



The Scientific Committee on Solar-Terrestrial Physics (SCOSTEP)

## ANNUAL REPORT (1 JANUARY – 31 DECEMBER, 2018)

*Prepared by Marianna G. Shepherd, SCOSTEP Scientific Secretary*

The report that follows covers the period from 1 January to 31 December 2018. It reflects the activities carried out by the organization and its current scientific program, “Variability of the Sun and Its Terrestrial Impact” (VarSITI). The main SCOSTEP event was the 14<sup>th</sup> Quadrennial Solar-Terrestrial Physics Symposium (STP14) held in Toronto, Canada during July 9 – 13, 2018. SCOSTEP through its Capacity Building and VarSITI programs supported 18 scientific conferences and workshops and the development of 5 databases. The collaboration with the ISWI (International Space Weather Initiative) continued through the support of ISWI meetings and the International Space Science Schools. SCOSTEP participated in the 55<sup>th</sup> Scientific and Technical Subcommittee (STSC) of the UN COPUOS (Committee on the Peaceful Use of Outer Space) as a permanent observer. These events were communicated to the SCOSTEP scientific community via the SCOSTEP and VarSITI Newsletters and the results achieved are summarized in this report.

### 1. 14<sup>TH</sup> QUADRENNIAL SOLAR-TERRESTRIAL PHYSICS SYMPOSIUM – JULY 9 – 13, 2018, TORONTO, CANADA

SCOSTEP’s 14<sup>th</sup> Quadrennial Solar-Terrestrial Physics Symposium (STP14) was held during July 9-13, 2018, at York University, Toronto, Canada. The Symposium gathered 150 scientists from 26 countries, Austria, Brazil, Bulgaria, Canada, China, the Czech Republic, Finland, France, Germany, Georgia, Greece, Hungary, India, Italy, Japan, Korea, New Zealand, Nigeria, Norway, Poland, Russia, Spain, Switzerland, Taiwan, the UK, and the USA, to discuss the detailed relationships of the Earth to the Sun. The event was sponsored by the Centre for Research in Earth and Space Science (CRESS) with support from the Lassonde School of Engineering (LSE) of York University, SCOSTEP, the USA’s National Science Foundation, the Core-to-Core Program of the Japan Society for the Promotion of Science, the Project for Solar-Terrestrial Environment Predictions, Japan, and the International Association of Geomagnetism and Aeronomy (IAGA). All sponsors have been acknowledged in the Abstracts Book, on the STP14 website (<http://www.scostepevents.ca/>) and in all printed materials associated with the conference, e.g. posters, Newsletters. The Symposium program, Abstracts book and the presentations can be found on line at the STP14 website: <http://www.scostepevents.ca/>.

The program included 120 oral presentations and 39 posters organized in 14 sessions with 4 keynote speakers, 25 invited speakers and 8 plenary speakers. Keynote presentations were given by David Kendall (UNCOPUOS, Canada), Larry Paxton (Johns Hopkins University, Atmospheric Physics Laboratory, USA), Irina Mironova (St. Petersburg State University, Russia), and Spiro Antiochos (NASA Goddard Space Flight Centre, USA).

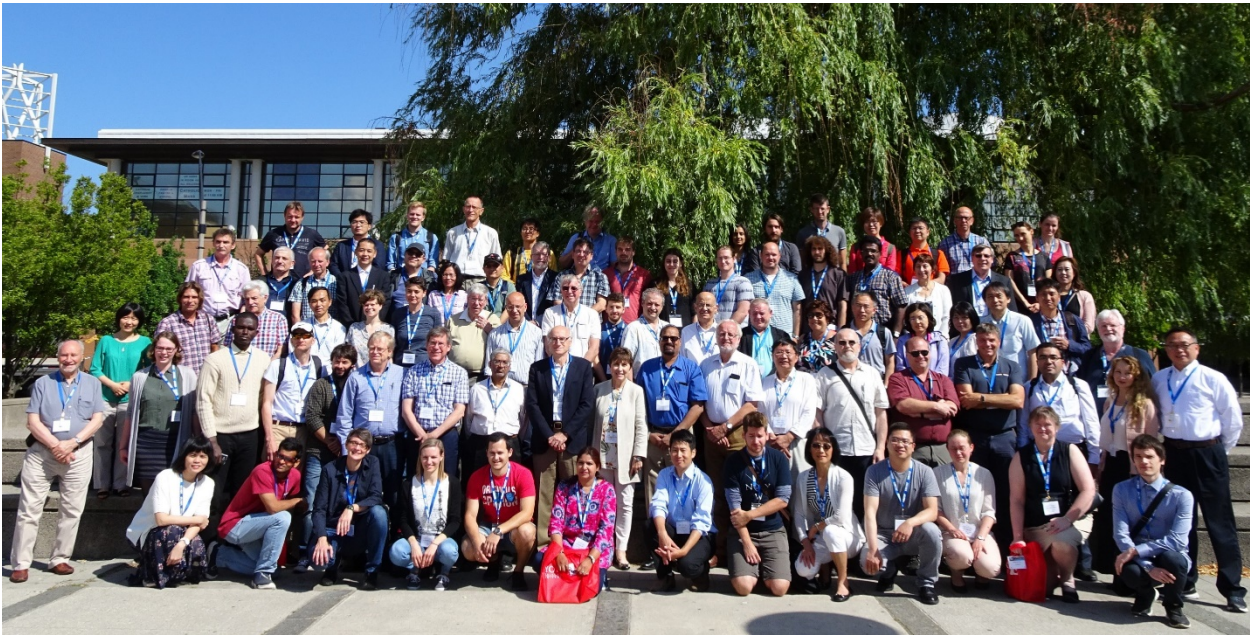
At the opening session the attendees were welcomed by the SCOSTEP President, Nat Gopalswamy (NASA), Regina Lee (Associate Dean, Research & Graduate Studies, Lassonde School of Engineering, LSE), James Whiteway (Director, CRESS), and Eric Laliberté (Canadian Space Agency), followed by inaugural lectures on the history of Solar-Terrestrial Science in Canada by David Boteler (Natural Resources Canada, NRCan) and highlights of the VarSITI (Variability of the Sun and Its Terrestrial Impact) program within SCOSTEP, by the Program’s Co-chair Kazuo Shiokawa of Nagoya University, Japan.



*Photo 1: SCOSTEP's President Nat Gopalswamy welcoming the attendees on behalf of SCOSTEP and the Science Organizing Committee.*

The implementation of the event, including registration and the audio-visual support was carried out with the help of graduate students and Post-Doctoral Fellows from the Lassonde School of Engineering. Attendees varied from distinguished scientists in the field to graduate students. A portion of the registration fee paid by the attendees was made available to support early career scientists and graduate students, thus providing a broad spectrum of experience.

