



The Scientific Committee on Solar-Terrestrial Physics (SCOSTEP)

Annual Report (1 January – 31 December, 2014)

Prepared by Marianna G. Shepherd, SCOSTEP Scientific Secretary

The report that follows covers the period from 1 January to 31 December, 2014. It reflects the activities carried out by the organization and its new scientific program, “Variability of the Sun and Its Terrestrial Impact” (VarSITI). SCOSTEP participated in the 51th Scientific and Technical Subcommittee (STSC) of the UN COPUOS (Committee on the Peaceful Use of Outer Space) as a permanent observer and held its 13th Quadrennial Solar-Terrestrial Physics Symposium. SCOSTEP through VarSITI supported ten scientific conferences and workshops and developed closer collaboration with the ISWI (International Space Weather Initiative) through the support of ISWI meetings and the International Space Science Schools. These events were communicated to the SCOSTEP scientific community via the SCOSTEP and VarSITI Newsletters and the results achieved are summarized in this report.

SCOSTEP/VarSITI Program

The new SCOSTEP scientific program VarSITI began in January 2014 and will continue till 2018 focusing on the current period of low solar activity and its impact on Earth. The program will span various times scales from the order of thousands of years to milliseconds, and for various connected locations ranging from the solar interior to the Earth's atmosphere. In order to elucidate various Sun-Earth connections, we encourage communication between solar (solar interior, Sun, and the heliosphere) and geospace (magnetosphere, ionosphere, and atmosphere) scientists. Campaign observations and data analysis will be selected for specific time intervals to focus collaboration between relevant satellite and ground-based missions as well as modeling efforts. Four scientific projects are being carried out in VarSITI: 1) Solar Evolution and Extrema (SEE); 2) International Study of Earth-Affecting Solar Transients (ISEST/Minimax24); 3) Specification and Prediction of the Coupled Inner-Magnetospheric Environment (SPeCIMEN), and (4) Role Of the Sun and the Middle atmosphere/thermosphere/ ionosphere In Climate (ROSMIC). Information on the VarSITI activities can be found at <http://www.varsiti.org/> and the VarSITI Newsletters, copies of which can be found in the VarSITI Media section of the SCOSTEP website, at http://www.yorku.ca/scostep/?page_id=1509.

13th Quadrennial Solar-Terrestrial Physics Symposium (STP13), Xi'an, China

SCOSTEP's scientific activities in 2014 culminated at the 13th Quadrennial Solar-Terrestrial Physics Symposium, held in Xi'an, Shanxi province, China, during **12 -17 October**. The symposium was organized and hosted by the National Space Science Center (NSSC), Chinese Academy of Sciences. Support for the conference was provided by the Ministry of Science and Technology of the People's Republic of China (MOST), the National Natural Science Foundation of China, the National Science Center for Space Weather, University of Science and Technology of China (USTC), the International Association of Geomagnetism and Aeronomy (IAGA), the International Association of Meteorology and Atmospheric Sciences (IAMAS), the Abdus Salam International Centre for Theoretical Physics (ICTP), the Asian Office of Aerospace Research and Development (AOARD), Office of Naval Research, COSPAR (Committee on

Space Research), US National Science Foundation (US NSF) and SCOSTEP. With the contributions from COSPAR, IAGA, ICTP, AOARD and SCOSTEP a total of 46 participants received a full or partial support (registration fee waivers) for their attendance of the STP13 symposium. Two hundred and sixty (260) scientists participated in the conference, giving 165 oral presentations including 55 invited and overview talks, and 70 posters. The presentations covered the three trusts of SCOSTEP's research, namely: 1) intra-atmospheric chain; 2) electromagnetic chain; and 3) mass chain (CME/Flares). A one day workshop was also held to analyze Sun-to-Earth MiniMax24 events, an initiative of the SCOSTEP VarSITI/ISEST (International Study of Earth-affecting Solar Transients/ MiniMax24) project. Twenty three (23) presentations were made on results from the MiniMax24 observation campaign, examining Earth-affecting solar transients, and the low activity of solar cycle 24. The book of abstracts, the conference program and most of the presentations can be found at http://www.yorku.ca/scostep/?page_id=1747.



Photo 1: Group photo of the participants in SCOSTEP's 13th Quadrennial Solar-Terrestrial Physics Symposium.

