from the CAWSES <http://www.bu.edu/cawses/capacity.html> or the SCOSTEP <http://www.scostep.ucar.edu/> websites. The comics are also available in “blank balloon format” for translation to other languages. In general, there has been a great enthusiasm on this front. Within a few days of announcement on the availability of these comics we have already received requests from several volunteers that are willing to take up the task of translating these comics into French, Indian languages Hindi and Marathi, Spanish, Swedish, Russian, Thai, and four African languages: Hausa, Igbo, Yoruba, and Pidgin. If you are interested in translating these into another language, please contact us for further details. As always, I look forward to participation from many of you in the CAWSES science activities.

Summary of 2007 SCOSTEP Bureau and General Council Meetings in Perugia, Italy

Submitted by Gang Lu (ganglu@ucar.edu)

The SCOSTEP Bureau meeting was held in Perugia, Italy, on 7 July 2007, followed by the General Council meeting on

8 July. The full text of meeting minutes is available at <http://www.scostep.ucar.edu>. Below is the brief summary of the meetings:

1. SCOSTEP Overview: Past Year and Future Plan

Prof. Marvin Geller, President of SCOSTEP, pointed out that SCOSTEP has recovered from the significant budget shortfall during its Solar-Terrestrial Energy Program (STEP) in 1990-1997. It is now in a relatively healthy financial condition with about a 1-year operational fund being reserved. The financial conditions of SCOSTEP directly affect its future in terms of the scientific programs that SCOSTEP sponsors. With CAWSES now being extended to the second phase, a financially healthy SCOSTEP is critical to ensure the success of CAWSES-2.

2. Electronic Educational Comic Books

As part of the CAWSES Capacity Building effort, in collaboration with Prof. Kamide as well as Nagoya University, six comic books have been translated into English. SCOSTEP will set aside some funds for this capacity building effort. The bureau members unanimously passed the budget to facilitate the publication of the electronic version of the comic books. Another new comic book is currently under development, which will focus on one of the CAWSES Science Themes.

3. CAWSES reports (current status and Phase-2 planning)

Dr. Susan Avery gave an overview of CAWSES activities during the period of 2006-2007. She highlighted some of the major achievements by all four Science Themes, particularly on the very successful First Virtual Conference on the Sun-Earth Connection in November 2006 led by Dr. Janet Kozyra (the co-chair of Theme 2).

Regarding the CAWSES Phase-2 planning, Dr. Avery pointed out that CAWSES is really an agent that brings together scientists from different disciplines. It functions to facilitate countries to obtain funds toward solar-terrestrial research. Although the current four-Theme structure seems to work, the CAWSES-2 will need some integration and modification, and additional research topics may be adopted. An Executive Committee will be formed soon to lay out the detailed strategic plan for CAWSES-2. Bureau members provided some initial input to Susan Avery regarding the Executive Committee membership.

4. New Subscription Dues Structures

Dr. S. T. Wu presented the new SCOSTEP Subscription Dues Structures to the Bureau. The subscription structure change was prompted by the similar subscription fee changes taken by ICSU. The SCOSTEP subscription fees have remained the same since 1993, while the annual inflation rate from

1993 to 2006 increased by 2.8% on average. The raise of the subscription dues is therefore justified by the inflation rate. In addition, the current SCOSTEP subscription income prevents us from supporting its scientific programs (currently it is the CAWSES program) at a healthy level. The Bureau recommended an increase in the subscription fees by 25% for all 7 subscription categories. At the General Council meeting, the council members expressed opposing views with most member countries in favor of an increase in the proposed subscription fee. In accordance with the SCOSTEP Constitution, a count of weighted votes by the adherent national representatives who attended the Council meeting was carried, which resulted in 24 votes in favor of the measure and 9 votes against it. The new subscription dues structures were therefore passed by the Council, and they will become effective in 2008.

5. National Reports

- Dr. Brian Fraser highlighted some of solar-terrestrial (ST) research activities in Australia. Australian Government Antarctic Division is carrying out ST research using synoptic magnetic and photometric observations as well as LIDARs. Researchers at University of Sydney have been very active in pursuing both theoretical and observational studies in solar physics. The southern hemisphere HF radars managed by La Trobe University have provided new insights into ionospheric electrodynamics. University of Newcastle has a very active group of researchers focusing on space physics and space weather using various satellite and ground-based instruments, along with numerical modeling.
- Dr. Andrew Yau gave the Canadian national report on behalf of Prof. William Liu (who is the Canadian representative to SCOSTEP). The report showed that Canada has a very active ST program consisting of ~200 researchers in various universities over Canada, and the research areas cover from the Sun to the lower atmosphere of the Earth. Canada also has an excellent space program, with 5 research satellites being launched since 2005, and 4 more missions either under construction or in the second phase of the review process.

The scientist does not study nature because it is useful; he studies it because he delights in it, and he delights in it because it is beautiful. If nature were not beautiful, it would not be worth knowing, and if nature were not worth knowing, life would not be worth living.

- Jules Henri Poincaré (1854-1912)

In Science the credit goes to the man who convinces the world, not to the man to whom the idea first occurred.