The event was widely praised by the attendees for the compact and friendly environment provided by the York University setting. In addition, the registration, accommodation and operational procedures were more personal than would otherwise have been the case.



*Photo 2. Group photo of some of the participants in STP14, July 10, 2018, Toronto*

## **2. SCOSTEP SPONSORED SCIENTIFIC MEETINGS AND WORKSHOPS (IN CHRONOLOGICAL ORDER)**

- **13<sup>th</sup> Conference on "Plasma Physics in the Solar System" – Space Research Institute, Moscow, 12 – 16 February 2018.**

The 13<sup>th</sup> Conference "Plasma Physics in the Solar System" was organized by Space Research Institute (IKI), Moscow, Russia and held in IKI on 12-16 February, 2018. The program of the Conference included the following main traditional sections: 1. Theory and observations of the Sun, 2. Solar wind and heliosphere, 3. Ionosphere, 4. Magnetosphere, 5. Theory of space plasma, 6. Theory and observation of current layers, 7. Turbulence and chaos, as well as Special sections: S1. Space weather forecast and applied questions of physics of the magnetosphere

and ionosphere, S2. Wave phenomena in space plasma, S3. The impact of space factors on the Earth's atmosphere and climate (see conference web-site: <https://plasma2018.cosmos.ru/en> ). There were more 300 participants from 6 countries. A large part of presentations were translated in real time in [https://www.youtube.com/watch?v=Zl3PD\\_d9sJA](https://www.youtube.com/watch?v=Zl3PD_d9sJA) . The conference was supported by VarSITI grant.

- **Dynamic Sun II: Solar Magnetism from Interior to the Corona – Siem Reap, Cambodia, 12-16 February, 2018**

The “Dynamic Sun” is a new conference series, which provides a highly visible platform for the observers, theoreticians, numerical modelers and instrumentation experts in solar physics and space science to discuss cutting edge scientific challenges. The Dynamic Sun II meeting, which focused on the recent achievements in understanding photospheric, chromospheric and coronal dynamics, energy transport between the solar interior and the solar atmosphere, and dynamical processes in the confined solar transients, took place during February 12-16, 2018 in Siem Reap, Cambodia. This meeting, supported by SCOSTEP/VarSITI and AOARD, was very successful with more than 60 attendees from more than 10 countries. Special attention was paid to the key goals of the proposed high-altitude and ground-based instruments, e.g., DKIST, EST, Sunrise III, and Aditya-I. To disseminate the results reported during the conference the refereed proceedings will be published as a special issue of *Annales Geophysicae* journal.



*Photo 3: Group Photo of the Dynamic Sun II.*

- **International School on Equatorial and low-latitude ionosphere (ISELION 2018) – Bandung, Indonesia, 5-9 March 2019**

The International School on Equatorial and low-latitude ionosphere (ISELION2018) was held at Bandung, Indonesia on March 5 – 9, 2018. Participants are 39 students and young scientists from 7 countries of Egypt, India, Indonesia, Malaysia, Nepal, Philippines, and Vietnam. Six lecturers (Nurul Shazana, Abdul Hamid, Buldan Muslim, Kazuo Shiokawa, Yoshimasa Tanaka, Mamoru Yamamoto, and Tatsuhiro Yokoyama) introduced ionospheric dynamics, measurement techniques including radars, Spread-F/plasma bubbles. A visit of Observatory of LAPAN and practice of ionogram processing was also held. Participants enjoyed lively discussions with the lecturers and mutual communications during this one-week school. Details of the school are available at <http://pussainsa.sains.lapan.go.id/event/iselion2018/> . This school was supported by LAPAN, ISEE/Nagoya University, JSPS core-to-core program B. Asia-Africa Science Platforms, PSTEP project, National Institute of Information and Communications Technology (NICT), and SCOSTEP.



Photo 4: Participant in ISELION 2018

- IAU Symposium 340 - Jaipur, India – February 18 - 24, 2018

The IAU Symposium 340 on “Long term datasets for the understanding of solar and stellar magnetic cycles” was held in Jaipur, India – February 18 - 24, 2018. The symposium provided an ideal opportunity for scientists from diverse, interdisciplinary areas such as solar, stellar, space and heliospheric physics to review the status of the different long-term datasets available across the globe. The symposium provided an excellent platform to exchange ideas on the understanding of solar long-term behavior, its effects and prediction. The Kodaikanal Observatory has observed the sun at wavelengths WL, Ca-II K, H-alpha since 1904. The digitization process has been completed recently and raw and calibrated data was made available to the global community through an announcement during the meeting. IAU Symposium 340 enabled a comparison of recent results from a wide variety of scientific disciplines. There were eight sessions with 25 invited talks and 46 contributed presentations. There were 153 poster presentation for young scientists. A total number of 233 registered participants attended the symposium, with 157 male and 69 female candidates from 26 different countries across the globe. All the presentations have been posted at the conference website at <https://www.iiap.res.in/iaus340/Home>. There were several education and outreach programs conducted during the conference, including a visit for the conference delegates to the Jantar Mantar, a world heritage site. There were workshops organized for the tourist guides with the theme of understanding the usage of the historical observatory instruments through Positional Astronomy observations. A full day workshop on computer based data analysis on long-term solar data sets was also organized for undergraduate and graduate students on the last day of the conference. Ninety students attended this workshop. Nat Gopalswamy also delivered a public lecture titled “Our life-giving star, the Sun and its dark side”.



Photo 5: Group photo of participants in the IAU 340

- AGU Chapman Conference - Particle Dynamics in the Earth's Radiation Belts – Cascais, Portugal, March 2018

The week long meeting, *Particle Dynamics in the Earth's Radiation Belts*, was organized under the auspices of the American Geophysical Union (AGU) Chapman Conference program. The conference was well attended, with roughly 100 attendees representing 14 countries. There was a strong contingent (~25%) of students and early career researchers who were supported by generous travel grants from the United States National Science Foundation (NSF) and the VarSITI program of SCOSTEP. Of particular note is that over half of the invited speakers (<https://chapman.agu.org/particle-dynamics/program-and-invited-speakers/>) were from underrepresented groups. The conference website (<https://chapman.agu.org/particle-dynamics/>) details the full scientific program (<https://agu.confex.com/agu/18chapman2/webprogram/start.html>) and includes .pdf files of nearly all of the oral and poster presentations given at the conference. A special issue of the Journal of Geophysical Research – Space is in preparation.

