The Scientific Committee on Solar-Terrestrial Physics (SCOSTEP)

Annual Report (January 1 – December 31, 2011)

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2011 ACTIVITIES

SCOSTEP Sponsored Scientific Meetings and Workshops

- ***4th International Space Climate Symposium, January 16-21, Goa (India)***

The 4th International Space Climate Symposium, Space Climate was held in Goa, India between 16th —21st January, 2011. This meeting brought together researchers from around the world to discuss the causes of the long-term variability of the Sun and its consequences, including its modulation of climate and the radiative and particulate environment in the heliosphere. The symposium had a special session dedicated to observations and modeling of the unusual minimum in solar activity at the end of solar cycle 23.

The sessions were structured around tutorial lectures reviewing major sub-fields of Space Climate, invited lectures summarizing recent advances in our understanding in those fields, and contributed lectures and posters reporting relevant research. There were 92 participants in attendance drawn from Asia, Europe and North America. Further details on this meeting are available online at the websites: http://www.iiserkol.ac.in/~spaceclimate4/

- ***4th IAGA/ICMA/CAWSES-II TG4 Workshop on Vertical Coupling in the Atmosphere/ Ionosphere System, February 14-18, Prague (Czech Republic)***

The 4th IAGA/ICMA/CAWSES-11 TG4 Workshop on "Vertical Coupling in the Atmosphere/ Ionosphere System" was held in Prague, Czech Republic, February 14- 18, 2011. The meeting was attended by a total of 75 senior and young scientists from 16 countries. During the 5-days workshop the participants presented 79 papers, from which 16 were solicited presentations. Before official opening of the workshop there were two public/educational lectures (By Esa Turunen and Mike Taylor) attended mainly by students from Prague grammar schools and university. The aim of the workshop was not only to address the physics behind the forcing mechanisms that originate in the lower atmosphere and play an important role on the upper atmosphere and ionosphere, but also to show the solutions of some of the problems which were only formulated during the 3rd IAGA/ICMA Workshop held in 2006 in Varna, Bulgaria. The meeting was designed so that research experts from both the middle and upper neutral atmosphere and ionosphere communities come together in order to present their work and assess/debate ongoing issues related to the theoretical, modeling and observational aspects of all kind of processes which transfer energy and momentum from the lower atmosphere to the upper atmosphere and ionosphere and vice versa. The programme focused on various aspects and topics of neutral dynamics as well as ionospheric electrodynamics and plasma physics. These included: 1) Coupling processes in the middle atmosphere, through planetary waves, mean flows and temperature variability; Gravity wave and tidal forcing of the middle atmosphere, and the role of dynamics, solar variability and greenhouse gasses on the chemical structure and feedback processes. 2) Coupling processes in the atmosphere/ionosphere system, due to: dynamical forcing of the ionosphere from

below; and electrodynamic coupling and plasma instabilities; the role of electrical processes in the coupling.

Figure 1: *Group photo of the participants in the 4th IAGA/ICMA/CAWSES-II Workshop*

This workshop brought together a mix of scientists doing mostly independent research on the fields of the MLT neutral atmosphere and the ionosphere, that is, on two collocated "spheres" of the near earth environment which remain closely coupled and in a continuous interaction. The meeting provided an excellent opportunity for these research communities to interact in a supplementary manner in reviewing and debating the progress done to date in the field of the upper atmosphere/ionosphere and come up with suggestions and ideas for further research on the vertical coupling of the atmosphere-ionosphere system.

The presentations at this Workshop will be published in a special issue of JASTP. The team of Guest Editors includes: Dora Pancheva (Geophysical Institute, BAS, Sofia, Bulgaria), Petra Koučka Knızova (Institute of Atmospheric Physics, CAS, Prague, Czech Republic), Kazuo Shiokawa (Solar-Terrestrial Environment Laboratory, Nagoya University, Japan) and Weixing Wan (Institute of Geology and Geophysics, Chinese Academy of Sciences, China).

- ***Chapman Conference on Gravity Wave Effects on General Circulation and Climate, February 28 - March 4th, Honolulu (Hawaii)***

The Chapman Conference on "Gravity Wave Effects on General Circulation and Climate" was held from 28 February through 4 March, 2011 at the East-West Center in Honolulu, Hawaii. The conference conveners were M. Joan Alexander, Kevin Hamilton and Kaoru Sato. The conference was attended by 87 scientists including 11 students from India, Argentina, Canada, England, Japan, Korea, Slovenia, France, Germany and The Netherlands.
(http://www.agu.org/meetings/chapman/2011/ccall/)

- ***3rd International Workshop, Solar influences on the magnetosphere, ionosphere and atmosphere, June 6-10, Sozopol (Bulgaria)***

The 3rd International workshop "Solar influences on the magnetosphere, ionosphere and atmosphere" was held in Sozopol, Bulgaria, during 6 - 10 June 2011. The scientific programme was comprised by the scientific program of the workshop: 1) Sun and solar activity, 2) Solar wind-magnetosphere-ionosphere interactions, 3) Solar effects in the ionosphere, 4) Solar influences on the

lower atmosphere and climate, 5) The variable Earth radiation field and its impact on humans, 6) Instrumentation for space weather monitoring, 7) Data processing, modeling and e-science.

The program included invited lectures summarizing recent advances in our understanding in those fields, and contributed lectures and posters reporting relevant research. A total of 10 oral and 4 poster sessions were held at which 86 papers were presented, out of those 5 were invited, 40 were oral and 41 were given as poster presentations. For more information on the workshop please see: http://www.stil.bas.bg/WS-sozopol/

- ***FTM-2Workshop, July 20-31, Kyoto/Hida Observatory (Japan)***

The first FMT data analysis workshop at UNICA in Peru was held in November, 2010 (http://esi.igp.gob.pe/FMTworkshop/) to educate young students and researchers how to analyze solar data taken by FMT and how to use a spectroscope for solar observations. This workshop was partly supported by CAWSES-II, and was very successful.

Figure 2: *A lecture by Prof. K. Shibata, Jul 20, 2011 (left) and Summary report by Peruvian young scientists, Jul 27, 2011 (right)*

As a continuation of the previous FMT workshop, a second FTM Workshop "Japan-Peru: FMT Summer School and Data Analysis Workshop" was held during July 20-27, 2011 at Hida Observatory, Kyoto University in Japan, and during July 28-31, 2011 at National Astronomical Observatory of Japan (NAOJ) (http://www.kwasan.kyotou.ac.jp/CHAIN/WS/2011Jul/). The purpose of the summer school/workshop was to teach students and young researchers how to analyze solar data more deeply and to teach them how to write scientific papers by using solar data (http://cawses-ii-wg3.blogspot.com/2011/07/chain-peru-japan-fmt-workshop-hida.html). There were about 30 participants, including 5 Peruvian young scientists at the workshop held at Hida Observatory. This FMT-Workshop was hosted by Kwasan and Hida Observatories, Kyoto University, Japan and NAOJ, and was financially supported by CAWSES-II and STE Laboratory of Nagoya University, Japan.

Figure 3: *Group photo of FMT-WS at Hida Observatory (July 20, 2011)*

The workshop continued at Hida Observatory with lectures on solar physics, space weather physics, and solar active phenomena especially related to FMT. There were also tutorial lectures on how to access (download) and analyze solar observational data not only by FMT, but also by other ground-based and space-born instruments. The young Peruvian scientists reported recent observation by FMT in

Peru. In additions to the lecture the attendees concentrated on data analysis of targets events determined during the discussion. Work on the data analysis has continued after the WS, and the results will be presented as scientific papers in near future.

At NAOJ the participants learned how to use a spectroscope and carried out actual spectroscopic observation by using a Coelostat, as well as learned how to analyze spectroheliogram, so that they would be able to obtain the data by operating the Coelostat-spectroscope of UNICA in near future. During the workshop at NAOJ, the participants also attended an international solar physics seminar, on "Quiet Sun magnetic field".

- ***ISWI-Europe Summer School in Space Science, Aug 21-27, Tatranská Lomnica (Slovakia)***

The 2011 ISWI – Europe Summer School in Space was held from August 21 to August 27, 2011 at the Astronomical Institute of the Slovak Academy of Sciences, in Tatranská Lomnica, Slovakia. Twenty five scientists from 11 countries gave invited lectures on the Solar corona and the inner heliosphere; Solar Eruptions, CMEs and Space Weather; CMEs / Data Analysis; Effects of Solar Activity on Earth's Climate Solar Energetic Particles, Solar Radio Emission Processes, Long-term Trends in the Ionosphere and Upper Atmosphere and other space weather topics. The workshop was attended by 76 scientists from 26 countries including 46 students.

Figure 4: *Group photo of the participants in the ISWI-Europe Summer School 2011*

The lectures presented at the workshop could be found at (http://stara.suh.sk/id/iswi/summer_school/scientific_program). Photos from the event could be found at http://stara.suh.sk/id/iswi/summer_school/photos

- ***IAU Symposium 286, Comparative Magnetic Minima: Characterizing quiet times in the Sun and Star, Oct 3-7, 2011, Mendoza (Argentina)***

IAU Symposium 286, "Comparative Magnetic Minima: Characterizing Quiet Times in the Sun and Stars", was held in Mendoza, Argentina during October 3 - 7, 2011. The meeting was attended by 93 scientists from 23 countries, Argentina, Belgium, Brazil, Colombia, Costa Rica, Denmark, Finland, France, Germany, Hungary, India, Israel, Italy, Japan, Mexico, Peru, Romania, Russia, Turkey, Spain, Sweden, Switzerland, UK, and USA.

Figure 5: *Group photo of the participants in the IAU S286 Symposium*

The goal of IAU S286 was to consider solar and stellar minima, from generative dynamo mechanisms, to in depth analyses from Sun to Earth for recent well observed and modeled minima, to the range in stellar cyclic activity, to outlier "grand minima". Solar, heliospheric, geospace, atmospheric, stellar, and planetary science were included in the meeting's scope.

At the meeting, both invited and contributed presentations were given describing how magnetic fields can be cyclically generated in solar and stellar interiors via various dynamo processes. Numerical models have increased in complexity to the point where many observed aspect of cycles in the Sun and stars are captured, although mysteries still remain. The question of the origins and implications of Grand Minima, for the Sun Earth system and also other stellar planetary systems, was the subject of several presentations. Both stellar observations and historical and cosmogenic records at the Earth were presented to form a basis of understanding of such fascinating intervals, and of solar/ stellar long term variability in general. The recent extended solar minimum was examined in detail from Sun to Earth, provoking discussions of the possibility of a trend in the Sun's current magnetic cycles towards a Grand Minimum, and the potential implications for the Earth's climate. (http://iaus286.iafe.uba.ar)

- ***10th Layered Phenomena of the Mesopause Region, 24-27 October, Blacksburg Virginia (USA)***

The 10th Layered Phenomenon of the Mesopause Region was held in Blacksburg Virginia, 24-27 October, 2011. This was the 10th symposium in a series which has become a regular biennial (triennial prior to 2007) catalyst for advancing our understanding of ice layers in the region of the mesopause and the environment in which they form. The workshop provides a forum for presentation and discussion of new results, new questions and new ideas ranging from the microphysics of mesospheric particles to the global processes controlling the state of the mesosphere. Researchers from all perspectives are invited to participate including ground-based, in-situ, and satellite measurements laboratory studies as well as modeling and theoretical studies on mesospheric ice phenomena and their coupled dynamical, radiative, chemical, and plasma environment. The workshop promotes discussion of the current state of knowledge and of future directions for international, interdisciplinary cooperation.

Figure 6: *The participants of the 10th LPMR Workshop at Virginia Tech. Not shown are invited keynote speaker John J. Olivero, James M. Russell III, Chad Fish, Justin Yonker, and David Fritts*

The workshop consist*ed* primarily of oral talks, some posters, and significant time for interaction and discussion. There were 40 scientists attending the workshop including 8 students. The focus areas of the Workshop were well within the scope of CAWSES-II and specifically related to the CAWSES' TG2 and TG4. Project 3/TG2 is "PMC/NLC altitude, frequency and brightness changes related to changes in dynamics and chemical composition". This is one of the overarching themes of LPMR and therefore the workshop. Project 1/TG4 "How do atmospheric waves connect tropospheric weather with ITM variability?" is also highly relevant as mesospheric ice layers are very sensitive to wave forcing from below. This area has received increased interest in recent years and so will be central to the workshop.

The SCOSTEP support facilitated capacity building as it provided a unique forum bringing together researchers from a variety of approaches, both active and passive ground and space based observers as well as modeling and theoretical. It has always been an important aspect of all LPMR workshops to encourage young researchers and students to participate and interact with more senior researchers.

An important outcome of the workshop is the formation of six sub-working groups to attack focused areas where further work is needed. The topics are: unifying the many data sets; understanding observations of ice particle size distributions; the role of small scale forcing such as gravity waves and turbulence; the role of tides and local time variability; the role of metal layers and surface chemistry; and global connections.

A special issue of the Journal for Atmospheric and Solar Terrestrial Physics has been proposed to publish results from the workshop. The next LPMR workshop is planned for summer 2013 at the University of Leeds, England. For further information on the workshop program please see http://www.cpe.vt.edu/LPMR/LPMRprogram.pdf

- ***2nd LISN Workshop, November 7-11, 2011, São José dos Campos (Brazil)***

During the last few years, the Low latitude ionospheric sensor network (LISN) community has installed over 40 GPS receivers and 5 magnetometers across the South American continent. This instrumentation has spurred several innovative investigations in aeronomy and space physics. LISN is about to start with the installation of 4 state-of-the-art ionosondes at locations closely aligned with the magnetic meridian that crosses the magnetic equator at 67° W. The new deployments will increase the capability of the LISN network to achieve a forecasting capability of the equatorial spread F (ESF) phenomena. The 2nd LISN workshop was organized to motivate the new members to learn about the LISN instrumentation and science and to engage them in scientific projects and campaigns. The LISN workshop also aimed at starting, and in other cases deepening, the collaborations between the US and South American members of the LISN community and a plan of scientific investigations in Space Weather was outlined. The Workshop was held at the campus of the Instituto Nacional de Pesquisas Espaciais (INPE) at Sao Jose dos Campos in Brazil between November 7 and 10, 2011. The workshop had four themes: (1) New instrumentation, their observable quantities and analysis techniques; (2) Discussions on the physics of the day-to-day variability of the low-latitude ionosphere and the development of a method to predict the initiation of equatorial spread F (ESF); (3) Talks and workshop discussions on space weather applications and the role of LISN on the development of an augmentation system in South America; (4) Define new projects and campaigns to achieve the scientific and forecasting goals.