1. SCOSTEP Sponsored Scientific Meetings and Workshops (in chronological order)

- **HEPPA/SOLARIS WORKSHOP, Baden-Baden, Germany**

The HEPPA/SOLARIS-2014 workshop (http://www.imkasf.kit.edu/english/HEPPA_SOLARIS_2014.php) held in Baden-Baden, Germany, on **5-9 May 2014** was the 5th meeting in a series focusing on the mechanisms by which energetic particles and solar irradiance affect the atmosphere and climate. Since 2012, the workshop has been organized in conjunction with the SPARC/SOLARIS-HEPPA community. The topics covered were: i) variability of energetic particle precipitation and solar irradiance; ii) uncertainties in their measurements; iii) observed and modelled impacts of solar forcing on the atmosphere (thermosphere to surface) and climate, and iv) predictions for future scenarios under a weakening sun.

One of the scientific highlights was the finding that the impact of energetic particle precipitation on regional North Atlantic climate can be similar in magnitude to solar irradiance forcing, which means that energetic particle precipitation needs to be included in climate modelling. HEPPA/SOLARIS-2014 was attended by 72 participants from 13 countries. All contributed papers were presented as posters, while 12 overview talks provided introductions to the topics. The next HEPPA/SOLARIS workshop will be held in 2016, in Helsinki, Finland.



Photo 2: Participants at the HEPPA-SOLARIS-2014 workshop held on 5-9 May, 2014 in Baden-Baden, Germany.

- **VarSITI/SEE kick-off meeting and BBC meeting, Sunny Beach, Bulgaria**

Two SCOSTEP/VarSITI funded meetings were held from **26 to 30 May 2014** in Sunny Beach, Bulgaria: the VarSITI SEE (Solar Evolution and Extrema) project kick-off meeting, and the meeting of the Balkan, Black Sea and Caspian Sea (“BBC”) regional Network for Space Weather Studies. Both took place during the regular 6th Workshop on Solar Influences on the Magnetosphere, Ionosphere and Atmosphere (<http://ws-sozopol.stil.bas.bg/>). Forty participants from 14 countries attended the meetings giving more than 50 presentations. Most of these presentations are available at <http://ws-sozopol.stil.bas.bg>. The SEE working groups and their leaders were defined, and the project’s working plan was discussed. The BBC Regional network decided to join VarSITI, and various joint activities were proposed. Olga Malandraki from Greece was elected as the BBC coordinator, and Venera Dobrica from Romania was elected as the new deputy editor-in-chief of the BBC journal Sun and Geosphere (www.sungeosphere.org) where the proceedings of the meetings will be published after a peer review.

The Balkan, Black Sea and Caspian Sea Regional Network on Space Weather Studies (BBC SWS Regional Network) has been very active in the frame-work of the IHY (International Heliophysical Year) and ISWI (International Space Weather Initiative) and comprises Armenia, Azerbaijan, Bosnia/Herzegovina, Bulgaria, Croatia, Georgia, Greece, Romania, Russia, Serbia, Turkey, and Ukraine (<http://www.bbc-spaceweather.org/>). It publishes its own international peer-reviewed journal ‘SUN and GEOSPHERE’ (<http://www.sungeosphere.org/>)

- **First meeting of the African Geophysical Society, Abuja, Nigeria**

The 1st Annual Conference of the African Geophysical Society (AGS) was held in Abuja, Nigeria during **2-6 June 2014**. The conference was attended by 82 of the 121 invited participants from 11 African countries, UK, Japan, and India. Thirty seven oral presentations and 24 posters were presented in the entire conference. The conference was hosted by the Centre for Atmospheric Research of the Nigerian Space Research and Development Agency, with financial support from SCOSTEP, the Japan Society for the Promotion of Science (JSPS), and the Solar-Terrestrial Environment Laboratory (STEL) of Nagoya University, Japan. Award of fellowship of AGS were presented to the following six distinguished

scientists in recognition of their great contributions to the development of Earth and Space Science in Africa: Prof. Cyril A. Onwumechili (Nigeria), Prof. Sandro M. Radicella (Argentina/Italy), Prof. Kiyohumi Yumoto (Japan), Prof. Ousseini Fambitakoye (France, Post Humus), Prof. Patricia H. Doherty (USA), and Dr. Endawoke Yizengaw (Ethiopia/USA).



