



# CAWSES News

Climate And Weather of the Sun-Earth System



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

**Message from the Chair**

Sunanda Basu ([sbasu@bu.edu](mailto:sbasu@bu.edu))

We just had a great celebration of CAWSES science through the STP-11 Symposium held in the beautiful city of Rio de Janeiro, Brazil during March 6-10. I am greatly appreciative of the efforts of Marv Geller, Chair of the Organizing Committee, Pierre Kaufmann, Chair of the Local Organizing Committee, and the members for its great success. We have now nearly come to the midway point of the planned five years of the CAWSES program and the SCOSTEP Bureau is rightfully thinking of what lies beyond CAWSES. I have been connected with CAWSES from its gestation as a member of the Long Range Planning Committee in 2001-02, to the preparation for its launch throughout 2003, and, its actual birth in 2004. I believe the time has come for a change in the leadership. The SCOSTEP Bureau has accepted my request to step-down and has appointed Susan Avery, Interim Provost at the University of Colorado, as the incoming Chair of CAWSES. We both agreed that Susan and I would serve as Co-chairs for the period of April 1-August 1, 2006 when she will become the Chair, SSG of CAWSES. Susan has wide experience in research, education and outreach and I am sure she will take CAWSES to new heights. Let me end with my sincere thanks to the entire global CAWSES community for the extraordinary help I received from all of you. I hope to see many of you at the third CAWSES planning meeting at Beijing on July 23, over which I will preside, as Susan has a long standing commitment at that time. Of course, I will remain your research colleague in the CAWSES science program so no good-byes are necessary!

**Message from the Incoming Chair Susan Avery**

([susan.avery@colorado.edu](mailto:susan.avery@colorado.edu))

I am delighted to join the CAWSES team as we move into the next phase of the program. Sunanda has been a persuasive and dynamic leader in getting CAWSES pulled together and established in many countries. I thoroughly enjoyed the

CAWSES presentations at the STP-11 Symposium in Brazil and look forward to other opportunities that allow us to communicate our scientific results from the various CAWSES Themes and projects. Over the next four months I hope to have some extended time to work with Sunanda, Raju, and the steering committee/Theme leaders as we work out the transition and important things we can do to even further enhance CAWSES science and capacity building. I look forward to working with all of you. Please join me in thanking Sunanda for her dedication and hard work on behalf of our science.

**Inside this issue:**

*Message from the Chair Sunanda Basu* ..... 1  
*Message from the Incoming Chair Susan Avery*..... 1  
*Update on CAWSES activities since September 2005* ..... 2  
*Report on SCOSTEP Bureau meetings in Rio, Brazil March 5–12...* 2  
*Report on STP-11 Symposium, March 6-10, 2006*..... 3  
*CAWSES Committee Members (March 2006)* ..... 3  
*Awards/Honors for SCOSTEP/CAWSES Scientists* ..... 4  
*Progress under CAWSES Themes* ..... 4  
*Theme 1: Solar Influences on Climate*..... 4  
*Theme 2: Space Weather: Science and Applications* ..... 5  
*Report of CAWSES Space Weather workshop at Stanford, December 10-12, 2005* ..... 5  
*Virtual Poster Session on the results from Sun-to-Earth Observational campaigns during May, 2006*..... 5  
*Theme 3: Atmospheric Coupling Processes* ..... 5  
*Report on CAWSES Ice Layers Campaign in 2005* ..... 5  
*Progress of Coupling Processes in the Equatorial Atmosphere (CPEA) project* ..... 6  
*Low latitude radar network for investigation of dynamical processes in the mesosphere-lower thermosphere region*..... 6  
*Theme 4: Space Climatology*..... 6  
*Theme 4.1: Solar Irradiance Variability*..... 7  
*Capacity Building and Education*..... 7  
*Report on the First Capacity Building Workshop on Space Science during November 7-15, 2005 at NCU, Taiwan*..... 7  
*CAWSES Brazil meeting at the STP-11 Symposium in Rio de Janeiro, March 06-10 2006*..... 7  
*Contributions from the CAWSES Community* ..... 7  
*Improving the derivation of Dst index* ..... 7  
*TIDI Observations of the Mesosphere and Lower Thermosphere*..... 8  
*Solar Irradiance Improvements Survey Results*..... 9  
*Two new optical and magnetometer stations in Canada at polar-cap and subauroral latitudes* ..... 9  
*International Space Weather Conference, November 21-25, 2005, MaCau* ..... 10  
*Important Announcements from the CAWSES Office*..... 10  
*ICTP Advanced School on Space Weather in May 2-19, 2006 in Miramare - Trieste, Italy*..... 10

<i>CAWSES Workshop on Ice Layers, May 15-17, 2006.....</i>	<i>10</i>
<i>IAGA/ICMA/CAWSES Workshop on Long Term trends in Atmosphere, September 4-8, 2006.....</i>	<i>10</i>
<i>CAWSES International Workshop on Space Weather Modeling (CSWM) November 14-17, 2006.....</i>	<i>11</i>
<i>MST-11: Eleventh International Workshop On Technical And Scientific Aspects Of MST Radar at NARL, Gadanki, India, during December 11-15, 2006.....</i>	<i>11</i>
<i>International School of Atmospheric Radars (ISAR), at NCU, Taiwan during January-February, 2007.....</i>	<i>11</i>
<i>International Symposium on Coupling Processes in the Equatorial Atmosphere (CPEA Symposium) during March 20-23, 2007.....</i>	<i>11</i>
<i>Special Sessions with CAWSES science results during major meetings:.....</i>	<i>12</i>
<i>3rd Annual CAWSES science planning meeting on July 23, 2006 in Beijing, China.....</i>	<i>12</i>
<i>CAWSES News</i>	<i>12</i>
<i>March 2006.....</i>	<i>12</i>

**Update on CAWSES activities since September 2005**

D. Pallamraju ([raju@cawses.bu.edu](mailto:raju@cawses.bu.edu))

We are now approaching the half-way mark of the initially planned 5 years of the CAWSES program. I am happy to report that the program has matured and is yielding many results. The working groups of all the Themes are in place and they are making their experimental plans, identifying data analysis epochs for existing datasets, planning workshops for data analysis and reporting of results. In this *CAWSES News* you will notice several science results and reports of these activities.

The major observational activity has been the CAWSES Space Weather and Atmospheric Coupling Campaigns during September-October 2005. These dates were timed to coincide with the month-long operations of incoherent scatter radar (ISR) during September. In addition, this campaign period took advantage of the Solar filament campaign during September 7-21. The campaign began with a bang as a giant sunspot began erupting on September 7 and within a week it released 11 X-class flares and 28 M-class flares. Such occurrences during the CAWSES campaign were monitored by several space-borne and ground based instrumentation. This campaign was the focus of discussion at a small CAWSES Space Weather Workshop held at Stanford University, USA during December 10-12. Several questions were identified and they will form the focus of detailed data analysis for the forthcoming Virtual Poster Session being organized during May 2006 (see report by J. Kozyra below). The Atmospheric Coupling campaign too produced exciting results, some of which are scheduled to be presented in the special session on CAWSES campaigns in the Joint Assembly during May 23-26 in Baltimore, USA.

As part of the Atmospheric Coupling Processes Theme, the CAWSES Ice layers campaign was held in the summer of 2005. Since these ice layers are very sensitive to background conditions, they are well suited for an investigation of long-term and solar-induced changes in the upper atmosphere. The results from this campaign will be discussed in a Workshop in Kuehlungsborn, Germany during May 15-17, 2006. Further, the Coupling Processes in Equatorial Atmosphere (CPEA) group

had a two month campaign, November-December of 2005, which involved ground and radiosonde measurements to investigate: the convection over the South Asian region; gravity wave excitation due to orography; spatial structure for generation of plasma bubbles; and so on. The papers emanating from this campaign are currently in the review process for printing in the Journal of Meteorological Society of Japan.