Figure 7: *The participants in the 2nd LINS Workshop.*

One of the outcomes of the international conference has been to develop a plan for investigations and campaigns that will make it possible to forecast communication outages and to correct navigation errors. These projects will have a decisive influence on the development of emerging aeronautical navigation satellite systems in South America and will be part of a global navigation system. For further information on LISN the reader is referred to: http://lisn.igp.gob.pe/

SCOSTEP Bureau and General Council Meetings

SCOSTEP organizes and conducts international solar-terrestrial physics (STP) programs of finite duration in cooperation with other International Council for Science (ICSU) bodies. Results from these

programs are shared with the community of SCOSTEP scientists by joining in conducting meetings, conferences, and workshops and by publishing newsletters, handbooks and special journal issues.

The relevant ICSU bodies are represented in SCOSTEP by the Bureau members (IAU, IAGA, IAMAS, IUPAP, COSPAR, URSI, SCAR; IUGG has a liaison).

SCOSTEP is one of the 17 interdisciplinary bodies of ICSU, along with COSPAR and SCAR.

The general requirement for conducting a scientific program is that it be approved by at least two of the participating bodies. The current scientific programme supported by SCOSTEP is the Climate and Weather of the Sun-Earth System (CAWSES - Phase II).

There have been a number of changes in the SCOSTEP Secretariat since July 2010, when the Office was moved to York University, Toronto and is supported by the Canadian Space Agency and the Centre for Research in Earth and Space Science of York University. A number of activities were undertaken in preparation for the SCOSTEP Election of new Executive officers, which took place in July 2011.

In 2011 there were changes in the SCOSTEP Bureau as well, with new appointments for the ICSU bodies represented by: Mark Lester (IUPAP) replacing Sandra Chapman (UK), Lee-Anne McKinnell (URSI) (South Africa) replacing Christian Hanuise (France), Takuji Nakamura (COSPAR) replacing Ryoichi Fujii (Japan), and David Siskind (IAMAS) replacing Kevin Hamilton (USA). (For more information on the SCOSTEP Bureau please see the SCOSTEP Website, http://www.yorku.ca/scostep/).

1. Bureau Meeting, July 2, 2011 (Melbourne, Australia)

The SCOSTEP Bureau held it meeting on July 2, 2011, in Melbourne, Australia, during the IUGG General Assembly. The Bureau meeting was chaired by Robert Vincent, SCOSTEP's President. The annual report on SCOSTEP activities for 2010 and up to that meeting, together with SCOSTEP's Financial Audit were presented by the SCOSTEP Scientific Secretary, M. Shepherd, and approved by the Bureau. In October 2010 a committee comprised of N. Gopalswamy, B. Schmieder and C. Hanuise was given the task of reviewing the list of Science Discipline Representatives (SDR) and updating it. The committee presented its report and the recommendations for new SDR were discussed. It was proposed that the duration of the appointments should be not more than 6 years to ensure active and engaged SDRs and General Council. The Bureau reviewed a report on the voting results (number, geographic representation) and discussed the logistics for the election by the General Council of new SCOSTEP Executive Officers, President and Vice President, on July 3, 2011. An Election Committee was appointed to overlook the election procedure and count the ballots. A status report on SCOSTEP activities, support for workshops and the results from these workshops was presented by the Scientific Secretary, followed by a report from the SCOSTEP/CAWSES-II Co-chair, Prof. Susan Avery, on the progress of the programme. It was pointed out that the programme objectives were successfully carried out, led by the CAWSES Team Groups and their Leaders. A number of scientific conferences and workshops were organized as part of the CAWSES programme and supported by CAWSES and SCOSTEP. Most of the organization and the administration of these workshops was done through the SCOSTEP Secretariat, but with the appointment of Dr. Lynn Harvey (Laboratory for Atmospheric and Space Physics, Univ. of Colorado) as CAWSES II Secretary in April 2011, Prof. S. Avery expressed confidence that the management of the programme would greatly improve and would be on track. The appointment of L. Harvey became even more necessary in view of the fact that the other CAWSES II Co-chair, DR. Alan Rodgers had just stepped down for health reasons. More on the CAWSES II programme is given further in this presentation.

This was Prof. Robert Vincent's last Bureau meeting as SCOSTEP President and the Bureau thanked him for his leadership and service to the SCOSTEP community. The Bureau also thanked Dr. Brigitte Schmieder for her contribution and service as SCOSTEP's Vice-President.

2. SCOSTEP General Council Meeting, July 3, 2011 (Melbourne, Australia)

In January 2011 all members of the GC received election kits with information on the candidates for Election of new SCOSTEP Executive Officers, a total of 85 members of the GC, including National Adherent Representatives (NAR), Science Discipline Representatives (SDR), CAWSES Steering Committee and the SCOSTEP Bureau. The results from the contest for a new SCOSTEP Logo were in with 9 submissions. On July 3, 2011 a meeting of the General Council was held to elect new SCOSTEP Executive Officers, President and Vice-President. All members of the General Council casted their ballots by mail. From the 85 Members contacted, 75 voted, or 88% of the total, electing Dr. Natchimuthuk (Nat) Gopalswamy (NASA/GSFC, USA) for SCOSTEP President and Prof. Dr. Franz-Josef Lübken (Leibniz Institute of Atmospheric Physics, Germany) – for Vice-President.

A contest for a new SCOSTEP logo was conducted in the months preceding the meeting in Melbourne and the results were presented to the Bureau. The General Council also voted on the new logo and the one which received the most votes was approved as the new SCOSTEP logo. The new SCOSTEP logo is featured on the SCOSTEP Website and all SCOSTEP documents, including this report.

3. Bureau Meeting, October 9-10, 2011, Greenbelt, USA

On October 9-10, 2011 the SCOSTEP Bureau held its first meeting after the Elections in Melbourne, which took place in Greenbelt, MD (near Washington, DC). Some of the decisions made are given below.

It was decided that the CAWSES Virtual Institute (VI) should be reorganized according to the current needs of the CAWSES programme. The basic concept of the VI was to serve as a forum for discussions and information on Solar-Terrestrial Physics. The concept for using the internet as a medium of outreach and training need be reconsidered and it was suggested that the VI be converted to an on-line resource database with links to other outreach sites (e.g. NASA, JAXA, CNES, CSA, …), which already have experience with the organization of the information and are easily accessible and free of charge. Some of these links are already available on the SCOSTEP website (http://www.yorku.ca/scostep/) and will be further extended and updated as new information becomes available on an on-going basis. The new VI will consider including also information on meta-data and will be linked with Internet sites where such information is available. Tutorial lectures presented at various conferences and workshops will be recorded or compiled and made part of the VI, thus creating a virtual library. Using the Y-Tube as a medium for such tutorial lectures; all these are intended to be a part of the SCOSTEP/CAWSES Capacity building activity.

The Bureau unanimously agreed that CAWSES dedicated conferences are very important and was decided that there should be one dedicated CAWSES meeting per year and CAWSES sessions at other international meetings like AOGS, WPGM, URSI, etc., which should raise the CAWSES profile, particularly at conferences by the organizations represented in the Bureau, thus broadening the organization's outreach . Combined meetings between several TG's will be encouraged in order to enhance interaction and mutual understanding. Significant effort will be invested in Capacity building by providing intensive lecture series, training courses, capacity building sessions as a part of a workshop, etc. These should also be addressed within the more general workshops wherever possible.

Extensive discussions have begun on SCOSTEP's future programmes, to follow after the completion of CAWSES II. A committee will be appointed to solicit and review proposals prior to recommending which programme(s) should be considered. The topics should be timely, should involve SCOSTEP areas of research and should include most (all) countries. Two scenarios have been considered: 1) after the CAWSES-II model, namely a number of working groups within a single programme with one overarching theme; 2) smaller (2-3) programmes, as was done prior to CAWSES I. Such smaller programmes with

narrower focus could serve as preparatory studies for an overarching future programme. CAWSES has already encompasses many of the topics of current interest. A similar structure and objectives could provide continuation to the current research structure established for example in Japan, Germany, India. The future German ROMIC (Role Of the MIddle atmosphere in Climate) programme could be adopted as one of the future SCOSTEP programmes. A committee has been formed from the community at large, including members of the General Council to solicit, assess and recommend what the new research trends will be in the coming 4 years and beyond.

Updates on CAWSES-II

Work on various projects related to the four CAWSES themes continued under the guidance of the Team Group Leaders with the support of the SCOSTEP Secretariat. In April 2011 Dr. Lynn Harvey from the Laboratory for Atmospheric and Space Physics (LASP), University of Colorado at Boulder, was appointed as assistance to the CAWSES Co-chairs in support of the scientific endeavors of the CAWSES-II programme. This appointment was in response to a request by Prof. Susan Avery and Dr. Alan Rodger, the CAWSES II Co-chairs that the SCOSTEP Bureau provided funding in order to establish a part-time position to help with the CAWSES-II management. The request stemmed from the fact that both co-chairs (S. Avery and A. Rodger) had large responsibilities in their formal jobs as heads of large organizations and therefore were unable to devote as much time as they would have liked in dealing with CAWSES related issues. Dr. Lynn Harvey assisted the CAWSES Co-chairs in the day-to-day management of the CAWSES-II administration and in particular the updating of the CAWSES website and presentations for the SCOSTEP/CAWSES session at the IUGG General Assembly held in Melbourne, Australia, June 28-July 6, 2011. On July 1, 2011 Dr. Alan Roger stepped down from the position of CAWSES Co-chairs for health reason. At the SCOSTEP Bureau meeting on July 2, 2011 the CAWSES II activity was examined and it was suggested that changes in the programme's leadership were required to ensure that it would fulfill its goals in the remaining two years and a half years. Prof. Susan Avery agreed to continue acting as CAWSES Chair until new CAWSES Executives are appointed.

In September 2011 the Bureau unanimously approved the appointment of new CAWSES Co-chairs, Dr. Joseph M. Davila (NASA/GSFC) and Prof. Toshitaka Tsuda (RISH/Kyoto University), who replaced Prof. Susan Avery (Woods Hole Oceanographic Institution) and Dr. Alan Rodger (British Antarctic Survey).

Joseph Davila conceived and implemented the STEREO mission, has been Executive Director of the IHY Secretariat and is currently leading the International Space Weather Initiative (ISWI). He was Principal Investigator for the Solar Extreme-ultraviolet R Telescope and Spectrograph (SERTS) and has conducted research on the structure of the solar corona.

Toshitaka Tsuda has been a SCOSTEP Bureau member for many years; he was involved in the PSMOS programme and is familiar with SCOSTEP. He is the Director of Research Institute for Sustainable Humanosphere (RISH) in Kyoto University. He has also been working on atmospheric coupling processes as part of CAWESES II.

SCOSTEP is grateful for their willingness to serve.

With the appointment of Dr. Davila and Prof. Tsuda, Dr. Lynn Harvey position became obsolit and ended in September 2011.

At the SCOSTEP Bureau meeting in Greenbelt T. Tsuda and J. Davila presented an action plan for implementation in the remaining time of the CAWSES programme. As part of this plan the CAWSES web page at http://www.cawses.org will be reactivated. The site will continue functioning until the end of the CAWSES-II programme in 2013.

The Co-chairs have divided the responsibilities for the CAWSES themes as follows: Joseph Davila is responsible for TG1 (Annika Seppälä & Katja Matthes) and TG3 (Kazunari Shibata & Joe Borovski), while

Toshitaka Tsuda is responsible for TG2 (Daniel Marsh & Jan Laštovička) and TG4 (Jens Oberheide & Kazuo Shiokawa).

Combined meetings between several TG's will be encouraged in order to enhance interaction and mutual understanding. Significant effort will be invested in *Capacity building* by providing intensive lecture series, training courses, capacity building sessions as part of workshops, conferences, etc. These activities should also be promoted and implemented within the more general workshops wherever possible.

TG leaders will strongly be encouraged to propose a session(s) at various international assembly; AGU, EGU, AOGS, JpGU, thus broadening the SCOSTEP/CAWSES scientific outreach. It was suggested that the CAWSES TG leaders should have working meetings independently of the Bureau meeting and more frequently to review the CAWSES activities.

The first CAWSES Business meeting between the new CAWSES Co-chairs and TD Leaders was held on November 30, 2011 via telecom. The next Business meeting is scheduled for April 22, 2012 prior to the EGU General Assembly in Vienna, Austria.

Collaboration between CAWSES and ISWI, ILWS (International Leaving With a Star), etc. will be promoted and increased. SCOSTEP's President, N. Gopalswamy attended the ISWI summer School in Slovakia and gave invited presentations at the ILWS Conference, in China in August 2011 and at the ICSU General Assembly in Rome, Italy, in September 2011.

In addition to the dedicated SCOSTEP/CAWSES session organized during the IUGG General Assembly in Melbourne, SCOSTEP/CAWSES related sessions were also organized during the AOGS meeting in Taipei, August 2011 (Duggirala Pallamraju), and the URSI General Assembly in Istanbul in August 2011 (Christian Hanuise).

