Space Weather Workshop
Omni Interlocken Hotel – Broomfield, CO
May 1-5, 2017

Poster Abstracts

Aminialragia-Giamini, S
Poster Number: S24
Poster - The Virtual Time-Series Solar Proton Event Model

Authors: S. Aminalragia-Giamini, I. Sandberg, C. Papadimitriou, P. Jiggens and I. A. Daglis

Presented by: Ingamar Sandberg

Abstract: A new statistical model for the description of Solar Proton Event (SPE) characteristics is presented. The model is based on the construction and the subsequent analysis of Virtual Time-Series (VTS) of solar energetic proton (SEP) fluxes. We have used the SEP flux series of ESA SEPEM Reference Dataset (SEPEM RDS v2.0) to derive underlying characteristics of SPEs and used this information to construct virtual time-series containing spectrally coherent SPE flux profiles (based on seed events from the SEPEM RDS v2.0) for arbitrary time intervals. We demonstrate that the virtual fluxes reproduce all the key statistical properties of the original dataset while expanding the resulting distributions where there are poor statistics (such as at extremes).
The virtual time-series produced can be used to derive probabilistic models of mission-important quantities of the SEP environment such as Cumulative Mission Fluence, Worst-Case SPE Fluence and Peak Flux which can be applied in risk estimates. Moreover, these derived quantities can be input into other tools to calculate effects quantities such as total dose and single-event-upset. The creation of VTS also allows for more complex calculations, such as magnetospheric shielding effects, to be applied to the (virtual) flux data prior to calculation of model outputs which hitherto was not possible with the traditional use of distribution functions to directly calculate SEP environment quantities. We also compare the results of our model with existing models, (SAPPHIRE, ESP, JPL) and show there is a good level of agreement.

Arsov, Kirco
Poster Number: I1
Poster - Ionospheric modelling to boost the PPP-RTK positioning and navigation in Australia

Authors: Kirco Arsov, Michael Terkildsen, and German Olivares

Presented by: Graham Steward

Abstract: This paper deals with implementation of 3-D ionospheric model to support the GNSS positioning and navigation activities in Australia. We will introduce two strategies for Slant Total Electron Content (STEC) estimation from GNSS CORS sites in Australia. In the first scenario, the STEC is estimated in the PPP-RTK network processing. The ionosphere is estimated together with other GNSS network parameters, such as Satellite Clocks, Satellite Phase Biases, etc. Another approach is where STEC is estimated on a station by station basis by taking advantage of already known station position and different satellite ambiguities relations. Accuracy studies and considerations will be presented and discussed. Furthermore, based on this STEC, 3-D ionosphere modeling will be performed. We will present the simple interpolation, 3-D Tomography and bi-cubic splines as modeling techniques. In order to assess these models, a (user) PPP-RTK test bed is established and a sensitivity matrix will be introduced and analyzed based on time to first fix (TTFF) of ambiguities, positioning accuracy, PPP-RTK solution convergence time etc. Different spatial configurations and constellations will be presented and assessed.

Barnard, Luke
Poster Number: S11
Poster – Testing the Current Paradigm for Space Weather Prediction with Heliospheric Imagers

Authors: Curt A. de Koning, Christopher J. Scot, Mathew J. Owens, Julia Wilkinson, Jackie A. Davies

Presented by: Curt de Koning

Abstract: Currently, space weather forecast centers around the world, such as NOAA/SPWC and the UK Met Office, issue CME arrival time forecasts using numerical models initiated by photospheric and coronagraph data only. Heliospheric imagers (HIs), which provide a wide-angle view of the outer corona and inner heliosphere, offer the only direct observations of solar wind plasma between the solar corona and Earth orbit.

Rather than using the commonplace J-Map approach to track CMEs in HI, we develop an improved tracking technique based on analysis of the whole heliospheric image. Predictions of the arrival of CMEs in geospace from the resulting elongation-time profiles requires the use of a CME geometric model, such as Harmonic Mean, Self-Similar Expansion, or Ellipse Evolution to convert from elongation to radial distance. However, the efficacy of these geometric models, even when constrained by prior coronagraph observations, does not compare favorably with a SWPC forecast of the same event. We argue that these results imply that the assumptions of the CME geometric models are routinely invalidated and question their utility in a space weather forecasting context.

These results argue for several possible courses of action, including deployment of a polarising heliospheric imager for future L5 and L1 operational space weather forecasting missions. Such polarising heliospheric imagers will allow for the direct extraction of CME geometry, including asymmetries and other leading-edge distortions that cannot be incorporated into the CME geometric models mentioned above; this will allow for improved spatial tracking of CMEs. In addition, for both a polarising and an unpolarised heliospheric imager, these results argue for the continuing development of more advanced techniques such as assimilative modelling and ensemble pruning methods.

Berdermann, Jens (German Aeorspace Center)
Poster Number: I2
Poster - The Ionosphere Monitoring and Prediction Center

Authors: J. Berdermann, K.D. Missling, M. Kriegel, C. Borries, H. Barkmann, M. Tegler, C. Krafft, R. Geib, N. Jakowski, V. Wilken, D. Wenzel, M. Hoque ,H. Sato, Max Wegner, T. Gerzen and D. Minkwitz

Abstract: The performance of radio systems used in space based communication, navigation and remote sensing is affected by the ionospheric variability. Moreover, ionospheric disturbances caused by space weather effects may degrade the accuracy, reliability and availability of Global Navigation Satellite Systems (GNSS), such as GPS and the future civilian European system Galileo. The Ionosphere Monitoring and Prediction Center (IMPC) of DLR provides a near real-time information and data service on the current state of the ionosphere, related forecasts and warnings. Well established ground and space based GNSS measurements offer a unique chance to permanently monitor the electron density and the structure of the ionosphere-plasmasphere system on global scale. Threats due to the ionosphere can be mitigated with the help of IMPC services such as forecast and warnings of ionospheric disturbances.

Bisi, Mario (Science & Technology Facilities Council)
Poster Number: S21
Poster - The Worldwide Interplanetary Scintillation (IPS) Stations (WIPSS) Network:

October 2016 Campaign – LOFAR and ISEE Initial Investigations

Authors: Mario M. Bisi (STFC RAL Space, UK), Richard A. Fallows (ASTRON, The Netherlands), Bernard V. Jackson (UCSD,USA), Munetoshi Tokumaru (Nagoya University, Japan), Hsiu-Shan Yu (UCSD, USA), and David Barnes (STFC RAL Space, UK)

Abstract: Interplanetary scintillation (IPS) can be used to provide a global measure of velocity and density as well as indications of changes in the plasma and magnetic-field rotations along each observational line of sight. There is now (since late-2014) a well-defined IPS Common Data Format (IPSCDFv1.0 – with IPSCDFv1.1 rollout expected in mid-/late-2017) which is being implemented by the majority of the global IPS community. The new Worldwide IPS Stations (WIPSS) Network aims to bring together the worldwide real-time-capable IPS observatories, as well as those used on a more-campaign-only basis, with well-developed and tested analyses techniques being unified across the majority of IPS-capable systems coming under WIPSS. If the observations of IPS are formally inverted into a three-dimensional (3-D) tomographic reconstruction (such as using the University of California, San Diego – UCSD – kinematic model and reconstruction technique), then source-surface magnetic fields can also be propagated out to the Earth (and beyond) as well as in-situ data also being incorporated into the reconstruction. By combining IPS data from multiple observing locations, we can increase both the spatial and temporal coverage across the whole of the inner heliosphere. Currently, the tomography has been undertaken near-operationally since around 2000 using IPS data only from the Institute for Space-Earth Environmental Research (ISEE) (formerly STELab/STEL), Nagoya University, Japan, and has been used scientifically since the 1990s. During October 2016, a unique opportunity arose whereby the European-based LOw Frequency ARray (LOFAR) novel "software" radio telescope was used to make nearly four weeks of continuous observations of IPS as a heliospheric space-weather pilot campaign. This was expanded into a global effort to include observations of IPS from many other IPS-capable/IPS-dedicated WIPSS Network systems. IPS data from both LOFAR and ISEE are used in this study from which we present some initial findings.

