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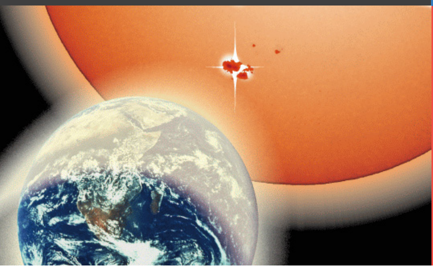

VarSITI Newsletter

Inside this issue

Project ROSMIC

Article 1:

EISCAT_3D Radar for Studies of the Polar Ionosphere and Magnetosphere

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EISCAT_3D will be multi-static phased array radar for incoherent scatter observations which probe the charged components of the Earth's atmosphere by transmitting a high-power radio wave and measuring with high accuracy, the back-scattered waves. A well-developed theory exists, to derive physical parameters from the measured signals (cf. e.g., Stubbe and Hagfors, 1997). The measurements are used for studying the magnetosphere and near-Earth space as well as plasma processes induced with the EISCAT Heater (e.g., Rietveld et al., 2003). The same radar instruments are also used to observe hard targets and coherent scatter signals like meteor trails and head echoes, small solar system objects and the distinct radar echoes that are linked to turbulence and dusty plasma interactions in the mesosphere (i.e., Polar Mesospheric Summer Echoes, PMSE). All these different applications are included in the science case for EISCAT_3D (McCrea et al., 2015).

EISCAT_3D will consist of a core site with a transmitting and receiving radar arrays and four sites with receiving antenna arrays at distances between 100

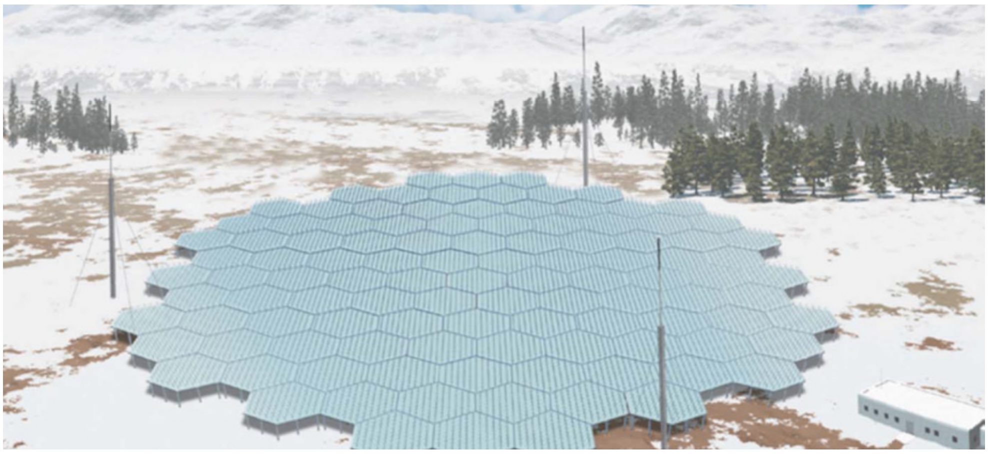

Figure 1. Schematic illustration of an EISCAT_3D radar site that consists of 109 sub-arrays each consisting of 91 antennas. (Figure adapted from Tsuda et al., 2016).

and 250 km facility (Wannberg et al., 2010) with world-leading measurement capabilities. It will operate in a band approximately 30 MHz wide around the centre frequency 233 MHz. Each antenna array will consist of a large number of single antennas whose individual signals are digitally controlled. High-speed electronics changes the time delay between the antenna elements to form multiple beams and beam direction can be varied instantaneously. EISCAT_3D can measure on spatial scales that are smaller than the conventional radar beam width, it can scan in fast mode large volumes in space, and measure with high time resolution. It has the capability to instantaneously change its mode of operation, which can be used for sudden events with pre-defined characteristics. Monitoring observations can be used for studies of, e.g. PMSE and space weather phenomena. EIS-

Figure 2. The kick-off meeting for the implementation of EISCAT_3D stage 1 took place in September 2017 and was hosted by UiT the Arctic University of Norway. This photograph shows the participants in front of a test sub-array. In the background the antenna of the EISCAT VHF radar is seen. (Image courtesy of Craig Heinselman, EISCAT Scientific Association).

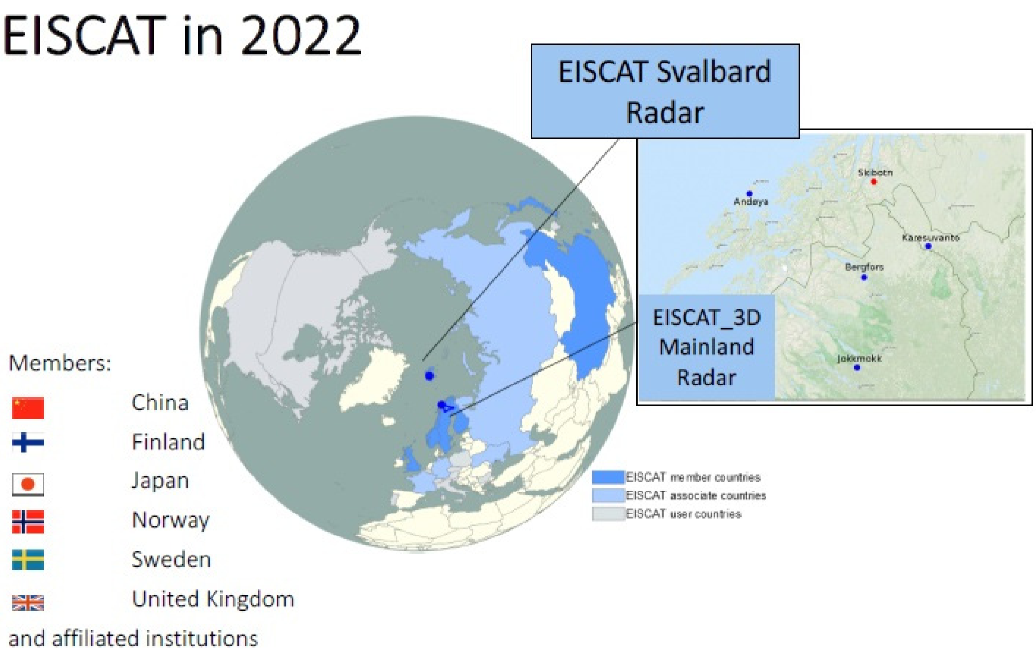

Figure 3. EISCAT on world-map showing the locations of the radar sites on the Scandinavian mainland and on Svalbard. EISCAT_3D consists of five sites that will be built near Skibotn Norway, Karesuvanto, Finland, Bergfors, Sweden, Andoøya, Norway and Jokkmokk, Sweden. The first stage consists of three sites and will start operation in 2022. The present EISCAT associate countries are marked in dark blue, but there are EISCAT users around the globe. (Adapted from figures provided by EISCAT Scientific Association).

CAT_3D will measure up to roughly 1,200 km altitude above the Northern mainland Scandinavia, a region that is unique for research into the polar atmosphere and that hosts extensive research infrastructure.

The EISCAT_3D radar will start operation in 2022 and it is operated by the EISCAT Scientific Association, an existing organisation that operates incoherent scatter radars in the Scandinavian Arctic. The Association is funded and operated by research councils and research institutions in Norway, Sweden, Finland, Japan, China and the United Kingdom. The European Strategy Forum on Research Infrastructures (ESFRI) selected EISCAT_3D for inclusion in the Roadmap 2008 for Large-Scale European Research Infrastructures for the next 20-30 years.

In Japan the EISCAT_3D project is integrated into programmes to study of coupling processes in the solar-terrestrial system (Tsuda et al., 2016). Nagoya University has been collaborating with UiT, The Arctic University of Norway in Tromsø for two decades and have operated several instruments such as a sodium LIDAR, auroral imagers, millimeter-wave spectrometer, magnetometer, photometer, at the EISCAT Tromsø site. Using EISCAT_3D will improve the understandings of Magnetosphere-Ionosphere-Thermosphere-Mesosphere-Stratosphere connections. A particular goal of the collaboration between ISEE and UiT will be the study of dusty plasma in the mesosphere and structures of PMSE (cf. Mann et al., 2016) for which, as for many other studies EISCAT_3D will provide unprecedented measurement capabilities.

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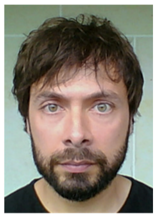
Project SEE / ISEST

Article 2:

Solar Wind Research with Solar Orbiter and Parker Solar Probe: Data Tools, Models and Strategies



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The solar wind is an uninterrupted flow of highly ionized plasma that is accelerated in the low solar corona and expands into the interplanetary space. Fast and slow wind streams develop at different places in the solar atmosphere, reflecting the global distribution of the coronal magnetic field during solar cycle (Fig. 1). The solar wind is a key component of space weather, being the source of large-scale interplanetary structures such as coronating interaction regions that perturb planetary atmospheres, affecting the propagation of impulsive perturbations (such as Coronal Mass Ejections) and channelling energetic particles from the Sun to Earth-like distances and beyond.