We are very pleased that Sunanda Basu was invited to give an URSI General Lecture in New Delhi, India on "Impacts of Extreme Solar Disturbances on the Earth's Near-Space Environment". A feature article entitled, "CAWSES Fosters Sun-to-Earth Observations," by Sarah Simpson, has been published in the November 2005 issue of the *Space Weather Journal*. Marv Geller was invited to give a talk on CAWSES at Beijing University. Invitations and articles such as these are recognition of the efforts that we, the CAWSES community, are putting forward for fostering investigations of the Sun-Earth system.

The CAWSES-AOPR office coordinated the first Capacity Building Workshop in November 2005 wherein several students from South Asian countries were trained on satellite data analysis tools. Further, to foster capacity building, CAWSES is co-sponsoring various activities, such as; the International Advanced School on Space Weather at ICTP, Trieste in Italy, COSPAR, and IAGA/ICMA/CAWSES Workshop on Long-Term Trends in the Atmosphere.

The most recent activity for the CAWSES community was SCOSTEP's STP-11 meeting that was held in Rio de Janeiro, Brazil during March 6-10. There have also been several changes in the structure of SCOSTEP of great importance to CAWSES (see below). We look forward to Susan Avery's leadership and hope to benefit from Sunanda's wealth of experience far into the future.

We had to reduce the font size to 10 from the usual 11 to include most of your contributions. Therefore, although you will notice 12 printed pages, just as the previous Newsletters, more developments are reported in this *CAWSES News*. I hope you will enjoy reading these reports as much as I do!

**Report on SCOSTEP Bureau meetings in Rio, Brazil March 5-12, 2006**

Abstracted from Notes of Joe Allen ([joe.h.allen@noaa.gov](mailto:joe.h.allen@noaa.gov))

SCOSTEP Bureau meeting was held on March 5. Minutes of this meeting are in preparation and will be posted on the SCOSTEP website when completed. Sunanda Basu represented CAWSES and gave a detailed presentation on the very active current status of CAWSES. At that meeting, the Bureau confirmed that Susan Avery will become the Co-Chair of CAWSES with Sunanda for a 6-month overlap period beginning April 1 and then will become Chair of the CAWSES Science Steering Group on August 1, 2006. The Bureau also accepted the retirement of Joe H. Allen, the long-time SCOSTEP Scientific Secretary. Both Sunanda and Joe had announced their

intention to relinquish their duties due to health reasons at the Bureau Meeting in Taipei in May 2005. The Bureau unanimously confirmed Gang Lu, Research Scientist at the National Center for Atmospheric Research (NCAR) as Scientific Secretary for SCOSTEP and accepted the kind offer of Tim Killeen, Director, NCAR, to locate the Secretariat there. On March 11, the SCOSTEP General Council met to discuss Bureau actions and consider concerns expressed by national Adherent Representatives. The Bureau held a half-day closing meeting on March 12 to consider actions arising from the Council Meeting the day before and to complete their agenda. The next meeting of the SCOSTEP Bureau will take place in conjunction with the IUGG Meeting in Perugia in July 2007.

### **Report on STP-11 Symposium, March 6-10, 2006**

Gang Lu ([ganglu@ucar.edu](mailto:ganglu@ucar.edu))

The 11th Quadrennial Solar Terrestrial Physics Symposium (STP-11) was held during March 6-10, 2006 in Rio de Janeiro, Brazil. The conference was attended by 135 participants from 26 countries in South and North America, East and West Europe, Asia, Australia, and Africa. The sessions of STP-11 were organized according to the CAWSES science Themes. Prof. C. de Jager gave the opening keynote talk on "Solar Activity and Climate Variation". Other keynote presentations were given by J. Allen on "Space Weather", G. Brasseur on "Middle Atmosphere", A. Petrukovich on "Magnetotail Global Dynamical Structure and Stability", and T. Killeen on "Progress and Challenges in Thermosphere-Ionosphere Sciences". The keynote presentations along with a number of other papers are now available at: <http://www.ngdc.noaa.gov/stp/SCOSTEP/scostep.html> and <http://www.hao.ucar.edu/scostep>.

Other invited and contributed presentations given in the conference covered a wide range of research areas in the Sun-Earth system, from solar activities, magnetospheric and ionospheric disturbances, to the coupling processes in the middle and upper atmosphere. Over 170 scientific papers were presented at the conference in either oral or poster format, showing great advances in recent understanding of the coupled Sun-Earth system.

Meetings of opportunity were held by the ISES Group led by David Boteler of Canada to discuss the establishment of a Space Weather Warning Center in Brazil to provide services to South America, Central America and Mexico. Also a special evening meeting on CAWSES opportunities in Brazil was held on March 8 and informative presentations were given by our Brazilian colleagues on their very active participation in the Sun-Earth system science.

### **CAWSES Committee Members (March 2006)**

#### **Science Steering Group**

<b>Sunanda Basu, Chair</b>	<a href="mailto:sbasu@bu.edu">sbasu@bu.edu</a>
<b>Susan Avery, Incoming Chair</b>	<a href="mailto:susan.avery@colorado.edu">susan.avery@colorado.edu</a>
J.-L. Bougeret	<a href="mailto:jean-louis.bougeret@obspm.fr">jean-louis.bougeret@obspm.fr</a>
J. Haigh	<a href="mailto:j.haigh@ic.ac.uk">j.haigh@ic.ac.uk</a>
Y. Kamide	<a href="mailto:kamide@stelab.nagoya-u.ac.jp">kamide@stelab.nagoya-u.ac.jp</a>

C.-H. Liu	<a href="mailto:chliu@cc.ncu.edu.tw">chliu@cc.ncu.edu.tw</a>
A. Richmond	<a href="mailto:richmond@ncar.ucar.edu">richmond@ncar.ucar.edu</a>
L. Zelenyi	<a href="mailto:lzelenyi@iki.rssi.ru">lzelenyi@iki.rssi.ru</a>
D. Pallamraju, Scientific Coordinator	<a href="mailto:raju@cawses.bu.edu">raju@cawses.bu.edu</a>
E. Buck, Program Administrator	<a href="mailto:etbuck@bu.edu">etbuck@bu.edu</a>

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

<b>M. Lockwood, Co-Chair</b>	<a href="mailto:mike.lockwood@rl.ac.uk">mike.lockwood@rl.ac.uk</a>
<b>L. Gray, Co-Chair</b>	<a href="mailto:lesley@met.rdg.ac.uk">lesley@met.rdg.ac.uk</a>

#### **WG 1.1 Assessment of Evidence for the Solar Influence on Climate:**

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

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

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

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

<b>J. Kozyra, Co-Chair</b>	<a href="mailto:jukozyra@engin.umich.edu">jukozyra@engin.umich.edu</a>
<b>K. Shibata, Co-Chair</b>	<a href="mailto:shibata@kwasan.kyoto-u.ac.jp">shibata@kwasan.kyoto-u.ac.jp</a>
S. Basu	<a href="mailto:basu@ppd.nrl.navy.mil">basu@ppd.nrl.navy.mil</a>
W. Gonzalez	<a href="mailto:gonzalez@dye.inpe.br">gonzalez@dye.inpe.br</a>
A. Petrukovich	<a href="mailto:apetruko@iki.rssi.ru">apetruko@iki.rssi.ru</a>
R. Schwenn	<a href="mailto:schwenn@limpi.mpg.de">schwenn@limpi.mpg.de</a>
R. Sridharan	<a href="mailto:r_sridharan@vssc.org">r_sridharan@vssc.org</a>
F. Wei	<a href="mailto:fswwei@spaceweather.ac.cn">fswwei@spaceweather.ac.cn</a>