Bonadonna, Michael (NOAA – OFCM)
Poster Number: G7
Poster - Two Decades of Interagency Partnership and Accomplishments

Authors: Michael Bonadonna1, Louis Lanzerotti2, Judson Stailey1
1 - Office of the Federal Coordinator for Meteorological Services and Supporting Research (OFCM), National Oceanic and Atmospheric Administration, U.S. Department of Commerce, Silver Spring, MD 20910
2 – Center for Solar-Terrestrial Research, New Jersey Institute of Technology, Newark, New Jersey 07102

Abstract: This paper describes the development of the United States National Space Weather Program (NSWP) from early interests in space environmental phenomena and their impact through the culmination of the program in 2015. Over its 21-year run, the NSWP facilitated substantial improvements in the capabilities of federal space weather services and fostered broad and enduring partnerships with industry and the academic community within the U.S. and internationally. Under the management of the Office of the Federal Coordinator for Meteorological Services and Supporting Research (OFCM) a coalition of ten federal agencies worked together from 1994 to 2015 to advance the national space weather enterprise. The paper describes key events and accomplishments of the NSWP interagency partnership while recognizing the great achievements made by the individual agencies. In order to provide context, the paper also discusses several important events outside the NSWP purview. Some of these external events influenced the course of the NSWP, while others were encouraged by the NSWP partnership. Following the establishment of the Space Weather Operations, Research, and Mitigation Task Force of the National Science and Technology Council in the White House and the deactivation of the NSWP Council, the agencies now play a supporting role in the national effort as the Federal engagement in the National Space Weather Partnership graduates to a higher level.

Citation: Bonadonna, M., L. Lanzerotti, and J. Stailey (2016), The National Space Weather Program: Two decades of interagency partnership and accomplishments, Space Weather, 15, doi:10.1002/2016SW001523.

Boudouridis, Athanasios (University of Colorado, Boulder)
Poster Number: M8
Poster - Development of a Bow-tie Inversion Technique for Real-time Processing of the GOES-R SEISS MPS-HI Electron Channels and Comparison with the Baseline Matrix Inversion Technique

Authors: A. Boudouridis, J. V. Rodriguez, and B. T. Kress

Abstract: The Space Environment In-Situ Suite (SEISS) on GOES-R includes a new instrument for measuring radiation belt electrons and protons, the Magnetospheric Particle Sensor – High Energy (MPS-HI). The baseline calibration algorithm for the conversion of raw MPS-HI electron telescope counts to fluxes is based on the inversion of the geometric factor matrix that relates raw counts to electron fluxes, C=Rij F. This matrix is derived from the Geant4 simulation results of electron transport through the telescope solid state detectors, scaled and shifted based on measurements in electron beams. The inverse matrix, R-1ij, provides the electron fluxes from the measured counts and has no constraints placed on the inversion in order to ensure a realistic result. The baseline algorithm exhibits substantial errors in the electron flux determination, approaching or exceeding 100% in the high energy (E7-E10) differential channels and the integral E10A channel. Our first approach to mitigating the problem is to apply instead a diagonal array produced by the so-called bow-tie technique for the characterization of a particle sensor instrument response. The purpose of the bow-tie analysis is to calculate for each energy channel an energy/geometric factor pair applicable to a wide range of energy spectra, and for which the geometric factor error is minimized. Previous applications of the technique have used small analytical families of energy spectra. For the first time, to our knowledge, we derive bow-tie factors using a large number of observed high-resolution spectra. Specifically, we use the cross-calibrated CRRES satellite MEA and HEEF data set from the period 1990-1991 (Johnston et al., AFRL-RV-PS-TR-2014-0016, 2014), restricted to 6<L<8. A number of randomly selected CRRES spectra from a subset of the data is used to perform the bow-tie analysis and determine the channel energy/geometric factor characteristics. The remaining CRRES spectra are first converted to counts using the Geant4 simulation results, and then inverted back to fluxes using both the baseline matrix inversion and the bow-tie technique inversion. The retrieved electron spectra from the two methods are then compared to the original CRRES proxy spectra. We conduct both case study and statistical error analysis of the two inversion techniques to show that, in general, the diagonal bow-tie array performs better than the baseline matrix inversion for the high energy (E7-E10) differential channels and the integral E10A channel. We repeat our study for different bow-tie analysis samples and CRRES proxy data sets, and compare the results.

Brown, Denzel (Presbyterian College)
Poster Number: M15
Poster - Superposed Epoch Analysis of Physiological Fluctuations: Possible Space Weather Connections

Authors: James Wanliss, Germaine Cornélissen, Franz Halberg and Denzel Brown

Abstract: There is a strong connection between space weather and fluctuations in technological systems. Recent studies also suggest a statistical connection between space weather and subsequent fluctuations in the physiology of living creatures. This connection, however, has remained controversial and difficult to demonstrate. Here we present support for a response of human physiology to forcing from the explosive onset of the largest of space weather events – space storms. We consider a case study of over sixteen years of relatively high temporal resolution measurements of human blood pressure (systolic, diastolic) and heart rate variability to test for correlations with space weather. We find no statistically significant change in human blood pressure but the results imply a statistically significant drop in heart rate during the main

phase of space storms. Our empirical findings shed light on how human physiology may respond to exogenous space weather forcing.

Cade, Trey (Baylor University)
Poster Number: G8
Poster - An Inquiry-Based Approach to Teaching Space Weather to Undergraduate Non-Science Majors

Authors: Trey Cade

Abstract: Undergraduate Space Weather education is an important component of creating a society that is knowledgeable about space weather and its societal impacts. The space physics community has made great strides in providing academic education for students, typically physics and engineering majors, who are interested in pursuing a career in the space sciences or space weather. What is rarely addressed, however, is providing a broader space weather education to undergraduate students as a whole. To help address this gap, I have created an introductory space weather course for non-science majors, with the idea of expanding exposure to space weather beyond the typical physics and engineering students. The philosophy and methodologies used in this course will be presented, as well as the results of the first attempts to teach it. Using an approach more tailored to the non-scientist, courses such as this can be an effective means of broadening space weather education and outreach.

Carver, Matthew
Poster Number: M4
Poster – Cross-calibration of proton measurements from the Combined X-ray Dosimeter on GPS

Authors: Matthew Carver, Steven Morley, John Sullivan, Juan Rodriguez

Presented by: Steven Morley

Abstract: More than 167 satellite-years of GPS energetic particle data have been made open to the public, with more being collected every day. The large number of satellites in the GPS constellation offers an unprecedented ability to perform research and analyses using a multipoint, comprehensive picture of the Earth's space environment distributed across 6 orbital planes. However, as the instruments aboard were not designed for a purely scientific purpose it is necessary to demonstrate their ability to accurately describe the space environment.
We present the cross-calibration procedure for the GPS proton measurements against data from the energetic particle sensor on the NOAA GOES satellites. Because proton fluxes at medium earth orbit are relatively stable, temporal coincidences between satellites during solar energetic particle events are chosen as calibration times as they offer orders of magnitude change in proton fluxes for comparison. This large set of validated proton flux measurements will benefit current modeling tools for predicting space weather and magnetosphere dynamics allowing scientists to better understand the effect these space weather events have on our technological systems.