The Solar Orbiter spacecraft – tailored to address the connections between the Sun and it's environment – was designed to directly correlate remote detections (e.g., EUV, white-light, X-ray emissions and magnetic fields at the solar surface) with measurements made all along its orbit around the Sun (e.g., particle fluxes, local wind speeds, magnetic fields). NASA's Parker Solar Probe mission will go even closer to take measurements in the solar corona. Linking datasets across instrumentation and space missions requires considerable modeling and tool development.

The ESA Modelling and Data Analysis Working Group (MADAWG) is an international team of scientists actively developing tools and methods that aim at instigating synergies between different instruments and missions. The MADAWG is currently deploying new tools that will provide information on how Solar Orbiter and Parker Solar Probe (making in situ measurements) connect magnetically to the solar atmosphere that they will also remotely sense (Fig. 2). These tools will provide both connectivity forecasts and analysis of past da-

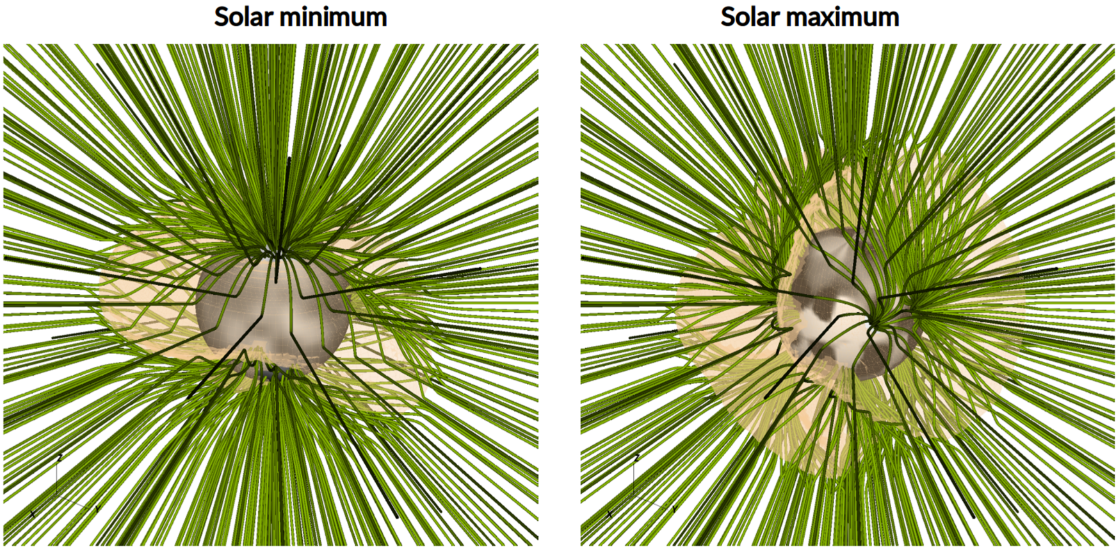


Figure 1. Two typical magnetic field configuration in the low corona at the minimum and maximum of solar activity, obtained via PFSS extrapolation of Wilcox Solar Observatory maps. Other magnetogram sources (from ground and space observatories, and from magnetic map forecast models) are also analysed by the MADAWG tools.

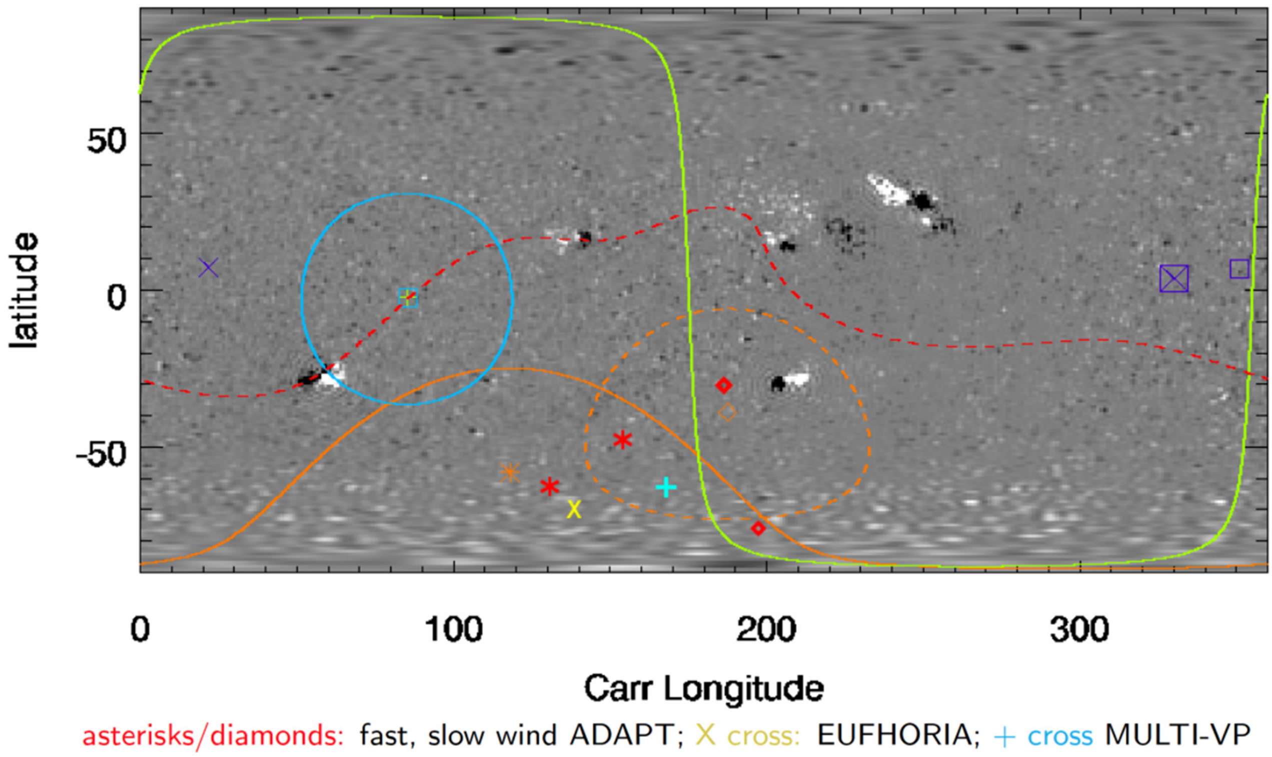


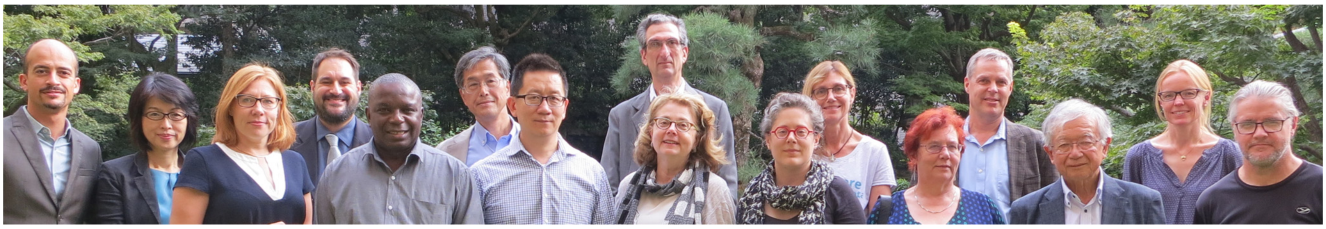
Figure 2. Benchmarking the connectivity estimates performed by the MADAWG team using past data. The figures shows a SDO/HMI magnetogram with magnetic footpoints of fieldlines connected with the expected Solar Orbiter position using a variety of methods and models (orange, red, yellow and cyan symbols). The blue square indicates the position of the spacecraft, and the green line its visible limbs. The red line indicates the helisopheric current sheet. The violet symbols indicate Parker Solar Probe position and footpoints at the same instant.

ta. The backbone of the modelling pipeline runs and couples together a wide set of mature models developed by the solar and heliospheric physics communities, in order to ensure robusteness and forecast redundancy. Important work is also under way to develop new numerical models and data products to derive the physical properties of the time-evolving surface and coronal magnetic field as well as the 3D properties of the coronal and solar wind plasma including bulk properties and composition. This will provide quantitative information to test theories on the structure and heating processes of the solar corona and the origin of the solar wind.

Article 3:

Towards Trusted Data Services: World Data System & Certification

WDS Scientific Committee[1]



WDS Scientific Committee Members

Over the last 20 years, the exchange and availability of research data has undergone a major upheaval with the widespread use of the Internet. Researchers and research organizations, such as those involved in SCOSTEP activities, had obviously not waited for this electronic era to exchange observations, data, and data-products. However, data sharing has been accelerated from a traditional and relational, even personal, transmission mode to a new world of fast online possibilities.

In this context, neophytes and non-specialists can sometimes get lost. As a data user, one may cite secondary data sources rather than the original data provider. As a data provider, one may deposit data somewhere that does not manage and preserve them appropriately. Selection from a wide variety of data repositories necessarily raises questions of trustworthiness (Figure 1):

- Are data in this repository reliable and verifiable?
- Can I use and quote them in my research?
- If I want to make my data available to the community, will this repository retain the usage rights/licences I have defined?
- Will it recognize me as the data owner and provider?

Figure 1. As a stakeholder or a data provider, how do I know which data repository I may TRUST? A or B?