- 41<sup>st</sup> Annual Seminar on Physics of the auroral phenomena – March 12 – 16, 2018, Apatity, Russia

The 41<sup>st</sup> Annual Seminar "Physics of the auroral phenomena" has been held during March 12 – 16, 2018 in Apatity (Murmansk region, Russia). The organizer of the Seminar is the Polar Geophysical Institute (PGI) of the Russian Academy of Science. More than 80 representatives from 22 research institutes and universities distributed across Russia (from Kaliningrad to Yakutsk) took part in the Seminar. Of these, more than 25 people are young scientists from Moscow, St. Petersburg, Kaliningrad, Apatity and Murmansk. Among the participants there were 3 representatives of foreign research institutes (from China and Bulgaria). 56 oral and 73 poster presentations were presented. The Seminar is devoted to the discussion of the latest results obtained by Russian and foreign scientists on the space physics processes in the polar cap, auroral and sub-auroral regions. The SCOSTEP/VarSITI program was a co-sponsor of the Seminar and partially supported the attendance of some young scientists, students and invited speakers. The received abstracts and program are available at Abstracts Book 2018 and Program.

- The 8<sup>th</sup> biennial VERSIM Workshop: VLF/ELF Remote Sensing of Ionospheres and Magnetosphere – March 19 – 23, 2018, Apatity, Russia

The 8<sup>th</sup> Biennial Workshop of VERSIM, the joint IAGA-URSI working group, was held on March 19 – 21, 2018 in Polar Geophysical Institute (Apatity, Russia). The workshop was attended by 42 participants (Russia - 19 (6 from PGI), Finland - 5, Japan - 5, Hungary - 5, Czech Republic - 3, USA - 3, France - 1, UK – 1), who presented 50 oral and 4 poster reports. The following session themes were held: D-region phenomena and propagation in the Earth Ionosphere cavity; Wave propagation in E and F regions; ELF and VLF waves related to lightning discharges; New instruments and results of specific measurements; Magnetospheric ELF/VLF phenomena; Radiation belt dynamics (not only related to ELF/VLF waves); Laboratory modeling of cyclotron wave-particle interactions. The meeting was supported by SCOSTEP/VarSITI, IAGA, and URSI. A more detailed summary of the meeting including the program and abstracts can be found at <http://pgi.ru/conf/versim2018>.

- DKIST Critical Science Plan Workshop 5: Wave generation and propagation – April 9 – 11, 2018, Newcastle upon Tyne, UK

In preparation for first-light observations at the 4-m class Daniel K Inouye Solar Telescope (DKIST):

<https://dkist.nso.edu/>), in early 2020, the National Solar Observatory (Boulder, USA) has been supporting 9 Critical Science Plan (CSP) development workshops. The DKIST is a 4-m class ground-based solar telescope currently being constructed on Mt. Haleakala on Maui, Hawaii. The DKIST is funded by the National Science Foundation (NSF) and the Corporate Office of the Association of Universities for Research in Astronomy (AURA: <http://www.aura-astronomy.org/>). DKIST will be the most powerful solar telescope in the world at first light, therefore, of major interest to the global solar physics community. Dr. Eamon Scullion of the Mathematics, Physics and Electrical Engineering Dept. of Northumbria University (Newcastle upon Tyne) and Prof James McAteer of New Mexico State University (NM) organized a highly productive 2.5 day workshop, April 9 – 11, 2018, in Newcastle upon Tyne (UK). The workshop brought together 41 participants (27 UK/EU and 14 USA) consisting of senior experts, early career researchers and DKIST instrument scientists, incorporating a variety of observational, numerical and theoretical solar physics expertise. The aim of the workshop was to develop multiple Science-Use-Cases (SUCs) to form part of the DKIST Critical Science Plan, addressing the first 2 years of observing operations, specifically addressing the solar physics research of, "Wave generation and propagation". For more information see here: <http://eclipse2017.nso.edu/science/dkist/dkistcritical-science-plan/workshop-5/>. The highly successful outcome of the workshop was the creation of 32 unique SUCs and the continued development of 3 existing SUCs. The details of these are published on the DKIST Critical Science Plan JIRA site (<https://id.atlassian.com/login>). The workshop was financially supported by SCOSTEP/VarSITI, NSO and NSF of USA, the Science and Technology Facilities Council (STFC, UK) and the Multi-Disciplinary Research Theme (MDRT) of Extreme Environments at Northumbria University (<https://www.northumbria.ac.uk/sun>).

- **4<sup>th</sup> International ANGWIN Workshop: Exploration of the High-latitude Upper Atmosphere Wave Dynamics – April 24 – 26, 2018, San Jose dos Campos, Brazil**

The 4<sup>th</sup> International ANGWIN (*ANtarctic Gravity Wave Instrument Network*) Workshop was held during April 24 – 26, 2018 at the National Institute for Space Research (INPE), São José dos Campos, SP, Brazil. The main purpose of the workshop was to combine new Antarctic and Arctic observations using optical and radio-wave techniques, and results with modeling studies to gain fresh knowledge and insight of their largescale effects on the general circulation of the polar regions lower, middle and upper atmosphere and ionosphere. The workshop provided an opportunity for early career scientists/students to work with some of the leading experts in this field of research. The workshop achieved the purpose with 35 participants from 8 countries (USA, UK, Germany, Island, South Africa, Korea, Japan and Brazil), and 33 oral presentations. The workshop program, abstracts and photos are available at <http://www.inpe.br/angwin/>. The workshop was supported by the VarSITI/SCOSTEP and IAMS/IUGG.

- **10<sup>th</sup> International Workshop on “Long-Term Changes and Trends in the Atmosphere” – May 14 – 18, 2018, Hefei, China**

The 10<sup>th</sup> International Workshop on “Long-Term Changes and Trends in the Atmosphere” was held at Hefei, China during May 14 – 18, 2018. About 130 participants from 13 countries and regions of China (Argentina, Australia, Czech Republic, Finland, Germany, India, Japan, Malaysia, Russia, Taiwan, UK and USA,) attended the workshop. This highly successful meeting was the most attended in this trends workshop series. The main traditional sessions included trends and variability in the stratosphere, mesosphere, thermosphere, ionosphere and modelling trends. Altogether 69 oral papers (including key notes and invited presentations) and 25 posters were presented. In addition, three tutorials for graduate students and young scientists were presented on the history of trends research, dynamics and modeling. Nearly all copies of the oral presentations can be found at <http://trends2018.ustc.edu.cn/programs.html>.