Cilliers, Pierre (South African National Space Agency) EPOSTER
Poster Number: I11
Poster - Evaluation of HF Radio Propagation Predictions based on ICEPAC

Authors: Pierre J. Cilliers, Teboho Nxele, Mpho Tshisaphungo and Donald W. Danskin

Abstract: The Regional Space Weather Centre for Africa, located at the South African National Space Agency (SANSA) in Hermanus, South Africa, offers HF radio propagation predictions for users of HF radio communication. This paper reports on the verification of Maximum Usable Frequency (MUF) predictions made by means of the Ionospheric Communications Enhanced Profile Analysis and Circuit

(ICEPAC) model. The verification is done by comparison of MUF with foF2 measurements from DIGISONDES in the African region operated by SANSA. The study considers long-term predictions (up to 98 days) for two full years of predictions (2011, 2012). It is shown that HF radio frequency predictions using the ICEPAC software are well matched by Ionosonde observations of foF2, under geomagnetically quiet conditions. ICEPAC is proven to be a relatively stable model with no extreme outliers even for a lead time of 98-days. The results of this study provide a baseline for future models to evaluate the accuracy of HF propagation predictions. Some anomalies that occur during geomagnetically active conditions are presented. The histograms and the fitted Gaussian distributions of the prediction error provide a useful means of displaying the accuracy and the bias in the predictions. Typical values of RMSE were found to be 1 MHz ± 20%. All of the correlation coefficients between the predicted MUF and the measured foF2 are larger than 0.90 for lead times up to 98 days. The predictions of MUF by means of ICEPAC are within the accuracy required for practical application for the regions under investigation.

Codrescu, Mihail (NOAA/SWPC)
Poster Number: I17
Poster - On the importance of Data Assimilation for the Thermosphere Ionosphere System

Authors: Stefan M. Codrescu, Mihail V. Codrescu, and Mariangel Fedrizzi

Abstract: Modern technological systems like GNSS positioning, HF communications, radar ranging, satellite communications, and power distribution are all affected by space weather and can become unreliable during disturbed conditions. For large space weather events the thermosphere and ionosphere, driven by strong external forcing and under the influence of feed-back loops, exhibit large deviations from climatology. Such extreme space weather conditions can have high impacts on systems and are notoriously difficult to reproduce by models. Successful specification and forecasting during such events requires physics based ionosphere thermosphere models and Data Assimilation (DA) schemes. DA in the thermosphere ionosphere system is required because of the impossibility to measure the forcing of the system with the necessary spatial and temporal resolution. We present preliminary results from the implementation of an Ensemble Kalman Filter that uses CTIPe as the background model.

Connell, Jim (University of New Hampshire)
Poster Number: M21
Poster – The GOES-16 Energetic Heavy Ion Instrument Heavy Ion Fluxes for Space Weather Applications

Authors: J. J. Connell[1] and C. Lopate[1]
[1]The University of New Hampshire, Department of Physics and the Space Science Center

Abstract: The Energetic Heavy Ion Sensor (EHIS) was built by the University of New Hampshire subcontracted to Assurance Technology Corporation, as part of the Space Environmental In---Situ Suite (SEISS) on the new GOES---16 satellite. EHIS measures energetic ions in space over the range 10---200 MeV for protons and energy ranges for heavy ions corresponding to the same stopping range (e.g., 19--- 207 MeV/u for carbon and 38---488 MeV/u for iron). For the GOES Level 1---B and Level 2 data products, heavy ions are distinguished in EHIS using pulse---height analysis with on---board processing which produces charge histograms for five energy bands which are normalized to priority rate data on the ground. EHIS uses the Angle Detecting Inclined Sensors (ADIS) technique to provide single---element charge resolution. The instrumental cadence for histograms is 1 minute and the primary Level 1---B heavy ion data products are 1---minute and 5---minute averages.
Heavy ions comprise only ~1% of energetic ions in space, but are of disproportionate importance for Space Weather since the energy deposition of charged particles scales as ~Z^2 while the nuclear interaction cross---sections typically scale as ~A^2/3. We discuss the preliminary EHIS heavy ion data results and their application to Space Weather.

Cook, Michael (University of North Dakota)
Poster Number: M16
Poster - Analysis of Citizen Science Aurora Data Collected by Aurorasaurus in 2016

Authors: Michael Cook, Elizabeth MacDonald and Burcu Kosar

Abstract: Aurorasaurus project has been actively collecting ground-based reports of the aurora globally since its initial launch in 2014. The citizen science reports of the aurora are collected via the project's website and apps and are also mined from Twitter. All reports are groomed for quality and checked for obvious data integrity issues. We investigate the dataset for the year of 2016 to see how the number of reports varied with geomagnetic activity. We also examined the meta-data accompanying the citizen science reports to extract detailed information about the observed aurora in 2016. Results are compared with the earlier analysis of 2015. We also report the results of user database analysis to see the growth of our community and project.

Copeland, Kyle (FAA) EPOSTER
Poster Number: S28
Poster - Evaluating Simple Shielding Approximations for Galactic Cosmic Radiation Using OLTARIS

Authors: Kyle Copeland

Abstract: The dominant source of ionizing radiation in the aerospace environment is galactic cosmic radiation (GCR). Traditionally, calculations of exposure rates for vehicle occupants in aircraft have not included vehicle structure. This research compares calculations of effective dose equivalent rate from GCR made using this very simple approximation with more involved techniques inside a lightly shielded vehicle (<20 g/cm*cm) using the NASA web tool OLTARIS. While results with shielding are considerably different than if shielding were entirely neglected, calculations using air in lieu of aluminum do not vary much from calculations using aluminum. As expected, air is consistently a superior shield to aluminum, but its relative effectiveness decreases as shield mass increases and results are never more than 7% different, suggesting that the approximation of simulating vehicle materials as additional air is a reasonable correction technique to use with software such as CARI and EPCARD when estimating crewmember doses.

Cui, Yanmei (National Space Science Center, CAS)
Poster Number: S12
Poster - Statistical study of magnetic cause of confined flares

Authors: Yanmei Cui, Siqing Liu, Haimin Wang

Abstract: CMEs and flares are two different manifestations of the same energy release process in the coronal. Eruptive flares are associated with CMEs and confined flares are without CMEs. Previous studies believed that the AR non-potentiality and strong confinement from the overlying magnetic arcades are two main magnetic cause for the confined flares. In this study, we collected 58 X-class flares produced in active regions within 30 degree of solar disk, which include 38 eruptive events and 20 confined events. By using SOHO/MDI and SDO/HMI magnetic field data, the area of gradient-weighted polarity inversion region and the decay index are calculated, which describe the AR non-potentiality and the gradient of strapping fields, respectively. Though a statistically study, it is found that the decay index of confined flares tends to be smaller than that of eruptive flares. Meanwhile, the area of gradient-weighted polarity inversion region and the soft x-ray flare fluence have positive relationships with CME speeds for eruptive flares.

de Koning, Curt (University of Colorado)

Poster Number: S10
Poster - Various Ways to Calculate CME Mass

Authors: Curt A. de Koning

Abstract: Coronal mass ejections (CMEs) are intrinsically three-dimensional structures that appear as two-dimensional projections when viewed in white light. With only single-viewpoint total brightness images, such as those from SOHO/LASCO, it is not possible to calculate a true CME mass because total-brightness images do not contain any depth or directional information. Adding additional viewpoints, or using polarimetry, enables calculation of a de-projected CME mass that better approximates the true CME mass. An accurate estimation of CME mass is important in a space weather context, since at least one study has shown that an order of magnitude variation in mass for an energetic CME may result in a variability of more than four hours in arrival time prediction at Earth using the WSA-Enlil model. In this poster, we discuss a variety of ways to estimate CME mass, including a three-view approach, a one-view approach based on polarimetry, and a two-step approach based on forward modeling of the CME.