-Sir William Osler (1849-1919)

- Dr. Gang Lu presented a report on behalf of the Chinese National Representative Prof. Z. Xiao. China has made significant progress in recent years in ST research. National conferences on space physics have been held in China biannually since 2003. There is a very active working group on space weather research and application. China has established a close relationship with CAWSES and SCOSTEP. In fact, SCOSTEP officers have paid a number of visits to Chinese universities and research institutes during past few years. China also has a very active space program. It has successfully launched the Double Star satellites. A new mission consisting of 3 spacecrafts has passed comprehensive review, and is expected to be launched in 2012. China will hold its 12th Space Physics Conference in November 2007 in Sanya, China.
- Dr. Christian Hanuise reported on some of the ST activities in France during the past year. France is an active participant of International Heliophysical Year (IHY). France organized the 1st IHY workshop in Paris, and education-outreach exhibitions in commercial centers in France, Germany, Italy, and Switzerland. French scientists are taking leadership roles in several ST programs, including Dr. J. L. Bougeret chairing the IHY European Coordination, Dr. J. Lillensten chairing the COST Space Weather activity, Dr. C. Hanuise chairing the Interdisciplinary Working Group on Physical Processes of Space Weather, and Dr. B. Schmieder serving on the CAWSES Phase-2 Planning Committee.
- Dr. Karin Labitzke reported on CAWSES related activities in Germany on behalf of Prof. Franz-Josef Luebken. One of the Priority Programs is the German CAWSES program that focuses on upper atmospheric research, including the effects of solar forcing, the dynamical and chemical processes of the atmosphere, and the coupling with forcing from lower atmosphere. The program is funded by German Science Foundation (DFG). It covers the period from 2005 to 2011, consisting of three 2-year phases. Each of the 2-year phases is funded at approximately the \$5M level. The current 2nd phase will support 9 postdoctoral scientists and 24 graduate students involving 18 institutes in Germany.
- Dr. Milos Revallo reported on the ST activities taking place in Slovakia during the period of 2005-2006. Slovakia has been maintaining several ground-based

observatories which make routine measurements of solar and geomagnetic activities. Slovakia is also an active participant in a number of ESA-led space missions as well as other international ST programs. The Slovak National Committee is currently chaired by Jan Rybak with Adriana Ondraskova as the Vice Chair, and Milos Revallo as the Scientific Secretary. Slovakia plans to establish its regional CAWSES program in the coming years.

6. Election of New SCOSTEP President and Vice President

The new SCOSTEP officio was elected after the final ballot counting at the General Council meeting: Prof. Robert Vincent from Australia is the new SCOSTEP President and Dr. Brigitte Schmieder from France is the Vice President. Both will serve a 4-year term which became effective right after the General Council meeting.

7. STP-12 Proposals and Next Bureau Meeting

Three excellent proposals to host the STP-12 symposium were received from Germany (presented by Franz-Josef Luebken), Hungary (presented by Judit Pap on behalf of Andras Ludmany), and Russia (presented by Oleg Troshichev). After a lengthy discussion on the effective costs for the symposium, the Bureau members short listed German and Hungarian proposals but were evenly divided between them. Geller informed the Council that the announcement of the STP-12 location and dates will be made at a later time after the newly elected president and vice president have a chance to review these two proposals and make the final decision.

The next Bureau meeting will be held on 28 October 2007 in Kyoto, Japan, soon after the International CAWSES Symposium.

CAWSES Committee Members (September 2007)

Susan Avery, Chair	susan.avery@colorado.edu
D. Pallamraju, Scientific Coordinator	raju@cawses.bu.edu
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 CAUSES/IAGA/GEM Magnetospheric Observations:

I. Mann, WG 2.2 Leader imann@space.ualberta.ca
M. Engebretson engebret@augsborg.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@cspars.uah.edu

WG 2.4 Continuous H α Imaging Network (CHAIN)

H. Kurokawa, WG 2.4 Leader 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@cspars.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, WG 3.1 Co-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.igmm.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.igmm.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 fsojka@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

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

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:

Prof. Masahisa Sugiura passed away on August 13, 2007 in Tokyo at the age of 81. He was the first person to obtain a Ph.D. at the University of Alaska and was supervised by Prof. Sydney Chapman on the subject of geomagnetic storms. Whilst there he invented and developed with Dr. Neil Davis the AE index, a major contribution to the field of solar-terrestrial physics. He served as director of the World Data Center for Geomagnetism, Kyoto and also as a WDC Panel member and a member of IAGA Executive Committee. He was elected an AGU fellow in 1985 and was awarded the Hasegawa-Nagata Prize from Society of Geomagnetism and Earth, Planetary and Space Sciences in 2006.

Dr. Ashesh Prosad Mitra passed away September 3, 2007 in New Delhi at the age of 80. Dr. Mitra's major work had been in the field of earth's near-space environment, through ground-based and space techniques. His work on cosmic radio noise for studying the upper atmosphere led to a series of discoveries in ionosphere, solar physics and cosmic rays. Dr. AP Mitra was an Eminent Radio Scientist, an URSI Honorary President since 2002, Chairman of the URSI Standing Committee on Developing Countries and URSI Representa-

tive at International Geosphere-Biosphere Program (IGBP). He also served the radio community as the URSI Vice-President (1978-1984) and URSI President (1984-1987).