#### **WG 2.1 Enhanced Resolution GPS TEC Maps:**

<b>A. Coster, WG 2.1 Co-Leader</b>	<a href="mailto:ajc@haystack.mit.edu">ajc@haystack.mit.edu</a>
<b>M. Hernandez-Pajares, WG 2.1 Co-Leader</b>	<a href="mailto:manuel@mat.upc.es">manuel@mat.upc.es</a>
E. de Paula	<a href="mailto:eurico@dae.inpe.br">eurico@dae.inpe.br</a>
C. Mitchell	<a href="mailto:c.n.mitchell@bath.ac.uk">c.n.mitchell@bath.ac.uk</a>
C. Valladares	<a href="mailto:valladar@bc.edu">valladar@bc.edu</a>

#### **WG 2.2 CAWSES/IAGA/GEM Magnetospheric Observations:**

<b>I. Mann, WG 2.2 Leader</b>	<a href="mailto:imann@space.ualberta.ca">imann@space.ualberta.ca</a>
M. Engebretson	<a href="mailto:engebret@augsborg.edu">engebret@augsborg.edu</a>
J. Love	<a href="mailto:jlove@usgs.gov">jlove@usgs.gov</a>
M. Moldwin	<a href="mailto:mmoldwin@ucla.edu">mmoldwin@ucla.edu</a>
A. Viljanen	<a href="mailto:ari.viljanen@fmi.fi">ari.viljanen@fmi.fi</a>
K. Yumoto	<a href="mailto:yumoto@geo.kyushu-u.ac.jp">yumoto@geo.kyushu-u.ac.jp</a>
E. Zesta	<a href="mailto:ezesta@atmos.ucla.edu">ezesta@atmos.ucla.edu</a>

#### **WG 2.3 Solar Sources of Geoeffective Disturbances:**

<b>N. Gopalswamy, WG 2.3 Leader</b>	<a href="mailto:gopals@fugee.gsfc.nasa.gov">gopals@fugee.gsfc.nasa.gov</a>
B. Jackson	<a href="mailto:bjackson@ucsd.edu">bjackson@ucsd.edu</a>

S. T. Wu *wus@cspar.uah.edu*  
WG 2.4 Continuous H $\alpha$  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@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, WG 3.1 Co-Leader *m.g.mlynczak@larc.nasa.gov*  
W. Ward, WG 3.1 Co-Leader *ward@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

**M.A. Geller, Co-Chair** *Marvin.Geller@sunysb.edu*  
**S.-T. Wu, Co-Chair** *wus@cspar.uah.edu*  
**Gang Lu, Scientific Secretary** *ganglu@ucar.edu*

### Awards/Honors for SCOSTEP/CAWSES Scientists

**Joe Allen** has been nominated as an honorary SCOSTEP fellow in March 2006.

**R. A. Heelis** has been nominated AGU Fellow for 2006. He will deliver the Nicolet Lecture at the AGU Joint Assembly in May 2006.

**S.-T. Wu** received the first James A. Van Allen Space Environment Award from the American Institute of Aeronautics and Astronautics (AIAA) in January 2006.

We congratulate them on their well-deserved recognition.

### Progress under CAWSES Themes

#### Theme 1: Solar Influences on Climate

In June 2005, there was a Workshop on Solar Variability and Planetary Climates at ISSI, Bern. Another meeting is expected there in April 2006 for the preparation of the proceedings. The upcoming volume in the Space Science Series of ISSI, on Solar Variability and Planetary Climates is progressing nicely. This volume is being edited by five people among whom are Lesley Gray and Michael Lockwood, the Co-Chairs of Theme 1. The contents of this hardcover book published by Springer will also be available as an issue of the *Space Science Reviews* in 2007.

"The open society, the unrestricted access to knowledge, the unplanned and uninhibited association of men for its furtherance - these are what may make a vast, complex, ever growing, ever changing, ever more specialized and expert technological world, nevertheless a world of human community."

– **J. Robert Oppenheimer**, (1904-1967)

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

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### *Report of CAWSES Space Weather workshop at Stanford, December 10-12, 2005*

Report by K. Shibata ([shibata@kwasan.kyoto-u.ac.jp](mailto:shibata@kwasan.kyoto-u.ac.jp))

A mini-workshop on Space Weather was held at Stanford University during December 10-12, 2005. The purpose of the workshop was not only to discuss the campaign observation results of September 2005, for both the 2<sup>nd</sup> CAWSES Space Weather and JOP178 Solar Filament observation campaigns, but also to encourage better communication between solar and geophysicists through collaboration on the campaign observational results. About 36 people attended, including 16 solar physicists and 20 geophysicists, mainly from USA and Japan. Though the time after the campaign was short, interesting reports of various observations were presented, partly because the solar activity during this campaign was extremely high due to the delta-type sunspot region NOAA 0808 from where 11 X-class and 28 M-class flares occurred during the campaign. It was also found that intensive communication between solar and geophysicists was quite useful and necessary, and this kind of interdisciplinary meetings (even small and informal in nature) will have to be held more frequently in the future. We appreciate all SOC members: J. Kozyra, K. Shibata, J. T. Hoeksema, T. Roudier, T. Ogino, S. Kikuchi, H. Hudson, B. Tsurutani, N. Nitta, N. Gopalswamy, B. Schmieder, M. Oka, and particularly thank T. Hoeksema for his help as LOC-chair.

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### *Virtual Poster Session on the results from Sun-to-Earth Observational campaigns during May, 2006*

Report by Janet U. Kozyra ([jukozyra@engin.umich.edu](mailto:jukozyra@engin.umich.edu))

An Internet-based cross-disciplinary analysis campaign that will make heavy use of Great Observatory missions as well as international satellite and ground-based assets is being undertaken with joint support from the CAWSES, IHY, LWS, and ICESTAR programs planned for May 2006. An evolving list of open science questions that serve as sun-to-Earth focus areas for the worldwide campaign were identified during a small interdisciplinary CAWSES workshop at Stanford University in December 2005, as well as during a joint CAWSES/ICESTAR session at the CEDAR meeting in Boulder during the preceding summer. The analysis campaign will take place over the Internet in the form of Virtual Poster Sessions with message boards and monitors that summarize the important science issues and new results daily. Poster authors will be asked to closely monitor their message boards during the day of their poster session as well as the following day. Outreach to other disciplines and international students will take the form of tutorial talks that place campaign science issues into the context of the current state of knowledge in each discipline area. Global models and data sets (TEC, magnetometer maps, ULF wave maps, assimilative models, MHD model outputs, continuous solar images) will be available to provide context for local and regional observations. The Community Coordinated Modeling Center (CCMC) is developing a small number of new data display formats that

extract data from global models and place it in the same format as the observations either for ground-based stations or along satellite tracks. Other ideas being explored include real time upload of additional posters in response to issues raised during the poster session, library of related articles, reference archive of observations, etc. Please stay tuned for more information on this Virtual Poster Session.