Photo 3: Group photo of the participants in the 1st Annual conference of the African Geophysical Society.

- **African Space Science School, Kigali, Rwanda**

The African School on Space Science (ASSS) took place in Rwanda, Kigali City during **30 June - 11 July, 2014**. The School was jointly organized by the Abdus Salam International Centre for Theoretical Physics (ICTP, Italy), the Institute of Scientific Research of Boston College (B.C, USA) and the University of Rwanda (UR) College of Science and Technology (CST) with the financial support from various space science programs including SCOSTEP.



Photo 4: African School on Space Science, Kigali, Rwanda, 30 June – 11 July, 2014

The school gathered 63 participants including Lecturers and students with the majority of students coming from the East-African Region. The ASSS covered topics related to the physical phenomena of the solar magnetosphere - ionospheric coupling and their impact on the near-Earth space environment. The school created an opportunity for senior and young space scientists to interact and share knowledge in space science. The school also strengthened the vision and understanding of the importance of research in space science and its applications for the development of mankind (i.e. GPS use for research, practical applications and scientific exploration). The closing ceremonies of the African School on Space Science were honored by the Minister of Education in Rwanda.

- **5th IAGA/ICMA/CAWSES Workshop, Antalya, Turkey**

The 5th IAGA/ICMA/CAWSES workshop was held in the Akdeniz University in Antalya, Turkey, **11 - 15 August, 2014**. The meeting was attended by a total of 60 senior and young scientists from 12 countries. During the 5-day workshop the participants presented 60 papers, including 11 solicited presentations. The meeting was open for graduate students from Akdeniz University. The workshop obtained financial supports from the SCOSTEP/VarSITI program, the International Association of Geomagnetism and Aeronomy (IAGA) and International Commission on the Middle Atmosphere (ICMA). This meeting provided an excellent opportunity for the scientists to discuss the progress done to date in the field of the upper atmosphere-ionosphere interaction and outlined suggestions and ideas for further research on the vertical coupling of the atmosphere-ionosphere system.

- **14th European Solar Physics Meeting, Dublin, Ireland**

The 14th European Solar Physics Meeting (ESPM-14; <http://www.espm14.ie>) was held in Trinity College Dublin, Ireland during **8 – 12 September 2014**. The ESPM conference series is organized every three years by the European Solar Physics Division (ESPD) and aims to highlight all aspects of modern solar physics research, including activities in both observation and theory that span from the interior of the Sun out into the wider heliosphere.

The ESPM-14 played host to 240 scientists (~1/4 of which were PhD students) who presented more than 180 posters, 68 contributed talks and 23 invited reviews. The internationally inclusive nature of ESPM-14 was clearly demonstrated by the participation of scientists from countries outside Europe, including Australia, Brazil, India, Japan, Mexico, Republic of (South) Korea and the USA. Thanks to the SCOSTEP/VarSITI program, ESPM-14 provided financial support to 2 registered PhD students and 3 junior postdoctoral researchers from developing countries.

- **Cluster/MAARBLE/Van Allen Probes Conference, Rhodes, Greece**

The “Geospace Revisited”, a joint Cluster/MAARBLE/Van Allen Probes conference (<http://geospacerev.space.noa.gr>) was held in Rhodes, Greece, on **15 to 20 September 2014**, and was attended by 160 participants from 26 countries - mainly from USA, Japan, China and the European Union. The central aim of the conference was to revisit long-standing issues of geospace dynamic phenomena through investigations with space and ground-based measurements combined with theory, models and simulations. The keynote talk on “James Van Allen and the discovery of the radiation belts” by Stamatios Krimigis opened the conference, which included six plenary sessions, with topics ranging from upstream transient phenomena and processes in the magneto-tail to ring current and radiation belt dynamics. Ninety five (95) oral and 70 poster presentations delved into the problems of solar-terrestrial coupling and the complex interplay of particles, fields and waves in geospace and kept the interest of the participants unabated throughout the week. The conference included also two well-

attended splinter sessions on Radiation Belt Specification and on the VarSITI/SPeCIMEN project of SCOSTEP, as well as several other mission and project splinter meetings. A special issue of *Annales Geophysicae* with papers of the conference is in preparation.



Photo 5: Group photograph of participants in the joint Cluster/MAARBLE/Van Allen Probes conference.