[1] https://www.icsu-wds.org/organization/scientific-committee

ICSU[2] foresaw the need to ensure that data are openly available and discoverable for future generations, and decided at its 29th General Assembly in 2008 to create the World Data System[3] (WDS) with a mission to promote *"long-term stewardship of, and universal and equitable access to,* ***quality-assured scientific data and data services, products, and information*** *across a range of disciplines in the natural and social sciences, and the humanities."* Specifically, WDS aims to facilitate scientific research "*by coordinating and supporting* ***trusted scientific data services*** *for the provision, use, and preservation of relevant datasets, while strengthening their links with the research community."*

WDS does not work in isolation, rather it interacts with the whole international community dealing with research data to get a complete picture at all levels. It has a large variety of partners from the public (e.g., national Academies of Science and international Associations and Unions), and private (e.g., publishers) sectors. In particular, WDS works with fellow non-profit organizations in the data landscape (e.g., RDA, Re3data, ORCID, DataCite, OECD, Crossref).

To increase trust in data repositories, WDS has created two categories of certified Members[4]: Regular and Network (Figure 2). Certification[5] goes far beyond simple accreditation, the list of certification requirements[6] (covering authenticity, integrity, confidentiality, and availability of data and services) provide a transparent and objective measure that data repositories are compliant with international and disciplinary standards. For non-mature data repositories, the criteria help improve their procedures in a really practical way, and may be seen as guidance to reach the minimum required quality level.

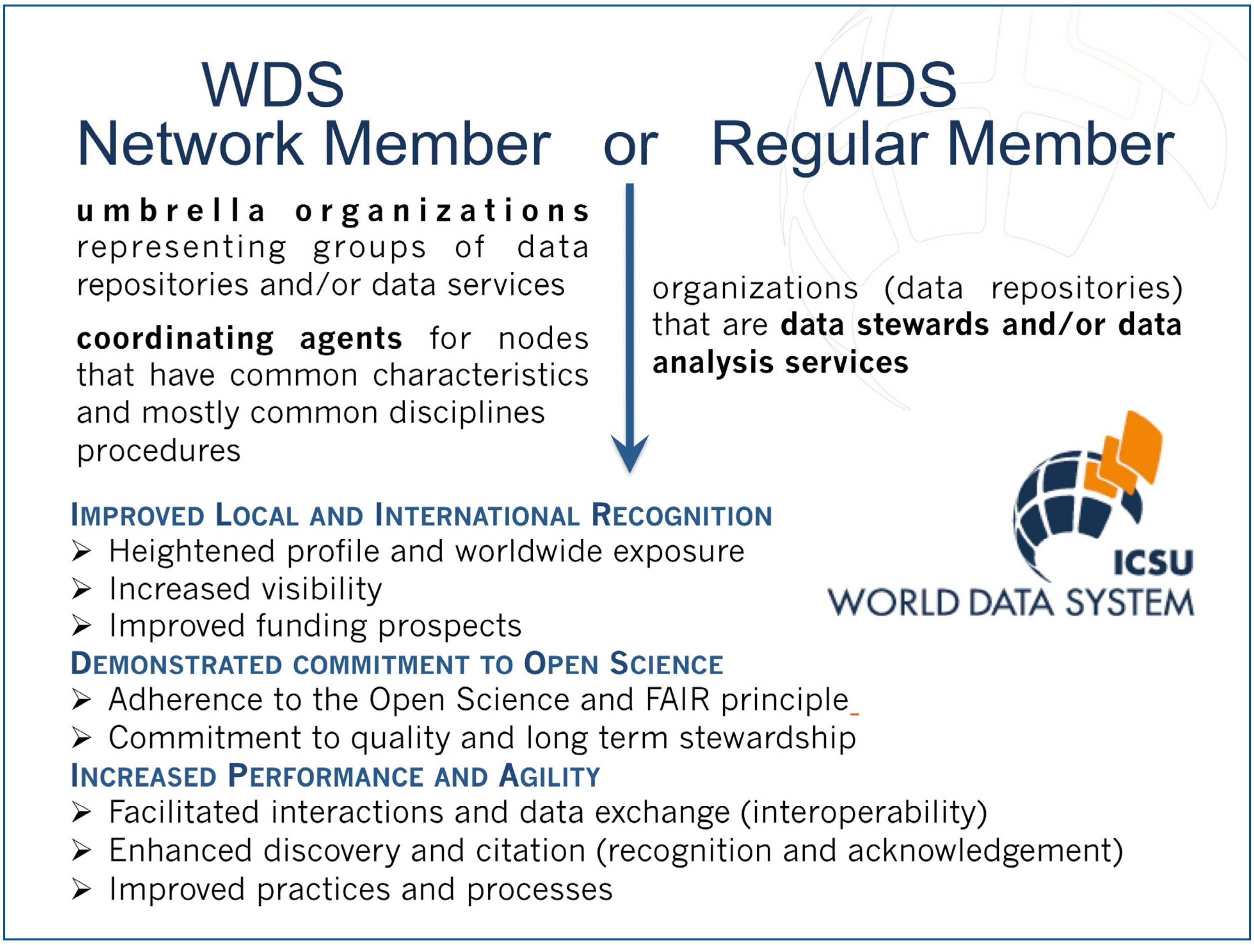


Figure 2. Improvements brought by WDS membership.

The benefits to all stakeholders of having certified data repositories are numerous, and are of primary importance in the frame of SCOSTEP activities. Indeed, data are key to global cooperation in solar–terrestrial research.

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[2] At their joint General Assembly in Taipei in October 2017, the members of the International Council for Science and the International Social Science Council took a final decision to merge their two organizations to become the International Science Council.
[3] https://www.icsu-wds.org/
[4] https://www.icsu-wds.org/community/membership
[5] https://www.icsu-wds.org/services/certification
[6] https://doi.org/10.5281/zenodo.168411

Article 4:

An Introduction on ISEST (International Study of Earth-Affecting Solar Transients) Working Group on Solar Energetic Particles

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Olga Malandraki

Solar Energetic Particles (SEPs) constitute an important contributor to the characterization of the space environment. They are emitted from the Sun in association with solar flares and Coronal Mass ejection (CME)-driven shock waves. SEP radiation storms may have durations from a period of hours to days or even weeks and have a large range of energy spectrum profiles. These events pose a threat to modern technology strongly relying on spacecraft and are a serious radiation hazard to humans in space, and are additionally of concern for avionics and commercial aviation in extreme circumstances (Malandraki and Crosby, 2018a).

The main objective of the Working Group on SEPs (WG6) of the VarSITI/ISEST project, directly aligned with the ISEST science objectives, is the improvement of our understanding of the origin, acceleration and transport of energetic particles in the heliosphere, in association with CMEs and Corotating Interaction Regions (CIRs) propagation and evolution.

The scientific issues pursued within the WG6 included the SEP release time and radio bursts (Kouloumvakos et al., 2015), understanding the shock type at SEP injection (Kozarev et al., 2015), particle acceleration by magnetic islands in the heliosphere (Khabarova et al., 2016, 2017), triangulation of shocks in 3-D for the study of γ-ray events (Plotnikov et al., 2017), joint Ne/O and Fe/O analysis to diagnose large SEP events (Tan et al., 2017), 3-D modeling of SEP propagation within the heliosphere (Dalla et al., 2017), are abundance enhancements power-law in Mass per Charge A/Q?, comparison of First Ionization Potential (FIP) plots of SEPs in the slow solar wind (Reames et al., 2017),

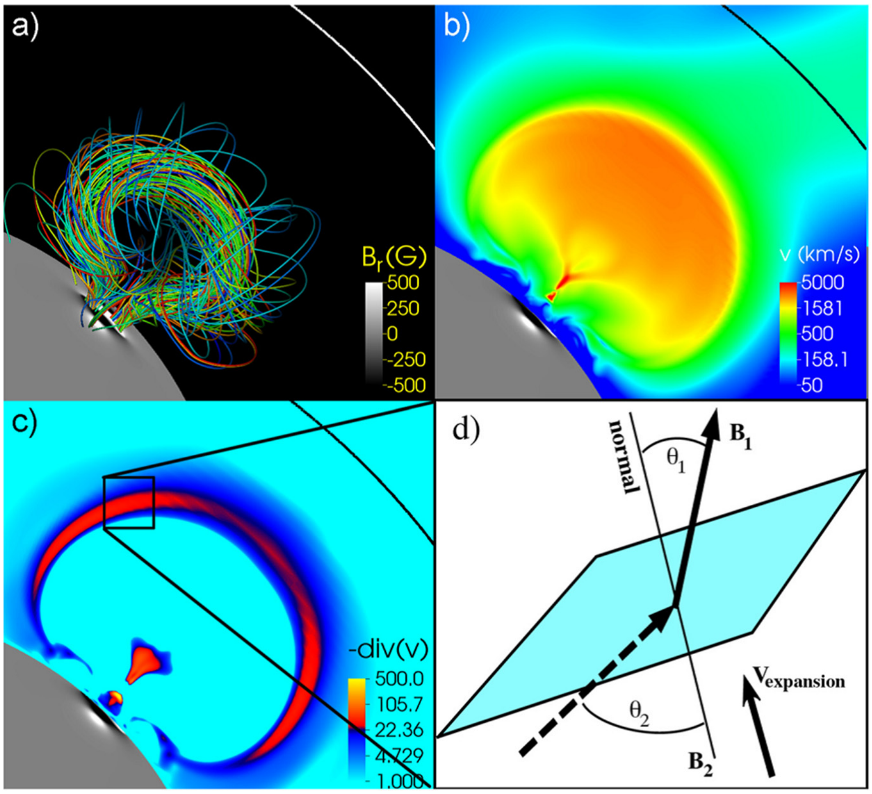

Figure 1. Configuration in the low corona based on MAS simulations (Schwadron et al., 2014) showing a strong compression driven by the expansion of a CME. The strong compression on the flank of the CME create the conditions that lead to rapid particle acceleration (from Schwadron et al., 2015).