Active CAWSES-II and SCOSTEP related projects

In 2011 the Priority program "CAWSES" of the German DFG, led by Prof. Dr. F.-J. Lübken, was completed. The reports on the results from this programme were compiled in the form of a monograph with 33 chapters, peer reviewed, which is scheduled for publication by Springer Verlag in 2012 (Editor F.-J. Lübken).

CAWSES India (for details see Appendix: National Reports and SCOSTEP Website). Organized a national CAWSES conference with international participation and the results were peers reviewed compiled in a special issue of the Journal of Solar-Terrestrial Physics, on "Atmospheric Coupling Processes in the Sun-Earth System".

ISSI (International Space Science Institute) team 152, led by Dr. Peter Hoffmann on "Vertical coupling processes using tidal campaign data".

ISSI workshop and review book on *The Energetic and Momentum Coupling between the Earth's Atmospheric and Plasma Environments*.

In August - September 2011, the First Tidal Campaign of CAWSES-II was carried out, as a follow-up from the CAWSES-I .

EISCAT 3D: phased array antennas, imaging capability, under proposal.

German radar for turbulence and winds in Andoya.

Global Observing Campaigns on Tides, W. Ward, continuation since CAWSES-I.

SuperDARN radars: toward midlatitudes

Spaceborne lidar – next steps?

ESA – SWARM satellite constellation – 3 CHAMP equivalent satellites (launch 2011)

ISS – IMAP: launch 2013 (Japanese airglow imager on International Space Station)

SCOSTEP Secretariat, York University, Toronto

The new SCOSTEP Secretariat hosted by the Centre for Research in Earth and Space Science of York University has been fully operational since August 2010 and very active in the months leading to the SCOSTEP Election in Melbourne and throughout 2011.

All General Council (GC) members were contacted and the SCOSTEP data base corrected and updated. A contest for a new SCOSEP Logo was launched and the results were available in April 2011. All GC members voted on the selection of the new logo and the results were announced at the GC meeting in Melbourne, July 2011.

Support for various SCOSTEP and CAWSES/SCOSTEP workshops was administered promptly and reports were acquired following those workshops.

A three-member committee (Brigitte Schmieder, Christian Hanuise and Nat Gopalswamy) appointed by the SCOSTEP President Robert Vincent was given the task of updating the list of SDRs to the SCOSTEP General Council. The recommendations were presented to the SCOSTEP Bureau on July 2, 2011 for discussion and approval. With the new appointments and replacements the total number of the SDRs is now 54.

The Scientific Secretary organized the Bureau and General Council meetings in Melbourne and Greenbelt in July and October, as well as the CAWSES Business meetings via telecom in November, 2011. The Scientific Secretary prepared election kits with information on all candidates for SCOSTEP Executive officers, organized and carried out the voting and the SCOSTEP election, created and manages the SCOSTEP website, prepared outreach materials posters and brochures, and re-printed the available nine comic books in English. The work of the SCOSTEP Scientific Secretary is supported by the Canadian Space Agency (CSA).

In February and April, 2011 two new members of the Bureau were appointed to represent COSPAR – Prof. Takuji Nakamura (Japan) replacing Prof. Ryoichi Fujii (Japan) and IUPAP - Prof. Mark Lester replacing Prof. Sandra Chapman. In August 2011 Dr. David Siskind (USA) was appointed to represent IAMAS replacing Prof. Kevin Hamilton, while Prof. Lee-Anne McKinnel (SA) was appointed to represent ICSU replacing Dr. Christian Hanuise.

Education/Training Activities/Outreach

1. SCOSTEP

The new SCOSTEP Website launched in October 2010 was upgraded and is available at http://www.yorku.ca/scostep/.

SCOSTEP has been sponsoring a series of 'Comic Books' designed to raise the awareness of the general public, and young people in particular, about issues in solar-terrestrial science; an initiative of Prof. Yosuke Kamide, Solar-Terrestrial Energy Laboratory, Nagoya University. Originally produced in Japanese, the books have been translated into English, French, German, Hindi, Italian, Korean, Russian, and Spanish, with translations now ongoing into Bulgarian, Chinese, Czech, Finnish, Hebrew, Marathi, Nigerian (Hausa, Igbo, Yoruba & Pidgin), Swedish and Thai. Blank drawings are available to translate the books into other languages. There are currently 9 Comic books translated into English (http://www.yorku.ca/scostep/?page_id=366).

As part of the Capacity Building effort, the SCOSTEP educational comic books have reached young people in many countries. SCOSTEP continues to encourage more countries to translate the comics to their native languages.. The comic books in English, French, German, Hindi, Italian, Russian and Spanish are now available at http://www/yorku.ca/scostep/?page_id=366, and follow the link. More translation are available and will be uploaded to the respective site.

A new comic book on "Space Weather" is currently under development at Nagoya University in Japan, which will become the 10th book of a series of educational comics sponsored by SCOSTEP/CAWSES. Japan has also formed a new SCOSTEP subcommittee chaired by Prof. T. Ogino and has established its own Task Groups corresponding to each of the CAWSES-II themes, including Capacity Building and eSciences. The Japanese CAWSES-II kickoff meeting was held on June 16-17, 2010, with 78 participants.

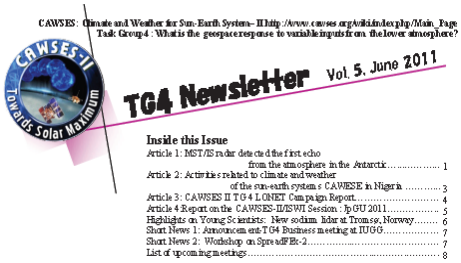
The Website contains also a section on "Science Topics" where seminal review papers are presented (http://www.yorku.ca/scostep/?page_id=34). Links are also provided to the Education Outreach sites of NASA and the CSA, which can be found under "Reports for General Public" (http://www.yorku.ca/scostep/?page_id=97). These sites provide connections to various organizations relevant to SCOSTEP and solar-terrestrial physics research such as CAWSES, CEDAR, COSPAR, IAGA, IAMAS, NOAA, SEC, SCAR, URSI (http://www.yorku.ca/scostep/?page_id=27), as well other organizations, e.g. CSA and the Science Council of Japan (http://www.yorku.ca/scostep/?page_id=164).

SCOSTEP Posters, talks and comic books were presented at the ICSU General Assembly, September 2011, Rome and AGU Fall Meeting in San Francisco, December 2011.

In December 2011 SCOSTEP commenced the release of a Newsletter. The Newsletter is prepared by the Scientific Secretary and will be issued on a quadrennial basis. The next issue is scheduled for April, 2012.

2. CAWSES

Information on all CAWSES II activities could be found at http://www.cawses.org/CAWSES/Home.html and http://www.cawses.org/CAWSES/Home.html. The first Newsletter for CAWSES II TG4 was issued in June 2010. All seven TG4 newsletters can be found at http://www.yorku.ca/scostep/?page_id=116 .


CAWSES : Climate and Weather for Sun-Earth System– II http://www.cawses.org/wiki/index.php/Main_Page
Task Group 4 : What is the geospace response to variable inputs from the lower atmosphere?

CAWSES-II Towards Solar Maximum

TG4 Newsletter Vol. 5, June 2011

Inside this Issue

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Figure 8: *The front page of one of the CAWSES TG4 Newsletters.*

3. National Adherent Activities

(Note: The information on Education, training and outreach has been extracted from the available National Adherent Reports, given in the Appendix and on the Website).

The UK Royal Society's Summer Exhibition is a chance of scientists from all disciplines to showcase their work to public. Competition to exhibit at this prestigious event is tough, with only 1 in 4 exhibits chosen. In 2011, one of the selected exhibits highlighted the work of Cluster and its investigation of the magnetosphere and the aurora. Aurora Explorer stand was conceived by Prof. Andrew Fazakerley (UCL-MSSL) following the 10th anniversary of the launch of the Cluster II mission. Prof. Fazakerley put together a team of international scientists to showcase the science of Cluster. The exhibit consisted of interactive, audio and visual displays such as: 1) A magnetosphere in a bottle (UCL) - using iron filings suspended in oil and surrounded by current carrying wires to demonstrate the shape of the magnetosphere; 2) Find the hidden currents (Imperial) - using mini Cluster spacecraft, find a current boundary hidden in space, 3) The Planeterrella - an example of an early experiment that linked the

aurora, currents and the Earth's magnetic field which creates artificial aurora-like emission, 4) Falling marbles auroral acceleration - measure the acceleration of marbles down a track by measuring their speed at multiple locations; an analogue of the observations Cluster is making of acceleration of electrons and ions above the aurora, 5) Aurora in a box - a neon light display which is an analog to auroral emission; currents passing through our atmosphere cause the atmospheric gases to glow, 6) The sounds of the aurora - radio emissions from the particle acceleration process that causes the aurora turned into sound waves!

A number of new videos of the magnetosphere and Cluster spacecraft were created for this event and can be seen on The Aurora Explorer YouTube channel. Details of the summer exhibition and more information about the stand can be found on the Royal Society website.

The “Frozen Planet” TV series, aired on BBC in autumn 2011 and on the US Discovery Channel in spring 2012, will include filming carried out at the EISCAT Svalbard Radar. One episode of a BBC radio series about the Earth’s atmosphere (“Thin Air”, broadcast on BBC Radio 4 and the BBC World Service in January 2011) was recorded at the EISCAT site in Tromso. Many individual UK scientists participated in outreach events and media activities, some related to publication of journal articles in the field, e.g. 1) Long solar minimum; 2) Increase in solar storms over next few solar cycles; 3) Solar variability; 4) STEREO observations; 5) Solar magneto-seismology; 6) Solar magnetic waves; 7) Space weather effects; 8) Cluster mission celebrating 10 years in orbit; 9) Discovery of a spot associated with Enceladus in Saturn’s aurora, 10) Discovery of a spot associated with Enceladus in Saturn’s aurora; 11) Discovery of an atmosphere at Saturn’s moon Rhea.

One US ongoing activity is the preparation of a Decadal Survey for Heliophysics, which is being undertaken by the US National Research Council. That report advises all US agencies with solar terrestrial research programs. That report is now in review, and will be released in 2012.

Future plans

The CAWSES-II program is now in full swing, and it will remain as the main scientific program of SCOSTEP until the end of 2013. The program consists of four task groups to address the four scientific questions: (1) What are the solar influences on Earth's climate? (2) How will geospace respond to an altered climate? (3) How does short-term solar variability affect the geospace environment?, and (4) What is the geospace response to variable waves from the lower atmosphere? Each task group has further identified and formed a number of projects. As in the past CAWSES program, these projects are truly grass roots, consisting of scientists around world. In addition to the four task groups, CAWSES II also establishes a Virtual Institute in order to most effectively coordinate international collaborations among scientists around the world, particularly those from developing countries as well as early career scientists and students. The Virtual Institute is in the process of being reorganized taking advantage of cyber-infrastructure technology and develop necessary software into facilitating cross-disciplinary research, and data and resource management. It will establish digital libraries and host virtual scientific conferences, which will benefit greatly young scientists. Public education and capacity building will continue to be a core part of CAWSES II and SCOSTEP. In addition to developing new educational comic books, the SCOSTEP/CAWSES Virtual Institute will provide easier access to data and research tools by scientists from developing nations and will build an international network of graduate students and early-career scientists. SCOSTEP is dedicated to fulfill its long-term responsibility to promote international interdisciplinary programs in solar-terrestrial physics. SCOSTEP will continue to work within the ICSU framework to encourage cross-disciplinary conferences and to facilitate cross-project cooperation and multi-national research collaboration. SCOSTEP will continue conducting programs with the scientific goal of advancing quantitative understanding of coupling mechanisms responsible for the transfer of mass and energy throughout the solar-terrestrial system. The practical goal is to improve

predictability of the effects of the variable components of solar energy and disturbance on the terrestrial environment. These disturbances range from interference with satellite and aircraft communications systems, to blackouts of electric power grids. At the Bureau meeting in Greenbelt a small subgroup was established to consider long-range planning for further STP science programs after the completion of CAWSES.

Publications:

Some of the highlights of CAWSES II Team Group Publications, as well as a list of publications for 2011, as provided in the available National Adherent Reports (please see Appendix) are given below:

Special Issue of *J. Adv. Space Res*., "Solar Variability, Cosmic Rays and Climate", 2011.

Special Issues in *Adv. Space Res*. and *J. Atmos. Solar-Terr. Phys*. on "Atmospheric Coupling Processes in the Sun-Earth System", Editors: Duggirala Pallamraju, Charles Lin, and Gang Lu.

Usoskin, I. G., et al., Ionization effect of solar particle GLE events in low and middle atmosphere, *Atmos. Chem. Phys*., 11, 1979-1988, 2011.

JGR Special Section, "Long-term changes in the stratosphere, mesosphere, thermosphere, and ionosphere", 2011.

Figure 9: *The front pages of two of the peer reviewed conference proceedings.*

Amabayo E.B., McKinnell L.A., and Cilliers P.J., Statistical Characterisation of Spread F over South Africa, Adv. Space Res.48, 12, 2043-2052, 2011.

Bilitza D., McKinnell L.A., Reinisch B., Nsumei P., Fuller-Rowell T., The International Reference Ionosphere (IRI) today and in the future, J. of Geodesy, 85, 12, 909-920, 2011.

Carlson, B. E., T. Gjesteland, N. Østgaard. Terrestrial gamma-ray flash electron beam geometry, fluence, and detection frequency. J. Geophys. Res doi:10.1029/2011JA016812, 2011.

Carlson, B. E., T. Gjesteland, N. Østgaard. The terrestrial gamma-ray flash source luminosity distribution. Submitted J. Geophys. Res Sept 2011.

Carlson, B. E., T. Gjesteland, N. Østgaard. The frequency of Terrestrial Gamma-ray Flash Electron Beam Observations. Proceedings of the URSI GA, 2011.