De la Luz, Victor Hugo (SCiESMEX/National University of Mexico) EPOSTER
Poster Number: G3
Poster - The Mexican Early Warning System of Space Weather

Authors: Américo González-Esparza, Pedro Corona, Xavier Gonzalez, Julio Mejia, and Maria Sergeeva

Abstract: One of the most important products in the Mexican Space Weather Service (SCiESMEX) is the Early Warning of Space Weather System. The aim of the project is deliver in real time an automatic warning from the public international alert by SWPC/NOAA to the Mexican National Center for Disaster Prevention (CENAPRED) and the general public. The work of SCiESMEX is translate the information received from SWPC to the mexican context, this include transform and validate the alerts to agree the mexican policies of civil protection and the protocols of CENAPRED. The code get the SWPC/NOAA alerts, decodifies the information, translate automatically to spanish, create an email, twitt and SMS automatically, segment the information and delivery the product by SMS, Twitter, Facebook, webpage, and by email. The latency of the alert is 5 minutes. The code is running since January of 2015 without major interruptions.

DeLuca, Edward (Smithsonian Astrophysical Observatory)
Poster Number: S1
Poster - The COronal Spectrographic Imager in the Extreme ultraviolet (COSIE) Mission

Authors: The COSIE Team

Abstract: COSIE, a proposed MoO for the ISS, will demonstrate the capabilities of a high throughput wide field EUV imager and an associated objective grating spectrograph. If selected the telescope will be operational in Summer 2022. Science and space weather goals and objective for the mission will be presented.

De Nardin, Clezio (INPE)
Poster Number: G4
Poster - Recent Development on the RWC-Brazil Space Weather products: Regional Magnetic Indices, Total Solar Irradiance, TEC Maps Extension and DIX Maps

Authors: Embrace Space Weather Program Team

Abstract: Since the Embrace (Brazilian Space Weather Study and Monitoring program, from Portuguese "Estudo e Monitoramento BRAasileiro de Clima Espacial") Program start is operations in July 4, 2008, the main purpose of the actives have being to monitor the Solar-Terrestrial environment, the magnetosphere, the upper atmosphere and the ground induced currents to prevent effects on technological and economic activities. Since then we have being visiting several different space weather costumers and we have host three workshops of Brazilian space weather users at the Embrace facilities. From the inputs and requests collected from the users the Embrace Program decided to monitored several physical parameters of the sun-earth environment through a large ground base network of scientific sensors and under collaboration with space weather centers partners. Most of these physical parameters are daily published on the Brazilian space weather program web portal, related to the entire network sensors available. A comprehensive data bank and an interface layer are under development to allow an easy and direct access to the useful information. Nowadays, the users will count on products derived from a GNSS monitor network primary covering most of the South American territory; a digisonde network that monitors the ionospheric profiles in four equatorial and low latitude sites; several solar radio telescopes to monitor solar activity, and a magnetometer network, a global ionospheric physical model. Regarding outreach, we publish a daily bulletin in Portuguese with the status of the space weather environment on the Sun, in the Interplanetary Medium and close to the Earth. Recently, we have release brand new products and update others. We are currently extending the GNSS monitor network to cover up to the border of US territory. Also, a disturbance index map named DIX Map is under development, which is based on the GNSS Tec Maps. Moreover, we have developed the Ksa, a regional magnetic index that have being recently texted it against Kp and a brand new model have being developed to monitor the total solar irradiance and, in the future, forecast it.

Dichter, Bronek (Assurance Technology Corporation)
Poster Number: M6
Poster - New GOES-16 Space Weather Energetic Particle Instruments

Authors: Bronislaw Dichter, Gary Galica, Michael Golightly, Sam Tsui

Abstract: The recently launched GOES-R series spacecraft (GOES-16) carries a new suite of highly capable space weather instruments (SEISS) which offer significant measurement performance advances over the previous GOES N-P series energetic particle instruments. SEISS instruments meet the goals of the spacecraft user community in the diagnosis and prevention of spacecraft anomalies and the needs of the science community which relies on GOES to provide data for both long term databases and for event studies in order to develop improved models of the space environment. One key improvement is a better specification of medium energy radiation environment responsible for deep dielectric spacecraft charging. The energy of the measureable flux ranges were extended significantly to cover the region from lowest observed to the highest observed flux levels. The number of differential energy channels was also increased. The measurement cadence was increased from one measurement per 32 seconds to one per second. The energetic particle sensors Magnetospheric Particle Sensor-High (MPS-HI) and the Solar and Galactic Particle Sensor (SPGS) carry solid state detector telescopes that cover a proton range of 80 keV to 500 MeV in 23 logarithmically spaced differential energy channels, an electron energy range of 50 keV to 4 MeV in 10 differential energy channels and an alpha particle range of 4.7 to 1,000 MeV in 12 channels. In addition there are several integral channels and a channel that measures the flux of high energy particles that cause Single Event Effects (SEE). The MPS-HI has ten telescopes, with five look angles each for electrons and protons that cover a 170 degree field of regard. There are two SGPS instruments, one viewing east and one west. We provide an overview of the sensor configurations and performance and the results of performance modeling using the GEANT code. Initial on-orbit data and comparison to the present GOES-13 data will also be presented. In particular we will display data from the east and west facing SGPS units and its comparison to GOES-13 EPAD data. The performance of the data from the MPS-HI telescopes will be discussed and compared to the GOES-13 MAGPD and MAGED data.

Eastes, Richard
Poster Number: I18

Poster – Global-scale Observations of the Limb and Disk (GOLD) Mission – Ultraviolet Remote Sensing of Earth's Space Environment

Authors: R. W. Eastes1, M. Codrescu2, W. E. McClintock3, A. G. Burns4, S. C. Solomon4, D. N. Anderson2, L. Andersson3, R. E. Daniell5, S. L. England6, J. S Evans7, J. E. Harvey8, A. Krywonos1, J. D. Lumpe9, A. D. Richmond4, D. W. Rusch3, O. Siegmund10, T. N. Woods3, A. Aksnes11, S. A. Budzien12, K. F. Dymond12, F. G. Eparvier3, C. R. Martinis13, J. Oberheide14, and H. Foroosh15

Presented by: Mihail Codrescu

Abstract: The GOLD mission of opportunity will fly a far ultraviolet imaging spectrograph in geostationary (GEO) orbit as a hosted payload. The GOLD imager, now being integrated onto the SES-14 satellite, is scheduled for launch in late 2017. SES-14, a commercial communications satellite, will be stationed over eastern South America at 47.5° west longitude. The GOLD imager has two identical channels. Each channel can scan the full disk at a 30 minute cadence, making spectral images of Earth's UV emission from 132 to 162 nm, as well as make a measurement on the Earth's limb. Remote sensing techniques that have been proven on previous Low Earth Orbit (LEO) missions will be used to derive fundamental parameters for the neutral and ionized space environment. Parameters that will be derived include composition (O/N2 ratio) and temperature of the neutral atmosphere on the dayside disk. On the nightside, peak electron densities will be obtained in the low latitude ionosphere. Similar imaging of atmospheric composition from LEO, at only a daily cadence for revisiting locations, has already provided many new insights into the behavior of Earth's Thermosphere-Ionosphere (T-I) system. From geostationary orbit, GOLD can repeatedly image the same geographic locations over most of the hemisphere at a cadence comparable to that of the T-I system (order of an hour). Such time resolution and spatial coverage will allow the mission to track the changes due to geomagnetic storms, variations in solar extreme ultraviolet radiation, and forcing from the lower atmosphere. In addition to providing a new perspective by being able to repeatedly remotely sense the same hemisphere at a high cadence, GOLD's simultaneous measurements of not only composition but also temperatures across the disk will provide a valuable, new parameter for understanding of how the T-I system responds to forcing from the Sun and the lower atmosphere.