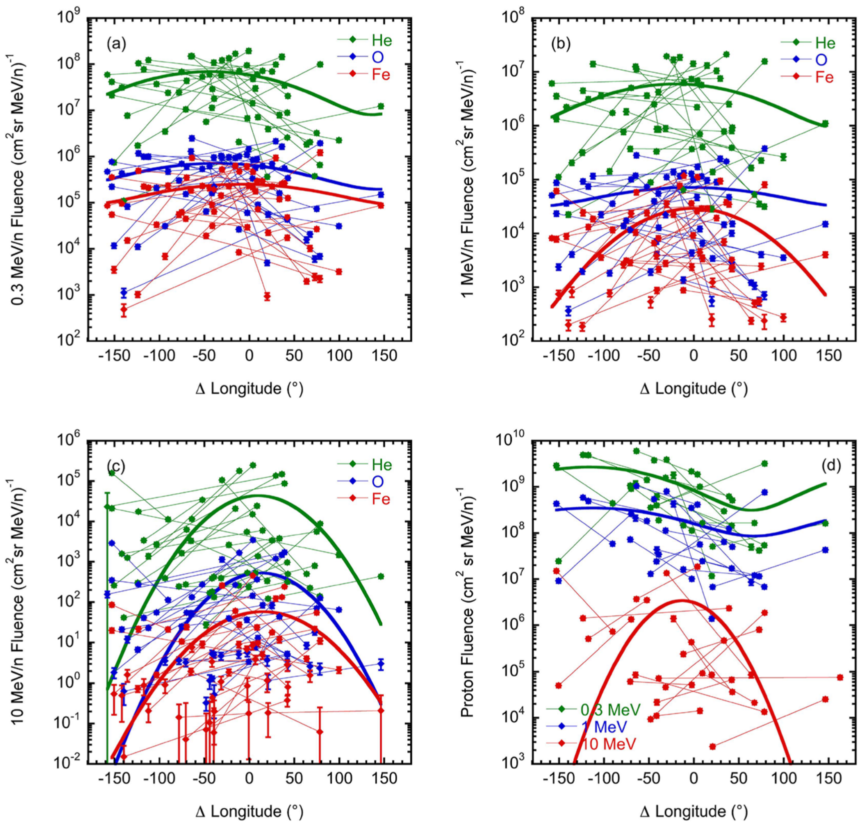

Figure 2. Periodic Gaussian fits (indicated by thick curves) to the two-spacecraft evenbts for He, O and Fe at (a) 0.3, (b) 1, and (c) 10 MeV n^{-1}, protons at all three energies are in panel (d). Individual events are connected by lines. Note that there were fewer two-spacecraft events measured in H (i.e., more events were three-spacecraft events). Δ Longitude values are calculated as flare-spacecraft footpoints, thus negative values correspond to footpoints west of the flare location, and positive values correspond to locations east of the flare (from Cohen et al., 2016) .

high-energy SEP events forecasting (Núñez et al., 2017, 2018), and the study of the 2017 September 10 SEP/ Ground Level Enhancement (GLE) event.

A contribution of the Balkan, Black Sea, and Caspian Sea Regional Network on Space Weather Studies (BBC SWS) are the HESPERIA UMASEP-500 and the HESPERIA REleASE tools which make real-time predictions of the occurrence of >500 MeV and GLE events and 30-50 MeV proton flux at L1, respectively, which are operational at the National Observatory of Athens (HESPERIA website http://www.hesperia.astro.noa.gr) (Malandraki and Crosby, 2018b).

Table 1

Comparison of Large Outlying and Main Sequence SEP Events with >100 MeV Proton Fluence >2 × 10^5 pfu s in Figure 6 of Grechnev et al. (2015)

Date	SXR Peak Time	SXR Class	SXR Duration	SXR Fluence	35 GHz Fluence	CME Speed	CME Width	>100 MeV Fluence	GLE?/ % Inc.	DH II?	0.5 MeV e- to 10 Mev pr Ratio
Outliers	UT		minutes	10^{-3} J m^{-2}	10^5 sfu s (a)	km s^{-1}	°	10^3 pfu s(b)			
2000 Nov 8	23:27	M7.9	201	66	2.1	1738	>170	13000	yes?/-	yes	4.69E+01
2001 Dec 26	5:36	M7.6	306	110	8.2	1446	>212	600	yes/5	yes	8.44E+01
2002 Apr 21	1:47	X1.6	179	280	7.2	2393	360	1500	no/-	yes	7.13E+01
2012 May 17	1:47	M5.1	141	31	1.7	1582	360	305	yes/16	yes	5.20E+01
Main Sequence											
2001 Apr 2	21:51	X18.4	59	930	38	2505	244	220	no/ -	yes	1.12E+02
2002 Aug 24	1:11	X3.5	83	178	46	1913	360	400	yes/5	yes	1.62E+02
2005 Jan 20	7:00	X7.9	93	500	370	2800	360	6400	yes/269	yes	1.64E+02
2006 Dec 13	2:39	X3.7	82	310	32	1774	360	1900	yes/92	yes	1.78E+02

Note. (a) 1 sfu = 1 solar flux unit = 10^{-22} W m^{-2} Hz^{-1}; (b) 1 pfu = 1 proton flux unit = 1 pr cm^{-2} s^{-1} sr^{-1}. Data sources: http://www.ngdc.noaa.gov/stp/satellite/goes/dataaccess.html; http://cdaw.gsfc.nasa.gov/CME_list/; http://www-lep.gsfc.nasa.gov/waves/; http://cosmicrays.oulu.fi/GLE.html; http://www2.physik.uni-kiel.de/SOHO/phpeph/EPHIN.htm; Grechnev et al. (2015), Cliver & Ling (2009).

Schwadron et al., 2015 found that strong compressions and shocks in the low corona may naturally create broken power-law distributions that arise in large SEP events (Figure 1). Cliver et al., 2016, presented evidence that inclusion of omitted events (outliers) by Grechnev et al. 2015 supports shock acceleration for >100 MeV protons than flare-resident SEP acceleration (Table 1, from Cliver et al., 2016). Cohen et al., 2017 found no clear evidence for a Q/M dependence to the widths or centers of the 41 ion event distributions studied, suggesting that rigidity-related processes are not the dominant means of spreading particles in longitude (Figure 2). The CME kinematics and SEP spectra during the 2012 July 23 backside event were studied by Gopalswamy et al., 2016. It was found to be an extreme event in terms of the SEPs it accelerated (Figure 3). Gopalswamy 2017 studied extreme solar eruptions and their space weather consequences (Figure 4).

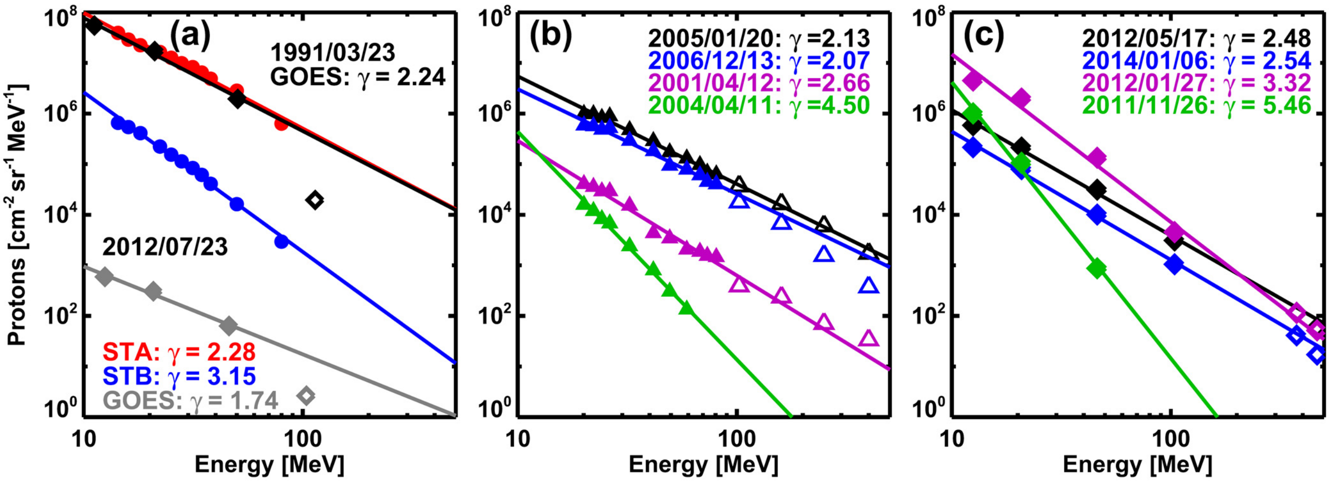

Figure 3. STA (HET) fluence spectrum of the 2012 July 23 event compared with that of several large SEP and GLE events. (a) Spectra of the 2012 July 23 event from STA, STB, and GOES compared with that of the 1991 March 23 event. (b) Fluence spectra of a set of cycle-23 SEP events including two GLEs (2006 December 13 and 2005 January 20), a regular SEP event (2001 April 12), and a Filament Eruption (FE) SEP event (2004 April 11). (c) Fluence spectra of a set of cycle 24 SEP events including two GLEs (2012 May 17 and 2014 January 06), a regular SEP event (2012 January 27) and an FE SEP event (2011 November 26) (from Gopalswamy et al., 2016).