Collier, A. B., & Hughes, A. R. W. Lightning and the African ITCZ. J.Atmospheric &Solar-Terres.Physics, 73, 2392-2398, 2011.

Collier, A. B., & Hughes, A. R. W. A Harmonic Model for the Temporal Variation of Lightning Activity over Africa. J.Geophys.Res.116, D05105, 2011.

Collier, A. B., Lichtenberger, J., Clilverd, M. A., Steinbach, P., andRodger, C. J. Source Region for Whistlers Detected at Rothera, Antarctica. J.Geophys.Res.116, A03219, 2011.

Collier, A., T. Gjesteland, N. Østgaard. Assessing the Power Law Distribution of TGFs. Accepted J. Geophys. Res, doi:10.1029/2011JA016612, June 2011.

Collier, A., T. Gjesteland, N. Østgaard. Terrestrial Gamma-ray Flash Intensity Distribution. Proceedings of the URSI GA, 2011.

Firoz, K.A., J.Hwang, I.Dorotovič, T.Pintér and Subhash C.Kaushik: Relationship of ground level enhancements with solar, interplanetary and geophysical parameters, Astrophysics and Space Science, Volume 331, Number 2, 469-484, DOI: 10.1007/s10509-010-0473-0

Förster, M., S. E. Haaland, E. Doornbos,Thermospheric vorticity at high geomagnetic latitudes from CHAMP data and its IMF dependence, Ann. Geophys., 29, 181-186, 2011.

Gjesteland, T., N. Østgaard, A. B. Collier, B. E. Carlson, M. B. Cohen, N. G. Lehtinen Confining the Angular Distribution of TGF Emission. Proceedings of the URSI GA, 2011.

Gjesteland, T., N. Østgaard, A. B. Collier, B. E. Carlson, M. B. Cohen, N. G. Lehtinen Confining the Angular Distribution of Terrestrial Gamma-ray Flash Emission. Accepted J. Geophys. Res, doi:10.1029/2011JA016716, Aug 2011.

Habarulema, J. B., McKinnell L.A., and Opperman B.D.L, Regional GPS TEC modelling; Attempted spatial and temporal extrapolation of TEC using neural networks, J. Geophys. Res., 116, A04314, 2011

Jin et al., Whole atmosphere-ionosphere coupled model, JGR, 2011.

Juusola, L., N. Østgaard, E. Tanskanaen, N. Partamies, K. Snekvik, Earthward Plasma Sheet Flows During Substorm Phases, J. Geophys. Res, Accepted, doi:10.1029/2011JA016852, Aug 2011.

Juusola, L., N. Østgaard, E. Tanskanaen, Statistics of Plasma Sheet Convection, J. Geophys. Res, Vol. 116, A08201, doi:10.1029/2011JA016479, 2011.

Kronberg, E.A., R. Bucik, S. Haaland, B. Klecker, K. Keika, M. I. Desai, P. W. Daly, M. Yamauchi, R. Gomez-Herrero, A. T. Y. Lui, On the origin of the energetic ion events measured upstream of the Earth's bow shock by STEREO, Cluster, and Geotail, J. Geophys. Res., 116, A02210, doi:10.1029/2010JA015561, 2011.

Lazutin, L.L., E.A.Muraveva, K.Kúdela and M.Slivka: Verification of magnetic field models based on measurements of solar cosmic ray protons in the magnetosphere, Geomagnetism and Aeronomy, Volume 51, Number 2, 198-209, DOI: 10.1134/S0016793211010087

Manuel R., S. E. S. Ferreira, M. S. Potgieter, R. du T. Strauss, N. E. Engelbrecht, Time-dependent cosmic ray modulation, Adv. Space Res. 47, 1529-1537, 2011a.

Meszárosová, H., M.Karlický and J.Rybák: Magnetoacoustic Wave Trains in the 11 July 2005 Radio Event with Fiber Bursts, Solar Physics, Volume 273, Number 2, 393-402, DOI: 10.1007/s11207-011-9794-6

Moraal, H., McCracken, K.G. The Time Structure of Ground Level Enhancements in Solar Cycle 23, Space Sci. Rev. online, 2011

Ngwira C., McKinnell L.A., and Cilliers P.J., Geomagnetic activity indicators for geomagnetically induced current studies in South Africa, Adv. Space Res. 48, 529–534, 2011.

Okike, O., andCollier, A. B. A multivariate study of Forbush decrease simultaneity. J.Atmospheric & Solar-Terres.Physics, 73, 796-804, 2011.

Østgaard, N., K. M. Laundal, L. Juusola , A. Aasnes, S. E. Haaland, J. M. Weygand. Interhemispherical asymmetry of substorm onset locations and the Interplanetary Magnetic Field. Geophys. Res. Lett., Vol. 38, L08104, doi:10.1029/2011GL046767

Østgaard,N., B. K. Humberset, K. M. Laundal, Evolution of auroral asymmetries in the conjugate hemispheres during two substorms, Geophys. Res. Lett., Vol. 38, No. L03101, doi:10.1029/2010GL046057

Pancheva, D. and P. Mukhtarov: Atmospheric tides and planetary waves: Recent progress based on SABER/TIMED temperature measurements (2002-2007), in *Aeronomy of the Earth's Atmosphere and Ionosphere,* eds. M. Abdu and D. Pancheva, doi:10.1007/978-94-007-0326-1_2, Springer, 2011.

Portnyagin, Yu. I., E.G. Merzlyakov, T.V. Soloveva, A.I. Pogoreltsev, E.V. Suvorova, P. Muktarov,and D. Pancheva, Height-latitude structure of the vertical component of the migrating semidiurnal tide in the upper mesosphere and lower thermosphere region (80-100 km), *IANFiz. Atmos. Okeana,* v. 47, N 1, pp. 118-129, 2011.

Potgieter M. S., Cosmic rays in the inner heliosphere: Insights from observations, theory and models, Space Sci. Reviews, online, 2011.

Potgieter, M. S., S. E. S. Ferreira, R. du T. Strauss, Galactic cosmic rays in the dynamic heliosphere, Proc. 12th ICATPP Conference on Cosmic Rays for Particle and Astroparticle Physics, Como, Italy. S. Diani, C. Leroy, P.G. Rancoita (eds), 441-453, 2011.

Sibanda P., and McKinnell L.A., Topside ionospheric vertical electron density profile reconstruction using GPS and ionosonde data: possibilities for South Africa, Ann. Geophys., 29, 229-236, 2011.

Sternal O., N. E. Engelbrecht, R. A. Burger, S. E. S. Ferreira, H. Fichtner, B. Heber, A. Kopp, M. S. Potgieter, K. Scherer. Possible evidence for a Fisk-type heliospheric magnetic field I: Analysing Ulysses/KET electron observations, Astrophys. J., 741, 23:1-12, 2011.

Strauss R. du T., M.S. Potgieter, A. Kopp and I. Büsching. On the propagation times and energy losses of cosmic rays in the heliosphere, J. Geophys. Res, 116, A12105:1-13, 2011.

Strauss R. du T., M. S. Potgieter, I. Büsching, A. Kopp. Modeling the modulation of galactic and Jovian electrons by stochastic processes, Astrophys. J., 735, 83:1-13, 2011.

Sumod, et al., Correlation between the mesopause temperature and h'F at Trivandrum, AnnGeo, 2011.

Teh, W.-L., B. U. Ö. Sonnerup, G. Paschmann, S. E. Haaland, Local structure of directional discontinuities in the solar wind, J. Geophys. Res., 116, A04105, doi:10.1029/2010JA016152, 2011.

Tshisaphungo, M., McKinnell L.A., Magnus L., and Habarulema J.B., An attempt to validate HF propagation prediction conditions over Sub-Saharan Africa, Space Weather, 9, 508001, 2011.

Vaivads, A., G. Andersson, S. D. Bale, C. M. Cully, J. De Keyser, M. Fujimoto, S. Grahn, S. Haaland, H. Ji, Yu. V. Khotyaintsev, A. Lazarian, B. Lavraud, I. R. Mann, R. Nakamura, T. K. M. Nakamura, Y. Narita, A. Retino, F. Sahraoui, A. Schekochihin, S. J. Schwartz, I. Shinohara, L. Sorriso-Valvo, EIDOSCOPE: particle acceleration at boundaries, Experimental Astronomy, pp. 1-37, doi:10.1007/s10686-011-9233-6, 2011.

Valach, F., M.Revallo, P.Hejda, J.Bochníček: Predictions of SEP events by means of a linear filter and layer-recurrent neural network, Acta Astronautica, Volume 69, Issues 9-10, November-December 2011, Pages 758 - 766

Vineeth, et al., Quasi 16-day PW modulate mesopause temperature, JGR, 2011.

APPENDIX: National Reports

The purpose of the National Adherent Reports is to provide information on the solar-terrestrial physics activities in the respective member countries for the period of the current report, including publications, capacity building and public outreach. All National Adherent representatives have been asked to provide reports outlining the STP activities and projects in which their scientific communities have been involved in during 2011, participation in national and international conferences, publications, and outreach. A summary of the available reports is provided herein. The reports themselves could be found on the SCOSTEP Website, in the Archives/Reports section.

Bulgaria (Dora Pancheva):

Bulgaria is the initiator and the first coordinator of the **Balkan, Black sea and Caspian Sea Network for Space Weather Studies** which was formed in 2006 and consists of 12 countries. The network regularly publishes an international peer-reviewed journal "Sun and Geosphere".

Bulgaria participates actively in the **"International Space Weather Initiative";** this is an UN/NASA/JAXA/BAS international program with 89 participating countries. Katya Georgieva is a member of the Steering committee of the program as well as Katya Georgieva and Dimiter Danov are members of the Secretariat. We also manage the web page of the program.

A regular workshop on **"Solar influences on the magnetosphere, ionosphere and atmosphere"** is held yearly in the beginning of June in Sozopol, Bulgaria. In 2011 the workshop was supported by SCOSTEP with a grand of 5000 USD. A total of 65 participants from 12 countries all over the world presented 86 presentations (5 invited, 40 contributed oral and 41 poster papers).

A session on **"Space weather and space climate: coupling processes from the Sun to the Earth"** is convened yearly by Katya Georgieva during the Annual Meeting of Asia and Oceania Geosciences Society (AOGS). Dora Pancheva convened the A06.1 symposium **"Coupling Processes in the Atmosphere-Ionosphere System"** held at the XXV IUGG General Assembly, 28 June - 7 July 2011, Melbourne, Australia. Scientists from Bulgaria attended the following international meetings: EGU 2010 and 2011(Vienna); "Space climate symposium" (2009 – Finland, 2011 – India); Pulkovo conference on "Solar and Solar-Terrestrial Physics" in 2009, 2010, 2011 (Russia); Central European Solar Physics Meeting (2009 and 2011); Hvar Colloquium "Active Sun" 2010 (Croatia); 4thIAGA/ICMA/CAWSES-II TG4 Workshop on "Vertical Coupling in the Atmosphere-Ionosphere System", 2011 (Prague, Czech Republic – (i) this workshop was funded by SCOSTEP with a grant of 4000 USD; (ii) the scientific program of the workshop was organized by Dora Pancheva); IUGG 2011 (Melbourne).

The full report can be found on the SCOSTEP website: http://www.yorku.ca/scostep/.

Canada (William Ward):

Canadian participation in activities associated with Scientific Committee On Solar-Terrestrial Physics (SCOSTEP) advances the policy objectives of a number of Canadian institutions and organizations (Canadian Space Agency (CSA), Environment Canada (EC), Natural Resources Canada (NRCan), NSERC).

Scientific work in this field involves:

- instrument development (ground based and satellite) for observing the atmosphere and geospace environment,
- advances in the analysis and associated interpretation of relevant international global satellite data sets,
- the production of new data products of value to the larger community, the construction of global models
- the formulation of theoretical insights which allow a deeper understanding of the Earth's atmosphere and near-space environment and its interaction with the Sun.

The work involved in these activities requires the participation of graduate students, post-doctoral fellows and young scientists and are a vehicle for the achievement of NSERC's goal of training Canada's next generation of scientists and engineers.

The advances in understanding and technical knowledge generated by these activities provide the foundation for innovative activities in CSA, EC, and NRCan and the industries engaging in activities with these agencies.

Work in this field of science supports the Federal priorities for Canadian Science and Technology investment as described in the 2007 Federal document, "Mobilizing Science and Technology to Canada's Advantage". It provides a unique opportunity for work which requires a global perspective, is

interdisciplinary and is important for current social and political policy decisions. As such it produces highly qualified people with unique skills and perspectives and supports the S&T People Advantage.

It also impacts three of the areas identified for Canadian Knowledge Advantage, namely: Environmental science and technologies, Natural resources and energy and Information and communications technologies. Knowledge developed in these areas is essential for success in any associated entrepreneurial activity.

Although not directly measurable using conventional economic measures, activity in this area is essential for identifying potential threats and risks to the maintenance of our current way of life and identifying solutions. These threats could occur through a variety of causes including

- Changes in the longer term behaviour of the sun
- Significant solar storms
- Asteroids'
- Changes to our atmosphere which could change the radiative/thermal environment of the biosphere.

The field of science represented by SCOSTEP is vital for the longer term interests of Canadians. Understanding the nature of solar variability, how the Earth's atmosphere and geospace environment respond to this variability and how this response will change as a result of changes in the composition of the atmosphere is essential for the longer term well being of Canadians. Networks involved in this area of science include the Canadian Network of the Detection of Atmospheric Change (CANDAC) and Canadian Geospace Monitoring (CGSM) each of which involve 50 or more scientists in the Canadian community.

As with the discovery of the ozone hole and the resulting behavioral and policy changes, the value of this research lies less with actual product development and more with our ability to make strategic longer term decisions which positively impact the quality of life of Canadians.