Progress Under CAWSES Themes

Theme 3: Atmospheric Coupling Processes

Spectacular Mountain Wave Events Observed by HIRDLS Submitted by M. Joan Alexander (alexand@cora.nwra.com)

The High Resolution Dynamics Limb Sounder (HIRDLS) on the Aura satellite measures temperature profiles of the atmosphere, revealing small-scale atmospheric buoyancy waves (also known as “gravity waves”) in fine detail. Flow over mountains is one mechanism for generating gravity waves, which propagate vertically upwards carrying momentum flux. Although gravity waves tend to be small in scale and occur as sporadic events, collectively these waves are also responsible for driving global-scale winds that affect weather and climate. They are among the most important coupling mechanisms between the lower and the upper atmosphere. To understand their global-scale wind effects, researchers must estimate the wave momentum fluxes, which require measurements with very high horizontal and vertical resolution.

In a NASA funded study led by Dr. Joan Alexander of NWRA collaborating with Dr. John Gille and his colleagues at the National Center for Atmospheric Research, the University of Colorado, and Oxford University, researchers have analyzed HIRDLS data to produce daily global maps of gravity wave momentum flux that identify the locations and sources of intermittent gravity wave events. The study identifies the waves in adjacent HIRDLS temperature profiles, and estimates the temperature amplitude and horizontal and vertical

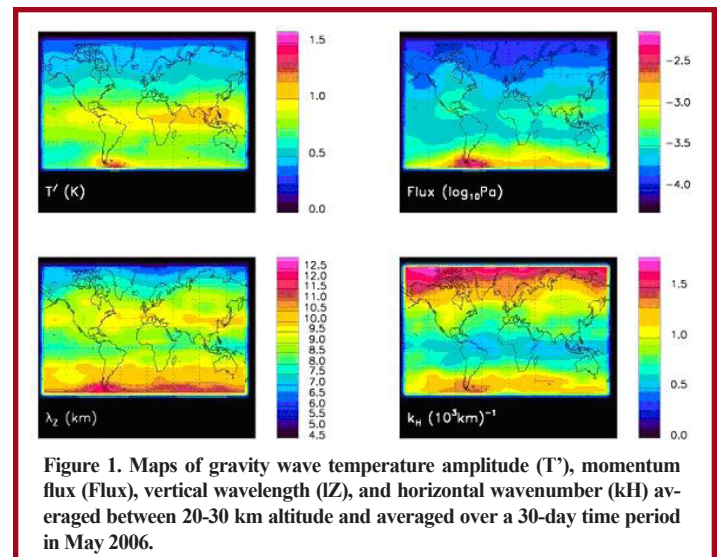


Figure 1. Maps of gravity wave temperature amplitude (T'), momentum flux (Flux), vertical wavelength (λ_z), and horizontal wavenumber (k_H) averaged between 20-30 km altitude and averaged over a 30-day time period in May 2006.

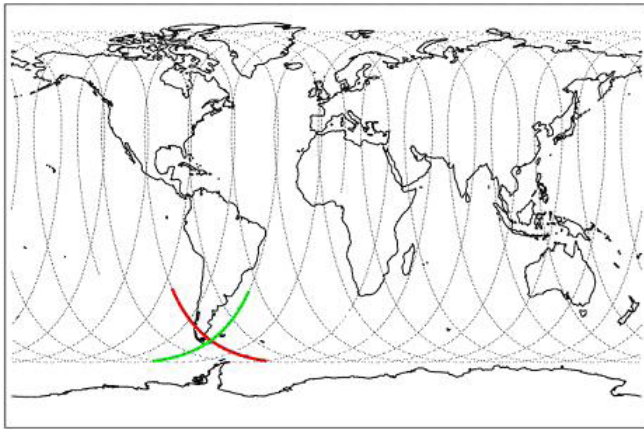


Figure 2. Map of the locations of HIRDLS temperature profiles obtained on 8 May 2006.

wavelengths for each profile pair. From the results, maps of momentum flux can be estimated. The average for a 30-day period in May 2006 at 25-km altitude is shown in Figure 1. In comparison to the temperature amplitudes, the momentum flux emphasizes the waves with longer λ_z and larger kH . The location of the largest fluxes is near the Patagonia region of South America, a region where mountain waves commonly occur.

Dots on the map in Figure 2 show the locations of individual HIRDLS profiles observed on a day when the wave temperature amplitude and momentum flux over Patagonia is twice the mean value. Two segments are highlighted (red and green lines) where HIRDLS observes a strong mountain wave event.

The temperatures obtained along these two segments are shown in Figure 3 as functions of horizontal distance along the orbit vs altitude. Large-scale mean temperatures have been removed to reveal the waves. The alternating red and blue colored