- **International Space Science School, Lima, Peru**

The SCOSTEP/ISWI International School on Space Science (ISSS) was held in the headquarters of the Instituto Geofísico del Perú (IGP) in the city of Lima, Peru, during **15 – 23 September, 2014**. The School was organized as part of the activities of the X COLAGE (Tenth Latin American Conference on Space Geophysics) that was held in Cusco, Peru. In this way, students participating of the conference also had the opportunity to attend the School. In this edition of the ISSS, 42 students participated, mainly coming from Latin American countries. The student distribution by country was as follows: Argentina 3, Brazil 15, Chile 2, Colombia 3, Mexico 3, Peru 13, Spain, 1, Uruguay 1, and USA 1. All students received financial support to participate in the School. In addition, 20 professors from various international institutions attended the International Science School. In order to facilitate the participation of the students in the X COLAGE and also in the ISSS, the local organizing committee covered partially the cost of flight tickets for students. The international sponsors were the Scientific Committee on Solar-Terrestrial Physics (SCOSTEP), the International Space Weather Initiative (ISWI), and National Science Foundation (NSF). Additionally, the local sponsors and organizers were the Instituto Geofísico del Perú (IGP), Ciencia Internacional (CI), and Comisión Nacional de Ciencia, Tecnología, e Innovación Tecnológica (CONCYTEC).

- **Second International ANGWIN Workshop, Utah, USA**

New observational and modelling studies of gravity waves have significantly improved our understanding of their important role for transporting energy and momentum within the middle atmosphere and the coupled thermosphere/ionosphere system. However, gravity wave fluxes and dynamical contributions at polar latitudes are not well understood, primarily due to a paucity of measurements. ANGWIN (*ANTarctic Gravity Wave Instrument Network*) is a highly successful "grass roots" program initiated in 2011 that utilizes a network of instrumentation operated at several international research stations around Antarctica with the primary research goal of quantifying and understanding the dominant sources, propagation and impact of a broad spectrum of gravity waves on a continental-wide scale. The 2nd ANGWIN Workshop on *High-Latitude Wave Dynamics and Coupling* was held at Utah State University, USA during **1 – 3 October, 2014**. The goal of the 3-day workshop was to combine together new Antarctic and Arctic observations and results with modelling studies to gain fresh

knowledge and insight of their large-scale effects on the general circulation of the polar-region's lower, middle and upper atmosphere and ionosphere. The workshop was attended by 24 scientists and 12 graduate students encompassing a broad-range of expertise in polar aeronomy from Australia, Brazil, Canada, Germany, Japan, the USA and UK. The workshop was very successful with 38 oral presentations bringing together new ground-based, aircraft and satellite measurements and modeling studies to further knowledge and understanding of gravity wave dynamics and coupling in the Antarctic and Arctic regions. The lively discussions between established scientists, young researchers and graduate students were most rewarding. The next workshop will be hosted by the British Antarctic Survey (BAS), Cambridge, UK in 2016. The workshop was part of the SCOSTEP ROSMIC/VarSITI project.



Photo 6: The participants in the 2nd International ANGWIN Workshop: High-Latitude Wave Dynamics and Coupling

- **Second TOSCA Training School, Trieste, Italy**

The 2nd TOSCA training school on “Solar variability and climate response” was held at Abdus Salam International Centre for Theoretical Physics (ICTP), Trieste, Italy, from **13 to 17 October 2014**. The school was organized by COST Action ES1005 TOSCA (Towards a more complete assessment of the impact of solar variability on the Earth’s climate), the FP7 collaborative project SOLID, and the Abdus Salam ICTP. It aimed at providing young scientists with a global understanding of the role of solar variability in climate change. 28 students attended the school from 16 countries. The program included lectures, computer classes, and team work. Various topics were covered, including the basics properties (solar, heliospheric, and atmospheric physics), diagnostic techniques, errors and uncertainties, needed research, socio-economic aspects. At the end of the school, the participants were asked to complete an online and anonymous evaluation form which indicated a high degree of satisfaction with the organization and the curriculum and in particular with the lectures and team work activities which were carried out. The SCOSTEP financial support contributed to make the school possible.



Photo 7: The participants in the 2nd TOSCA training school on “Solar variability and climate response”

2. SCOSTEP Bureau 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).

2.1. SCOSTEP Bureau Meetings

The SCOSTEP Bureau held its annual meeting on **20 March, 2014**, in Prague, Czech Republic. A Bureau meeting was also held prior to the STP13 Symposium in Xi'an on **12 October, 2014**. Minutes from the meetings can be found on the SCOSTEP Website.