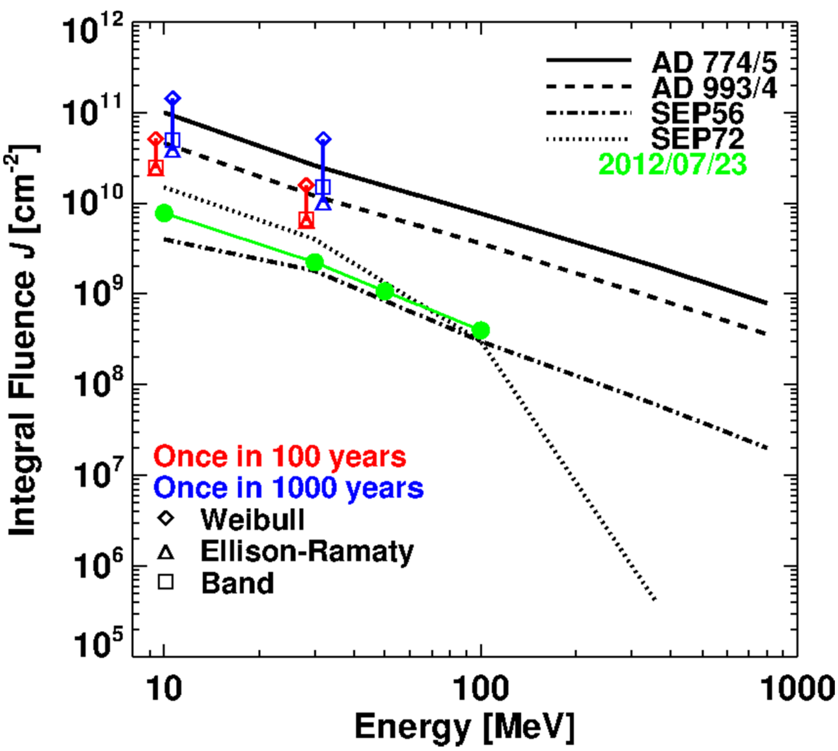

Figure 4. The 100-year and 1000-year data pointed derived from the cumulative distributions are superposed on the spectra of the AD774 and AD993 particle events obtained by Mekhaldi et al., 2015. Estimates of 100-year and 1000-year event sizes from Weibull, Ellison-Ramaty and Band functions are shown using different symbols. The spectra of the 1956 February 23 (SEP56) and 1972 August 4 (SEP72) solar proton events are also shown from Mekhaldi et al., 2015, who used the re-evaluated spectra from Webber et al., 2007. Also shown is the spectrum of the 2012 July 23 extreme event from Gopalswamy et al., 2016 (from Gopalswamy 2017).

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Highlight on Young Scientists 1:

Accessing the MLT Dynamics from Meteor Observations

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Gunter Stober

Every day, millions of meteoroids, enter the Earth's atmosphere. Due to collisions with the impinging air molecules, they are decelerated and heated and some of them start to be vaporized forming an ambipolar diffusing plasma trail, which can be detected by radars either as specular meteor trails or as plasma bubble around the meteoroid itself, called meteor head echo. In particular, specular meteors provide valuable information about atmospheric dynamics at the mesosphere/lower thermosphere (MLT).

Meanwhile, several meteor radars are operated for more than a decade. These long time series are analyzed to study the mean wind climatologies and solar cycle effects or, as well as other longer period atmospheric modes (Figure 1a). We also developed an adaptive spectral filter to decompose the times series, which allows to study the day-to-day variability of tides (Figure 1b).

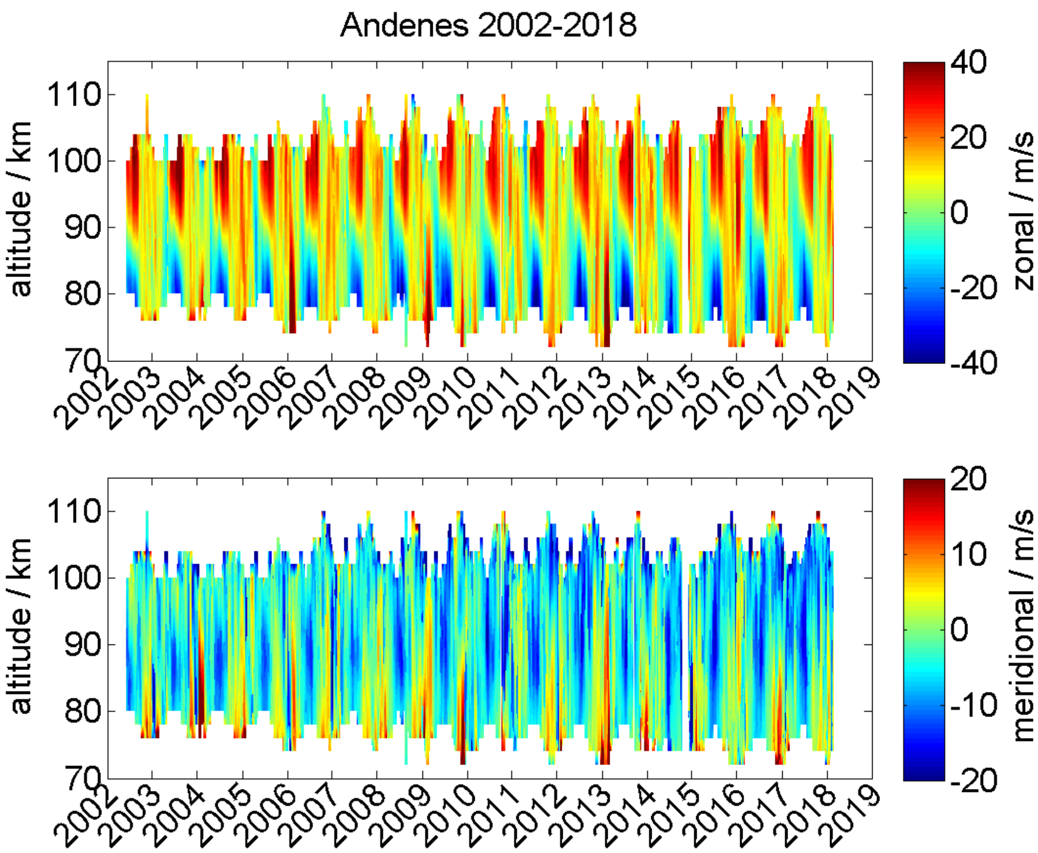

Figure 1a. Time series of mean zonal and meridional winds obtained from the Andenes MR from June 2002 until February 2018.

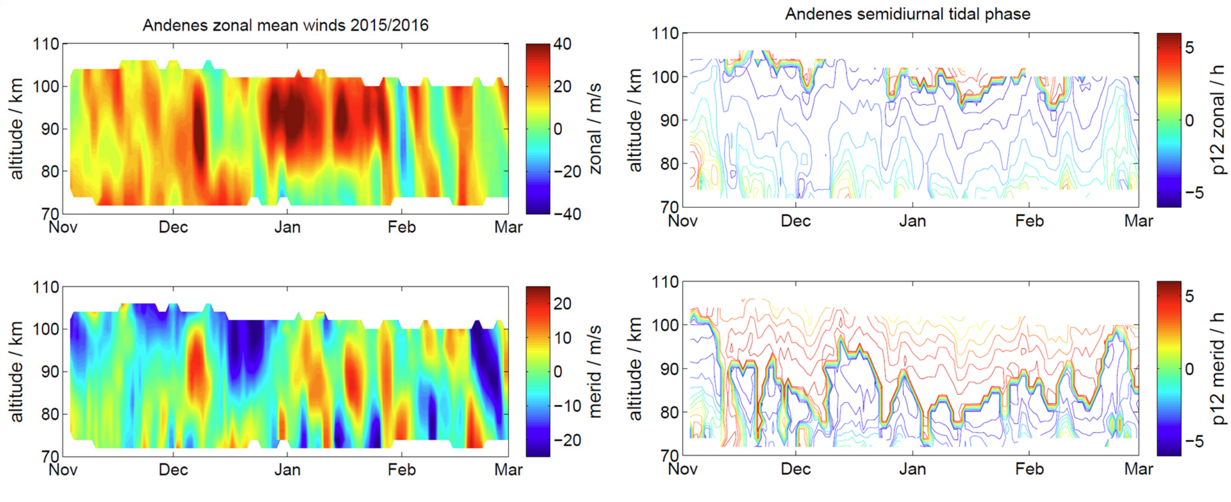

Figure 1b. Comparing the zonal and meridional mean wind components with the phase evolution of the semi-diurnal tide over the winter season shows that the vertical tidal propagation is connected to the back-ground mean winds in the MLT.