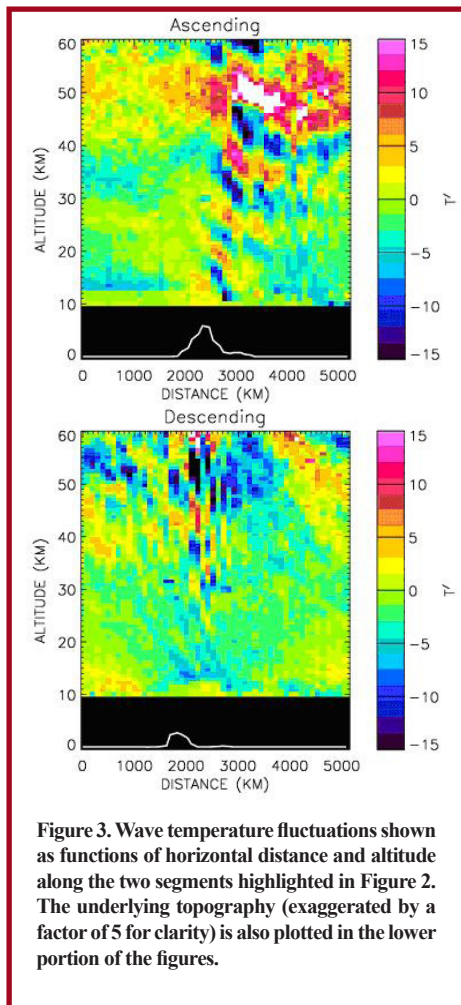


Figure 3. Wave temperature fluctuations shown as functions of horizontal distance and altitude along the two segments highlighted in Figure 2. The underlying topography (exaggerated by a factor of 5 for clarity) is also plotted in the lower portion of the figures.

regions show warm and cold temperature oscillations caused by the mountain waves. West is to the left in both panels. The mountain waves can be seen to extend to very high altitudes, up to 60 km (37 miles), into the region known as the mesosphere. Propagation of mountain waves into the mesosphere has been predicted in theoretical studies, but has not been previously observed unambiguously. The high resolution of the HIRDLS measurements allows researchers to study these waves in fine detail and to improved predictions of wave effects on the general circulation of the atmosphere.

Report on the Second CAWSES Global Tidal Campaign Workshop held during August 27 – 30, 2007

Submitted by William Ward (wward@unb.ca)

The Second CAWSES Global Tidal Campaign Workshop took place in Fredericton, NB, Canada from August 27 - 30. The meeting provided an opportunity for the analysis of the data from the first three CAWSES tidal campaigns (September 1 - October 31, 2005, March 1 - April 30, 2007 and June 1 - August 15, 2007). In terms of the analysis of the tidal data, two categories were identified: primary analyses (which involved quantities be directly related to the tidal fields (i.e. wind or temperature)) and derived analyses (which involved quantities which were a function of the primary parameters and other parameters (airglow, constituents or magnetometer data for example)). At this workshop we concentrated on the primary analysis since it was clear that if our primary analyses were inconsistent between observation sites then it was unlikely that our derived analysis would be correct.

The initial analyses were very encouraging. Good consistency was found between TIMED satellite observations, radar observations at several sites, and model results. This consistency was felt to be due to the inclusion of all tidal components of significant amplitude in the construction amplitudes and phases from the satellite and models. In addition, consistent results were found between the Millstone Hill incoherent scatter radar and lidar wind results from Colorado State University. To our knowledge, this is the first time that consistency between various observation types and models has ever been obtained. Some of these results will be placed on the Tidal Campaign web site (www.unb.ca/physics/CAWSES_GTC) in the next couple of weeks and a GRL article on these analyses is being prepared.

Activity associated with this project will continue over the coming year. The Fourth Tidal Campaign will take place from December 1, 2007 to January 31, 2008. This period was chosen so that campaigns for all four seasons will have been undertaken. In addition, the Third CAWSES Global Tidal Campaign Workshop will take place in Fredericton during the week of August 25, 2008. Over the next year analyses

There is just one thing I can promise you about the outer-space program: your tax dollar will go farther.

- Wernher von Braun (1912 - 1977)

of the various campaigns will continue and we expect this workshop to involve the modeling community to a greater extent than this year's workshop.

We are still interested in data from the earlier campaigns. Scientists interested in providing data are requested to contact the following topic leaders (or William Ward in the case where a topic leader hasn't been identified).

Radar - Meteor, MF: (*Werner Singer, singer@iap-kborn.de*)

Radar - Incoherent Scatter: (*Larisa Goncharenko, lpg@haystack.mit.edu*)

Lidar: (*Michael Gerding, gerding@iap-kborn.de, Philippe Keckhut, Philippe.Keckhut@aerov.jussieu.fr*)

Optical imagers, spectrometers, interferometers: (*Juergen Scheer, jurgen@caerce.edu.ar, jurgen@iafe.uba.ar*)

Satellite - dynamics: wind/temperature (*Jens Oberheide, joberh@uni-wuppertal.de*)

Satellite - constituents: stratosphere, mesosphere, lower thermosphere (*Dan Marsh, marsh@ucar.edu*)

Satellite - troposphere: water vapor, convection (*TBD*)

Magnetometers: Ionosphere, current systems (*S. Gurubaran, gurubara@iigs.iigm.res.in*)

Models: GCMs, linear models, mechanistic models (*William Ward, wward@unb.ca*)

Ionosondes: (*TBD*)

GPS: temperature, water (COSMIC/CHAMP) (*TBD*)

A database for the campaigns is being set up to ensure that the data is available in the longer term. Rules of the road have been drafted and access to the database requires agreement to these rules by the user. Access to the database will be provided through the campaign web site (mentioned above). The form of the data which

we are interested in is as follows:

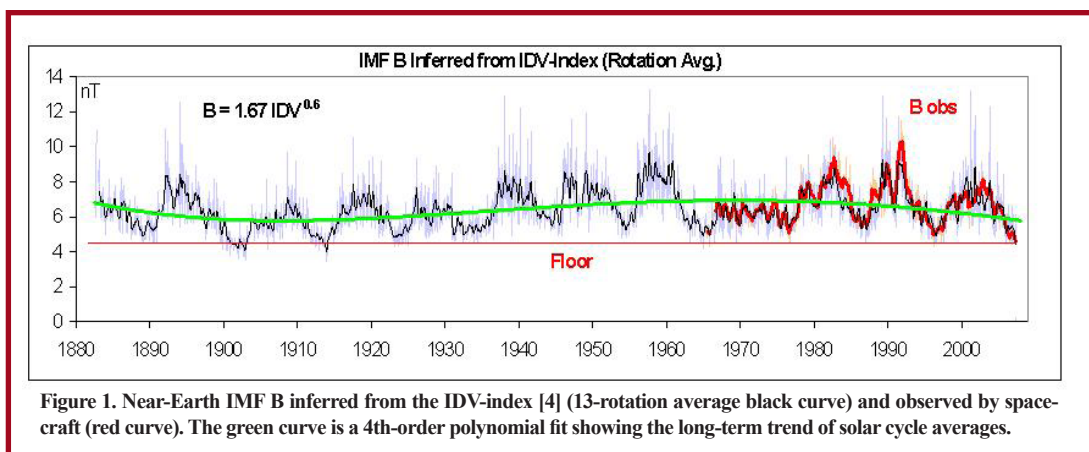
- **For ground based measurements with full local time coverage:** we would like to have hourly averages and variances and four-day fits to components (diurnal, semidiurnal, terdiurnal)
- **For ground based measurements with partial local time coverage:** we would like to have hourly averages
- **For satellite observations of constituents:** we would like global maps and component analyses when appropriate.
- **For satellite observations of dynamics:** we would like latitude/height profiles of tidal components planetary waves and background zonal means.
- **For models:** monthly determinations of component amplitudes and phases as a function of height and latitude are needed. When possible, we would like calculations using the constituent profiles determined during the program.

In the coming year, we anticipate further exciting science. Along with the analyses and comparisons between the various datasets, we will be involving groups that are involved in modeling and data assimilation. Next year's workshop will bring these various groups together and we look forward to further exciting inter-comparisons.

Theme 4: Space Climatology

"Floors" in IMF, EUV, and therefore in TSI
Submitted by Leif Svalgaard (leif@leif.org)

Recent work [1] suggests that the Interplanetary Magnetic Field (IMF) strength, B , at each sunspot minimum varies but little (less than a nT). This is clearly seen in Figure 1. The variation of B within a solar cycle seems to be due to extra (and likely closed [2]) magnetic flux added by Coronal Mass Ejections (CMEs) riding on top of a "floor" of somewhere between 4 and 5 nT, leading to the conclusion that the open magnetic flux is nearly constant with time, and that, in particular, there is no secular variation of the open flux.



Geomagnetic data back to the 1840s [3] further support this conclusion. In fact, B for the current cycle 23 matches well with B for cycle 13, 107 years earlier.

It was pointed out in *CAWSES News Vol. 4 No. 1* [5] that the amplitude of the diurnal variation of the geomagnetic Y-component is an excellent proxy for the F10.7cm radio flux and thus also for the EUV flux (more precisely, the FUV, as the Sq current flows in the E layer). Figure 2 shows a trend in the amplitude of 10% since the 1840s that can be understood as being due to an increase of ionospheric conductance resulting from the 10% decrease of the Earth's main field. Correcting for this effect yields the red curve in Figure 2.

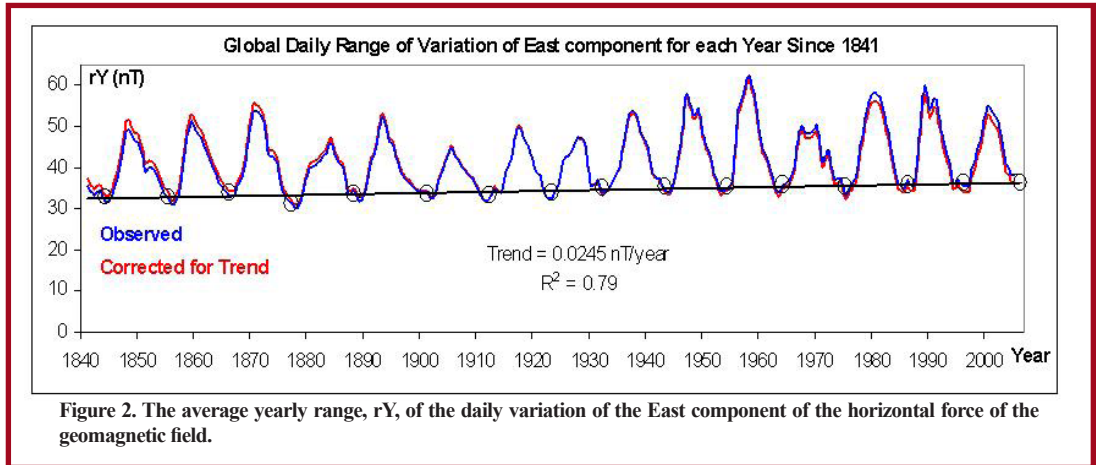


Figure 2. The average yearly range, rY, of the daily variation of the East component of the horizontal force of the geomagnetic field.