Photo 6: Group photo of Participants in the 10<sup>th</sup> Trends Workshop

- 6<sup>th</sup> International Conference "Atmosphere, Ionosphere, Safety" (AIS-2018) – June 3 – 9, 2018, Zelenogradsk, Russia

The 6<sup>th</sup> International Conference "Atmosphere, Ionosphere, Safety" (AIS-2018) was held in Zelenogradsk, Russia, during June 3 - 9, 2018. More than 130 scientists from 10 countries – Brazil, Czech Republic, Italy, Mexico, Netherlands, Norway, Russia, Switzerland, Taiwan and USA, including 42 young scientists attended the conference. The AIS-2018 conference topics cover many aspects of the solar-terrestrial physics, from the magnetospheric and plasma physics to the influence of the solar activity, meteorological and anthropogenic sources on the atmospheric climate and space weather. In the framework of the conference the Second Baltic young scientists (<39 years old) International School on "Magnetosphere-Ionosphere-Atmosphere Couplin" and young scientist competition took place. 14 lecturers, 70 oral and 50 poster reports introduced inter-disciplinary aspects of atmospheric climate, atmospheric chemistry, wave-particle interaction, ionospheric physics and space weather. Details of the conference are available at <http://ais2018.ru/>

- Tenth Workshop "Solar Influences on the Magnetosphere, Ionosphere and Atmosphere"

The 10<sup>th</sup> Workshop "Solar Influences on the Magnetosphere, Ionosphere and Atmosphere" was held in Primorsko, Bulgaria during June 4 - 8, 2018. The workshop, organized by the Space Climate department of the Space Research and Technology Institute, at the Bulgarian Academy of Sciences, was attended by 76 participants from 15 countries. The 94 oral and poster presentations covered all aspects of solar-terrestrial influences, from physics of the Sun including predictions of future solar activity, solar transients, solar wind and its interactions with the Earth's magnetosphere, to solar effects in the ionosphere and atmosphere, including relation to climate change, to influences on the solid Earth and biosphere. The presentations and the proceedings of the workshop are available online at <http://ws-sozopol.stil.bas.bg/> .

As a part of the workshop, for the first time a summer school for young scientists "Sun, space weather and space climate" was held, organized by Prof. Dibyendu Nandi (Center of Excellence in Space Sciences India (CESSI), Indian Institute of Science Education & Research (IISER), Kolkata, India). A special session dedicated to the recent recalibrations of the sunspot indices marked the kick-off of the VarSITI project "Long-term solar variability and sunspot indices". This workshop was the first forum at which SCOSTEP's next scientific program was publicly discussed. The next program's concept text had been sent before the workshop to all the participants, and the

summary of the discussions was provided as a feedback to the Committee for the SCOSTEP Next Scientific Program.

- **7th HEPPA-SOLARIS Workshop - Roanoke, Virginia, USA, 11 – 14 June, 2018**

The 7<sup>th</sup> HEPPA-SOLARIS Workshop was held June 11-14 2018 in Roanoke, Virginia, USA. The focus of the workshop was on observational and modeling studies of the influences of solar radiation and energetic particle precipitation on the atmosphere and climate. Sessions were held on: solar and precipitating particle variability; solar photon and particle effects on the stratosphere and above; dynamical processes influencing the coupling of altitude regions; solar and particle effects on the troposphere and climate system; and tools for assessing solar and precipitating particle influences. There were 35 presentations including 7 posters. Participants represented 8 countries (USA, Norway, Spain, Finland, United Kingdom, Germany, Japan, Brazil). An open process for nominating invited talks led to a broad set of presentations with many new results and many stimulating discussions. In addition to VarSITI, support was provided by Virginia Tech (the host institution) as well as SPARC. (<http://www.cpe.vt.edu/heppa.solaris.2018/>).



*Photo 7: The participants in the 7<sup>th</sup> HEPPA-SOLARIS Workshop, 2018*

- **7<sup>th</sup> IAGA/ICMA/SCOSTEP Workshop on Vertical Coupling in the Atmosphere-Ionosphere System, July 2-6, 2018, Potsdam, Germany.**

The traditional 7<sup>th</sup> IAGA/ICMA/SCOSTEP Workshop on Vertical Coupling in the Atmosphere-Ionosphere System was held in the campus of the GFZ German Research Centre for Geosciences, Helmholtz Centre Potsdam from July 2 – 6, 2018. Audience at the Workshop included 60 scientists from 30 institutions across 18 countries spanning Asia, Europe, Africa, North and South America. During five days of workshop over 50 oral contributions and 16 posters were presented, among them 5 solicited talks. This meeting offered an excellent opportunity for scientists of broad research area, from lower, through middle and upper atmosphere and ionosphere and magnetosphere, to present and discuss their recent results. Communication between scientists has been very fruitful and initiated further cooperation. The following meeting is planned for 2020. The organizers appreciate substantial financial support provided by SCOSTEP/VarSITI (project ROSMIC) together with IAGA and IUGG that allowed twelve scientists to participate.





*Photo 8: Group photo of the participants*

- **45<sup>th</sup> Annual European Meeting on Atmospheric Studies by Optical Methods – August 27 – 31, 2018, Kiruna, Sweden**

The 45<sup>th</sup> Annual European Meeting on Atmospheric Studies by Optical Methods (45AM) was organized by the Swedish Institute of Space Physics in Kiruna, Sweden. The meeting lasted for one week (August 27-31) at the end of the summer 2018. More than 50 participants took part in 45AM, presenting 50 oral and 10 poster presentations. Although the meeting has the title “Annual European Meeting” it attracts scientist from all parts of the world, especially from North America, Japan and former Soviet Union countries. This annual meeting aims to bring together scientists and graduate students from Europe as well as from other parts of the world to exchange experiences, share scientific results, and plan and coordinate future experiments. The meeting program covered a wide range of phenomena where optical techniques are used to learn about processes in the atmosphere. It included seven sessions: aurora and ionosphere-thermosphere interaction; noctilucent clouds and mesospheric aeronomy; transient luminous events; aerosol and clouds; meteors; active experiments in the upper atmosphere; ground-based, in-situ and space-based instruments, new facilities; and EISCAT\_3D and optical instruments. SCOSTEP’s VarSITI program was a co-sponsor of 45AM and partially supported the attendance of some young scientists, students and invited speakers. The conference program, abstracts and photos are available at <http://45am.irf.se>.



*Photo 9: Group Photo of the participants*

- ISEST 2018 Workshop

The "International Study of Earth-affecting Solar Transients ISEST 2018 Workshop", organized by Hvar Observatory, Faculty of Geodesy, University of Zagreb, was held from September 24 to 28, 2018 in the Hotel Amfora, Hvar, Croatia. The meeting was a concluding workshop of the ISEST project (<http://solar.gmu.edu/heliophysics/index.php/ISEST>). More than 70 participants from 22 countries took part in ISEST 2018, presenting 41 oral presentations and 36 posters. The full Scientific Program, including the Abstract Book and the List of Participants is available under the link "Abstract book" at <http://oh.geof.unizg.hr/index.php/en/meetings/isest-2018>. The meeting was held under the auspices of the Hvar Town Council and Croatian Astronomical Society. The Colloquium was sponsored by the Ministry of Science and Education, Republic of Croatia, the SCOSTEP/VarSITI program, International Association of Geomagnetism and Aeronomy (IAGA), and International Union of Geodesy and Geophysics (IUGG).