Eparvier, Francis (Universit of Colorado)
Poster Number: S17
Poster - The Extreme Ultraviolet and X-Ray Sensors (EXIS) on GOES-16: Measurements, Data Products, and First Results

Authors: F.G. Eparvier, T.N. Woods, A.R. Jones, M. Snow, D.L. Woodraska, E.M.B. Thiemann, W. McClintock, M. Anfinson, R. Viereck, J. Machol, M. Todirita, G.J. Comeyne, & S.K. Tadikonda

Abstract: Launched in November 2016, the NOAA GOES-16 satellite has the EXIS suite that consists of all new versions of the Extreme Ultraviolet Sensors (EUVS) and X-Ray Sensors (XRS) for monitoring the solar irradiance in the wavelength range that drives the thermosphere and ionosphere. The new XRS features updated technology, an increased dynamic range, and flare location capability, while continuing the longstanding historical record of solar soft X-ray measurements of flare variability. The previous version of the EUVS measured broad bandpasses, whereas the new EUVS measures specific solar line emissions selected to span the range of temperatures and variability in the solar atmosphere, allowing for the modeling of the full spectral range. In this poster we will give an overview of the measurements, data products, and first results for the GOES-16 EXIS.

Fedrizzi, Mariangel (University of Colorado/CIRES and NOAA/SWPCC**)**
Poster Number: I20

Poster - Assessing the Capabilities and Limitations of Physics-Based Models in Capturing the Ionosphere and Thermosphere Storm-Time Response

Authors: Mariangel Fedrizzi, Naomi Maruyama, Timothy J. Fuller-Rowell, Phil Richards, Tzu-Wei Fang, Mihail Codrescu, Anthea J. Coster

Abstract: The Sun can directly impact the Earth's environment during solar storms when the interaction between their magnetic fields can severely modify the quiet-time electric fields and current patterns in the ionosphere, which in turn affect neutral temperature, density, winds and composition, and plasma density. The nature of the various solar wind features and their interaction with the upper atmosphere is likely to channel the response into different pathways. Depending on whether the forcing is impulsive or gradual, of long or short durations, intense or moderate, the partitioning of the energy will be different. For instance, a sudden onset of energy deposition is likely to generate a more intense wave field at the expense of the energy being partitioned into local heating, thermal expansion, and composition change. The net electrodynamic and ionospheric response is likely to be significantly different in the two cases. As the ionosphere and thermosphere constituents are controlled by gravity, diffusion, chemical reactions, and bulk transport, it is essential to understand how these processes determine global responses in O and N2 after heating occurs at high latitudes. Since these disturbances are superimposed on a solar EUV-driven circulation system that is mainly ordered in a geographic coordinate frame that varies with local time and season, the interactions can be complex, and ionosphere-thermosphere responses are very different depending on prevailing conditions. The relative abundances of O and N2 are fundamental to understanding local plasma densities and total mass densities, both of which are key parameters underlying space weather forecast needs. In this study, the Coupled model of the Thermosphere, Ionosphere, Plasmasphere and electrodynamics (CTIPe) and the recently developed Ionosphere-Plasmasphere-Electrodynamics (IPE) models are used to quantitatively assess how well the models reproduce the structure of the O/N2 changes and the negative phase observed during geomagnetic storm events. Various datasets from ground and space are used to validate the model results.

Fedrizzi, Mariangel (University of Colorado/CIRES and NOAA/SWPCC)
Poster Number: I21
Poster – CTIPe Neutral Density: Recent Results and Validation Metrics

Authors: Mariangel Fedrizzi, Timothy J. Fuller-Rowell, Mihail Codrescu, Valery Yudin

Abstract: Solar extreme ultraviolet (EUV) and far ultraviolet (FUV) radiation is the primary heat source driving temperature and density changes in the thermosphere during quiet geomagnetic conditions, while Joule heating and auroral precipitation are the dominant heating sources affecting the neutral atmosphere gas during geomagnetic storms. The upper atmosphere structure is also impacted by atmospheric waves generated in the lower atmosphere and at Earth's surface carrying energy and momentum upward from tropical storms, stratospheric jets, volcanic eruptions, thermal tides, and winds flowing over topography and surface features. Increases in the temperature and density of the upper atmosphere can have a direct impact on low Earth orbit (LEO) spacecraft that are susceptible to the effects of atmospheric drag. Drag is largest uncertainty in determining orbits for satellites operating in LEO, and the most difficult force to model mainly because of the complexity of neutral atmosphere variations driven by solar radiation, magnetospheric energy inputs, and lower atmosphere forcing. Increased drag lowers the average satellite altitudes, changing their orbit, decreasing the lifespan of space assets, and making satellite tracking difficult. In this study, results from the self-consistent physics-based coupled thermosphere-ionosphere-plasmasphere electrodynamics (CTIPe) model are used along with ground and space observations to assess CTIPe model capabilities in simulating the upper atmosphere's climatology, day-to-day-variability, and weather, as well as identify areas that need to be improved in the model. This is a necessary step towards a deeper understanding of the internal and external physical processes driving neutral density variability, which can lead to improvements in the specification and prediction of drag forces on satellites.

Fernandez-Gomez, Isabel (German Aerospace Center DLR)

Poster Number: I16
Poster - Overview of the 2015 St. Patrick's day storm using CTIPe model and GNSS data

Authors: Isabel Fernandez-Gomez, Mariangel Fedrizzi, Mihail V. Codrescu, Claudia Borries

A**bstract:** The complexity of the Sun – Earth system increases during magnetically disturbed conditions, caused by intense solar activity. One of the strongest geomagnetic storms of the solar cycle 24 occurred following a coronal mass ejection (CME) impact; it was the St. Patrick's Day storm on the 17 March 2015. As a result of these extreme conditions, ionospheric instabilities were produced, generating disturbances in the ionospheric density (ionospheric storms) that could produce disruptions in communications and positioning. To explore how the ionosphere – thermosphere system responded to this event, we use the Coupled Thermosphere Ionosphere Plasmasphere electrodynamics global, three dimensional, non-linear physics based model (CTIPe), that reproduces the changes in the thermospheric winds, composition and electron densities during the storm. To have a more complete understanding of the processes responsible of the observed effects, observational data derived from Global Navigation Satellite Systems (GNSS) and ground-based measurements are used to support the interpretation of the model outcome.