Further, recent developments using multi-static passive meteor radar networks further allows to investigate GW on regional scales with a horizontal resolution of 30x30 km and a temporal resolution of 30 minutes. From such horizontally resolved wind measurements, we infer horizontal wavelength spectra (Figure 2a) and b)) to investigate the relative importance of vertical and divergent modes for the energy budget at the MLT.

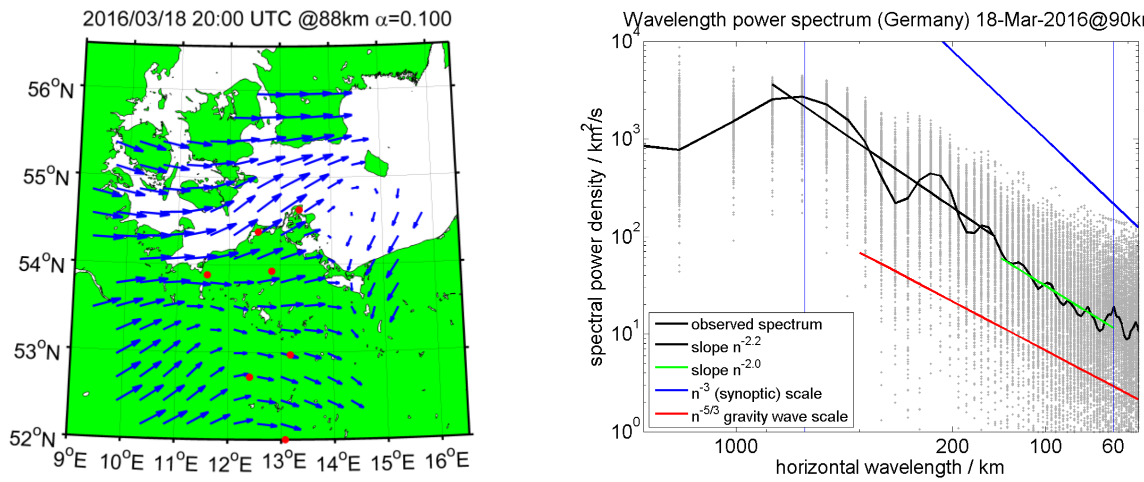

Figure 2a and 2b. The left figure shows a 2d horizontally resolved wind field using the MMARIA (Multistatic Multifrequency Agile Radar for investigation of the Atmosphere) meteor radar network in Germany. The horizontal wavelength spectra on the right was obtained by averaging thousands spectra observed in the domain area.

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Highlight on Young Scientists 2:

Applications of 2D-TEC Maps Generated Using Satellite Based Augmentation System for Ionospheric Studies

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Sneha Yadav

Satellite Based Augmentation system (SBAS), which is primarily used for life critical application like aviation, can also be served as an effective tool to study the ionosphere. The vertical ionospheric delay broadcasted by SBAS can be used to generate 2D total electron content (TEC) maps [1]. The Indian SBAS-GAGAN (GPS Aided Geo Augmented Navigation) has been used to generate the 2D-TEC maps which are having a large latitudinal (5°S–45°N) and longitudinal (55–110°E) coverage.

These maps have been used to study the various aspects of Equatorial Ionization Anomaly (EIA), specifically the (i) evolution (ii) longitudinal structure, and (iii) its variability during space weather events. In one such study shown in Fig. 1, the complete reversal in the longitudinal structure of EIA has been observed during the recovery phase of the St. Patrick's day geomagnetic storm (18 March 2015) as compared to the quiet day (16 March 2015) [2].

The SBAS generated TEC maps get updated in every 5 min and can also be used to generate the spatial maps of the scintillation activity (S_4 Index) as shown in Fig. 2. These maps which can be generated as early as 1930 LT are effective in forecasting the maximum strength of the scintillations (S_{4max}) over a given night [3].

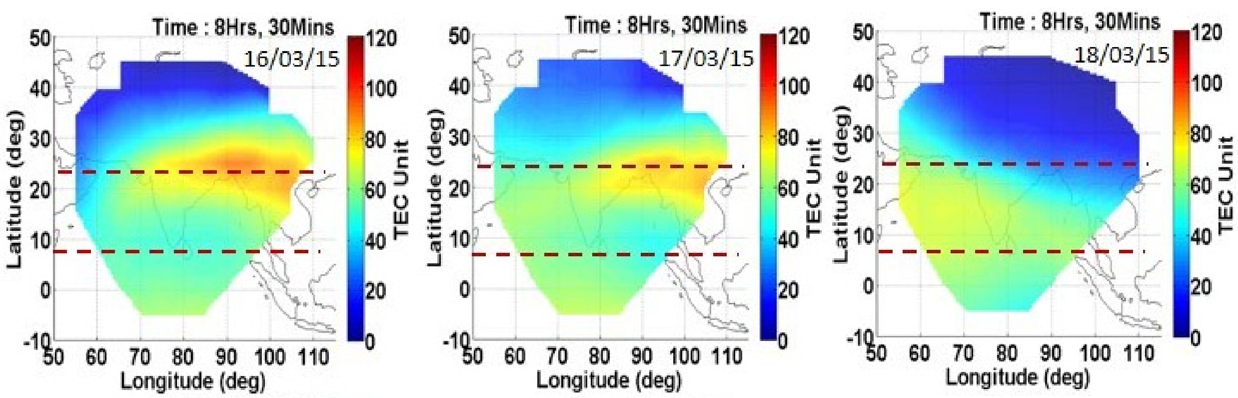

Figure 1. The 2D TEC maps from 16 to 18 March 2015 during afternoon sector (0830 UT). The colour code represents the TEC values. The horizontal red dashed lines show the location of geomagnetic equator and 15° geomagnetic latitude over Indian longitudes.

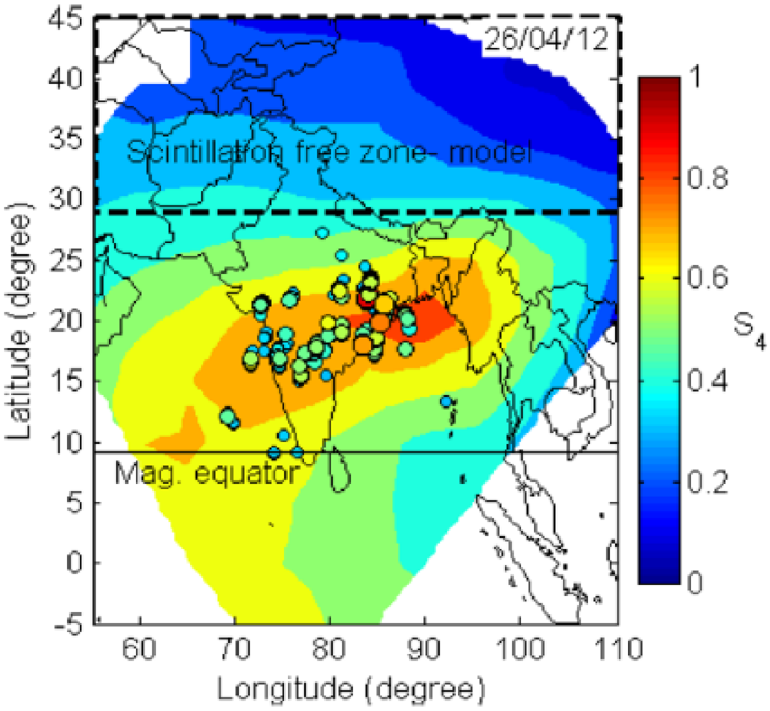

Figure 2. Comparison of forecasted scintillation strength with actual measurements of the S_4 index on a typical day (April 26, 2012). The circles denote the S_4 measurements observed by ground stations and the color code inside circles depicts the strength of the measured scintillation. The actual measurements are less than the predicted S_{4max}.

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1. Sunda, S., R. Sridharan, B. M. Vyas, P. V. Khekale, K. S. Parikh, A. S. Ganeshan, C. R. Sudhir, S. V. Satish, and M. S. Bagiya (2015), Satellite-based augmentation systems: A novel and cost-effective tool for ionospheric and space weather studies, Space Weather, 13, 6–15, doi:10.1002/2014SW001103.

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Highlight on Young Scientists 3:

Radiation Belt Dynamics: Trapped and Precipitating Particle Behavior and New Measurement Techniques

Ashley Greeley

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The outer radiation belt has a highly dynamic electron population, and the inner a slowly changing proton population. It is important to characterize both to fully understand the dynamics of the radiation belts.

We study the inner zone trapped protons to evaluate secular variations of the terrestrial magnetic field using Solar Anomalous and Magnetospheric Particle Explorer (SAMPEX). We observe the longitudinal (0.20°+-0.04° west/year) and latitudinal drift (0.11°+-0.01° south/year) of the South Atlantic Anomaly (SAA) and compare it to the IGRF model [Jones et al., 2017].