Photo 10: Group photo of the participants

- The 15<sup>th</sup> International Symposium on Equatorial Aeronomy (ISEA-15), October 22 – 26, 2018, Ahmedabad, India

The 15<sup>th</sup> International Symposium on Equatorial Aeronomy (ISEA-15) was held at the Physical Research Laboratory (PRL), Ahmedabad, India during October 22 – 26, 2018. In all 249 abstracts accepted were distributed in the seven scientific themes in ISEA-15: Equatorial E- and F-region irregularities: Cause and effects; Longitudinal dependence of equatorial electrodynamics; Mesosphere Ionosphere Thermosphere coupling at low- and mid-latitudes; Mid- and low-latitude effects of global atmospheric wave coupling; Space weather effects on low- and mid-latitudes; Results from new techniques, experiments, and campaigns; and Future trends, opportunities, and challenges in low-latitude aeronomy. There were 64 oral presentations. All the posters were displayed on all the days, thus providing time for extended interactions. There were around 180 participants from 22 countries, with over 60 participants from out of India. A young scientist presentation competition was held wherein 43 young scientists participated. More information about the program, abstracts and other updates are available on the ISEA-15 website (<https://www.prl.res.in/isea15>).



Photo 11: Group photo of participants

- **The 7<sup>th</sup> Brazilian Symposium on Space Geophysics and Aeronomy**

The 7<sup>th</sup> SBGEA Symposium was held at the Southern Regional Space Research Center (CRS) of the Brazilian National Institute for Space Research (INPE) from 5 to 9 November 2018, in Santa Maria-RS, Southern Brazil. The Brazilian Space Geophysics and Aeronomy Association encourage and promote the achievement of this scientific event every two years. The scientific objective of this symposium was to show results of observational, theoretical and modeling studies obtained in recent years that will allow a better understanding of the Space phenomena, with origin in the Sun and in the interplanetary medium, which affects the whole atmosphere and Earth's climate. The 7<sup>th</sup> SBGEA was organized in 8 scientific sessions, with 7 invited talks and 43 normal oral presentations, totalizing 50 oral talks, and about 130 poster presentations. This symposium was supported by VarSITI/SCOSTEP, SBGEA, CAPES, FAPESP, FAPERGS and CBJLSW/NSSC/ CAS. The details of the symposium can be found at <http://www.sbgea.org.br/en/vii-sbgea-2/>.



Photo 12: The 7<sup>th</sup> SBGEA Symposium official photo taken at CRS/INPE, Santa Maria-RS, on November 8, 2018.

### 3. SUPPORT FOR DATABASES

- **Virtual Laboratory for the comprehensive analysis of Forbush-Effects and Interplanetary Disturbances (ViLaFEID) – IZMIRAN, Russia**

During the period of January - October 2018 a team of scientists from IZMIRAN carried out the creation of a database called *ViLaFEID* (Virtual Laboratory for a comprehensive analysis of Forbush-Effects and Interplanetary Disturbances). The work was supported by a grant from the VarSITI/SCOSTEP program and was a part of the frame of International Study of Earth-Affecting Solar Transients (ISEST)/MiniMax24 (Creation of Database in the

open Access). Database of cosmic ray variations (VCR) was constructed and transferred in the open access. It contains the hourly values of the basic parameters of cosmic rays with rigidity of 10GV, variations of cosmic rays (CR) density and components of the CR anisotropy vector over the Earth atmosphere and magnetosphere. These data are obtained by the global survey method (GSM) based on observations by global neutron monitor network. It also includes data on the solar wind (speed, density, characteristics of IMF, etc.), and geomagnetic activity indices. The presented database contains information for more than 60 years and covers the period of July 1957 - December 2017. The authors considers this to be the largest (about 7,500 events) and most comprehensive source of data on cosmic ray variations. This database has open access on the Internet with a link to MySQL database as <http://crsb.izmiran.ru/phpmyadmin>.

- **Solar energetic electrons and radio emission signatures - SRTI-BAS, Bulgaria and NRIAG, Egypt**

The database consists of two components, namely a database of solar energetic electrons detected in situ by the Electron, Proton and Alpha Monitor - Deflected Electrons instrument (EPAM-DE) aboard ACE spacecraft and a database of the radio emission signatures (from ground-based and space-born instruments) in relation to the origin of these energetic electrons.

*ACE/EPAM Electron Event Catalog* (<http://www.nriag.sci.bg/aceepam-electron-event-catalog-2/>): The aim of the dual database is to generate a comprehensive online catalog of in situ observed solar energetic electrons and their radio emission signatures from decimetric to kilometric wavelengths. The electron data is collected from CDAW omni-database: <http://cdaweb.gsfc.nasa.gov/> with 12-sec time resolution in the two highest energy channels, 103–175 and 175–315 keV. The electron enhancements are first visually identified by an observed and then a semi-automatic routine is used to calculate the pre-event background level (using observer defined start and end times), the time of the electron onset time (defined as 3-sigma enhancement threshold), peak time and the background subtracted peak intensity at each energy channel. The resulted distribution of the identified electron events for both energy channels follows the solar cycle activity with a reduced number of electrons for solar cycle 24.

*Radio Emission Signatures Catalog* (<http://newserver.stil.bas.bg/SEPcatalog/>): The radio data are collected from various radio observatories, both in space and on ground, providing dynamic radio spectra and eight single frequency radio records from the four RSTN network stations. The authors have made 6 poster presentations, 5 oral presentations and one paper (non-refereed) on the creation and content of the database created.

- **Database of lidar signals at "Paratunka" station - IKIR FEB RAS, Paratunka, Russia**

At the time of this report there is no information on the project was available.

- **Database of Ionosphere and Magnetic Data - Klyuchi" (IMD-K) - IPGG SB RAS, Novosibirsk, Russia**

A new database of ionospheric and magnetic data was created at the Department of solar-terrestrial physics (Observatory "Klyuchi") of the Trofimuk Institute of Petroleum Geology and Geophysics of Siberian Branch of Russian Academy of Sciences (IPGG SB RAS, Novosibirsk, Russia). The database "Ionosphere and Magnetic Data - Klyuchi" (IMD-K) was created with SCOSTEP/VarSITI support and placed on website <http://im.ipgg.sbras.ru>. The website includes measurements of basic ionospheric parameters since 1969). Absolute minute values of all elements of terrestrial magnetism observed at the magnetic observatory "Novosibirsk" (NVS) since 1966, are

available at <http://www.wdc.bgs.ac.uk/data.html> and <http://www.intermagnet.org/data-donnee/data-eng.php>



Photo 13: The Magneto-Ionospheric Station “Klyuchi” (IMD-K).