2.2. New SCOSTEP Bureau members

In August 2014 the International Union of Radio Science (URSI) appointed Prof. Craig Rodger, University of Otago, New Zealand as its representative in the SCOSTEP Bureau, replacing Dr. Lee-Anne McKinnell.

2.3. New SCOSTEP Science Discipline Representatives

In 2014 six new Science Discipline Representatives (SDR) were appointed from SCOSTEP Adherent countries, which did not have such representatives in the SCOSTEP General Council, namely Finland, Greece, Hungary, Israel, New Zealand and Slovakia. With these new appointments the number of SRDs became 60.

3. SCOSTEP Awards – Distinguished Science and Distinguished Young Scientist

Recognizing the societal importance of studies in the field of solar-terrestrial physics and to give credit to scientists who contribute significantly to these studies and to SCOSTEP activities, the SCOSTEP Bureau has recently instituted three awards: SCOSTEP Distinguished Science Award, SCOSTEP Distinguished Young Scientist Award, and SCOSTEP Distinguished Service Award. The SCOSTEP Distinguished Young Scientist Award is given to young scientists who achieved considerable success in solar-terrestrial physics and took an active part in SCOSTEP-related activities. The SCOSTEP Distinguished Science Award is given in recognition of an outstanding contribution of a scientist to SCOSTEP science. SCOSTEP sub-committee headed by Dr. Vladimir Kuznetsov developed the modus operandi for the awards while the Awards Selection Committee was chaired by Prof. Marvin Geller, Past President of SCOSTEP. The SCOSTEP Awards is one of the new initiatives designed to raise the profile of SCOSTEP.

For its first installment, after a number of nominations from the solar-terrestrial community at large, the Awards Selection Committee unanimously selected and recommended to the SCOSTEP Bureau that Dr. Neel Savani and Dr. Jia Yue be the recipients of the SCOSTEP Distinguished Young Scientist Award for 2014. Prof. Gordon G. Shepherd was unanimously selected to be the recipient of the SCOSTEP Distinguished Science Award for 2014.

The SCOSTEP Distinguished Science Medals were presented to Dr. Jia Yue and Prof. Gordon Shepherd by the SCOSTEP President, Dr. Nat Gopalswamy at Solar-Terrestrial Physics Symposium (STP13), which took

place during **12 – 18 October, 2014**, in Xi'an, Shanxi, China. Dr. Neel Savani was not able to attend. His award was presented at a later date.

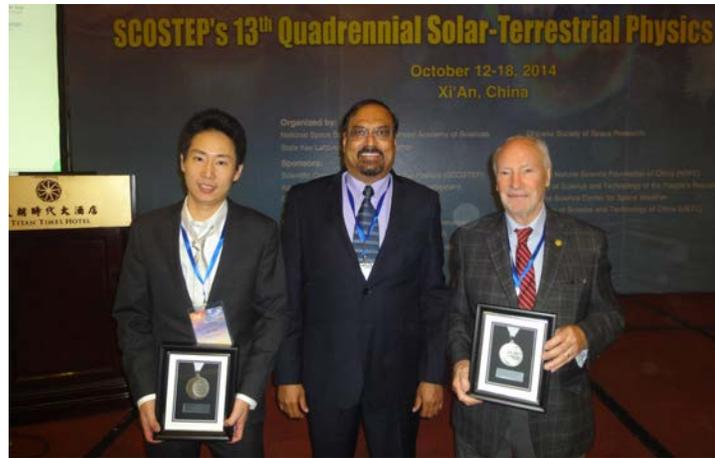


Photo 8: The SCOSTEP President Dr. Nat Gopalswamy with the recipients of the 2014 SCOSTEP's Distinguished Young Scientist Award, Dr. Jia Yue and Distinguished Science Award, Prof. Gordon Shepherd.

4. SCOSTEP Visiting Scholar Program

In 2014 the Scientific Committee on Solar-Terrestrial Physics announced the establishment of a new capacity building activity, the SCOSTEP Visiting Scholar (SVS) program. SCOSTEP is an interdisciplinary body of the International Council for Science, which strives to bring together different scientific disciplines to address scientific issues of international relevance. The SVS program will complement the current scientific program and public outreach activities of SCOSTEP.