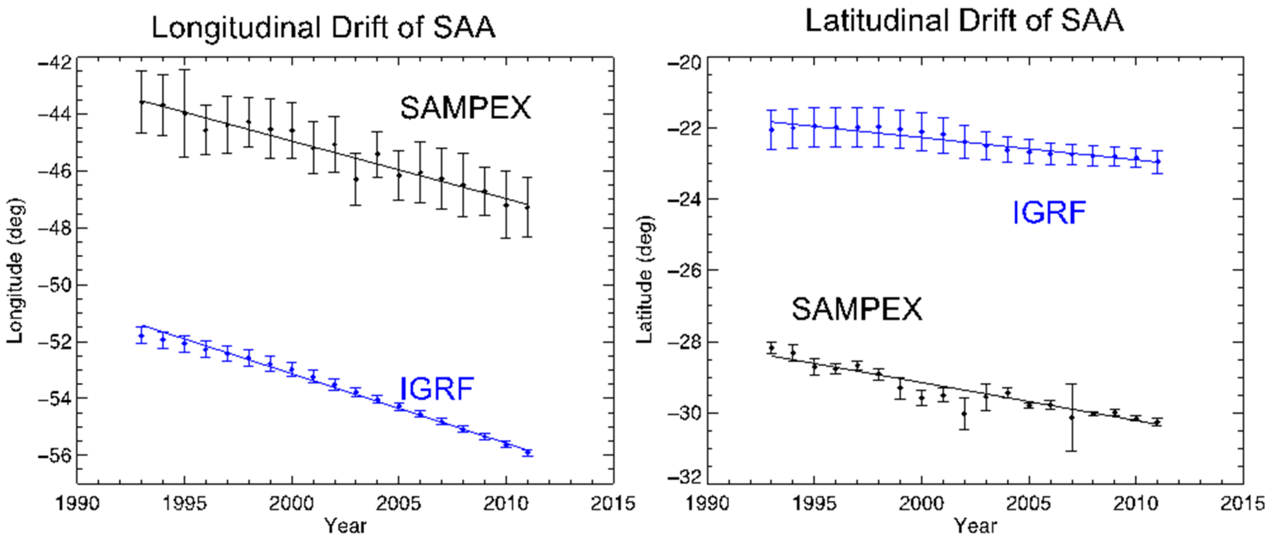

Figure 1. Peak count rate (near SAA) over time for latitude and longitude. Fit linearly for 1993-2011 (black), included errors on data. IGRF (blue) minimum magnetic field values with linear fit, including variance on the minimum.

We investigate the contribution of electron microbursts in the outer zone (rapid bursts of precipitation <1s) to global electron loss, thereby probing the connections between micro- and macro-processes in the outer belt. The contribution of microbursts to global electron loss during the recovery phase of storms has not been quantified. We find that there is a correlation between global loss and microburst activity [Greeley Jones et al., 2018].

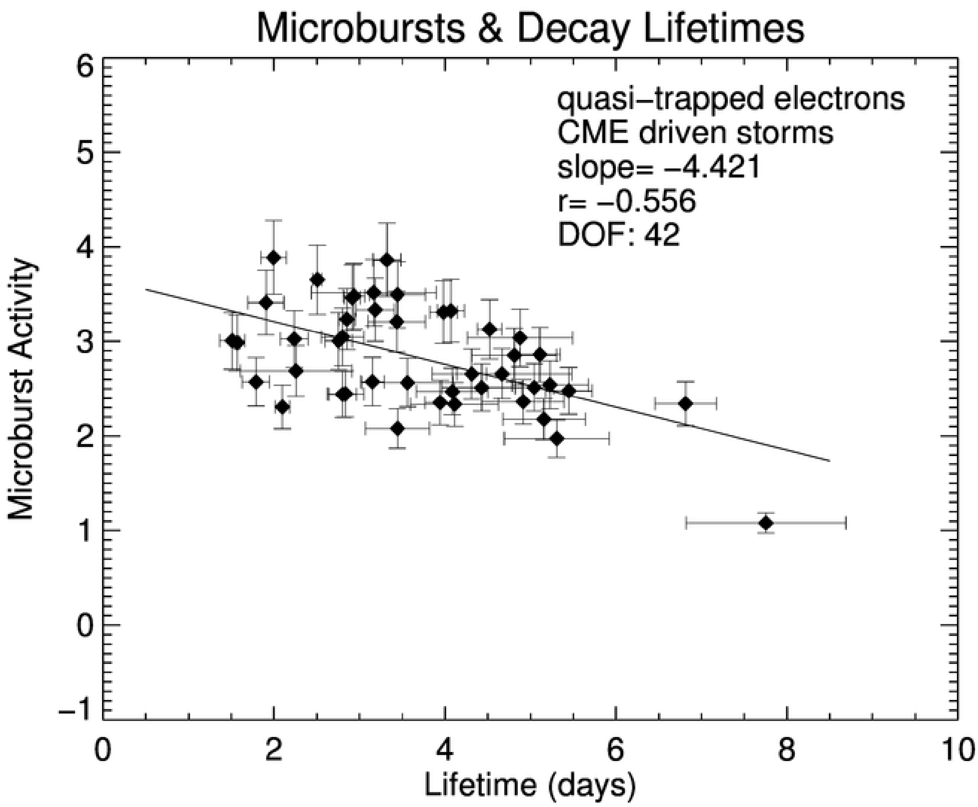

Figure 2. E-folding lifetime (tau) of global electron flux decay verses quantified microburst activity for quasi -trapped electrons in the recovery phase of a CME-driven storm. There is a linear fit on the square root of the microburst sums, and the slope, correlation coefficient (r) and degrees of freedom in the upper right.

We have designed and developed a new instrument MERiT (Miniaturized Electron Proton Telescope) to fly on a CubeSat mission, the Compact Radiation belt Explorer (CeREs), to measure radiation belt particles (to launch in 2018). We used Geant4 simulations to identify the type and energy of particles observed, the efficiencies of detection and background, and to optimize shielding.

References:

1. Jones, A. D., S. G. Kanekal, D. N. Baker, B. Klecker, M. D. Looper, J. E. Mazur, and Q. Schiller (2017), SAMPEX observations of the South Atlantic anomaly secular drift during solar cycles 22–24, *Space Weather*, 15, 44-52, doi: 10.1002/2016SW001525.

2. A.D. Jones Greeley, S.G. Kanekal, D. N. Baker, B. Klecker, Q. Schiller ,Quantifying the contribution of microbursts to global electron loss in the radiation belts, Journal of Geophysical Research, To be submitted.

Project SPeCIMEN

Meeting Report

Meeting Report 1:

The 8th Workshop on VLF/ELF Remote Sensing of Ionospheres and Magnetospheres (VERSIM)

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Andrei Demekhov

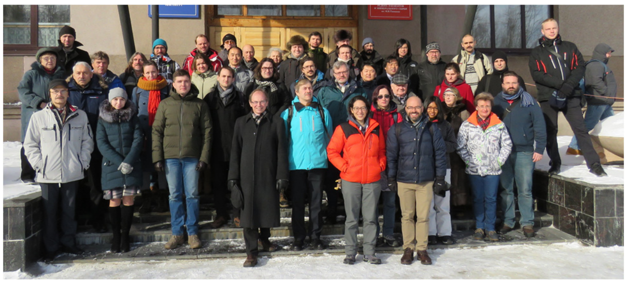

Figure 1. Group photo of participants.

The 8th biennial Workhop of VERSIM, the joint IAGA-URSI working group, was held on 19-23 March 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.

64 abstracts were accepted. After some cancellations, 50 oral and 4 poster reports were presented. Each oral talk was given a 20-min time slot. The following session themes were identified, being held in a sequence:
- 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 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.

Project SPeCIMEN

Meeting Report 2:

41st Annual Seminar "Physics of the Auroral Phenomena"

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Irina Despirak

Figure 1. Group photo of participants.

The 41st Annual Seminar "Physics of the auroral phenomena" has been held during 12-16 March 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 subauroral regions.

The Seminar subjects cover all aspects of the solar-terrestrial relations: 1) Storms and substorms; 2) Fields, currents, particles in the magnetosphere; 3) Waves, wave-particle interaction; 4) The sun, the solar wind, cosmic rays; 5) The ionosphere and the upper atmosphere; 6) Lower atmosphere, ozone; 7) Heliobiosphere.

The 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 http://pgia.ru:81/seminar/abstracts_book2018.pdf and http://pgia.ru:81/seminar/program/. The Seminar will be followed by publication of the proceedings, which will be available both online at http://pgia.ru/seminar/archive/ and in print. The electronic version of the seminar proceedings is published by the Russian Science Electronic Library (https://elibrary.ru/title_about.asp?id=57098).

Meeting Report

Project ROSMIC

Meeting Report 3:

4th International ANGWIN Workshop: Exploration of the High-latitude Upper Atmosphere Wave Dynamics

HisaoTakahashi

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During the period from April 24 to 26, 2018, "4th International **ANGWIN** (ANtarctic Gravity Wave Instrument Network) Workshop" was held at National Institute for Space Research (INPE), São José dos Campos, SP, Brazil. The main purpose of the workshop was to combine together new Antarctic and Arctic observations using optical and radio-wave techniques, and results with modeling studies

Figure 1. Workshop photo (at INPE Campus, April 25, 2018) .

to gain fresh knowledge and insight of their large-scale 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 next ANGWIN workshop will be held in Korea in 2020. We thank VarSITI/SCOSTEP and IAMS/IUGG for the financial support and encouragements.