- **Database of Interplanetary Small-scale Magnetic Flux Ropes - University of Alabama in Huntsville, USA**

With a partial support of the SCOSTEP/VarSITI program (in addition to a number of NASA and NSF grants) a database was developed of small-scale magnetic flux ropes (SSMFRs) in the solar wind, detected by utilizing the Grad-Shafranov (GS) reconstruction technique. The database includes Wind and ACE in-situ spacecraft measurements from 1996 to 2017 (<http://www.fluxrope.info/>). Quantitative modeling and analysis of small-scale magnetic flux ropes from in-situ spacecraft measurements are essential for a better understanding of how they originate and interact with other solar wind structures. A brief description of the methodology based on the GS reconstruction method are available on the database website. The total number of small-scale flux ropes employing an automated detection approach is 48,902 for the ACE in-situ spacecraft data, where the total count of occurrence is 35,526 for the Solar Cycle 23 (1998 - December 2008) and 13,376 for the Solar Cycle 24 (December 2008 - 2017).

#### 4. CAPACITY BUILDING ACTIVITIES

SCOSTEP is actively involved in the advancement of Capacity Building and scientific excellence through its scientific programs and partnership with the ISWI, ICSU and URSI. Through its initiatives, e.g. Space Science Schools, SCOSTEP Visiting Fellowships (SVS), SCOSTEP facilitates the training, interaction and collaboration of young and early career scientists with the best of the STP scientific community.

- *Solar-Terrestrial Physics Symposia (STP)*: Every 4 years - assess progress made by the scientific program. The 14<sup>th</sup> Quadrennial Solar-Terrestrial Physics Symposium (STP14) – July 9 – 13, 2018, York University, Toronto, Canada
- *SCOSTEP Visiting Scholar (SVS) Program*: Initiated in 2014, to support training visits by graduate students or young scientists from developing countries to an advanced laboratory (up to 3 months) – 10 recipients of the SVS
- *International Space Science Schools*: Every year to provide advanced training to PhD students and Post-Doctoral Fellows in collaboration with the International Space Weather Initiative (ISWI), International Council for Science (ICSU), and International Union of Radio Science (URSI).

SCOSTEP has collaborated with the ISWI in capacity building and science education (CBASE) activities in Asia, Africa, and South America in collaboration with the URSI and ICSU regional offices for Asia and the Pacific (ICSU/ROAP), Africa (ICSU/ROA), and Latin America and the Caribbean (ICSU/ROLAC).

The CBASE activities consist of three elements:

- conducting advanced schools in Space Weather/Space Science for young people (scientists and graduate students)
- organizing teacher workshops for the benefit of school teachers in the host country
- conducting space instrumentation workshops to disseminate information on low-cost instruments that can be deployed in developing countries to gather valuable data on space weather from ground.

SCOSTEP and ISWI activities promote space Sun-Earth connection studies via complementary approaches in international scientific collaborations, capacity building, and public outreach.

#### **4.1. SCOSTEP VISITING SCHOLARSHIP PROGRAM – 2018**

The SCOSTEP Visiting Scholarship (SVS) program was established in the fall of 2014 with the objective of providing training to young scientists and graduate students from developing countries in well-established solar-terrestrial physics laboratories and institutions, for periods of between one and three months. The training will help the young scientists to advance their career in solar terrestrial physics using the technique/ skill they learned during the training. SCOSTEP provides the airfare, while the host institute provides the living expenses (accommodation, sustenance, ground transportation, visa fees and other incidentals). The aim is to fund at least four scholars each year, one related to each of the four SCOSTEP/VarSITI themes (<http://www.varsiti.org/>).

The SCOSTEP Visiting Scholarship (SVS) program was established in the fall of 2014 with the objective of providing training to young scientists and graduate students from developing countries in well-established solar-terrestrial physics laboratories and institutions, for periods of between one and three months. To date there have been four SVS competitions with the best candidates being able to advance their career in solar terrestrial physics using the technique/skill they learned during their training. SCOSTEP provides the airfare, while the host institute covers the living expenses. The aim of the SVS program is to fund at least four scholars each year, one related to each of the four SCOSTEP/ VarSITI themes (<http://www.varsiti.org/>). However, due to the great interest in the program and excellent candidates SCOSTEP has exceedingly increased the number of scholars supported.

The Announcement of Opportunity for the SCOSTEP Visiting Scholarship 2018 (SVS-2018) competition was released on December 1, 2017. On the recommendation of the SVS Selection Committee, Chaired by Prof. Nicole Vilmer (France) the format for the applications was changed to reflect the diversity in scientific experience of the candidates. Two application categories were introduced, Category 1 for graduate students (M.Sc. and PhD) and Category 2 for Postdoctoral fellows (PDFs) with experience up to 5 years from date of graduation at the time of application.

On February 25, 2018 all applications submitted to the SCOSTEP Secretariat in response to the 2018 SVS Announcement of Opportunity were sent for evaluation by the SVS Selection Committee, led by Prof. Nicole Vilmer (France) and members: Paul Baki (Kenya), Katya Georgieva (Bulgaria), Jean-Pierre Raulin (Brazil), Mike Taylor (USA), and Akimasa Yoshikawa (Japan). Fourteen applications were received: India (6), Indonesia (2), Nepal (1), Nigeria(1), Rwanda (1), South Africa (1), Sudan (1), Ukraine (1). On April 12, 2018 the recipients of the

SVS grants were announced. They are for Category 1: Ranadeep Sarkar (India), Sai Gowtam V (India), Katerina Aksenova (Ukraine), Suresh Karuppiyah (India) Rhorom Priyatikanto (Indonesia); and for Category 2 Dr. Sneda Yadav (India) and Dr. G. Sindhuja (India).