Participation by industry and university researchers in the development of space instrumentation, models and data analysis techniques provides opportunities for innovation. For example, instrumentation developed in Canada and accepted by the international community can become the choice for future operational observations. The Michelson interferometer which was developed for CSA's SciSat I by BOMEM is one example. Due to the success of this mission there have now been several requests to BOMEM for similar instruments from the international community resulting in their being contracted for the construction of additional interferometers. This story is being played out in a number of areas. Research activities in this area account for tens of millions of dollars of funding. Industrial involvement in this area involves activities close to an order of magnitude greater than this.

Support and maintenance of Canadian expertise in this area, allows Canada to take advantage of international opportunities associated with various space agencies (NASA (USA), ESA (Europe), JAXA (Japan), etc.).This can take place in two ways.

- Ideas and expertise for the development of scientific instruments for satellites and the analysis of the associated data can be provided by the Canadian scientific community. This results in opportunities for the further refinement of these ideas within Canada and the possibility of external funding for this work.
- The contracting of Canadian companies to manufacture elements of these satellites.
  An example (among many) is the Canadian participation in the European Space Agency's Swarm mission. Instruments developed at the University of Calgary (David Knudsen) are being built by COM DEV International Ltd in Cambridge for this mission. The associated ESA contract is for $14M.

China (Z. Xiao):

The STP scientific community in China holds a National Conference once every two years which is also open to space scientists from abroad. The 14th National Conference was held on 25-30 October 2011 in Chongqing. This was a multi-disciplinary conference including subjects as: Space Plasma Physics; Solar Corona and Solar Wind; Planetary and Earth's Magnetosphere, Ionosphere and Upper Atmosphere, Cosmic-Ray Physics; The Sun-Earth System Couplings; Space exploration and Probing, Simulation and Modeling; Polar Aeronomy; Space Weather and its effects. A series of specialised meetings on space weather were also held, the latest in July 2010 in Shanghai, as well as a summer school for young scientists, in May 2011 in Shanghai, organized by the Polar Research Institute of China. Each of above mentioned meetings had more than 130 scientists attended from universities, institutions of CAS and national ministries. The scientific discussion focused on the solar wind origin, magnetic connection, Ultra Low Frequency wave (ULF) in the inner magnetosphere and its impact on energetic particles, solar wind- magnetosphere interaction and coupling of magnetosphere-ionosphere-thermosphere and coupling of lower atmosphere-ionosphere. Some models on the shock propagation in interplanetary space and arriving time to the earth were put forward for prediction of space weather events. New space research has been conducted on Double Star in cooperating with the Cluster mission, as two satellites were launched in equatorial and polar orbits separately to form under proper conditions a six point's simultaneous observation of structures in the space around the earth's magnetosphere Program.

Other projects also included the Meridian Project which is a multi-station chain along 120°E to monitor space environment and parameters of space weather is being established in China; KuaFu project is a space project proposed by Chinese scientists with strong international participation, comprising three satellites, Kuafu A, Kuafu B1 and B2 to realize 24/7 continuous imaging of the northern aurora borealis and inner magnetosphere.

China (Taipei) (Lou Lee):

The funds for the study of solar-terrestrial relationship in China (Taipei) are supported by the Atmospheric Division of the National Science Council and National Space Program Office (NSPO). The major interests of the study focus on the following topics: wave propagation in middle atmosphere and ionosphere, wave and disturbance of solar plasma, shock wave in interplanetary medium, coupling of solar wind and magnetosphere, plasma instability in magnetosphere, seismic effect on ionosphere, ionospheric responses to the solar activity and lower atmospheric disturbance, ionospheric tomography, ionospheric plasma irregularities, ionospheric equatorial anomaly, lightning effect on lower ionosphere. Almost all of the professional scientists doing the researches associated with the solar-terrestrial relationship are from academia, including National Central University, National Cheng-Kung University, Chinese Culture University, and Fu-Jen University. The SCOSTEP Committee of China (Taipei) consists of 15 members, and the chairman of the Committee currently is Prof. L.C. Lee. The detailed report on the STP- related activities in China (Taipei) can be found on the SCOSTEP Web site.

Capacity Building: Under the auspicious of Ministry of Education, National Science Council and National Central University in Taiwan, International School on Atmospheric Radar (ISAR) is held annually on the campus of National Central University (NCU) at Chung-Li, Taiwan since 2006. The School ISAR-NCU aims to train graduate student and young scientist who are interested in the field of radar remote sensing atmosphere and ionosphere and would like to develop their careers in this field. Two-week courses that are offered by ISAR-NCU cover the introduction to theory of EM wave propagation in random media, ionospheric physics, coherent scatter radar, radar meteorology, ionospheric measurements using ground-based facilities and satellite, radar signal processing and analysis, and hand on experiment in

radar instrumentation. The School lecturers are not only from the NCU faculties, but also from the international community with expertise in the fields of atmospheric and ionospheric sciences and radar/radio system development and experimental applications. ISAR-NCU 2011 is scheduled to be held on the campus of NCU in November 2011.

A number of international and national conferences and workshops related to solar-terrestrial physics were held in 2011. The information on these activities is based on the National Reports by the respective National Representatives.

- 2011 AOGS Meeting, Taipei, Taiwan, August 8-12, 2011.
- 5th FORMOSAT-3/COSMIC Data Users Workshop 2011, Taipei, Taiwan, April 13-15, 2011.
- 2011 International Space Plasma Symposium (ISPS), National Cheng-Kung University, Tainan, Taiwan, August 14-19, 2011
- ISAR-NCU 2011, National Central University, Chung-Li, Taiwan, November 14-23, 2011.

Germany (Franz-Josef Lübken):

(*Note: The following is a copy of F.-J. Luebken's presentation at the SCOSTEP General Council meeting in Melbourne, July 3, 2011*).

CAWSES in Germany: priority programme of the DFG (German Science Foundation) 6 years (3 x 2): 2005-2011: 100 projects ~ 14 Million US - $~30 institutes involved(~120 scientists + PhD); National programme with strong encouragement for international cooperation.

Science Topics covered in STP projects:

1) Solar radiation: reconstruction of solar irradiance, models of the Sun, heliosphere etc → Katlenburg-Lindau, Bochum, Kiel, Bremen
2) Observations and modeling various time scales: from hours to centuries(specific: solar cycle + trends)
3) Solar effects from thermosphere to troposphere
4) Stratosphere –thermosphere:
    - ozone: solar influence, dynamics, coupling
    - solar impact on other trace gases
    - reactive species (NOx) from thermosphere
    - particle precipitation effects on chemistry
    - ionization, ion chemistry
    - galactic cosmic ray influence
    - feedback with thermal/dynamical structure → Jülich, Berlin, Karlsruhe, Bremen, Hamburg, Osnabrück, Mainz
5) Mesosphere and ionosphere:
    - solar/lower atm.: trace gases (H_2O, O_3, ...)
    - ice layers (NLC, PMC,PMSE)
    - influence of waves and SPE
    - role of temperature, winds, gravity waves, tides
    - microphysics (dust, ionisation, ...)
    - trends in the ionosphere (Es, ...) → Kühlungsborn, Bremen, Katlenburg-Lindau, Bochum, Kiel, Potsdam, Leipzig, Wuppertal
6) Coupling by dynamics:
    - mean circulation
    - planetary waves, influence from/on ozone, heating, ...
    - gravity waves: climatology, breaking, turbulence, solar influence

- tides: excitation/propagation of (non-)migrating components up to the thermosphere
- feedback on trace gases, chemistry, ...
- feedback on thermal and dynamical structure → Jülich, Wuppertal, Frankfurt, Potsdam, Kühlungsborn, Berlin, Katlenburg-Lindau

7) Troposphere:
   - climate studies from the upper atmosphere to the ocean
   - influence of GCR on clouds and composition
   - microphysics of cloud charging → Berlin, Karlsruhe, Jülich

The reports on the Priority Programme were compiled in a book, to be published in 2012 (Figure 10):

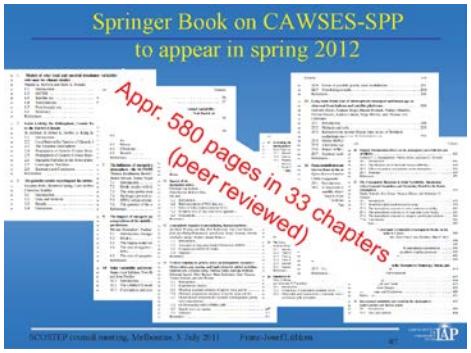

Figure 10: *An exert from F.-J. Lübken's presentation at the CAWSES session, IUGG, Melbourne. It gives the content of the book on the German Priority Programme CAWSES.*

Planning for the future: The German atmospheric/solar science community has proposed a new research topic to the German ministry for science and education (BMBF), namely ROMIC (Role of middle atmosphere in climate). The main topics to be covered are 1. Long period variations in the stratosphere, mesosphere, and lower thermosphere, 2. Coupling mechanisms, 3. Relevance for climate, and 4. Natural forcing. The proposal was accepted by BMBF and a call for for proposals was released in February 2012.
See http://www.bmbf.de/foerderungen/18082.php for more details

Hungary (András Ludmány):

Activities conducted by Hungarian institutes involved in solar-terrestrial research: **Geodetic and Geophysical Research Institute of the Hungarian Academy of Sciences** (Csatkai u. 6–8, H-9400 Sopron; Hungary, http://www.ggki.hu)

Long-term variations of ionospheric parameters. (P.Bencze) Periods of FLR (field line resonance) type pulsations have been used to determine electron density along magnetic lines of force. Input data were the earth-current records of the institute. The process can be modelled as a resonant circuit where he ohmic load corresponds to the electron density. Around maximum solar activity the electron density is concentrated at the ends of the field line, in the vicinity of the mirror points, while in years of minimum solar activity the plasma distribution along field lines is uniform. .

Background Schumann resonances. (G. Sátori, I. Lemperger, T. Nagy, J. Szendrői) Schumann resonance (SR) records were analyzed at midlatitude and polar stations to study the day-night asymmetry of the Earth-ionosphere cavity. The sharp SR amplitude variations at ionospheric sunrise/sunset occur with high accuracy indicating the ionospheric origins of these changes. Solar radiation-induced changes in ionospheric height and the Schumann resonance waveguide were examined on different time scales. The insensitivity of the Schumann resonance cavity to changes in ionizing radiation lends stability to the medium.

Atmospheric electricity. (F. Märcz) A long-term decrease has been found in the electric potential gradient (PG). The PG quickly responds to the Forbush-decrease. The data of relatively undisturbed dawn hours were separately studied and a significant period of 1.68 years was found. In disturbed intervals this period was not detected.

Observation and interpretation of the ULF-ELF-VLF variations (Á. Kis, I. Lemperger, J. Szendrői, V. Wesztergom)

- Geomagnetic and geoelectric variations have been analysed by using the *Kp* index and the unique, fifty years long geoelectric (telluric) data set of the institute. The variations of the two indices are different but both of them reflect the same geoelectromagnetic activity which in turn correlated with solar activity.

- The variations of the electromagnetic surface impedance tensor have been studied on the geomagnetic and telluric records of the institute. The periods found in the range of 12-120 min have a 27-day modulation. An ionospheric source model of the magnetospheric Pc5 pulsation sources has also been developed.

- By using Cluster data the extension of earlier analyses showed that the ions of 30-160 keV energy range are accelerated at the foreshock region by the same Fermi mechanism as ions at lower energies.

- It has been shown that field-aligned beam (FAB) ions, i.e. solar wind ions reflected on the quasiperpendicular side of the bow shock and propagating in the upstream direction along the magnetic field lines, are scattered by the local waves. This results in the appearance of FAB ions population in the foreshock region on the quasi-parallel side of the bow shock.

Heliophysical Observatory, Hungarian Academy of Sciences (H-4010 Debrecen, Egyetem tér 1. Hungary, http://fenyi.solarobs.unideb.hu)

New photospheric data. In the reported period the Heliophysical Observatory was an active member of the broadest European cooperation in the solar-terrestrial research, the SOTERIA (SOlar-TERrestrial Investigations and Archives) project, a European FP7 effort which coordinated the research activity of 16 European institutes. The staff of the observatory focused on the production of the most detailed photospheric databases, the SDD catalogue (SOHO/MDI-Debrecen sunspot Data). The observational basis of the data was the SOHO/MDI continuum and magnetogram observational material. Two catalogues have been produced. The sunspot catalogue is the most detailed dataset of its kind, it contains all relevant data, including magnetic field, of all sunspots and sunspot groups at a 1.5 hourly cadence. The other material is a catalogue of photospheric faculae, also first of its kind. The catalogues are accessible online through a user-friendly html-presentation. (L. Győri, T. Baranyi)

Investigation results are achieved in the following fields: active region - irradiance connections (T. Baranyi), calibration problems of photospheric data (L. Győri), cycle-dependent Coriolis motion of solar active regions, long-term hemispheric phase-lag variation, magnetic field - torsional oscillation connection, forecast of next cycle amplitude (J. Muraközy, A. Ludmány).

Flare forecast efforts. The members of the SOTERIA consortium prepared a next FP7 project, named eHEROES (Environment for Human Exploration and RObotic Experimentation in Space) which will be supported in 2012-2014. As a task of this program the Debrecen Observatory started developing a flare forecast tool exploiting the research potential of the new detailed SDD catalogue.

Space Research Group, Eötvös University (H-1117 Budapest, Pázmány Péter sétány 1/A.)

Investigation of whistlers (J. Lichtenberger, Cs. Ferencz, O. Ferencz, D. Hamar, P. Steinbach, B. Székely)

The group conducted pioneering work in the automatic detection and analysis of whistlers. These are important and inexpensive diagnostic tools for the investigation of the plasmaspheric electron density but their exploitation was earlier restricted because the detection procedure needed significant human assistance. The Automatic Whistler Detector and Analyzer (AWDA) system developed by the team increased the number of detected cases by orders of magnitude. The successful system has been recently upgraded by an algorithm to determine the plasmaspheric electron density. These data can be used in space weather models. The tool has been operated in several international cooperations to examine simultaneously the conjugate points of the guiding magnetic field lines. The developing

AWDAnet will have a broader scope than space instruments. The quasi real-time procedure needs a PC cluster containing 100 CPU.