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## *Theme 3: Atmospheric Coupling Processes*

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### *Report on CAWSES Ice Layers Campaign in 2005*

Report by Franz-Josef Luebken, Scott Bailey, Ulf-Peter Hoppe ([luebken@iap-kborn.de](mailto:luebken@iap-kborn.de))

The Theme 3 project entitled “Solar influence on minor constituents and layers at the extra-tropical summer mesopause” was established in 2004. One of the major activities within this project was to stimulate and coordinate activities in the summer of 2005 to measure atmospheric parameters related to ice particles in the mesopause region at middle and polar latitudes. This included ground based and satellite borne detection of ice layers and measurements of temperatures, winds, and minor constituents. The aim of this coordinated effort was to study the morphology of ice layers and related atmospheric parameters. These ice layers are very sensitive to background conditions and are therefore well suited to indicate long-term and solar-induced changes in the upper atmosphere. The 2005 campaign also encouraged relevant modeling efforts, for example, the microphysics of ice particle generation and GCM modeling to study the seasonal and geographical distributions of ice layers and feedback effects on the atmosphere.

In the summer of 2005 several research groups participated in the campaign and performed simultaneous measurements on various platforms. For example, lidar and radar measurements, respectively, of NLC (noctilucent clouds) and PMSE (polar mesosphere summer echoes) were performed quasi continuously at mid and Arctic latitudes. They also measured temperatures and winds. At the same time instruments on board various satellites (e.g., ODIN, ENVISAT, TIMED, SBUV, ACE, UARS) measured ice layers and trace gases in the summer mesopause region, some for the first time. Information about the background atmosphere is available from various instruments (lidars, radars, ground based microwave radiometer, satellite based spectrometers etc.). Rocket borne instruments measured dust particles in the mesosphere which play a major role in ice particle nucleation. In January 2005 (i.e., just before the summer campaign) a major field campaign was conducted in Northern Norway to study polar mesosphere winter echoes, the winter counterpart of PMSE with unexplained origin.

Model studies made impressive progress in the last few years to better understand the microphysical processes of ice particle generation and the seasonal and geographical distribution of ice layers. A workshop is planned for May 2006 in Kuehlungsborn (see page 10) to collect and discuss the available measurements and to interpret the results with the help of simulations and models.

### ***Progress of Coupling Processes in the Equatorial Atmosphere (CPEA) project***

Report by Shoichiro Fukao and Mamoru Yamamoto  
([yamamoto@kurasc.kyoto-u.jp](mailto:yamamoto@kurasc.kyoto-u.jp))

The Indonesian Archipelago within the Western Pacific region is known to be the center of intense atmospheric motion and global atmospheric change. The mechanisms of these atmospheric changes and fluctuations, however, have not yet been made clear due to the sparseness of observational data in that region. The Coupling Processes in the Equatorial Atmosphere (CPEA) program is a six-year (2001-2007) research project undertaken primarily by Japanese scientists to study dynamical and electrodynamical coupling processes in the equatorial atmosphere. CPEA hopes to foster pioneering research, primarily by means of ground-based observations in the Indonesian equatorial region. The main facility for CPEA is the Equatorial Atmosphere Radar (EAR), located right at the equator in West Sumatra, Indonesia. EAR has been continuously operated in close collaboration between the Research Institute for Sustainable Humanosphere (RISH), Kyoto University, and the National Institute of Aeronautics and Space (LAPAN) of Indonesia. In addition to the EAR, CPEA now operates several radars (one boundary layer radar, two X-band weather radars, a meteor radar, and a VHF radar for ionospheric irregularities, and an integrated system of Lidars (Mie Lidar, Rayleigh Lidar, and Na/Fe Lidar), optical instruments for airglow experiments (all-sky imager and temperature photometer), a GPS receiver, a magnetometer, a radiometer for water vapor, and several surface instruments for weather. We also have a FM-CW ionosonde that is one node of the equatorial ionosonde network operated by the National Institute of Information and Communications Technology (NICT). Also two MF radars in Pontianak and Pameungpeuk and one airglow imager in Tangjungsari are operated under CPEA. Most of the instruments are operated continuously. In addition to these long-period observations, we conducted two international observation campaigns, CPEA-I (March-May, 2004; known as the first CAWSES Space Weather and CPEA observational campaign) and CPEA-II (November-December 2005). During CPEA-I we launched many radiosondes from six sites (three sites in Indonesia, two sites in Malaysia, and a site in Singapore) every 6/12 hours. In CPEA-II, we selected three of these sites for every 6/12-hour launches, but conducted more intensive every-hour launches (each run was 18-24 hours duration) from the EAR site. Some examples from our noteworthy results are the following: peculiar features of cumulus convection over Sumatra; gravity wave excitation; ENSO and ISO signals in the mesopause-homopause region; spatial structure and onset of the plasma bubbles; and the conjugacy of equatorial plasma bubbles between the two hemispheres. We are now editing a special issue of the Journal of the Meteorological Society of Japan with 24 papers on our CPEA results. Information on the project and the facilities can be obtained from the following URLs.

CPEA (English): <http://www.rish.kyoto-u.ac.jp/cpea/CPEA-Eng>  
EAR (English): <http://www.rish.kyoto-u.ac.jp/ear/index-e.html>

### ***Low latitude radar network for investigation of dynamical processes in the mesosphere-lower thermosphere region***

Report by S. Gurubaran, H. Takahashi and T. Nakamura  
([gurubara@iigs.iigm.res.in](mailto:gurubara@iigs.iigm.res.in))

This is to inform the CAWSES community that a new activity aimed at utilizing the low latitude radar network for investigation of dynamical coupling processes in the tropical mesosphere-lower thermosphere (MLT) region under Theme 3 of CAWSES has been proposed during the CAWSES meeting at Toulouse in July 2005. This will form a part of the Theme 3 project: 'Equatorial Atmospheric Coupling Processes' (M. Yamamoto, H. Takahashi and S. Gurubaran are the coordinators for this project). This sub-project will have the primary objective of delineating and understanding the longitudinal structure and regional dynamics of planetary-scale waves like tides in the tropical MLT region.

Some topics that are to be addressed under this sub-project are:

- 1) Longitudinal variabilities of diurnal tide activity in winds at MLT heights: identification of migrating/non-migrating tides, zonal wavenumbers, etc., long- and short-term variabilities, relationship to sources (convection, orography, etc.) and background wind systems (QBO and SAO) in various longitude zones.
- 2) Equatorial waves and their regional characteristics, determination of zonal wavenumbers, relationship to convective activity.
- 3) Energy and momentum budgets of SAO, QBO and ISO at MLT heights: contributions from planetary-scale waves.

We would like to invite those who are involved in equatorial MLT research to join in this collaborative work. Please email us some details about the status of your radar systems (period of operation, heights covered, sampling time, height resolution, etc.). Initial studies under this sub-project will utilize data bases from recent years as many tropical radar installations started operating in 2002. We are in the process of identifying groups that will undertake collaborative studies aimed at promoting the above scientific areas that are important for Theme 3 of CAWSES.

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### ***Theme 4: Space Climatology***

Report by Claus Frohlich (Co-Chair) ([cfrohlich@pmodwrc.ch](mailto:cfrohlich@pmodwrc.ch))

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A major milestone was the STP-11 Symposium where Theme 4 was well represented with both invited and contributed talks. Moreover, Theme 4 had many informal discussions with members of Themes 1 and 3, in particular between the working groups with overlapping subjects. The cooperation between Themes 3 and 4 is already well established. Further, there is now an agreement that Theme 4 will be officially represented at the ISSI Team meeting of Theme 1 in late April this year.