The Announcement of Opportunity for the SCOSTEP Visiting Scholarship 2017 (SVS-2017) competition was released on December 1, 2016. Twelve graduate students and young scientists applied for the SVS- 2017 scholarship. On February 25, 2017 all applications submitted to the SCOSTEP Secretariat in response to the 2017 SVS Announcement of Opportunity were sent for evaluation by the SVS Selection Committee, led by Prof. Nicole Vilmer (France) and members: Alejandro Lara (Sanchez) (Mexico), Katya Georgieva (Bulgaria), Jean-Pierre Raulin (Brazil), Mike Taylor (USA), and Akimasa Yoshikawa (Japan). Fourteen applications were received in two categories: a) Category I: India (4), Indonesia (2), Rwanda (1), South Africa (1), Sudan (1) and Ukraine (1); b) Category II: India (3) and Nigeria (1): On April 1, 2018 the recipients of the SVS grants were announced. They are: Ranadeep Sarkar, (India); Sai G. Valluril (India); Ekaterina Aksenova (Ukraine); Suresh Karappiya (India); Rhorom Priyatikanto (Indonesia); Dr. Sneha Yadav (India), and Dr. G. Sinhuja (India).



**SARKAR, Ranadeep,**  
Udaipur Solar  
Observatory, India  
(NASA-GSFC, USA)

**Category I**



**GOATAM VALLURI, Sai,**  
Indian Institute of  
Geomagnetism  
(USTC, China)

**Category I**



**AKSENOVA, Ekaterina,**  
Institute of Radio  
Astronomy, NAS,  
Ukraine  
(ISEE, Nagoya Univ.,  
Japan)

**Category I**



**KARAPPIYAH, Suresh,**  
Dep. of Physics, Arul  
Anandar College, India  
(NASA/GSFC, USA)

**Category I**



**PRIYATIKANTO,  
Rhorom LAPAN,**  
Indonesia  
(NASA/GSFC, USA)

**Category I**



**Dr. YADAV, Sneha,**  
Space Physics Laboratory,  
India  
(ISEE, Nagoya Univ.)

**Category II**



**Dr. SINHUJA, G.,**  
Udaipur Solar  
Observatory, India  
(NASA/GSFC)

**Category II**

## 5. SCOSTEP AT STSC UN COPUOS, VIENNA

In January 2018, two presentations were made at the United Nations Committee on Peaceful Uses of Outer Space (UNCOPUOS) on SCOSTEP activities during 2017 and on the German scientific activities in solar terrestrial physics.

## 6. SCOSTEP'S NEXT SCIENTIFIC PROGRAM – 2019 – 2022

SCOSTEP has initiated work on the Next Scientific Program (NSP) to be launched in 2019. In October 2017, the SCOSTEP Bureau established a committee in order to coordinate the design of SCOSTEP's Next Scientific Program (NSP) from 2019 to 2022. The NSP committee comprises the following members: Ioannis Daglis (Greece) Chair, Annika Seppälä (New Zealand), Daniel Marsh (USA), Dibyendu Nandy (India), Emilia Kilpua (Finland), Katja Matthes (Germany), Loren Chang (Taiwan), Olga Khabarova (Russia), Qiu-Gong Zong (China), Rémi Thiéblemont (France), Sergio Dasso (Argentina). Over the course of 5 months, the committee deliberated through a series of teleconferences and email exchanges and prepared a draft text for the Next Scientific Program under the general concept of the "Predictability of the variable Solar-Terrestrial System" (PreSTo), with the aim of triggering interest and receiving feedback on open scientific issues and needs of the solar-terrestrial community.

On November 14-16, 2018, a Forum on the SCOSTEP NSP was held at ISSI Beijing. NSP committee members and external invited experts gave presentations on open issues in solar-terrestrial physics and discussed about the structure and the contents of PreSTo. The discussions formed the basis for the revision of the first draft of this document.

SCOSTEP is pleased to collaborate with the International Space Science Institute (ISSI) in NSP activities. ISSI generously agreed to hold two Fora, one in Beijing (ISSI-BJ) and the other in Bern (ISSI). The rationale for the ISSI-BJ Forum is to get the input from the large STP communities in China and other Asian countries. The proposed dates are November 14-16, 2018 (Beijing) and February 25-27, 2019 (Bern). The Bern Forum in 2019 will represent the culmination of the NSP committee activities in drafting the final report to be submitted to the SCOSTEP Bureau for further action. I take this opportunity to thank Dr. Rudolf von Steiger (ISSI – Bern), Dr. Maurizio Falanga (ISSI – Beijing), Professor Chi Wang (Director General, National Space Science Center of Chinese Academy of Sciences), and Professor Kazuo Shiokawa (Institute for Space-Earth Environmental Research, Nagoya University) for their generous financial support to the ISSI Fora.

## 7. SCOSTEP AWARDS – DISTINGUISHED YOUNG SCIENTIST AND DISTINGUISHED SCIENCE – 2019

The SCOSTEP 2018 **Distinguished Young Scientist Award** was given to **Dr. Kok Leng Yeo** from the Max Planck Institute for Solar System Research, Göttingen, Germany, for her paramount contributions to understanding the causes of solar irradiance variations and to advances in irradiance models of relevance for climate.



Dr. Yeo is clearly poised to become a future leader in the important field of solar irradiance modeling and Sun-climate connections. She has already made substantial contributions to improving the leading-edge SATIRE model at MPS, including the assimilation of observed solar magnetograms and, even more significantly, synthesizing magnetograms from 3-D MHD simulations of solar surface convection. She received her PhD only four years ago and she already has 7 first-author papers, 5 papers with more than 10 citations, 7 invited talks, and 2 review papers. Her work has appeared in *Physical Review Letters* and *Nature Astronomy* as well as *ApJ* and *A&A*. Her reconstruction of solar irradiance from 1974-2013 (Yeo et al 2014) has already garnered 63 citations and her new work on SATIRE-3D may prove to be even more innovative and influential.



The work of Dr. Kok Leng focuses on understanding and modelling solar irradiance variations on time scales of days to decades, a topic of great interest and importance for models of global change of Earth's climate.



*Photo 14: Dr. Kok Leng Yeo being presented with SCOSTEP's Distinguished Young Scientist medal by Dr. Nat Gopalswamy, July 9, 2018*

Dr. Kok Leng has reconstructed the total (TSI) and spectral (SSI) solar irradiance since 1974. Kok Leng has proposed and developed two independent empirical test models, which have helped to identify the source of the disagreement between the empirical and semi-empirical models. One of them is the EMPIRE model (Yeo et al. 2017a JGR 122), the first ever empirical model that takes the errors-in-variables (i.e. errors in the solar activity proxies) into account. These results have convincingly proved that the larger solar cycle variability in the UV range, critical for Earth's atmospheric models, returned by the semi-empirical models is more accurate, which has significant implications for Earth's atmospheric and climate-chemistry models.

In the last years, Kok Leng has been working on the development of the first irradiance model of a new generation, SATIRE-3D. She has created the first ever model entirely independent of irradiance measurements (Yeo et al. 2017b, Physical Review Letters 119).