KFKI RMKI Department of Space Physics, Hungarian Academy of Sciences (Konkoly Thege Miklós út 29-33, H-1121 Hungary)

The scientists of the institute participate in the SOTERIA FP7 project, they contributed to the work package dealing, among others, with solar wind - magnetosphere coupling and the terrestrial impact as well as space weather model validation and forecasting.

Heliospheric magnetic fields (G. Erdős) The declining phase of cycle 23 has been compared with the same periods of previous cycles. The open magnetic flux, solar wind and polar magnetic fields are weaker whereas the north-south excursion of the coronal magnetic neutral line is larger than earlier. The corotating interaction regions and the magnetic sector structure also exhibited characteristic differences in these periods. The rate of the well known southward extension of the heliospheric current sheet was revisited, it is about 2º- 3º .

Bow shock region (M. Tátrallyay, G. Erdős, G. Németh) Impacts of large solar events on the magnetopause and bow shock were analyzed in detail by using multispacecraft observations. Magnetic field depressions were also studied in this region and the were found to be related to increases in the energetic particle flux.

Properties of particle fluxes (K.Kecskeméty) The decay phases of energetic particle events were studied and the obtained exponential law of the decline supports the model of convection transport and adiabatic deceleration. Several works were devoted to quiet time fluxes. In quiet times the low energy particles show correlations with the MgII index. The abundances and charged states show characteristic variations depending on the level of activity allowing the interpretation that the moderate events at low solar activity may be the sources of low energy background particle fluxes. The galactic low energy proton spectrum is also examined in the inner heliosphere and it is found that the position of the intensity minimum of the proton spectrum dividing the solar and galactic populations shifts toward higher values with increasing solar activity.

India (S. Ananthakrishnan):

(Note: The full report can be found on the SCOSTEP Website, in the Archives section, under "Report and Documents". What follows is the introduction of that report).

The STP community in India has been active in all aspects of Solar-Terrestrial Physics. The country has vibrant optical and radio astronomical observation programmes in which investigations are being carried out on the Sun and its environment. Considerable work is continued to be carried out on the Sun-Earth plasma connections and one of the prioritized research topics in this field has been the space weather investigations. There is a growing awareness of Space weather effects and their impacts on the societal applications in the scientific community of the country. The manifestations of space weather in the near space environment are studied using a variety of observational tools, namely, magnetometers, active and passive radio techniques, and optical airglow photometers. All these studies have considerably advanced our knowledge about the near-Earth space environment. The successful launch of the YOUTHSAT, the small satellite mission of Indian Space Research Organization (ISRO), in April 2011, has been a landmark achievement the country has made in the pursuit of STP research. The strength of the STP community in India is around 300.

The national component of the Climate and Weather of Sun-Earth System (CAWSES), CAWSES-India, has provided the scientific community in India with a platform to pursue STP activities. The program was initially drawn up for a period of four years from 2004 to 2008, formulated on four major science themes, namely, (1) Solar Influence on Climate, (2) Space Weather: Science and Applications, (3)

Atmospheric Coupling Processes and (4) Space Climate. The program was designed to focus on phenomena unique to equatorial and low latitude region with special emphasis on the coupling processes in various domains. During Phase-I, 25 such projects were executed from more than 15 organizations/institutions in India wherein 19 students were working towards their doctoral degree and some of them have already been conferred with a Ph. D. degree. Apart from these projects, two multi-institutional campaign experiments have been carried out on "Space Weather Campaign with emphasis on equatorial spread-F" and on "Tidal wave campaign" involving many scientists who were already having projects under themes 2 and 3.

The international CAWSES program has been extended for a period of five years to address the issues related to Solar Maximum on application aspects of space weather impact on active satellites sending data and images, on climate change related aspects, etc. At the national level too, the CAWSES programme has been extended with Phase-II activities with three major themes, namely, (1) Solar Influence on Climate, (2) Space Weather and Space Climate, (3) Atmospheric Coupling Processes. Around 25 projects are being executed by various scientific groups in India under these themes.

National and International Conferences and Workshops, 2011:

- Workshop on Space Weather and Space Climate, held at the Physical Research Laboratory, Ahmedabad, 27 – 28 April 2011 (around 40 participants)
- National symposium on Plasma Science and Technology (PLASMA-2011) held at BIT, Patna during Dec. 21-24, 2011 (around 200 participants)
- Workshop on Growth of Geomagnetism: Challenges and Opportunities in the Next Two Decades, IIG, New Panvel, December 12-13, 2011 (around 40 participants)
- Indo-US Workshop on Advancing VLF Science through the Global AWESOME Network held at Goa during November 27-December 01, 2011 (around 50 participants)

Indian scientists also participated in the following conferences organized by SCOSTEP affiliated international bodies: 1) AGU Chapman Conference, Honolulu, Hawai, March 2011; 2) Higher Education South Africa/ Indo-Brazil-South Africa (HESA)/IBSA) Workshop on Mathematical Modeling of Fluctuations in Space Plasmas, Hermanus Magnetic Observatory, Hermanus, South Africa (May 05 – 06, 2011); 3) IUGG, Melbourne, Australia June28 – July 7, 2011; 4) URSI GASS 2011, Turkey, 13-20 August, 2011.

Current and upcoming missions and campaigns:

CAWSES-India Phase II, ISWI India, YOUTHSAT, Establishment of a new high-latitude station in Antarctica, Bharati (Larsemann Hills), National Large Solar Telescope (NLST) in the Himalayan region, the ADITYA-1 visible emission line space coronagraph, and the 50 cm Multi Aperture Solar Telescope (MAST) at the Udaipur Solar Observatory.

Japan (Tatsuki Ogino, (chair) and the Japanese SCOSTEP Committee, Science Council of Japan):

The 21th Japanese SCOSTEP committee members (December 2008 – September 2011): R. Fujii, M. Hirahara (secretary), T. Hirooka, M. Hoshino, M. Ishii, Y. Kasaba, T. Nakamura, T. Obara, T. Ogino (chair), Y. Omura, T. Sakao, N. Sato, K. Shibata, I. Shinohara, K. Shiokawa (secretary), Y. Takahashi, T. Tsuda, and M. Yamamoto

The committee meetings were held on; 1st: May 21, 2009, 2nd: Sept. 16, 2009, 3rd: Sept.29, 2009, 4th: Oct.2, 2009, 5th: May 25, 2010, 6th: June 16, 2010, 7th: May 25, 2011, and 8th: Aug. 29, 2011

1. ***Organizing CAWSES-II National Committee:***

The Japanese committee of the CAWSES-II was newly organized in the second half of 2009.
The chairs of each task groups are as follows.
TG1: T. Hirooka (Kyushu U), and Y. Takahashi (Hokkaido U)
TG2: T. Tsuda (RISH, Kyoto U), and M. Ishii (NICT)
TG3: K. Shibata (Kyoto U), T. Ogino (STEL, Nagoya U), M. Hirahara (Tokyo U), M. Hoshino (Tokyo U), Y. Omura (RISH, Kyoto U), and T. Shimizu (ISAS/JAXA)
TG4: K. Shiokawa (STEL, Nagoya U), and M. Yamamoto (RISH, Kyoto U)
Capacity building: K. Yumoto (Kyushu U), and S. Ueno (Kyoto U)
Escience and informatics (Virtual Institute): T. Iyemori (Kyoto U), I. Shinohara (ISAS/JAXA)

New website of the Japanese CAWSES-II committee was opened at http://www.stelab.nagoya-u.ac.jp/cawses2/index.html.

2. ***CAWSES-II Kickoff Symposium***

The CAWSES-II kickoff symposium was held at Kyoto University, Japan on June 16-17, 2010. Seventy-eight participants joined this symposium. Forty-four oral presentations and thirty-three poster presentations are made. The titles of the oral presentations are shown below, in order to show various Japanese projects related to the CAWSES-II. Symposium proceedings were published; the front page is shown in Figure 12. .

1. **Introduction of CAWSES-II**: Tatsuki Ogino

** **TG1** **

1. What is the solar influence on climate- Task Group 1 in CAWSES-II: Toshihiko Hirooka
2. Toward a Holistic Modeling of Cloud-Microphysics for Space Climate: Kanya Kusano, Wataru Ohfuchi, Akio Kawano, Shin-ichiro Shima and Yoji Kawamura
3. 11-year solar cycle signatures in MIROC-ESM-CHEM: Shingo Watanabe
4. Comworth Technologies LTD Influence of the solar cycle and QBO modulation on the Southern Annular Mode: Yuhji Kuroda and Koji Yamazaki
5. Change in temperature reconstructed by plant phenological data from historical documents in Kyoto, and its correspondence with solar variation: Yasuyuki Aono
6. Investigation of solar activity, cosmic ray variation, and their influence on climate change based on cosmogenic nuclides: Hiroko Miyahara, Yusuke Yokoyama, Yasuhiko and T. Yamaguchi

*** **TG2** ***

1. TG-2 How will geospace respond to an altered climate ? : Mamoru Ishii, Toshitaka Tsuda, Tetsuo Motoba, Hidekatsu Jin, Hitoshi Fujiwara, Yasunobu Miyoshi and Hiroyuki Shinagawa
2. Observations on minor constituents in the middle atmosphere by Superconducting Submillimeter-Wave Limb-Emission Sounder (SMILES): Masato Shiotani and SMILES mission team
3. Long-term ionospheric trend over Syowa Station, Antarctica: Motoba, T., M. Nakamura, T. Maruyama and M. Ishii

*** **TG3** ***

1. CAWSES-II Task Group 3 : How does short-term solar variability affect the geospace environment?: Kazunari Shibata
2. High Resolutional Observations of the Solar Surface from Space: Yukio Katsukawa
3. Hinode observations toward the solar maximum and its contributions to CAWSES-II researches: Toshifumi Shimizu and the Solar-B project team
4. Energetic particles in solar-terrestrial environment: Ryuho Kataoka

5. MAGDAS Project at SERC for Space Weather: K. Yumoto and MAGDAS/CPMN Group

6. Solar Wind – Radiation Belt Coupling: Yoshizumi Miyoshi and Ryuho Kataoka

*** **TG4** ***

1. What is the geospace response to variable inputs from the lower atmosphere?: Kazuo Shiokawa and Jens Oberheide

2. Program of the Antarctic Syowa MST/IS Radar (PANSY): Kaoru Sato, Masaki Tsutsumi, Toru Sato, Takuji Nakamura, Akinori Saito, Yoshihiro Tomikawa, Koji Nishimura, Hisao Yamagishi and Takashi Yamanouchi

3. Studies of ionosphere in Asia centered around the Equatorial Atmosphere Radar observations: Mamoru Yamamoto, Yuichi Otsuka, Tsutomu Nagatsuma, Takuya Tsugawa

4. Links between a stratospheric sudden warming and thermal structures and dynamics in the high-latitude mesosphere, lower thermosphere, and ionosphere: Kurihara, J., Y. Ogawa, S. Oyama, S. Nozawa, M. Tsutsumi, C. M. Hall, Y. Tomikawa and R. Fujii

5. Wave-4 structure of the equatorial mass density anomaly implication for direct wave penetration: Huixin Liu and Mamoru Yamamoto

6. Simulation studies of the thermosphere and ionosphere during CAWSES-II: Hitoshi Fujiwara, Yasunobu Miyoshi, Hidekatsu Jin, Hiroyuki Shinagawa, Kaori Terada and Shigeru Fujita

*** **Capacity Building** ***

1. CAWSES-II “Capacity Building” from Japan: K. Yumoto and S. UeNo

2. CAWSES-II / Capacity-Building Activities of Japan in South America -- SARINET and CHAIN Project : S. UeNo, K. Shibata, G. Kimura, S. Morita, K. Ichimoto, R. Kitai, S. Nagata, Y. Nakatani, K. Makita, M. Hoshino, M. Nishino, Y. Kato, Y. Tanaka and N.J. Schuch

*** **E-Science, Virtual Institute** ****

1. Japanese CAWSES-II Activity Related to E science, Informatics: Iku Shinohara, Toshihiko Iyemori and E science and Informatics task team in Japan

2. Inter-university Upper atmosphere Global Observation NETwork (IUGONET): H. Hayashi, Y. Koyama, T. Hori, Y. Tanaka, M. Kagitani, S. Abe, T. Kouno, D. Yoshida, S. Ueno, N. Kaneda, A. Shinbori and IUGONET project members

3. Scientific perspectives powered by IUGONET metadata database and integrated data analysis tool: T. Hori, Y. Koyama, Y. Tanaka, M. Kagitani, H. Hayashi, A. Shinbori, S. Ueno, D. Yoshida, S. Abe, T. Kouno, N. Kaneda, H. Tadokoro and IUGONET project members

3. ***CAWSES-II/ISWI international session during the JpGU meeting***

CAWSES-II/ISWI international sessions were held during the Japan Geoscience Union Meeting on May 25-26, 2010, and May 25-26, 2011. Thirty oral presentations and seven posters were presented in 2010, while twenty-two oral and eleven posters were presented in 2011. Details of the JpGU meetings are available at http://www.jpgu.org/meeting_e2010/index.htm for 2010 and http://www.jpgu.org/meeting_e2011/confprogram.html for 2011.

4. ***Proposal of CAWSES-II international symposium in 2013 in Japan***

The Japanese SCOSTEP Committee is proposing the CAWSES-II international symposium to be held at Nagoya University, Nagoya, Japan during the year of 2013. This meeting will comprehensively cover the four task groups of CAWSES-II as well as the activities of capacity building and Escience and informatics.