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### **Theme 4.1: Solar Irradiance Variability**

Report by Judit Pap ([papi@marta.gsfc.nasa.gov](mailto:papi@marta.gsfc.nasa.gov))

CAWSES WG 4.1, in conjunction with Theme 1, had a meeting on Solar Variability and Climate in Rome, during June 26-July 1, 2005. The meeting was a great success and the conference publication will be available in the forthcoming months. WG 4.1 has continued its efforts on supporting solar variability and climate research. This included a special session at the 2005 Fall AGU meeting on solar irradiance variations (organizers: Richard Willson and Judit Pap). The French PICARD mission is on schedule to be launched in October 2008. PICARD will carry two radiometers which will measure total solar irradiance and Sun Photometers for measuring spectral irradiance. This satellite will take high resolution images to measure solar diameter and limb oscillations. WG 4.1 invested lot of efforts in the development of the experiment on-board PICARD and an active collaboration between PICARD and HMI (Helioseismic and Magnetic Imager) on SDO (Solar Dynamic Observatory) is being developed to maximize the science outcome of the two experiments. We also note that PICARD has been designated as one of the ILWS missions.

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### **Capacity Building and Education**

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#### **Report on the First Capacity Building Workshop on Space Science during November 7-15, 2005 at NCU, Taiwan**

Report by Shin-Yi Su ([sysu@jupiter.ss.ncu.edu.tw](mailto:sysu@jupiter.ss.ncu.edu.tw))

The CAWSES-AOPR (Asia Oceania Pacific Rim) Coordinating Office located on the campus of National Central University (NCU) in cooperation with the National Science Council of the Republic of China held the “First Capacity Building Workshop of Space Science for Southeast Asian Scientists” during November 7-15, 2005 at NCU, Chung-Li, Taiwan. The purpose of the workshop was to introduce scientists in Southeast Asian region about the 2004-2008 worldwide scientific observation and research program Climate and Weather of the Sun-Earth System (CAWSES) which is sponsored by SCOSTEP. The central topic of the workshop was Space Weather effects on the Ionosphere. A total of 21 scientists from Indonesia, Thailand, and Vietnam participated in the workshop. The workshop tutors were from faculty members of Space Science Institute at NCU with two additional distinguished foreign scientists, Professors R. A. Heelis of UTD and K.-I. Oyama of ISAS/JAXA. The main teaching material was the data from 1999-2004 of Taiwan’s first satellite ROCSAT-1, now renamed as FORMOSAT-1. We distributed the satellite data to the participants to encourage them to use the space in-situ observations together with their respective local ground observations to study the regional variation of the ionospheric effects due to space weather impact. Great and enthusiastic responses have been received from the participants after the workshop. Valuable lessons learned from this first capacity building workshop will be incorporated into the second workshop which will be announced shortly.

### **CAWSES Brazil meeting at the STP-11 Symposium in Rio de Janeiro, March 06-10 2006**

Report by M.A. Abdu and H. Takahashi ([maabdu@dae.inpe.br](mailto:maabdu@dae.inpe.br))

A CAWSES–Brazil meeting was held on March 8 during the STP-11 Symposium in Rio de Janeiro, with the objective to discuss the research activities being conducted under the CAWSES Themes by different research institutions and groups in Brazil. The meeting was convened by M.A. Abdu and H. Takahashi from the Brazilian National Institute for Space Research (INPE), and was attended by around 40 participants that included scientists from Brazilian research centers, representatives from the SCOSTEP bureau and delegates from other participating countries. Brief opening remarks by the CAWSES Chair Sunanda Basu emphasized the importance of such regional meetings. That was followed by brief presentations by representatives from various institutions in Brazil. The presentations covered the following aspects of the CAWSES activities in Brazil: An overview of the CAWSES activities in Brazil, by M. A. Abdu (INPE); INPE’s ground based observational network for studies on Atmospheric Coupling Processes, by I. S. Batista (INPE); CAWSES Campaigns in Brazil in 2005, by H. Takahashi (INPE); CAWSES related projects and activities in southern Brazil at CRSPE/INPE, Santa Maria, by N. J. Schuch (CRSPE/INPE); CAWSES related research at UNIVAP, Sao Jose dos Campos, by P. R. Fagundes (UNIVAP); CAWSES related research at CRAAM, Sao Paulo, J. P. Raulin (CRAAM); Magnetospheric investigations at INPE related to CAWSES, by Alisson dal Lago (INPE); Theory and Modeling of the Influence of Solar Activities on Climate at INPE and WISER, by Abraham Chian (INPE); and Solar and Geophysical observations in ON and UFRJ, by Alexandre Andrei (ON, UFRJ). The meeting was a success in that it provided a good overview of the wide ranging activities related to the CAWSES Themes being conducted in Brazil.

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### **Contributions from the CAWSES Community**

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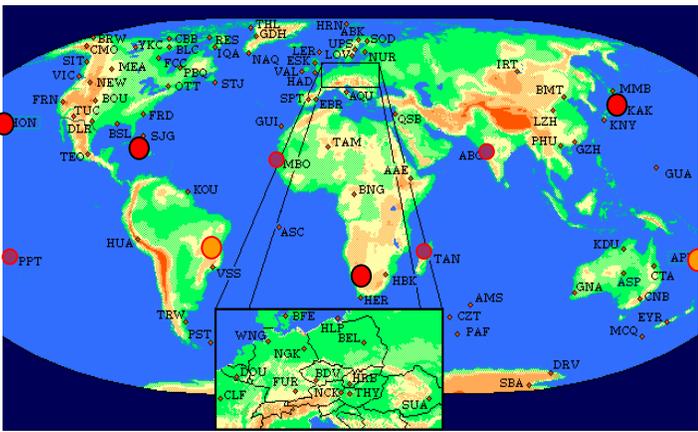
#### **Improving the derivation of Dst index**

Leif Svalgaard ([agu@leif.org](mailto:agu@leif.org))

In deriving the geomagnetic  $D_{st}$  index, there are several steps: 1) Selecting observatories at low latitude, yet still away from the equatorial electrojet, 2) Removing the ‘main field’ and 3) Removing the solar-diurnal regular variation. The commonly used procedures have problems. In this note I shall outline an approach that largely removes the existing problems.

#### **1) Selection of Observatories:**

The stations  used for the standard  $D_{st}$  index are predominantly in the Northern hemisphere. I propose to use two more stations  from the Southern Hemisphere. An additional four stations  (two in each hemisphere) would be even better and improve the longitudinal coverage. These stations are INTERMAGNET stations and data is available in near real-time as well as back in time.



## 2) Removing the ‘Main Field’

A common practice is to calculate an average “quiet” field using the “five quiet days” per month, except that some of these days may not be quiet at all; they just happen to be the least disturbed ones during that month. It would be better to use only days where *no* 3-hour interval had an *aa*-index value exceeding some threshold, say 12. Then compute the yearly averages of the day number within the year and of the geomagnetic component field value for all these “truly” quiet days within the year and fit a, say, 2<sup>nd</sup>-order polynomial to these yearly pairs of numbers for five years centered on the year within which we wish to derive the main field and finally use that fit to interpolate the main field for any given day within that year.

## 3) Removing the Solar-Diurnal Variation

The daily variation is complex and varies with season (solar zenith angle) and phase of the sunspot cycle (EUV flux). People have tried to describe this complicated variation by a combination of linear terms and a smoothed 2D Fourier expansion as function of time of year and time of day. This is not satisfactory, as the (un-modeled) day-to-day variation of the daily variation is as large as the variation itself.