Similar to the IMF, there seems to be a “floor” in rY and hence in F10.7cm flux and hence in the FUV flux. Thus, the geomagnetic evidence is that there has been no secular change in the background solar minimum EUV (FUV) flux in the past 165 years.

Direct measurements (although beset by calibration problems) of the Total Solar Irradiance (TSI) from satellites have only been available for 30 years and they indicate that the solar irradiance increases with the solar activity. Correlating mean annual TSI with the sunspot numbers allows one to estimate the part of TSI that varies with the sunspot number, as shown in the upper panel of Figure 3. If the TSI only depends linearly on the sunspot number, then irradiance lev-

els during the Maunder Minimum would be similar to the levels of current solar minima. But the TSI is a delicate balance between sunspot darkening and facular brightening. Although both of these increase (in opposite directions) with increasing solar activity, it is not a given that there could not be secular variations in the relative importance of these competing effects. Several reconstructions, reviewed in [6]

and reproduced in the lower panel of Figure 3, all postulate a source of long-term irradiance variability on centennial time scales. Each group of researchers has their own preferred additional source for changes in the “background” TSI, evidence of geomagnetic activity, open magnetic flux, ephemeral region occurrence, umbral/penumbral ratios, and the like. The existence of “floors” in IMF and FUV for over ~1.6 centuries argues for a lack of secular variations of these parameters on that time scale. I would suggest that if the lack of such secular variation undermines the circumstantial evidence for a “hidden” source of irradiance variability, then there might also be a floor in the TSI, such that the TSI during Grand Minima would simply be that observed at current solar minima. This obviously has implications for solar forcing of terrestrial climate.

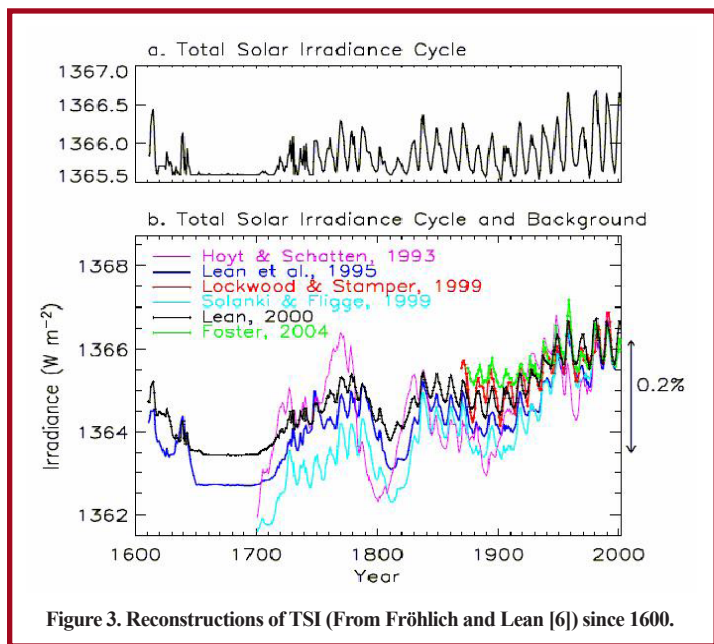


Figure 3. Reconstructions of TSI (From Fröhlich and Lean [6]) since 1600.

[1] Svalgaard, L & E. W. Cliver (2007) A Floor in the Solar Wind Magnetic Field, *Ap. J. Lett.*, 661, L203, doi:10.1086/518786.
 [2] Owens, M. J. & N. U. Crooker (2006) Coronal Mass Ejections and Magnetic Flux Buildup in the Heliosphere, *J. Geophys. Res.*, 111(A10), A10104, doi:10.1029/2006JA011641.
 [3] Svalgaard, L. & E. W. Cliver (2007) Long-term geomagnetic indices and their use in inferring solar wind parameters in the past, *J. Adv. Space Res.*, (in press), doi:10.1016/j.asr.2007.06.066.
 [4] Svalgaard, L. & E. W. Cliver (2005) The IDV-Index: Its Derivation and Use in Inferring Long-term Variations of the Interplanetary Magnetic Field Strength, *J. Geophys. Res.*, 110(A12), A12103, doi:10.1029/2005JA011203.
 [5] Svalgaard, L. (2007) Calibrating the Sunspot Number using the “Magnetic Needle”, *CAWSES News*, 4(1), 6.
 [6] Fröhlich, C. & J. Lean (2004) Solar Radiative Output and its Variability: Evidence and Mechanisms, *Astron. & Astrophys. Rev.*, 12(4), 273. Doi:10.1007/s00159-004-0024-1.

Progress on “Long term trends” Study (WG 4.4)

Submitted by John Emmert (john.emmert@nrl.navy.mil)

Last November, members of WG 4.4 of CAWSES and IAGA/ICMA WG II-F, led by Jan Lastovicka, published a perspective article in *Science* that outlines the current state of upper atmospheric and ionospheric trend research for the broader scientific community. Research on long-term variations in the upper atmosphere is gaining vitality as the community moves from “can we detect long-term trends?” to “do the observed trends form a coherent physical picture?”