Figure 12: *Left: top page of the Japanese CAWSES-II program. Right: Proceedings of the CAWSES-II Kickoff Symposium in Japan*

New Zealand (Craig J. Rodger):

New Zealand has a long history of scientific research in interdisciplinary solar-terrestrial physics. Due to our unique location in the world New Zealand researchers are both a user of international datasets, and a contributor to them. This continues to this day, involving both "local" and "hosted" instrumentation, both in New Zealand and in the Ross Sea region of Antarctica. In addition New Z researchers often work with international collaborators to increase the impact of our work in the wider international field. Our SCOSTEP-related science involves strong links to researchers in countries such the United Kingdom, United States, Finland, Hungary, and South Africa. New Zealand researchers have multiple SCOSTEP-related interests. Examples are given below:

Detection and importance of electron precipitation from the radiation belts: There has been strong research activity into the detection of electron precipitation from the radiation belts, as well determining the impact of this precipitation on neutral atmospheric chemistry and possible coupling to climate. The detection work has made use of both satellites (e.g., the French DEMETER, NOAA's POES, and NASA's SAMPEX) and ground based instruments. Of particular importance is the joint NZ-UK led Antarctic-Arctic Radiation-belt (Dynamic) Deposition - VLF Atmospheric Research Konsortium (AARDDVARK) network of subionospheric precipitation monitors. Over the last 5 years new tools have been developed to extract precipitating fluxes from AARDDVARK observations. A core focus of current activities is to extend these observations, and to validate using other tools, led by the academics and students at the University of Otago. Building on this work, the Otago researchers have been collaborating with European researchers to establish the atmospheric chemical changes driven by this precipitation, and in particular quantifying the production of ozone-destroying species like NOx and HOx. There are several publications in this area, and has led us to involvement in statistical studies into polar climate variability driven by Energetic Particle Precipitation.

Recent studies have shown that variations in the stratopause altitude can be linked to dynamics which can rapidly move air from the mesosphere to the stratosphere and are therefore potentially important in the indirect effect of Energetic Particle Precipitation (EPP). Work at the University of Canterbury has begun to examine the climatological variability of the temperature and altitude of the

stratopause using EOS MLS satellite data to examine these processes. Initial analysis suggests that interhemispheric linkages are often observed in stratopause properties. In particular, strong variations in the Southern hemisphere polar vortex in 2010 caused significant changes in the stratopause altitude and temperature all the way into the Northern hemisphere tropics. These patterns are currently being examined in an attempt to discern whether they are a reflection of previously observed stratosphere-mesosphere linkage or a separate phenomenon and how this might impact the EPP indirect effect.

Remote sensing the ionosphere and plasmasphere: There is particular focus on researching the natural variation of the lower-most section of the ionosphere, the D-region. Research campaigns undertaken by Assoc. Prof. Neil Thomson (University of Otago) conducted in New Zealand, Australia, Hawaii, the continental US, Canada and Iceland have focused on describing the "typical" electron density profiles of the D-region for both night and day conditions.

Continuous D-region monitoring is undertaken from Dunedin and Scott Base. New Zealand researchers operate several different experiments for probing the plasmasphere from the ground, primarily from Dunedin. This includes an instrument hosted in collaboration with the Eötvös Loránd University (Hungary). In addition, ionosondes are operated and maintained in Eyrewell and Scott Base (Antarctica) by the Department of Physics and Astronomy of the University of Canterbury. Other relevant experimental instruments operated in New Zealand include the University of Canterbury radars at Birdlings Flat (which includes the AMOR Meteor RADAR) and also Scott Base. Magnetometers are operated in New Zealand by the Institute of Geological and Nuclear Sciences Limited (providing data to the INTERMAGNET programme), Newcastle University (Australia), and Osaka Electro- Communication University (Japan).

Funding attracted: SCOSTEP-related research in New Zealand has been funded by multiple sources. An important source is Vote Education money from the New Zealand Government through the Universities. Our Antarctic focused programmes have received indirect (logistical) finding from Antarctica New Zealand and the Australian Antarctic Division. Direct funding includes the New Zealand Marsden fund, and the European Union Framework Project 7.

Publications: In this time period New Zealand researchers have published SCOSTEP-related research in at least 24 peer-reviewed papers in international journals.

Community outreach: In this time period there were more than 10 talks and seminars given to community groups and during visits to other Universities. Highlights include the Royal Society of New Zealand VIP Science Class on Astronomy (Wellington, March 2010) and a Scott Base science talk (Antarctica, November 2010). Media contributions include regional and New Zealand nationwide stories, in print, radio, and internet forms. The highlight is probably the 1 hour episode entitled *Sol Invictus* of the Radio New Zealand science show "Earthworks". This episode was a finalist for the 2009 New Zealand Radio Awards 5a – Best Documentary or Feature Programme.

Service: Professional service activities have included reviewing proposals submitted to international funding bodies and publications to international journals. New Zealand researchers have assisted a number of international funding does including the (U.S.) National Science Foundation, French Research Agency, South African National Research Foundation and NASA. For the last case this has included both "write in" reviews and attending panel meetings in Washington DC. The list of international journals includes Science, Nature Geophysics, Journal of Geophysical Research, Geophysical Research Letters, Journal of Atmospheric and Solar-Terrestrial Physics, Annales Geophysicae, Radio Science, Atmospheric Chemistry and Physics, and South African Journal of Science. New Zealanders also serve in SCOSTEP related professional bodies. For example, Craig Rodger from Otago University is the current co-chair of the IAGA/URSI working group on VLF/ELF Remote Sensing of the Ionosphere and Magnetosphere.

Meetings Attended and Presentations Made: SCOSTEP work has been presented by New Zealand researchers at multiple international conferences and workshops. These include 1 plenary lecture (at the South African Institute of Physics annual conference), at least 9 invited presentations, and more than 77 oral and poster presentations given by New Zealand professional researchers and postgraduate students. The meetings range from a small number of national examples (e.g., the annual New Zealand Annual Antarctic Conference's) to workshops (e.g., the

4th VERSIM workshop in Prague and the High Speed Solar Wind Streams and Geospace Interactions Workshop in Ambleside, UK and SCOSTEP in Berlin) to fullscale international conferences (e.g., IAGA, AGU Fall Meeting, URSI).

Education: During this time period 5 students from the University of Otago completed their postgraduate research work in SCOSTEP-related fields (1 PhD, 2 MSc and 2 BSc (Honours)). In addition, two students undertook summer research fellowships in these topic areas. There is currently 1 MSc working at Otago in this field, with another PhD student about to start, and an advertising campaign running for another funded PhD-position. The University of Canterbury has recently recruited a PhD student in related research. The New Zealand delegate to SCOSTEP is currently Assoc. Prof. Craig J. Rodger (Department of Physics, University of Otago, Dunedin, New Zealand). He has held the position since 2006, acting on behalf of the Royal Society of New Zealand. Craig Rodger would like to thank Adrian McDonald (Department of Physics and Astronomy, University of Canterbury) for input.

Norway (Nikolai Østgaard):

The report on Norwegian STP activities is based on research carried out at the University of Bergen, but also involve researchers from other Norwegian institutes: UNIS, UiTø, UiO, NILU and NTNU:

Conjugate studies: We have continued our studies on conjugate auroral phenomenon and published two papers on 1) How the interplanetary magnetic field, clock-angle and By control the asymmetric locations of substorm onset. In a separate paper we have shown how this asymmetry disappears during substorm expansion phase:

Cluster studies. We have two projects funded by Norwegian Research Council on Cluster studies. They are focused on:

Loss of plasma from the cusp, how much of the ion outflow from the cusp is recirculated through tail reconnection and how much is returned to the solar wind. So far results indicate that about 10-20% (2000 ton/year) is returned to the solar wind, which is probably balanced by mass added from meteors; 2) Plasma composition in the magnetotail – especially the ratio of oxygen to proptons. Our results confirm earlier results that this ratio increases during geomagnetic storms; 3) Fast flows in the magnetosphere – statistical studies of fast flows in magnetosphere. Both how they are related to solar wind forcing and how they vary during the different substorm phases; 4) Discontinuities in the solar wind and their impact on geomagnetic activity. One postdoc and one master student are involved in the Cluster studies.

ASIM and TGF (terrestrial gamma flashes) research: ASIM is a mission to the International Space Station to study tranisent lumnious events (TLE; sprites, elves and blue jets) and terrestrial gamma flashes (TGF). UiB is building an X-and Gamma-ray detector. This is funded by ESA and expected launch is 2014.

Our research on terrestrial gamma flashes are focused on trying to understand how these emissions are produced. TGFs are closely associated with lightning and thunderstorms and involve the most energetic radiation observed on Earth produced by natural processes. The fundamental mechanism and properties of the TGF source remain unknown, so our studies have focused on understanding observations of TGFs to better constrain the source. We have studied satellite observations of the energetic particles produced in TGFs and used such observations to constrain the

geometry of the source. We are also studying the intensity of TGF observations to determine the intrinsic brightness of the source and how it varies. These studies are supported by lightning simulations designed to understand the strong electric forces near the lightning channel that may contribute to TGF production.

SuperMAG has moved to Bergen: SuperMAG is a worldwide collaboration of organizations and national agencies that currently operate more than 300 ground-based magnetometers. SuperMAG is the only ground based magnetometer initiative of its kind. Before SuperMAG, global or even local studies required painstaking and labor intensive data-handling, which effectively limited research. The service currently provides about 20.000 plots and 1.500 downloads of digital data to the ~300 registered users.

Plans for new research infrastructure relevant to SCOSTEP: Norwegian groups currently play an important role in the planning of new major research infrastructure proposed to be deployed in the Svalbard region, Northern Scandinavia, and Antarctica. Two projects, SIOS and EISCAT-3D, are part of the European Strategy Forum on Research Infrastructure (ESFRI) updated Roadmap 2008, and one project, MAISR, is led by the SRI-International.

SIOS: SIOS is an international effort of 50 institutions from 15 countries to develop the research infrastructure in Svalbard into a multi-disciplinary Arctic Earth Observing System so that it can serve as an Arctic data node for future Earth System models. SIOS is currently led by Norway and the Research Council of Norway, and it covers a broad range of research fields; including space physics, meteorology, oceanography, biology, glaciology, geology and environmental research. A total of 11 key topics have been identified where observational data from Svalbard could play a key role to improve Earth System Models. Of highest importance to SCOSTEP is SIOS key topic 1, which addresses "vertical coupling in the arctic atmosphere downward from space". This question includes areas like: coupling between the troposphere, stratosphere, mesosphere and lower thermosphere layers; long-term changes in ionospheric parameters and responses to solar variability; atmospheric effects due to dust, aerosols, meteoric input, and cosmic radiation; energy input to the thermosphere from magnetic reconnection; turbulence and energy flow between small and large scales; long-term evolution of ion and neutral outflow; and inter-hemispheric conjugacy and seasonal dependence of solar wind coupling. To address these issues a broad range of new research infrastructure has been proposed, including continuous operations of the EISCAT Svalbard Radar for 10 years, the construction of new SuperDARN radars in Svalbard, upgrades of the SPEAR and SOUSY radar facilities in Longyearbyen, deployment of more optical instruments around Svalbard, and the launch of 21 sounding rockets into the middle and upper atmosphere. SIOS is currently in the preparatory phase, i.e. the planning stage. The Norwegian Government has voiced strong support for SIOS. Funding agencies in several other countries have also indicated positive interest. Pending binding agreements of financial support, SIOS could become operational sometime after 2013. The plan is to run SIOS for at least 10 years. More information can be found here: http://www.sios-svalbard.org/

EISCAT-3D: EISCAT-3D is a project led by Sweden and the EISCAT Scientific Association, but with strong interest from Norwegian groups. With EISCAT-3D the plan is to develop a three-dimensional imaging radar in Northern Scandinavia to replace the old EISCAT mainland system. EISCAT-3D will make continuous measurements of the geospace environment, and its coupling to the Earth's atmosphere. EISCAT-3D is currently in its preparatory phase too, which is scheduled to end in September 2014. Pending binding agreements of financial support, EISCAT-3D could be built sometime after 2015, as the largest and most powerful incoherent scatter radar in the world. More information can be found here: http://www.eiscat3d.se/

MAISR: MAISR is a new incoherent scatter radar to be deployed at the McMurdo base in Antarctica by SRI-international. The University of Bergen has been involved in the project as a scientific consultant.

Public outreach and education: Space Suitcase, for high school, advanced scientific instruments; GPS, geigermuller, sunspotter, telescope in H beta (solar flares), wide angle camera, magnetometer, laptop and manual; Space Science as integrated Polar research at University at Svalbard; Collaboration with NAROM - field courses at Andøya

Russia (Geliy Zherebtsov & Galina Kotova):

During 2011 five major national conferences on STP research (some with international participation) took place: 1) Annual international seminar at the Polar Geophysical Institute, Apatity 2011: March 1-4, 2011; 2) "JENAM-2011: European Week of Astronomy and Space Science" - Symposium S3: "The Sun: New Challenges" (St. Petersburg, July 4-8, 2011); 3) The 9th Russian-Mongolian Conference on Astronomy and Geophysics (Irkutsk, ISTP SB RAS, 10-13 October 2011); 4) Baikal Young Scientists' International School 2011: September 19-24 "Physical processes in space and circum-terrestrial environment"; 5) All-Russia annual conference "Solar and Solar-Terrestrial Physics" (St. Petersburg, Pulkovo Observatory, October 3-9, 2011.