A remarkable aspect of Kok Leng's work is that she did it rather independently and that many of the ideas were her own. She is very independent, very inventive, deep thinking and original young researcher. For her PhD thesis, she received the very prestigious Fred L. Scarf Award "for outstanding PhD thesis" of the American Geophysical Union, an indication of Kok Leng's great standing in the field and is a tribute to the quality of her work and to her intellect.

Used in conjunction with climate simulations, her new reconstruction of solar total and spectral irradiance will definitely lead to a great leap in our understanding of solar influence on global climate change.

The SCOSTEP **Distinguished Science Award** was given to **Professor Jeffrey M. Forbes**, Professor Emeritus and Research Professor, Department of Aerospace Engineering Sciences, University of Colorado, Boulder, USA.



Professor Jeffrey M. Forbes' work has provided the foundation for understanding the role of atmospheric tides in the electrodynamics of the ionosphere; wave driven variability in the mesosphere-thermosphere-ionosphere system, and thermospheric wind and neutral density variations due to solar flares and geomagnetic storms. He has played a leading role in both satellite missions and model development. Professor Forbes' work has had a profound influence in this area of Solar-Terrestrial Physics not only through his publications, which have been cited over 10,000 times, but also through his guidance of a large number of Ph.D. students. Professor Forbes has also played a leadership role in several international programs, such as the Middle Atmosphere Program, World Ionosphere Thermosphere Study program and Solar-Terrestrial Energy Program of SCOSTEP.

Professor Forbes has been scientifically active for more than 45 years and in that time has published over 280 articles in refereed publications, an h index of 53 and over 10,000 citations. His graduate work was undertaken

with Richard Lindzen, a colleague of Sidney Chapman, and the resulting papers (Forbes and Lindzen, JASTP, 1976a, b, 1977) and his 1981 review paper on the equatorial electrojet (Rev. Geophys. Space Phys.) laid the foundations for tidal/ionospheric coupling.

During his career he has made important contributions to our understanding of the dynamics, electro-dynamics and chemistry involved in the coupling of solar activity and its variability to the terrestrial atmosphere and geospace environment. His work involves the analysis of satellite data, the validation and development of numerical models, which describe these coupling processes, and support of satellite missions involved in observing the geospace environment. He has been instrumental in identifying the role waves play (in particular atmospheric tides) in coupling the lower atmosphere to the upper atmosphere. He has contributed significantly to the development of this field through his participation in numerous national and international review panels, which defined the key scientific questions of the field.



*Photo 15: Prof. Jeffrey M. Forbes is presented with SCOSTEP's Distinguished Scientist medal by Dr. Nat Gopalswamy, July 9, 2018*

Professor Forbes has played a leadership role in many of the SCOSTEP programs in the 1980's and 1990's. Professor Forbes has made (and is continuing to make) outstanding contributions to the field of solar-terrestrial relations. He has enriched the field scientifically, strategically given direction to international activities and provided service and support to SCOSTEP and his students and colleagues throughout his career.

## **8. 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 Bureau members are representative of the relevant ICSU bodies (IAU, IAGA, IAMAS, IUPAP, COSPAR, URSI, and SCAR) in SCOSTEP.

### **8.1 SCOSTEP BUREAU MEETING – APRIL 13, 2018, VIENNA**

The SCOSTEP Bureau held its annual meeting on April 29, 2017 at the Austrian Academy of Science, in Vienna, Austria.



*Photo 16: The SCOSTEP Bureau members, who attended the Bureau meeting on April 13, 2018. From left to right: F-J. Lübken, A. Chambodut, V. Kuznetsov, N. Gopalswamy, M. Shepherd, K. Georgieva, J. Chau*

Introductory remarks, summarizing main SCOSTEP's activities since the last Bureau meeting on April 27, 2017: SCOSTEP Visiting Scholarship (SVS), Distinguished Service Awards – 2017, 2nd VarSITI General symposium, Irkutsk, ISWI/SCOSTEP Space Science School, STSC UNCOPUOS, Constitutional Amendments, Next Science Program after VarSITI. The minutes from the meeting could be found on the SCOSTEP Website: <http://scostep.apps01.yorku.ca/about-2/archives/reports-and-documents/meeting-minutes/>

## 8.2 NEW BUREAU MEMBERS

In 2017 two new Bureau members were appointed: Prof. Dr. Jorge Chau (Leibniz Institute of Atmospheric Physics, Germany), replacing Prof. Craig Rodger as the representative of URSI, and Prof. Prasad Subramanian (India), replacing Prof. Mark Lester as the representative of IUPAP. This was the first Bureau meeting in which Prof. Chau and Prof. Subramanian took part. Dr. Aude Chambodut, Ecole et Observatoire des Sciences de la Terre, Strasbourg, France, is the new member of the SCOSTEP Bureau, representing the World Data Systems.

## 9. SCOSTEP SECRETARIAT ACTIVITIES

The work of the SCOSTEP Secretariat is supported by a Grant-in-aid to York University, at the level of 20% of the Scientific Secretary's time. The SCOSTEP Grant is gratefully acknowledged.

The SCOSTEP Secretariat continued its work in coordinating and managing all SCOSTEP related activities, as well as providing logistic and technical support for the VarSITI program. The Scientific Secretary Prof. M. Shepherd organized the annual SCOSTEP Bureau meeting on April 13, 2018 held at the Austrian Academy of Science, Vienna. In June 2017, M. Shepherd was tasked with the organization of the STP14 Symposium to be held at York University in July 2018 and appointed Chair of the Local Organizing Committee. Work on the organization of the

Symposium continued in 2018, dealing with all logistics related to the event itself as well as creating posters, registration of conference participants, Book of Abstracts, programs and timely update of the conference website. All relevant information can be found at the STP14 website: <http://www.scostepevents.ca/> designed and managed by Dr. Shepherd. The conference was very successful. Funds remaining after the completion of the event were returned to SCOSTEP. For more information please see Section 1 of this report.

The Scientific Secretary also managed the SCOSTEP Visiting Scholar program, oversaw the announcements and all SVS applications, as well as the logistics associated with the administration of the SVS grants. The Scientific Secretary organized the nominations and selection of the recipients of the SCOSTEP Distinguished Young Scientist and Distinguished Science Awards, all logistics related to the preparation and presentation of the awards, issued SCOSTEP Newsletters, administered the SCOSTEP Website, administered the SCOSTEP finances, administered VarSITI grants, participated in the ISSI Forum on the Next Science Program in Beijing, and looked after general day-to-day SCOSTEP business. Further information on the activities outlined in this report could be provided on request by the SCOSTEP Secretariat ([mshepherd@yorku.ca](mailto:mshepherd@yorku.ca)), or can be found at the SCOSTEP Website, <http://www.yorku.ca/scostep/>.