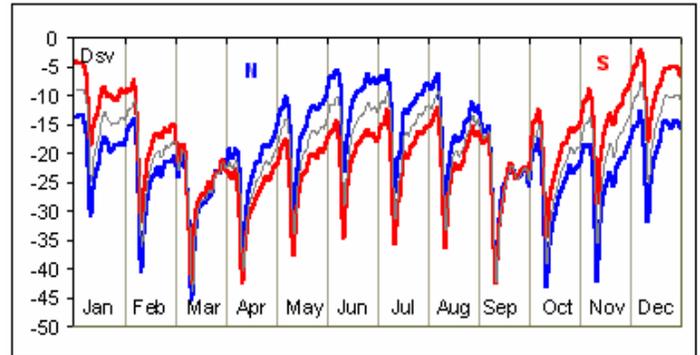
The regular solar-diurnal variation is effectively absent during the night-hours, so I suggest to bypass the problem by only using night hours and calculate  $D_{st}$  as the observed value minus the interpolated main field,  $H_0$ , with no empirical adjustments of any kind:

I have identified 14 stations (7 in the Northern Hemisphere - San Juan, Puerto Rico (SJG), Honolulu (HON), Kakioka (KAK), She-Shan (SSH), M’Bour (MBO), Tashkent (TKT), and Alibag (ABG); 7 in the Southern Hemisphere – Hermanus, Cape Town (HER-CTO), Apia (API), Tananarive (TAN), Pilar (PIL), Pamatai (PPT), Trelew (TRW), and Vassouras (VSS) in a latitude band suitable for derivation of  $D_{st}$  and with long-term coverage. No cosine (latitude) correction is necessary.

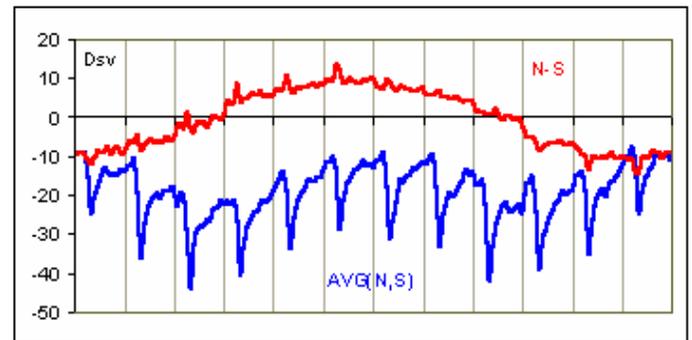
## The Annual Variation

I have swept a problem under the rug which is the Annual Variation. This is perhaps best illustrated with a superposed epoch analysis using Sudden Storm Commencements as key events: The data interval is 1929-2002. The curves plotted

within each month show 15 daily values superposed with the SSC on day four.  $D_{st}$  derived from the Northern and Southern hemispheric stations are shown in blue and red. It is clear that during local summer,  $D_{st}$  is more positive compared to local winter, however, their average cancels out this annual variation.



The difference (N-S) shows the annual variation in its simple, pure form. The average, (N+S)/2, shows no annual variation. Instead, the well-known *semiannual* variation is evident. The cause of the annual variation is not well understood, but that does not matter much for  $D_{st}$  because it cancels out in the balanced average of the two hemispheres.



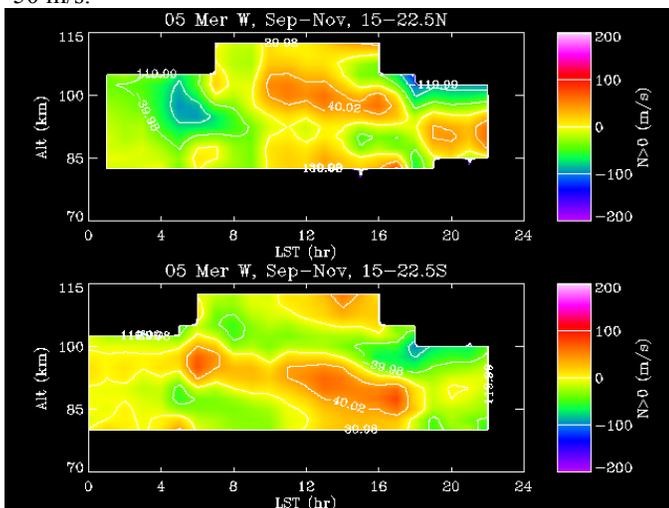
Because the official  $D_{st}$  index is the average of three stations from Northern hemisphere and only one from Southern hemisphere, the annual variation does not cancel out in a natural way and has to be explicitly removed, usually as part of the functions fitted for the removal of the solar diurnal variation. It does not seem necessary to employ complicated and perhaps dubious fitting procedures to construct a storm-time ring-current index. The key point is to use only nighttime data for taking solar diurnal variation into account and to use equal number of stations in both hemispheres in order to remove the annual variation in a natural way.

## TIDI Observations of the Mesosphere and Lower Thermosphere

Report by Rick Niciejewski ([niciejew@umich.edu](mailto:niciejew@umich.edu))

The NASA TIMED satellite has been measuring geophysical parameters of the terrestrial atmosphere on a continual basis since early 2002. The Thermosphere Ionosphere Doppler Imager (TIDI), built and operated by the University of Michigan, measures the neutral wind in the mesosphere and lower

thermosphere in an altitude range of 80 to 115 km via limb scanning, with a temporal resolution of 100 seconds and an altitude resolution of 2.5 km, and has a duty cycle of ~95%. The satellite precession rate of 12 minutes per day allows TIDI to sample all Local Solar Time during a 60-day “yaw-cycle” interval. As a consequence, it is convenient to average all measured winds during a “yaw-cycle” to generate climatological maps of the upper atmospheric wind pattern on a global basis. An example is shown in the figure below, where the meridional wind component is shown in a color-coded fashion as a function of altitude and local solar time for two opposing low latitude ranges for the period of mid-September to mid-November, 2005. The dominant signal expected at low latitudes in the mesosphere and lower thermosphere during the equinox period is the (1,1) component of the diurnal tide, which are clearly described by the TIDI winds. A vertical wavelength of approximately 24 km can be assigned to the winds, which have a maximum amplitude of ~50 m/s.



TIDI meridional winds measured from mid-September to mid-November 2005, grouped to synthesize an averaged day during this period. Winds over the latitude range 15-22.5 N (top) and 15-22.5 S (bottom) are shown as a function of altitude and Local Solar Time. The wind magnitude scale is given on the right. Data were extracted from the TIDI Level 2 (version 8) product, available via <http://tidi.engin.umich.edu>.

The period of study discussed above for the above figure coincides with the September/October 2005 CAUSES Global Observing Campaign, the goal of which is to characterize tides and their influence on the terrestrial atmosphere. Satellite wind measurements of the mesosphere and lower thermosphere from TIDI provide a global context to begin understanding correlations between planetary scale oscillations such as the QBO and upper atmosphere dynamics.

“The idea is to try to give all the information to help others to judge the value of your contribution; not just the information that leads to judgment in one particular direction or another.”  
 – **Richard P. Feynman**, (1918-1988)

### Solar Irradiance Improvements Survey Results

Report by Kent Tobiska ([ktobiska@spacenvironment.net](mailto:ktobiska@spacenvironment.net))

In October 2005 Space Environment Technologies (SET) sent out a survey asking how to improve solar irradiance products. Over 50 international responses indicated areas important to irradiance users and requested improvements for research and operations.

The irradiance improvements most requested are a) high spectral resolution b) higher time resolution, c) indices for use in specific applications, d) energy and spectral format variety, and e) combinations of solar models and data sets. The survey indicated that solar irradiance products are most used for atmospheric densities, ionospheric parameters, photoionization rates, and effects on spacecraft materials.

Using these responses, major improvements to irradiances are being made and include:

1) Provision of 6 solar indices (daily and 81-day F10.7, Sev, and Mg10.7 provided through SOLAR2000 (S2K) Research Grade (RG) v2.27) that will drive the new modified Jacchia model of thermospheric densities. This model reduces density uncertainties by half compared with previous Jacchia and MSIS type models (freely available in summer 2006 through <http://SpaceWx.com>).