Some of the results obtained from ground-based observations are based on data collected by the following scientific institutions:

- Central Astronomical Observatory of Russian Academy of Sciences at Pulkovo (CAO RAN, http://www.gao.spb.ru)
- The Special Astrophysical Observatory of Russian Academy of Sciences (Nizhny Arhyz, http://www.sao.ru/).
- Institute of Solar-Terrestrial Physics of Russian Academy of Sciences, Siberian Branch (ISTP RAS, http://iszf.irk.ru/)
- Radiophysical research institute (NIRFI, http://solar.nirfi.sci-nnov.ru/RAS_Zimenki/)

Detailed report featuring highlights of the Solar-Terrestrial Physics research in Russia, "Studies on Solar-Terrestrial Physics in Russia: 2010 – 2011", can be found at the SCOSTEP Wensite, in the Archive section, under Presentations (http://www.yorku.ca/scostep/?page_id=46).

Slovakia (Miloš Revallo):

Research activities in the field of Solar Terrestrial Physics in Slovakia are mainly performed in scientific institutions of the Slovak Academy of Sciences (SAS) and the Faculty of Mathematics, Physics and Informatics of the Comenius University (CU).

The main topics of STP research carried out nationally concern: cosmic rays (IEPSAS, SCOSS), ground-based geomagnetic observations (**GO GPISAS**), energetic particle dynamics and near-Earth plasma (**GPISAS**), research of the magnetosphere-ionosphere-atmosphere system (**DAPEMCU**), solar photosphere, chromosphere and solar activity (**AISAS**)

Cosmic rays registered by neutron monitor on the surface of the Earth are believed to originate from outer space. Whilst the intensities of the cosmic rays are observed to be enhanced with sudden, sharp and short-lived increases, they are termed as ground level enhancements (GLEs). In (1), a statistical study has been made to understand quantitative relationships between GLE events and simultaneous solar erupted factors.

Measurements of solar cosmic ray (SCR) protons in the magnetosphere can be used to verify models of the Earth's magnetic field. How possible changes in the model configurations of the magnetic field can allow to eliminate discrepancies with the experiment and to explain why solar protons with energies of several megaelectronvolts penetrate deep in the Earth's inner magnetosphere has been considered in (2).

A dm-radio emission with fiber bursts observed on 11 July 2005 was analyzed using wavelet filtration and spectral methods. The result obtained in (3) supports the model of fibers based on

magnetoacoustic waves. Using a density model of the solar atmosphere, the velocities of the magnetoacoustic waves have been derived, and magnetic field in the source of fiber bursts has been estimated.

Solar energetic particle (SEP) modelling has gained great interest in the community, specifically in connection with the safety of crews and the protection of technological systems of spacecraft situated outside the shielding of Earth's magnetosphere. Two models for the prediction of SEP events were considered in (4). The models are based on a linear filter and on a special type of dynamic artificial neural network known as the layer-recurrent neural network.

Outreach activities: Slovak Astronomy Seminar for Teachers 2011, Tatranská Lomnica, 14 - 16 April, 2011 (J.Rybák)

Participation in selected conferences: 2011 ISWI-Europe Summer School in Space Science, Tatranská Lomnica, Slovakia, 21 - 27 August 2011 (I.Dorotovič, J.Rybák, F.Valach) http://stara.suh.sk/id/iswi/summer_school/; Eighth European Space Weather Week, November 28 - December 02, 2011 - Namur, Belgium (M.Revallo, F.Valach)

Participation in the International Space Weather Initiative (ISWI) 2010 - 2012. Details can be found at http://stara.suh.sk/id/iswi/iswi_SK-en.htm

Future plans: Enhancement of cooperation within the frame of ISWI at national as well as international level.

South Africa (Marius S. Potgieter & Lee Anne McKinnell)

The National STP community concits of approximately 50 scientists. The institutions participating in STP activity are as follow: SANSA Space Science (Hermanus); University of KwaZulu-Natal (UKZN-Durban); Centre for Space Research (CSR) at North-West University (NWU-Potchefstroom). SA Astronomical Observatory (SAAO). The main topics of the STP research carried out nationally are Space Weather and Solar Activity; Solar Observations, Geospace Physics; Heliophysics, Cosmic Rays and Solar Energetic Particles

The following research projects were carried out at SANSA Space Science in 2011:

- HF propagation studies for Space Weather Applications
- GPS TEC Modeling for the South African region
- Plasmaspheric investigations using ground based instrumentation
- Lightning and VLF wave studies
- Event studies using co-located radars
- Geomagnetically Induced Current studies for South Africa
- Ionospheric Characterization and irregularity studies
- Dusty plasma investigations

Manuscripts published:

Sibanda P., and McKinnell L.A., Topside ionospheric vertical electron density profile reconstruction using GPS and ionosonde data: possibilities for South Africa, Ann. Geophys., 29, 229-236, 2011.

Habarulema, J. B., McKinnell L.A., and Opperman B.D.L, Regional GPS TEC modelling; Attempted spatial and temporal extrapolation of TEC using neural networks, J. Geophys. Res., 116, A04314, 2011

Tshisaphungo, M., McKinnell L.A., Magnus L., and Habarulema J.B., An attempt to validate HF propagation prediction conditions over Sub-Saharan Africa, Space Weather, 9, 508001, 2011.

Ngwira C., McKinnell L.A., and Cilliers P.J., Geomagnetic activity indicators for geomagnetically induced current studies in South Africa, Adv. Space Res. 48, 529–534, 2011.

Amabayo E.B., McKinnell L.A., and Cilliers P.J., Statistical Characterisation of Spread F over South Africa, Adv. Space Res.48, 12, 2043-2052, 2011.

Bilitza D., McKinnell L.A., Reinisch B., Nsumei P., Fuller-Rowell T., The International Reference Ionosphere (IRI) today and in the future, J. of Geodesy, 85, 12, 909-920, 2011.

Collier, A. B., & Hughes, A. R. W. Lightning and the African ITCZ. J.Atmospheric &Solar-Terres.Physics, 73, 2392-2398, 2011.

Collier, A. B., & Hughes, A. R. W. A Harmonic Model for the Temporal Variation of Lightning Activity over Africa. J.Geophys.Res.116, D05105, 2011.

Collier, A. B., Lichtenberger, J., Clilverd, M. A., Steinbach, P., and Rodger, C. J. Source Region for Whistlers Detected at Rothera, Antarctica. J.Geophys.Res.116, A03219, 2011.

Okike, O., Collier, A. B. A multivariate study of Forbush decrease simultaneity, J.Atmospheric & Solar-Terres.Physics, 73, 796-804, 2011

Research projects carried out at CSR-NWU in 2011:

- Space Weather in terms of Charged Particle Transport.
- Ground level enhancements with Neutron monitors; Solar Flares; Coronal mass ejections
- Solar and Heliospheric Physics. Observations and Numerical Modelling.
- South African National Antarctic Programme (SANAP).

Cosmic ray data are published online at http://www.nwu.ac.za/neutron-monitor
GLE data are published at http://www.nwu.ac.za/gle

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GLE data are published at http://www.nwu.ac.za/gle

Manuscripts published:

Sternal O., N. E. Engelbrecht, R. A. Burger, S. E. S. Ferreira, H. Fichtner, B. Heber, A. Kopp, M. S. Potgieter, K. Scherer. Possible evidence for a Fisk-type heliospheric magnetic field I: Analysing Ulysses/KET electron observations, Astrophys. J., 741, 23:1-12, 2011.

Strauss R. du T., M.S. Potgieter, A. Kopp and I. Büsching. On the propagation times and energy losses of cosmic rays in the heliosphere, J. Geophys. Res, 116, A12105:1-13, 2011.

Strauss R. du T., M. S. Potgieter, I. Büsching, A. Kopp. Modeling the modulation of galactic and Jovian electrons by stochastic processes, Astrophys. J., 735, 83:1-13, 2011.

Manuel R., S. E. S. Ferreira, M. S. Potgieter, R. du T. Strauss, N. E. Engelbrecht, Time-dependent cosmic ray modulation, Adv. Space Res. 47, 1529-1537, 2011a.

Potgieter M. S., Cosmic rays in the inner heliosphere: Insights from observations, theory and models, Space Sci. Reviews, online, 2011.

Potgieter, M. S., S. E. S. Ferreira, R. du T. Strauss, Galactic cosmic rays in the dynamic heliosphere, Proc. 12th ICATPP Conference on Cosmic Rays for Particle and Astroparticle Physics, Como, Italy. S. Diani, C. Leroy, P.G. Rancoita (eds), 441-453, 2011.

Moraal, H., McCracken, K.G. The Time Structure of Ground Level Enhancements in Solar Cycle 23, Space Sci. Rev. online, 2011.

Outreach Activities

SANSA Science Centre hosted around 6000 learners in 2011, organised a holiday activity in July and attended science exhibitions and festivals in the Western Cape, Gauteng, Eastern Cape, Limpopo and North-West provinces. In 2011, SANSA acquired a mobile learning unit that will be used to reach schools that are not able to send their learners to the science centre in Hermanus.

NWU hosts a Science Exploration Centre aimed at high school leaners with Physics and Chemistry as main subjects. Solar-terrestrial and Space Physics are specifically promoted within the context of science priorities in South Africa.

SAAO has partial/full solar eclipse outreach activities.

Capacity Building Activities

SANSA organised the following STP related capacity building activities:

Winter School in Space Physics for 3rd year Physics students Summer School in Signal Processing and computer programming for honours students

United Kingdom (Andrew Coates):

UK activity in the STP and solar-planetary physics area is strong in both the ground-based and space -based areas. There is work in research laboratories and in academia. The solar physics and solar-planetary physics communities are affiliated to the Royal Astronomical Society (RAS, www.ras.org.uk). A number of scientific meetings were organized on an annual basis under the auspices of the RAS, including at the National Astronomy Meeting. Descriptions of the communities and some of their activities can be found at: 1) UK solar physics community (http://www.uksolphys.org/), and 2)UK Magnetospheric, Ionospheric and Solar-Terrestrial physics community (http://www.mist.ac.uk/). Individual members of the community have been active in convening sessions at international conferences (e.g. EGU, AGU, COSPAR, AOGS, IAGA) and workshops (e.g. hosting the 16th EISCAT International Workshop in August 2013 at University of Lancaster), and in presenting many invited and contributed talks at national and international meetings.

As from April 2011 the UK has a new *Space Agency* (see http://www.bis.gov.uk/ukspaceagency). This agency will fund space projects, including STP (solar-terrestrial physics), e.g. the Cluster and Cassini mission operations are managed by the UK Space Agency and funded by ESA. Future mission opportunities, including Solar Orbiter where the UK is well represented on the payload, are also funded by UKSA. Space-based STP and solar-planetary science are funded by the Science and Technology Facilities Council (STFC).

Following a reorganisation of the remits of some UK research councils, responsibility for ground-based solar-terrestrial physics has been passed to the Natural Environment Research Council (NERC). Responsibility for space-based STP and space plasma physics is split between the Science and Technology Facilities Council (STFC) and the UK Space Agency (UKSA), with UKSA handling the operational aspects of the programme, while STFC funds the science exploitation activities. On the NERC side, responsibility for the UK involvement in EISCAT is co-ordinated through the NERC Services and Facilities programme, which is also responsible for the UK's MST radar at Capel Dewi and the CAMRa tropospheric radar at Chilbolton, which has also made some space debris measurements. NERC is in the process of renegotiating the UK EISCAT subscription, and the new arrangements should be clear in the next few months. The UK Solar System Data Centre at RAL is being jointly supported by NERC and STFC, consistent with the fact that it holds both ground-based and space-based STP data. Several UK groups now hold NERC grants for ground-based research into solar-terrestrial physics, including BAS, Bath, Lancaster, RAL and Southampton.

The ESA-led Solar Orbiter mission includes instruments led by Chris Owen (UCL-MSSL, Solar Wind Analyser) and Tim Horbury (Imperial College London, magnetometer)

There has been considerable high-level interest in space weather within the UK, as solar activity has begun to increase toward the next solar maximum. This has included a parliamentary enquiry into space weather risks, a high-profile report on space weather by a leading insurance company, and a large number of meetings and workshops. The UK Natural Hazards Partnership, organised by the Cabinet Office, has asked for inputs on space weather, while NERC is moving toward establishing a space weather activity as one of the topics under its Natural Hazards thematic programme.

There have been several proposals for studies related to space weather and space debris as part of ESA's Space Situational Awareness (SSA) programme, and several studies are already operational. In addition, a number of UK groups are already active in space weather programmes supported by the EU's 7th Framework Programme, including SPACEGUARD (BAS), ATMOP (UCL), ECLAT (Leicester) and HELIO (MSSL and RAL). An e-infrastructure programme based on the European space weather community (ESPAS) has been funded by the EU and will begin this autumn. The consortium includes RAL (as co-ordinator) together with other UK groups at UCL, Birmingham, Leicester and the UK Met Office (UKMO).

There have also been discussions at Chief Scientist level about establishing a firmer collaboration between the UK and the US on space weather issues, including a closer collaboration of the US National Oceanic and Atmospheric Administration (NOAA) and the UKMO. A workshop to progress this will be held in the autumn. The latest EU call for FP7 proposals included a reference to joint EU-US co-ordination on space weather, and seems likely to lead to bids before the end of the year.

USA (Marvin Geller)

The US solar-terrestrial research community is sizable, as indicated by the membership of the SPA section of the AGU. The 2011 numbers for the AGU SPA section are as follows:

Primary membership - 3885
Secondary membership - 6141

The primary membership includes 498 students.

The primary federal supporters of US solar-terrestrial research is NASA and the NSF.

For the NSF, the most recent figures are for 2010. In 2010, 130 awards were made in this area. Assuming an average award of $250 K, this implies a total NSF funding in this area of about $32.5 M. This does not include both NSF infrastructure funding and also funding for the High Altitude Observatory at NCAR. In the absence of specific figures from the NSF, a reasonable estimate for their yearly support of solar-terrestrial research is approximately $50 M.

One US ongoing activity is the preparation of a Decadal Survey for Heliophysics, which is being undertaken by the US National Research Council. That report advises all US agencies with solar terrestrial research programs. That report is now in review, and will be released in 2012.