Fry, Ghee (NASA Marshall Space Flight Center)
Poster Number: G9
Poster - Eclipse 2017: Partnering with NASA/MSFC to Inspire Students

Authors: Craig "Ghee" Fry1, Mitzi Adams1, Dennis Gallagher1 and Linda Krause1
1 NASA Marshall Space Flight Center

Abstract: NASA's Marshall Space Flight Center (MSFC) is partnering with the U.S. Space and Rocket Center (USSRC), and Austin Peay State University (APSU) to engage citizen scientists, engineers, and students in science investigations during the 2017 total solar eclipse. Investigations will support the Citizen Continental America Telescopic Eclipse (CATE, see Penn, et al., 2016) project, the Ham-Radio-Science Citizen Investigation (HamSci, see http://www.hamsci.org/), and the Interactive NASA Space Physics Ionosphere Radio Experiments (INSPIRE, see http://theinspireproject.org/). All planned activities will engage Space Campers from the USSRC, local high school students, and Boys and Girls Club students in the Clarksville, Tennessee and Hopkinsville, Kentucky area in the application of the scientific method as they explore a wide range of observations made during the eclipse. Hopkinsville, Kentucky is close to the point of greatest eclipse and will experience 2 minutes 40 seconds of totality. Clarksville, Tennessee (location of APSU) slightly southeast of Hopkinsville will receive 2 minutes 17 seconds of totality.
In addition to CATE as an outreach activity, we will observe the eclipse through a telescope with a broadcast-quality video camera, to allow for streaming/upload via a MSFC broadcast truck. Our HamSci (e.g., Silver, 2016) activities will focus on developing and operating a Reverse Beacon Network (RBN, e.g., Smith and Silver, 2016) station, a project that will allow studies of radio propagation changes during the eclipse to assess changing propagation conditions before, during, and after the eclipse. INSPIRE examines very low frequency natural radio emissions (0 to 10 KHz) to involve students of all ages in an exploration of their natural environment. Students will make passive observations and analyses of very low frequency (VLF) radio waves using an INSPIRE receiver. These observations will be analyzed to determine if natural VLF radio noise is influenced by passage of the eclipse shadow. For all activities, students will test their expectations and report their results.

Gonzalez-Esparza, J. Americo (Instituto de Geofisica, Universidad Nacional Autonoma de Mexico)
Poster Number: G2
Poster - Mexico observations of the great auroral storm of 1859

Authors: Consuelo Cuevas-Cardona

Abstract: We report historical records of the auroral observations detected in Mexico during the 1859 Carrington event.

Gonzalez-Esparza, J. Americo (Instituto de Geofisica, Universidad Nacional Autonoma de Mexico)
Poster Number: G1
Poster – Developing a Space Weather Strategy in Mexico

Authors: V. De la Luz, P. Corona-Romero, J. C. Mejia-Ambriz, M. A. Sergeeva, E. Romero-Hernandez, L. X. Gonzalez, E. Aguilar-Rodriguez

Abstract: The Mexican Space Weather Service (SCIESMEX) (www.sciesmex.unam.mx) initiated in October 2014 and it is operated by the Geophysics Institute at the National Autonomous University of Mexico (UNAM). The SCIESMEX observational capabilities combine a network of different ground instruments covering solar, interplanetary, geomagnetic, and ionospheric observations. The service became a Regional Warning Center (RWC) of the International Space Environment Services (ISES) in June 2015. We report the progress in developing a space weather strategy in Mexico. The plan includes: (1) to strengthen regional observational capabilities to monitor ionospheric and geomagnetic disturbances; (2) to develop of an early warning alert within the national civil protection system; (3) to study the vulnerability of critical technological systems in the country towards intense or extreme space weather events; and (4) to design national policies to prepare the reaction of the government to space weather hazards.

Good, Gregory (American Institute of Physics) EPOSTER
Poster Number: G6
Poster - Recording the Oral History of Space Weather: How We Are Learning to Live with a Star

Authors: Stephen Neal, Samantha Thompson

Abstract: Motivated by the question of how Space Weather has coalesced into a recognized research and enterprise community, the American Institute of Physics (AIP) aims to capture the history of this field in formation through the collection of oral history interviews with scientists and engineers.
Although serious study of solar-terrestrial interactions first took off in the 19th century as part of the study of "terrestrial magnetism," there was little apparent urgency to understanding this complex of phenomena before the mid-20th century. Since the launch of Explorer I in 1958, research in solar processes, solar wind, the impact of solar plasma and radiation on the Earth's magnetosphere, as well as efforts to understand the effects of solar variability on the Earth, technology, and humans working in space have provided critical information for day-to-day life on Earth and to our exploration of the solar system. In the last fifty years, not only have many discoveries been made, but scientists, engineers, and policy makers have come together to address the many different kinds of issues arising from the natural phenomena and its interactions with the technological environment we have built. Over the next three years, AIP is undertaking a systematic series of oral history interviews in order to capture the story of the next important techno-scientific-natural challenge after climate change.

Henney, Carl (Air Force Research Laboratory)
Poster Number: S9
Poster - Forecasting Space Weather Solar Indices with ADAPT/SIFT

Authors: Carl J. Henney, Kathleen Shurkin, C. Nick Arge, and Frank Hill

Abstract: Progress toward the forecasting of key space weather parameters, up to 7 days in advance, using SIFT (Solar Indices Forecasting Tool) with the ADAPT (Air Force Data Assimilative Photospheric

flux Transport) model will be presented. The forecasting method reviewed here is fully outlined in Henney et al. 2012 and Henney et al. 2015. The new method utilizes the solar near-side magnetic field distribution estimated with the ADAPT flux transport model as input to the SIFT empirical models that predict selected bands (between 0.1 to 175 nm) of solar soft X-ray (XUV), far ultraviolet (FUV), and extreme ultraviolet (EUV) irradiance, along with observed F10.7 (solar 10.7 cm, 2.8 GHz, radio flux), the sunspot number (SSN), and the Mg II core-to-wing ratio values. Input to the ADAPT model includes the photospheric magnetograms from the NISP (NSO Integrated Synoptic Program) ground-based instruments, GONG & VSM. We will provide a summary of recent updates regarding the ADAPT and SIFT models. The ADAPT model development is supported primarily by AFRL, with additional support from NASA. This work utilizes data produced collaboratively between AFRL and NSO.

Heyns, Michael (South African National Space Agency)
Poster Number: M17
Poster - Ensemble Estimation of Network Parameters: Strengthening the GIC Modelling Chain

Authors: M.J. Heyns, S.I. Lotz, P.J. Cilliers, and C.T. Gaunt

Abstract: Geomagnetically induced currents (GICs) at any specific node in a power network are assumed to be linearly related to the horizontal vector components of an induced plane-wave geoelectric field by a pair of network parameters, a and b. These parameters are not easily measurable explicitly but may be estimated empirically. A new method to derive estimates for a and b is presented where the linear relation is solved for more than two time instances. A geomagnetic storm time-series (of length n) of simultaneous GIC and geoelectric field data is used to solve for a and b for all possible pairs of equations, yielding approximately n2/2 estimates for a and b. The resulting ensembles of parameter estimates are analysed and found to be approximately Cauchy-distributed. The medians of the parameter ensembles are used to estimate GICs for an out-of-sample dataset and are found to out-perform previous estimation methods for the Halloween Storm of 2003 in the South African power network. For the first time, it is shown that errors in GIC and geoelectric field measurements are absorbed into the network parameter estimates. Using the interquartile range of ensemble estimates, a band of possible GIC values may be calculated. This band corresponds to an error estimate for predicted GIC. It is further shown that estimated network parameters vary with GIC magnitude during an event. This behaviour is then used to refine the parameter estimation further and allow for real time dynamic network parameter estimation that may improve GIC modelling efforts.

Hsu, Chih-Ting (National Central University of Taiwan)
Poster Number: I9
Poster - Assessment of the impact of FORMOSAT-7/COSMIC-2 GNSS RO observations on ionosphere specification and forecast using observing system simulation experiments

Authors: Chih-Ting Hsu, Tomoko Matsuo, Xinan Yue and Jann-Yenq Liu

Abstract: The Formosa Satellite-7/Constellation Observing System for Meteorology, Ionosphere and Climate-2 (FORMOSAT-7/COSMIC-2) GNSS RO payload can provide global observations of slant total electron content (sTEC) with unprecedentedly high spatial temporal resolution. By using observing system simulation experiments, we can quantitatively assess the impact of FORMOSAT-7/COSMIC-2 GNSS RO data on ionospheric specification and forecast. For this purpose, a coupled model of the Global Ionosphere Plasmasphere and the Thermosphere Ionosphere Electrodynamics General Circulation Model is incorporated into the NOAA ensemble Kalman filter data assimilation system. In ensemble Kalman filtering, it is critical to minimize the effects of sampling errors on the ensemble-based estimation of the correlation between observations and model states, in order to obtain high quality assimilation analysis. This presentation will demonstrate how an auxiliary ensemble Kalman filtering technique

designed specifically for the FORMOSAT-7/COSMIC-2 sTEC observations can enhance the impacts of FORMOSAT-7/COSMIC-2 GNSS RO data on ionospheric specification and forecast.