2) S2K RG v3 (summer 2006 release) will be a hybrid model (empirical/physical with real-time data ingestion) and will provide high spectral (0.1 nm) and time (1 minute) resolution of the XUV-EUV spectrum from 0.1-30.0 nm with unprecedented capabilities for looking at solar flare effects upon planetary ionospheres and atmospheres.

3) In 2006, ISO will publish the International Standard 21348 “Process for determining solar irradiances”. Many in the solar irradiance community have contributed to this document and S2K is fully compliant with ISO 21348.

S2K RG may be freely downloaded (S2KRG quick link - <http://SpaceWx.com>) and can run on the free IDL Virtual Machine. The Professional Grade model (hourly cadence forecasts with daily time resolution out to 5 solar rotations) is available directly from SET.

### Two new optical and magnetometer stations in Canada at polar-cap and subauroral latitudes

Report by Kazuo Shiokawa ([shiokawa@stelab.nagoya-u.ac.jp](mailto:shiokawa@stelab.nagoya-u.ac.jp))

New auroral and magnetic field measurements were started at two stations in Canada (Resolute Bay and Athabasca) by the Solar-Terrestrial Environment Laboratory, Nagoya University. The measurement at Resolute Bay (74.7N, 265.1E, geomagnetic latitude (MLAT): 83 degree) has been conducted since January 9, 2005, using a monochromatic all-sky cooled CCD imager. The measurements at Athabasca (54.7N, 246.7E, 62 MLAT) has been conducted since September 3, 2005, using a

monochromatic all-sky cooled-CCD imager, a filter-tilting meridian-scanning photometer for proton aurora, and an induction magnetometer. Quick-look plots and data availability are opened in the homepage at: <http://stdb2.stelab.nagoya-u.ac.jp/canada/>. The optical instruments at these stations are part of the Optical Mesosphere Thermosphere Imagers (OMTIs, homepage: <http://stdb2.stelab.nagoya-u.ac.jp/omti/>). These highly-sensitive optical and magnetic field measurements will be able to address the science issues described by Themes 2 and 3 of CAWSES.

The observation at Resolute Bay is carried out in collaboration with SRI International, USA, University of Calgary, Canada, and University of Electro-Communications, Japan. The observation at Athabasca is carried out in collaboration with Athabasca University and University of Calgary. This work is supported by Grant-in-Aid for Scientific Research (16403007) and by the 21st Century COE Program (Dynamics of the Sun-Earth-Life Interactive System, No. G-4) of the Ministry of Education, Culture, Sports, Science and Technology of Japan. This work is also supported by the Project 2 (Initiatives in geospace research using coordinated ground-satellite experiments) of the Geospace Research Center, Solar-Terrestrial Environment Laboratory, Nagoya University.

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***International Space Weather Conference, November 21-25, 2005, MaCau***

Report by Feng Xi Wei ([fswei@spaceweather.ac.cn](mailto:fswei@spaceweather.ac.cn))

Science and application of Space Weather is currently a hot topic in the scientific world. Studying and forecasting adverse space weather is a scientific challenge that has to be addressed for alleviating or reducing the adverse effects of space weather on navigation, communication and human health. Space weather is becoming an enterprise that contributes to welfare and peace for humankind. The steering committee of space weather at the Department of Geoscience of the National Natural Science Foundation of China and MaCau University of Science and Technology proposed an International Space Weather Conference, which was held November 21-25 at MaCau. This conference was a scientific activity of the CAWSES/SCOSTEP program. Prof. S. T. Wu, the vice-president of SCOSTEP, gave a speech at the opening ceremony. This conference was organized by The Committee of Science and Technology of MaCau and the National Natural Science Foundation of China, and co-organized by MaCau University of Science and Technology and the Center for Space Science and Applied Research, at the Chinese Academy of Sciences.

Over 200 scientists made presentations at the conference. During the five day meeting the state of art space weather science and its application was explored, new progress on space weather was discussed, and it was proposed that a communication platform of Chinese space scientists be established. Especially, popular scientific reports about space exploration and space science were given to MaCau University, which was greatly welcomed by the middle school students. In order to promote the development of the MaCau scientific community, a "MaCau Mini-satellite" will

be proposed by Chinese Scientists, and be built by university and middle school students under the instruction of associated scientists. It is expected that the proceedings of this conference will be published in an international scientific journal.

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***Important Announcements from the CAWSES Office***

D. Pallamraju ([raju@cawses.bu.edu](mailto:raju@cawses.bu.edu))

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***ICTP Advanced School on Space Weather in May 2-19, 2006 in Miramare - Trieste, Italy***

Advanced ICTP school on Space Weather, co-sponsored by CAWSES, COST, ICTP and the US NSWP will be held in Trieste during May 2–19, 2006. The course Co-Directors are Profs. M. Messerotti (Italy) and J. M. Forbes (USA). Topical areas will be covered with a view towards balanced treatment of basic physics, phenomenology and data analysis. The CAWSES support will especially be earmarked for our CAWSES colleagues from Africa.

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***CAWSES Workshop on Ice Layers, May 15-17, 2006***

Submitted by Franz-Josef Luebken ([luebken@iap-kborn.de](mailto:luebken@iap-kborn.de))

CAWSES workshop on Ice Layers, will take place at the Leibniz Institute of Atmospheric Physics in Kuehlungsborn, Germany during May 15-17, 2006. The main subject of this workshop is to exchange results from the "ice layer campaign" which was conducted in the summer of 2005. This includes all relevant measurements (noctilucent clouds, polar mesosphere summer echoes, polar mesosphere clouds, trace gases etc.) and model efforts. Contributions in a broader context are welcome, for example, measurements outside this period, on long term changes, on hemispheric differences of ice layers and related phenomena. More information about the workshop and the venue is available on their website at: [www.iap-kborn.de](http://www.iap-kborn.de) and from their local organizing committee. (Contact: Franz-Josef Luebken; Email: [luebken@iap-kborn.de](mailto:luebken@iap-kborn.de)).

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***IAGA/ICMA/CAWSES Workshop on Long Term trends in Atmosphere, September 4–8, 2006***

Submitted by John Emmert ([jemmert@gmu.edu](mailto:jemmert@gmu.edu))

Increasing concentration of greenhouse gases in the atmosphere, stratospheric ozone depletion, as well as long-term changes of solar and geomagnetic activity can result in long-term changes and trends in the stratosphere, mesosphere, thermosphere and ionosphere. The measurements of atmospheric constituents from space, airborne and ground-based platforms have blossomed in the past two decades and so do the atmospheric models. The main goal of this workshop is to review our current observational and model-simulation knowledge and understanding of the trends in the atmosphere. Papers dealing with availability and quality of observational data for trend studies, observational determination of long-term trends as well as those dealing with simulations and theoretical studies of trends in the mesosphere, thermosphere, ionosphere as well as in the stratosphere are welcome. Publication of proceedings in a peer reviewed international journal is foreseen. Deadline for

abstract submission is May 3, 2006 and the deadline for support application (+abstract) is March 20, 2006; both sent as e-mail attachments to Jan Lastovicka [jla@ufa.cas.cz](mailto:jla@ufa.cas.cz) and Thomas Ulich [thu@sgo.fi](mailto:thu@sgo.fi). Visit <http://www.sgo.fi/Events/ltt-2006/> for more information.