The objective of the SVS program is to provide training to young scientists and graduate students from developing countries in well-established solar terrestrial physics laboratories, for periods of between one and three months. The aim is to fund four scholars each year, one related to each of the four SCOSTEP VarSITI themes (<http://www.varsiti.org/>). The training will help the young scientists to advance their career in solar terrestrial physics using the technique/skills they acquired during the training. SCOSTEP will provide the airfare, while the hosting lab will provide living expenses. The SVS process will operate in conjunction with existing visiting scientist schemes with similar aims, whether organized by individual laboratories or other programs.

The SCOSTEP SVS committee is: Manuel Grande (chair) (UK), Maura Hagan (USA), Nicole Vilmer (France), Akimasa Yoshikawa (Japan), Babatunde Rabiun (Nigeria), Jean-Pierre Raulin (Brazil).

5. SCOSTEP at STSC UN COPUOS, Vienna

SCOSTEP's President and Scientific Secretary attended the 51st Session of the Scientific and Technical Subcommittee (STSC) of UN COPUOS (Committee on the Peaceful Use of Outer Space), held during 10-21 February, 2014 in Vienna, Austria. Two technical presentations were given on **12 February, 2014** on "Variability of the Sun and its Terrestrial Impact (VarSITI) - Scientific Committee on Solar Terrestrial Physics (SCOSTEP) New Scientific Program (2014-2018)" by N. Gopalswamy, and on "Highlights of the

Scientific Committee on Solar Terrestrial Physics (SCOSTEP) Climate And Weather of the Sun-Earth System - II (CAWSES II) Scientific Program (2009-2013)” by M. G. Shepherd. The presentations could be found at <http://www.unoosa.org/oosa/en/COPUOS/stsc/2014/presentations.html> and http://www.yorku.ca/scostep/?page_id=46.

6. Publications

The results from the CAWSES II program and the International CAWSES II Symposium, held in Nagoya in November 2013 were presented in a special issue of the Earth, Space and Planets (EPS) journal, while six review papers on highlights from the four CAWSES II themes, including an Introductory paper on the entire CAWSES program and E-Science were submitted to the Progress in Earth and Planetary Science (PEPS), An SpringerOpen journal. Three of the six CAWSES PEPS review papers are now published and available through open access as follows (<http://www.progearthplanetsci.com/>):

“Response of the mesosphere-thermosphere-ionosphere system to global change – CAWSES II contribution”, by Laštovička J, Beig G and Marsh DR *Progress in Earth and Planetary Science* 2014, 1:21 (11 Nov 2014)

“Response of the mesosphere-thermosphere-ionosphere system to global change – CAWSES II contribution”, by Laštovička J, Beig G and Marsh DR *Progress in Earth and Planetary Science* 2014, 1:21 (11 Nov 2014)

“The geospace response to variable inputs from the lower atmosphere: a review of the progress made by Task Group 4 of CAWSES II”, by Oberheide J, Shiokawa K, Gurubaran S, Ward WE, Fujiwara H, Kosch MJ, Makela JJ and Takahashi H *Progress in Earth and Planetary Science* 2015, 2:2 (11 Feb 2015)

The other three review papers on the activities of the CAWSES Task Group 3, e-Science and an Introductory to the entire issue are still under review.

7. SCOSTEP Secretariat Activities

The SCOSTEP Secretariat continued its work in coordinating and managing all SCOSTEP related activities, as well as providing logistic and technical support for the CAWSES and VarSITI programs. The Scientific Secretary Prof. M. Shepherd organized the annual SCOSTEP Bureau meetings in Prague and Xi’an and the General Council meeting in Xi’an and was involved in the organization of the STP13 symposium. M. Shepherd prepared posters featuring SCOSTEP activities as well as helped with the preparation of the National SCOSTEP-related posters all displayed at the STP13 symposium. The Scientific secretary also issued 2 SCOSTEP Newsletters, maintained the SCOSTEP Website, looked after the translation of the Comic books in foreign languages, administered the SCOSTEP finances and looked after general day-to-day SCOSTEP business.

Further information on the activities outlines in this report can be found at the SCOSTEP Website, <http://www.yorku.ca/scostep/> or could be provided on requested by the SCOSTEP Secretariat, mshepher@yorku.ca.