In May WG 4.4 convened a session on upper atmospheric long-term trends at the AGU Joint Assembly in Acapulco, Mexico. The purpose of that session was to provide an overview of the current state of upper atmospheric climate and global change research, including observations, data quality issues, modeling, and relevant analysis techniques. There is an emerging pattern of global change in the ionosphere and the neutral mesosphere and thermosphere; observed secular changes appear to be driven primarily by anthropogenic “greenhouse cooling”, with an accompanying thermospheric density decline and a downward displacement of ionospheric and airglow layers. Although the magnitude of these trends is predicted to be substantially higher than in the troposphere, their detection and attribution is often obscured by the large natural variability driven by solar and geomagnetic activity, and there are indications of nonlinear interplay between the anthropogenic secular changes and natural decadal-scale variability during the solar cycle. There are also outstanding gaps and uncertainties in dynamical variations and trends, their impact on vertical energy and momentum transfer, and the consequential influence on the composition and structure of the neutral and ionospheric layers.

A joint CAWSES and IAGA/ICMA workshop on upper atmospheric and ionospheric trends is being planned for September 2008, and will be held in St. Petersburg, Russia. Details and exact dates will be posted later on the CAWSES website.

In my youth I regarded the universe as an open book, printed in the language of equations, whereas now it appears to me as a text written in invisible ink, of which in our rare moments of grace we are able to decipher a small segment.

- Arthur Koestler (1905 - 1983)

Capacity Building and Education

Announcement: 3rd Capacity Building workshop by CAWSES – AOPR

Submitted by S-Y Su (sysu@jupiter.ss.ncu.edu.tw)

CAWSES-AOPR (CAWSES Asia Oceania Pacific Rim) coordinating office at National Central University, Chung-Li, Taiwan would like to invite scientists from Southeast Asian countries to participate in the Third Capacity Building Workshop of Space Science to be held from October 29 to November 7, 2007 on the campus of National Central University, Chung-Li, Taiwan. This workshop is sponsored by the National Science Council of the Republic of China with funds to support participants’ travel and living cost during the workshop. The theme of this workshop is to introduce the data usage from the FORMOSAT-3/COSMIC constellation satellite for ionospheric, atmospheric, and meteorological observations. Emphasis will be on the data utilization from FORMOSAT-3/COSMIC observations as well as coincident observations from ground observations at participants’ countries. The workshop schedule and application form can be downloaded from <http://140.115.111.70/CAWSES-AOPR/CB2007.html>. Seminar presentations from the participants on their regional research activities and results have been scheduled during the first two days of this Capacity Building Workshop. We invite all the participants to present their research activities and results. For further information, please contact Prof. S.-Y. Su.

Reports from the CAWSES Community

Significant longer-term periodicities in the proxy record of the Indian monsoon rainfall

Submitted by R. Ramesh (ramesh@prl.res.in)

Recently stable carbon and oxygen isotope ratios (denoted by $\delta^{13}\text{C}$ and $\delta^{18}\text{O}$ respectively, proxies for monsoon rainfall) of the last 331 years from an annually laminated speleothem (cave deposit) were measured. The time-series analysis of the data using Fast Fourier Transform (FFT) and the Maximum Likelihood Analyses (MLA) reveals significant power in several periods that have a likely solar origin e.g. 132, 21, 18, and 2.4 years. These cycles are non-stationary in nature. Using wavelet analysis we find that the ~21-year period is strong during 1850 to 1920. Between 1780 and 1920, low rainfall intervals are concurrent with low solar activity. However, this behavior breaks down for the older periods. In the $\delta^{13}\text{C}$ periodogram, additional significant periods appear viz., ~59, ~8, ~6.5 and ~3 years: these could have originated from solar variations and/or changes in the biological degradation of soil carbon. Surprisingly, while the low power solar cycles (viz. ~22 yr and ~2.4 yr) are seen in the

$\delta^{18}\text{O}$ and $\delta^{13}\text{C}$ spectra with the ~ 21 yr cycle dominating, the stronger ~ 11 year cycle is only weakly represented in the proxy record, confirming earlier findings based on a more limited data set.

Yadava, M.G. and Ramesh, R., Significant longer-term periodicities in the proxy record of the Indian monsoon rainfall, *New Astronomy* (2007), doi: 10.1016/j.newast.2007.04.001

Second phase of CAWSES Priority Programme in Germany Supports use of EISCAT

Submitted by F-J Luebken (luebken@iap-kborn.de) and J. Röttger (roettger@mps.mpg.de)

The German Science Foundation (DFG = Deutsche Forschungsgemeinschaft) has started the 2nd phase of the CAWSES priority programme in Germany for the period from mid 2007 to 2009. A total of 42 proposals were submitted to DFG and 30 were selected in an international peer review panel meeting in Bonn on January 22/23, 2007. A total of 24 PhD students and 9 postdocs at several universities and research institutes in Germany will be supported. The main research topics covered are characterization of solar radiation, influence on trace gases and aerosols, coupling by planetary and gravity waves (including tides), identification of solar signals in various parameters, and laboratory studies on charged aerosols. The DFG will spend approximately 4 Million US-Dollars within the next two years. The priority programme consists of 3 phases with a total period of 6 years.

As part of the priority programme the DFG followed the Max-Planck-Society as full member in the EISCAT Scientific Association as of January 1, 2007. This continues the full access to the EISCAT radar facilities in northern Scandinavia and on Svalbard for German scientists. The prime use of EISCAT will be for research topics covered within the priority programme, such as studies of the D-region and Polar Mesosphere Summer Echoes, investigation of coupling mechanisms in the magnetosphere-ionosphere-thermosphere system, and mapping of ionosphere electron content. A new office was established at the Copernicus Society in Katlenburg-Lindau to coordinate and support German scientists using EISCAT. The EISCAT membership fee and the personnel at the coordination office are funded by DFG.