Hughes, Joseph (University of Colorado, Boulder) EPOSTER
Poster Number: I24
Poster - Electromagnetic Perturbation Effects for Geosynchronous Debris

Authors: Joseph Hughes, Hanspeter Schaub

Abstract: Charged space objects experience small perturbative torques and forces from their interaction with Earth's magnetic field. These small perturbations can change the orbits of lightweight, uncontrolled debris objects dramatically even over short periods. This paper investigates the effects of the isolated Lorentz force, the effects of including or neglecting this and other electromagnetic perturbations in a full propagation, and then analyzes for which objects electromagnetic effects have the most impact. It is found that electromagnetic forces have a negligible impact on their own. However, if the center of charge is not collocated with the center of mass, electromagnetic torques are produced which due impact the attitude, and thus the translation by affecting the direction and magnitude of the solar radiation pressure force. The objects for which electrostatic torques have the most influence are charged above the kilovolt level, have a difference between their center of mass and center of charge, have highly attitude-dependent cross-sectional area, and are not spinning stably about an axis of maximum inertia. Fully coupled numerical simulation illustrate the impact of electromagnetic disturbances through the solar radiation pressure coupling.

Hurlburt, Neal (Lockheed Martin ATC)
Poster Number: S4
Poster - Observations of the corona and solar magnetic field for space weather forecasting

Authors: Neal Hurlburt, Alan Title, James Lemen and Cathy Chou

Abstract: Understanding the magnetic field emerging from the solar surface and its interaction with the solar corona is essential for developing methods to forecast space weather. Accurate forecasts require a full knowledge of the global distribution of the magnetic field. STEREO EUVI observations have demonstrated the value of multiple views of the corona to assess trigger conditions for flares and CMEs, but to date, magnetograph observations are only available from instruments located on the Sun-Earth line. We discuss a concept for a next generation compact, space-based magnetograph that can be deployed at geocentric orbit, or at the L1 or L5 Lagrange points to enable greater observational coverage of the solar surface. We also consider EUVI coronal observations, and in particular, we present data acquired with the SUVI instrument on the recently launched GOES-16 satellite. Comparing the results from SUVI, SDO AIA, and STEREO EUVI informs the derivation of the coronal observational requirements for future space weather monitoring systems.

Hwang, Junga (Korea Astronomy and Space Science Institute)
Poster Number: S22
Poster - Initial Validation of KREAM (Korean Radiation Exposure Assessment Model for aviation route dose)

Authors: Junga Hwang, Gyeongbok Jo, Kyunghwan Dokgo, Eunjin Choi, and Sung-Jun Noh

Abstract: Since Korean Air has begun to use the polar route from Seoul/ICN airport to New York/JFK airport on August 2006 in South Korea, there are explosive needs for the estimation and prediction against cosmic radiation exposure for Korean aircrew and passengers from public; the end user of the space weather. To keep pace with such needs from the public, Korean government made the law on safety standards and managements of cosmic radiation for the flight attendants and the pilots in 2013. And we have begun to develop our own Korean Radiation Exposure Assessment Model (KREAM) for aviation

route dose. GEANT4 model and NRLMSIS 00 model are used for calculation of the energetic particles' transport in the atmosphere and for obtaining the background atmospheric neutral densities depending on altitude. For prediction the radiation exposure in all the routes depending on the various space weather effects, we constructed a huge database from pre-arranged simulations using 15 years' geosynchronous proton data. We compare global effective dose map with NAIRAS for various space weather environments. Comparison between KREAM, CARI-6M and NAIRAS for Halloween event (28, Oct, 2003) shows good agreements qualtatively. In this paper, we present the results of quantitative comparison between NAIRAS and KREAM based on global dose map and some route doses. And we also show the initial validation by using ground data from Neutron Monitor observation and in-situ dose data from Liulin-6K onboard commercial flights of Korean Air and Czech University of Life Sciences Prague (CULS) covering one solar cycle.

Hwang, Junga (Korea Astronomy and Space Science Institute)
Poster Number: I19
Poster – Small scale magNetospheric and Ionospheric Plasma Experiments (SNIPE) for space weather research

Authors: Junga Hwang, Jaejin Lee, Jongdae Shon, Jaeheung Park, Young-Sil Kwak, Uk-Won Nam, and Won-Kee Park

Abstract: The observation of particles and waves using a single satellite inherently suffers from space-time ambiguity. Recently, such ambiguity has often been resolved by multi-satellite observations; however, the inter-satellite distances were generally larger than 100 km. Hence, the ambiguity could be resolved only for large-scale (> 100 km) structures while numerous microscale phenomena have been observed at low altitude satellite orbits. In order to resolve those spatial and temporal variations of the microscale plasma structures on the topside ionosphere, SNIPE mission consisted of four (TBD) nanosatellites (~10 kg) will be launched into a polar orbit at an altitude of 700 km (TBD). Two pairs of satellites will be deployed on orbit and the distances between each satellite will be from 10 to 100 km controlled by a formation flying algorithm. The SNIPE mission is equipped with scientific payloads which can measure the following geophysical parameters: density/temperature of cold ionospheric electrons, energetic (~100 keV) electron flux, and magnetic field vectors. All the payloads will have high temporal resolution (~ 16 Hz (TBD)). This mission is planned to launch in 2020.
The SNIPE mission aims to elucidate microscale (100 m-10 km) structures in the topside ionosphere (below altitude of 1,000 km), especially the fine-scale morphology of high-energy electron precipitation, cold plasma density/temperature, field-aligned currents, and electromagnetic waves. Hence, the mission will observe microscale structures of the following phenomena in geospace: high-latitude irregularities, such as polar-cap patches; field-aligned currents in the auroral oval; electro-magnetic ion cyclotron (EMIC) waves; hundreds keV electrons' precipitations, such as electron microbursts; subauroral plasma density troughs; and low-latitude plasma irregularities, such as ionospheric blobs and bubbles.
We have developed a 6U nanosatellite bus system as the basic platform for the SNIPE mission. Three basic plasma instruments shall be installed on all of each spacecraft, Particle Detector (PD), Langmuir Probe (LP), and Scientific MAGnetometer (SMAG). In addition we now discuss with NASA and JAXA to collaborate with the other payload opportunities into SNIPE mission.

Hozumi, Kornyanat (NICT)
Poster Number: I15
Poster - HF-START: A tangible space weather application

Authors: Kornyanat Hozumi, Takashi Maruyama, Susumu Saito, Takuya Tsugawa and Mamoru Ishii

Presented by: Mamoru Ishii

Abstract: HF-START (HF Simulator Targeting for All-users' Regional Telecommunications) is a user-friendly HF propagation simulator. It is developed to meet the needs of space weather users for, but not limit to, telecommunications. Prediction of communications failure due to space weather disturbances is of high priority.
NICT has operated space weather information center that is dealing with various data obtained from the Sun to the Earth, and produced a number of research outcomes. Modern appliances that employ electromagnetic wave enhance quality of life but are at a risk from severe space weather disturbances of which their subsequent processes are not fully understood. Space weather users who come from different background knowledge recently increase. Those users include aeronautical business company, power plant operator, GPS-related companies, insurance company, etc. Space weather information provided by NICT is, however, too professional to be understood and effectively used by the users. One of the efforts to overcome this issue is to translate the research level data to the user level data based on users' needs and to provide an immediate usable data. HF-START is used to simulate an influence of space weather on communication and positioning. For verification, we assume specific applications and evaluate HF-START by using the indices that users need for each application. Challenge on developing HF-START and on extending it to space weather users will be discussed.