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**CAWSES International Workshop on Space Weather Modeling (CSWM) November 14-17, 2006**

Submitted by K. Shibata ([shibata@kwasan.kyoto-u.ac.jp](mailto:shibata@kwasan.kyoto-u.ac.jp))

Advancement in our understanding of our Space Environment is in great demand now as the dynamic activities of the Sun, the solar wind, magnetosphere and ionosphere influence modern technology systems and can endanger the human life and health. The numerical simulation and modeling driven by integrating observations is a powerful method for understanding the complex Sun-Earth system, and it will be an important means for predicting the space weather. To address this issue an international CAWSES workshop on Space Weather is being organized at the Earth Simulation Center in Yokohama, Japan. This workshop will provide a forum for review of the recent progress and the next scientific challenges in space weather modeling research. Workshop topics include: Modeling of solar and heliospheric magnetic field; Modeling of solar flares, CMEs, and filament eruption; Modeling of solar energetic particles; Modeling of solar wind; Modeling of magnetospheric storm and sub-storm; Modeling of Magnetosphere-Ionosphere coupling; and New simulation algorithms of solar and space plasmas.

**Co-Sponsorship:**

Grant-in-Aid of the MEXT of Japan for Creative Scientific Research "The Basic Study of Space Weather Prediction", CAWSES/SCOSTEP, and others. Financial Support: Limited funds will be available to support qualified students for their local expense. Application information will be provided in the 2<sup>nd</sup> announcement.

**Conveners:**

Kanya Kusano, Earth Simulator Center, Japan Agency for Marine-Earth Science and Technology (JAMSTEC) 3173-25 Showa-machi, Kanazawa-ku, Yokohama 236-0001, Japan. PHONE: +81-45-778-5460 or 5823, FAX: +81-45-778-5493. E-mail: [kusano@jamstec.go.jp](mailto:kusano@jamstec.go.jp). The local map is available at: <http://www.es.jamstec.go.jp/esc/eng/Contact/map.html>

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**MST-11: Eleventh International Workshop On Technical And Scientific Aspects Of MST Radar at NARL, Gadanki, India, during December 11-15, 2006**

Submitted by J. Röttger ([roettger@linmpi.mpg.de](mailto:roettger@linmpi.mpg.de))

The international workshop on MST radar, held about every 2-3 years, is a major event that gathers together experts from all over the world, engaged in research and development of radar techniques to study the mesosphere, stratosphere, troposphere (MST) and the ionosphere. It also offers excellent opportunities to young scientists, research students and new entrants to the field for close interaction with the experts on the technical and scientific aspects of MST radar. The MST-11 will focus on all

aspects of radars, from technical to the results obtained by MST radars and their analysis techniques to address issues from troposphere to ionosphere.

Please email Prof. D. Narayana Rao [profdnrao@narl.gov.in](mailto:profdnrao@narl.gov.in) for further information and for indicating your interest to participate.

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**International School of Atmospheric Radars (ISAR), at NCU, Taiwan during January-February, 2007**

Submitted by J. Röttger ([roettger@linmpi.mpg.de](mailto:roettger@linmpi.mpg.de))

The wide-spread applications of atmospheric radars for scientific research of the atmosphere and for meteorological operations demand a proper knowledge of such atmospheric radar systems, and of the analysis, validation and interpretation of the acquired data. The school (ISAR), planned to be held over a period of one month in January-February 2007 at NCU, Taiwan, will cover the following subjects: fundamentals of atmospheric radars; hardware and basics of signal acquisition; data analysis and validation; special applications such as interferometry and polarimetry; scattering of radar waves; atmospheric winds; precipitation studies; waves and turbulence; meteorology of the troposphere and stratosphere; mesosphere and the basics of radar observations of the ionosphere. The ISAR-NCU directors are: Professors J. Röttger and C. J. Pan. The ISAR-NCU - is sponsored by the National Central University through funding by the Ministry of Education and the National Science Council of Taiwan, the Scientific Committee on Solar Terrestrial Physics (SCOSTEP) and the International Union of Radio Science (URSI).

Visit <http://www.ss.ncu.edu.tw/~ISAR> for more and future information.

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**International Symposium on Coupling Processes in the Equatorial Atmosphere (CPEA Symposium) during March 20-23, 2007**

An international symposium to discuss the coupling processes in the equatorial atmosphere will be held during March 20-23, 2007 at Kyoto University in Kyoto, Japan. The symposium will be devoted to a wide range of studies on and around the research project CPEA and would be a good opportunity for summarizing scientific accomplishment after EPIC and during the ongoing CAWSES program. We will solicit results from a variety of observations and model studies related to the equatorial region in all atmospheric layers from the troposphere to the ionosphere.

Deadline for abstract submission is November 15, 2006. Limited travel support is available. For more information please contact: [cpea-sympo@rish.kyoto-u.ac.jp](mailto:cpea-sympo@rish.kyoto-u.ac.jp) or visit <http://www.rish.kyoto-u.ac.jp/cpea-sympo/>; Abstract submission deadline: November 15, 2006; Travel application deadline: October 15, 2006.

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*"A new scientific truth does not triumph by convincing its opponents ... but rather because its opponents eventually die and a new generation grows up that is familiar with it."*  
– Max Planck, (1858-1947)

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**Special Sessions with CAWSES science results during major meetings:**

- EGU session on Climate and Weather of the Sun-Earth System (CAWSES) (AS1.12) EGU General Assembly in Vienna, Austria April 2-7, 2006.
- Coupling from the Sun to the Ground: Results from the CAWSES event studies and campaigns during 2004 and 2005 (SA05), AGU Joint Assembly in Baltimore, Maryland, May 23-26, 2006.
- Climatological variations in the upper atmosphere and ionosphere (SA02), AGU Joint Assembly in Baltimore, Maryland, May 23-26, 2006.
- Space Weather: Observations and modeling for applications and operations (PSW1), COSPAR Scientific Assembly, Beijing, China, July 16-23, 2006.
- Solar and extra-terrestrial influence in the middle atmosphere and associated coupling mechanisms through dynamics, composition and electro-dynamics (C2.1), COSPAR Scientific Assembly, Beijing, China, July 16-23, 2006.
- Tides, Waves and Coupling Processes from Troposphere to Ionosphere (C2.2), COSPAR Scientific Assembly, Beijing, China, July 16-23, 2006.
- Stratwarm effects and related circulation changes in the Mesosphere-Lower Thermosphere region (SA04), Western Pacific Geophysics Meeting, Beijing, China,

July 24-27, 2006.

- Space Weather Research: Theory, Modeling and Prediction (SH04), Western Pacific Geophysics Meeting, Beijing, China, July 24-27, 2006.
- Space Science Models: Tools for research and data analysis (SM06), Western Pacific Geophysics Meeting, Beijing, China, July 24-27, 2006.

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**3rd Annual CAWSES science planning meeting on July 23, 2006 in Beijing, China**

The 3<sup>rd</sup> CAWSES Science Planning meeting will be held on Sunday July 23, 2006 from 9 AM - 4 PM during the COSPAR meeting at Beijing. The CAWSES SSG, all the Theme members, and country representatives are invited to attend. This day-long meeting will provide an assessment of progress thus far and the direction for the near future. Sunanda Basu will Chair the meeting as Susan Avery has a long-standing commitment at that time. Please let us know if you plan to attend. This will help us in preparing the agenda. The location is being finalized in consultation with our Chinese colleagues. Please consult our webpage for further information.

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CAWSES News is also available on the web at: <http://www.bu.edu/cawses>  
Telephone: +011-617-353-5990; Fax: +011-617-353-6463  
([erbuck@bu.edu](mailto:erbuck@bu.edu))  
E. Buck, Program Administrator,  
([rajn@cawses.bu.edu](mailto:rajn@cawses.bu.edu))  
Editor, CAWSES News  
D. Pallamraju, Scientific Coordinator,



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



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