Project ROSMIC

Meeting Report 4:

10th Workshop on Long-term Changes and Trends in the Atmosphere

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[2]Hampton University, Hampton, VA, USA

Tao Li

Jia Yue

The 10th Workshop on Long-Term Changes and Trends in the Atmosphere was held at Hefei, China on May 14-18 2018. There are about 130 participants from 13 countries and regions of China, Germany, USA, Japan, Taiwan, Argentina, Czech Republic, Finland, Russia, Malaysia, India, UK, Australia, including many graduate students and young scientists. This highly successful meeting is

Figure 1. Group photo of the Trend Workshop.

the most attended in this trend workshop series. The main traditional sessions include trends and variability in the stratosphere, mesosphere, thermosphere, ionosphere and modeling trends. Altogether 69 oral papers (including key notes and invited papers) and 25 posters have been presented. In addition, three tutorials for students and young scientists were presented on the history of trend researches, dynamics and modeling. Jan Lastovicka gave a special seminar on how to publish in scientific journals for early career scientists. This meeting is supported by VarSITI. A special joint issue of Journal of Geophysical Research Space Physics and Journal of Geophysical Research Atmosphere is planned. Nearly all pdfs of the oral presentations will be available at: the webpage: http://trends2018.ustc.edu.cn/programs.html.

Meeting Report

Project SEE

Meeting Report 5:

Tenth Workshop “Solar Influences on the Magnetosphere, Ionosphere and Atmosphere”

Boian Kirov
Space Research and Technology Institute, Bulgarian Academy of Sciences, Sofia, Bulgaria

Boian Kirov

The 10th Workshop “Solar Influences on the Magnetosphere, Ionosphere and Atmosphere” was held in Primorsko, Bulgaria from 4 to 8 June 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

Figure 1. Some of the participants of the workshop.

relation to climate change, to influences on the solid Earth and biosphere. The presentations and the proceedings of the workshop will be 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 Dibyendu Nandi. 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 the 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 will be provided as a feedback to the Committee for the SCOSTEP Next Scientific Program.

Project ISEST / SPeCIMEN / ROSMIC

Meeting Report 6:

VI International Conference "Atmosphere, Ionosphere, Safety" (AIS-2018)

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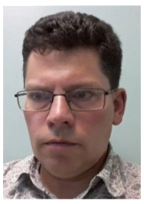
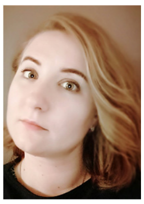
[2]West Department of Pushkov Institute of Terrestrial Magnetism, Ionosphere and Radio Wave Propagation, RAS, Kaliningrad, Russia
[3]Immanuel Kant Baltic Federal University, Kaliningrad, Russia



Maxim Golubkov

Maxim Klimenko



Olga Borchevkina

The VI International Conference “Atmosphere, Ionosphere, Safety” (AIS-2018) was held at the hotel “Sambiya” (Zelenogradsk, Kaliningrad region, Russia) on June 03-09, 2018. Participants were more than 130 scientists from 10 countries – Switzerland,

Figure 1. Group photo of AIS-2018, Baltic sea, Zelenogradsk, Russia June 2018.

Czech Republic, Norway, Mexico, Taiwan, USA, Italy, Netherlands, Brazil, and Russia including 42 young scientists. 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 Coupling» and young scientist competition were held. 14 lecturers, 70 oral and 50 poster reports introduced very interesting and interdisciplinary aspects of atmospheric climate, atmospheric chemistry, wave-particle interaction, ionospheric physics and space weather. AIS-2018 was supported by VARSITI, RFBR and the program «5-100» for improving competitiveness at IKBFU. Details of the conference are available at http://ais2018.ru/.

Meeting Report

VarSITI

Meeting Report 7:

DKIST Critical Science Plan Workshop 5

Eamon Scullion
Northumbria University,
Newcastle, UK

Eamon Scullion

Figure 1. Photograph of the Workshop.

The National Solar Observatory (Boulder, USA) is currently supporting 9 Critical Science Plan (CSP) development workshops, in preparation for first-light observations at the 4-m class Daniel K Inouye Solar Telescope (DKIST: https://dkist.nso.edu/), in early 2020. 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 is 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, from 9-11 April, at the Hilton Hotel Gateshead 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, encorporating 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/dkist-critical-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 now published on the DKIST Critical Science Plan JIRA site (https://id.atlassian.com/login), to be made publicly visible to the solar physics community. The workshop was financially supported by VarSITI, the Science and Technology Facilities Council (STFC, UK) and the Multi-Disciplinary Research Theme (MDRT) of Extreme Environments at Northumbria University. The organisers would like to thank additional funding support towards US participation costs in the workshop from the NSO and NSF. For more information on the Solar Physics Research Group at Northumbria University (UK) see the following link: https://www.northumbria.ac.uk/sun.

Upcoming meetings related to VarSITI

Conference	Date	Location	Contact Information
7th IAGA/ICMA/SCOSTEP workshop on Vertical Coupling in the Atmosphere-Ionosphere System	Jul. 2-6, 2018	Potsdam, Germany	https://www.gfz-potsdam.de/en/section/space-geodetic-techniques/topics/vcais-2018/vcais-2018/
SCOSTEP 14th Quadrennial Solar-Terrestrial Physics Symposium	Jul. 9-13, 2018	Toronto, Canada	http://www.scostepevents.ca/
42nd COSPAR Scientific Assembly	Jul. 14-22, 2018	Pasadena, CA, USA	https://www.cospar-assembly.org/
45th Annual Meeting on Atmospheric Studies by Optical Methods	Aug. 27-31, 2018	Kiruna, Sweden	http://45am.irf.se/
Annual African Geophysical Society (AGS) Conference on Space Weather	Sep. 24-27, 2018	Cairo, Egypt	http://www.spaceweather.edu.eg/AGS2018.html
ISEST 2018 Workshop XVIth Hvar Astrophysical Colloquium	Sep. 24-28, 2018	Hvar, Croatia	http://oh.geof.unizg.hr/index.php/en/meetings/184-isest-2018
15th International Symposium on Equatorial Aeronomy	Oct. 22-26, 2018	Ahmedabad, India	http://www.prl.res.in/isea15
7th Symposium of Brazilian Space Geophysics and Aeronomy Society (SBGEA)	Nov. 5-9, 2018	Santa Maria-RS, Brazil	http://www.sbgea.org.br/en/vii-sbgea-2/
2018 AGU Fall Meeting	Dec. 10-14, 2018	Washington, D.C., USA	https://fallmeeting.agu.org/2018/
EGU General Assembly 2019	Apr. 7-12, 2019	Vienna, Austria	https://egu2019.eu/home.html
Japan Geoscience Union Meeting 2019 (JpGU)	May 26-30, 2019	Makuhari, Chiba, Japan	http://www.jpgu.org/en/index.html
27th IUGG General Assembly	Jul. 8-18, 2019	Montreal, Canada	http://iugg2019montreal.com/
AOGS 2019 16th Annual Meeting	Jul. 28-Aug.2, 2019	Singapore	http://www.asiaoceania.org/society/index.asp

The purpose of the VarSITI newsletter is to promote communication among scientists related to the four VarSITI Projects (SEE, ISEST/MiniMax24, SPeCIMEN, and ROSMIC).

<u>The editors would like to ask you to submit the following articles to the VarSITI newsletter.</u>

Our newsletter has five categories of the articles:

1. Articles— Each article has a maximum of 500 words length and four figures/photos (at least two figures/photos).
   With the writer's approval, the small face photo will be also added.
   On campaign, ground observations, satellite observations, modeling, etc.
2. Meeting reports—Each meeting report has a maximum of 150 words length and one photo from the meeting.
   With the writer's approval, the small face photo will be also added.
   On workshop/conference/ symposium report related to VarSITI
3. Highlights on young scientists— Each highlight has a maximum of 200 words length and two figures.
   With the writer's approval, the small face photo will be also added.
   On the young scientist's own work related to VarSITI
4. Short news— Each short news has a maximum of 100 words length.
   Announcements of campaign, workshop, etc.
5. Meeting schedule

Category 3 (Highlights on young scientists) helps both young scientists and VarSITI members to know each other. Please contact the editors if you know any recommended young scientists who are willing to write an article on this category.

TO SUBMIT AN ARTICLE

Articles/figures/photos can be emailed to the Newsletter Secretary, Ms. Ayumi Asai (a-asai_at_isee.nagoya-u.ac.jp). If you have any questions or problem, please do not hesitate to ask us.

SUBSCRIPTION - VarSITI MAILING LIST

The PDF version of the VarSITI Newsletter is distributed through the VarSITI mailing list. The mailing list is created for each of the four Projects with an integrated list for all Projects. If you want to be included in the mailing list to receive future information of VarSITI, please send e-mail to "a-asai_at_isee.nagoya-u.ac.jp" (replace "_at_" by "@") with your full name, country, e-mail address to be included, and the name of the Project you are interested.

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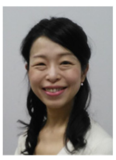

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