Announcements from the CAWSES office

D. Pallamraju (raju@cawses.bu.edu)

Fourth CAWSES Global Tidal Campaign in December 1 – January 31, 2008

The fourth CAWSES Global Tidal campaign will be held December 1, 2007 to January 31, 2008. The three Global Tidal



campaigns held previously were during equinoxes (September 1 - October 31, 2005, March 1 - April 30, 2007) and northern hemisphere summer solstices (June 1 - August 15, 2007). Hence, the fourth Tidal Campaign period was chosen so that campaigns for all four seasons will have been carried out. This unique database is expected to significantly advance our understanding of the migrating and the non-migrating atmospheric tides, their sources, their propagation characteristics, and impacts throughout the atmosphere. You all are encouraged to participate. For more details please visit: http://www.unb.ca/physics/CAWSES_GTC

In addition, the Third CAWSES Global Tidal Campaign Workshop will take place in Fredericton during the week of August 25, 2008. Please stay tuned for more information!

Sun-Earth Connection Virtual Conference Series: Session 2

“Encouraged by the success of the first Virtual Conference and by popular demand a second CAWSES Virtual Conference is planned for January 2008. Explore the state of the Sun-Earth system during extreme space weather. This conference will be a follow up of data analysis and modeling of data gathered during previous CAWSES observational campaigns and the questions/issues raised during the first Virtual Conference held in November 2006. You are all encouraged to participate in this Virtual Conference. Workshop details will be uploaded shortly on to the following URL: <http://workshops.jhuapl.edu/s1/index.html>. Please stay tuned for further information.

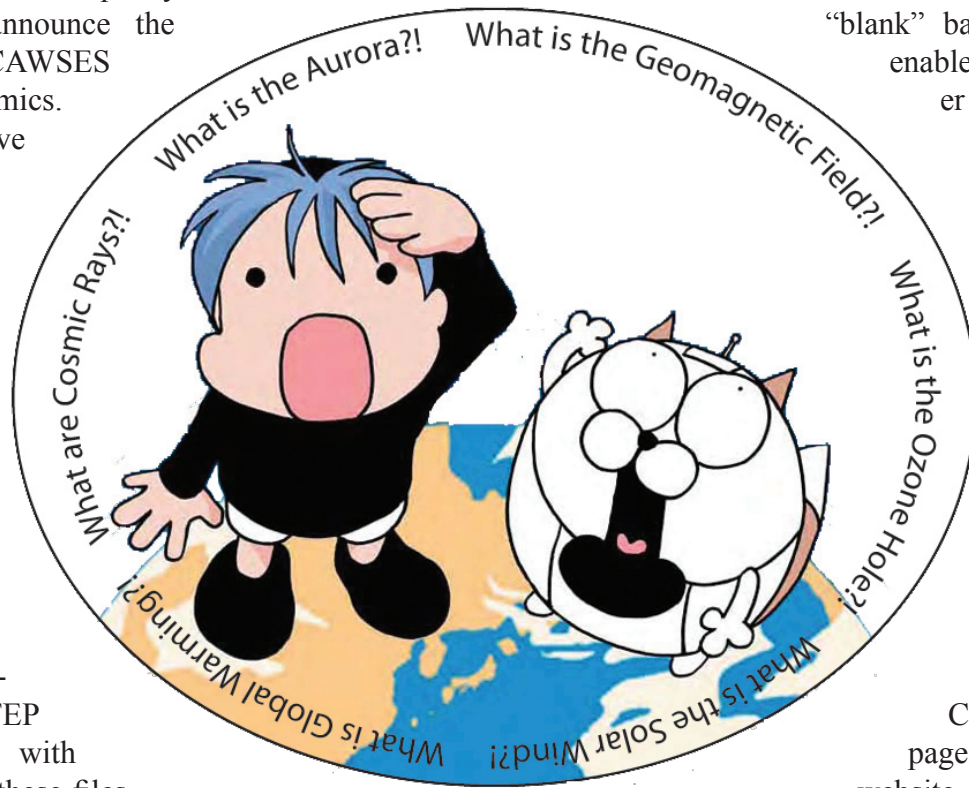


Research is to see what everybody else has seen, and to think what nobody else has thought.

-Albert Szent-Györgi (1893-1986)

As part of CAWSES Capacity Building Theme, we announce the availability of CAWSES Science Comics.

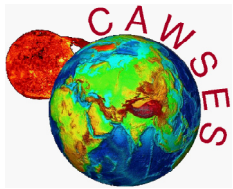
These comics have been made at Solar-Terrestrial Environment Laboratory (STEL), Nagoya University with the overall guidance of Prof. Y. Kamide. These were originally in the Japanese language but SCOSTEP in collaboration with STEL has made these files



available both in English and with “blank” balloons which will enable translation to other languages as well.

Through this effort CAWSES/SCOSTEP would like to reach a wider audience and get them interested in the CAWSES Science.

The CAWSES comics can be accessed from the Capacity Building page of the CAWSES website.



CAWSES News

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



D. Pallamraju, Scientific Coordinator,
Editor, *CAWSES News*
(raju@cawses.bu.edu)
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

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