Jackson, Bernard (University of California, San Diego) EPOSTER
Poster Number: S20
Poster - Low Resolution Bz Determinations and Forecasts From Field Coupling Between the Solar Wind and Geomagnetic Fields

Authors: Hsiu-Shan YU, Paul HICK, Andrew BUFFINGTON, Munetoshi TOKUMARU, Jaehun KIM, and Jongyeon YUN

Abstract: Because the Earth's axis is tilted relative to the ecliptic plane, the Geocentric Solar Magnetospheric (GSM) field can couple with the solar wind radial and tangential magnetic field components. This coupling provides a Bz field component that can be used to forecast geomagnetic activity. In this study, Global Oscillation Network Group (GONG) magnetograms are extrapolated upward from the solar surface using the Current Sheet Source Surface (CSSS) model (Zhao & Hoeksema, 1995). This model provides radial fields at a source surface, which here is placed at a solar distance of 15 Rs. These fields are next extrapolated to 1 AU using the University of California, San Diego (UCSD) tomographic modeling technique, and then compared with fields measured in situ near Earth. We find that significant positive correlations exist between all three extrapolated GSM fields and ACE in-situ measurements over the last ten years. The few nano-Tesla variation of Bz maximizes in spring and fall, and its variation is shown correlated with geomagnetic Kp and Dst indices. UCSD currently operates a website that predicts this low resolution GSM component field variation several days in advance. We show examples of the enhanced geomagnetic activity associated with southward dips of the predicted Bz component.

Jacobsen, Knut Stanley (Norwegian Mapping Authority)
Poster Number: I3
Poster - ROTI as a candidate for an ionospheric activity scale -- Weaknesses, Strengths & Examples of Observations

Authors: Knut Stanley Jacobsen

Abstract: Currently, the geomagnetic storm scale defined by NOAA is often used as a measure of the severity of an event disturbing GNSS services. However, the GNSS disturbances are not caused directly by geomagnetic field variations. Rather, they are both consequences of the interaction between solar wind structures and the magnetic field and atmosphere of the Earth. A scale that depends on a direct measure of the ionosphere would be a more fitting choice for GNSS users. The Rate-Of-TEC Index (ROTI) is a simple way of characterizing phase fluctuations in GNSS signals,and has been in use in the scientific community for many years. Its main strengths and weaknesses are presented. An overview is given of some recent

work on the topic of ionospheric disturbances, with particular focus on high latitudes, and what this reveals about the suitability of ROTI as a measure of GNSS disturbances.

Joshi, Dev (Boston College) EPOSTER
Poster Number: I12
Poster - A comparison of space and ground-based observations of equatorial plasma irregularities and implications for Spread F dynamics

Authors: Dev Raj Joshi,Keith Groves,John Retterer, Patrick A Roddy, Chaosong Huang

Abstract: Equatorial Spread F is the most severe natural space weather phenomenon known to occur on a regular basis. It is characterized by large-scale instabilities in the post-sunset low- latitude ionosphere and the subsequent formation of medium to small scale irregularities over large regions. The associated space weather impacts come in the form of disruptive radio wave scintillation effects representing the most critical impacts on man-made technologies, such as satellite communications and global navigation satellite systems (GNSS). The responsible mechanism for Spread F, formally identified as the gravitational Rayleigh-Taylor Instability, drives large-scale electron density structures known as depletions or low density plasma "bubbles" that originate at the magnetic equator and expand poleward as the perturbation electric fields map along magnetic field lines. In this paradigm the meridional extent of the disturbances is wholly determined by the height of the bubbles at the equator. Here we present an investigation of the occurrence and altitudes of bubbles as a function of solar flux from in situ observations in the context of ground based scintillation measurements. We analyze electron density data from the Communication/Navigation Outage Forecasting System (C/NOFS) satellite developed by the Air Force Research Laboratory. While the altitude variation of the spacecraft complicates the statistical comparisons of parameters for purposes that require height-normalized values, it readily supports investigations of altitude variability, specifically electron density irregularities. The investigation presented here will identify the regions affected by low-latitude scintillation, enhance our ability to model radio occultation results and provide insight into the growth mechanism and longitudinal variability of equatorial spread F. We present the first ever extensive comparison between ground station scintillation observations and satellite observations of the ion density irregularities. This allows us to gain new insight into the flux-tube expansion mechanism of equatorial plasma bubbles.

Katsavrias, Christos (National Observatory of Athens)
Poster Number: M10
Poster - Investigation of internal magnetospheric effects on electron acceleration and loss in the outer Van Allen belt

Authors: I.A. Daglis, W. Li, S. Dimitrakoudis, M. Georgiou and C. Papadimitriou
Abstract: In order to achieve the best possible specification and prediction of relativistic electron fluxes in the outer Van Allen belt, it is of utmost importance to understand their response to interplanetary and geospace drivers. We have investigated the response of the outer Van Allen belt electrons to various types of solar wind and internal magnetospheric forcing – in particular to Interplanetary Coronal Mass Ejections (ICMEs), to High Speed Streams (HSS), to geospace magnetic storms of different intensities and to intense magnetospheric substorms. We have employed multi-point particle and field observations in the inner magnetosphere (both in-situ and through ground-based remote sensing), including the Cluster, THEMIS, Van Allen Probes and POES constellations, the XMM and INTEGRAL spacecraft, and the CARISMA and IMAGE ground magnetometer arrays. The data provide a broad range of particle energies and a wide radial and azimuthal spatial coverage. Observations show that losses of equatorially mirroring electrons are primarily caused by magnetopause shadowing which in turn is achieved by outward diffusion driven by Pc5 ULF waves. Substorm-driven chorus wave activity, on the other hand, seems to be responsible for electron enhancements in the outer radiation belt even in the presence of pronounced outward diffusion.

Keebler, Timothy (Millersville University of Pennsylvania)
Poster Number: G10

Poster - High-altitude balloon payload design using customizable data acquisition

Authors: Timothy Keebler, Noah Stitely

Abstract: The Millersville University Space Weather Group recently formed under the Millersville University Student Chapter of the American Meteorological Society with interest jointly in conducting high-altitude solar research via balloon and engaging in public outreach related to space weather. Despite its recent genesis, the group is in the late planning and testing stages of the instrumentation for the balloon science payload. This payload aims to use cheap and customizable equipment to aid in the accessibility of near-space and allow for a more unified data collection network. The base of the data collection system will be a small computer, allowing for customization outside existing data loggers. For preliminary flights, an array of radiation probes based on GM tubes and UV sensors will be used to obtain radiation intensity reading for gamma and x-rays in the range of incident solar cosmic ray decay cascades as well as UVA and UVB. Furthermore, the flexible instrument package allows for possible future data transmission through the APRS system to provide data recovery remotely, eliminating the arduous process of payload retrieval. The group anticipates having the preliminary results from our first test flight, which will be used to improve the experimental design in preparation for subsequent launches, including a launch during the 21 August 2017 total eclipse.

Kooi, Jason (U.S. Naval Research Laboratory)
Poster Number: S3
Poster - Enhanced Measurement of the Coronal Magnetic Field Through Simultaneous Faraday Rotation and Thomson-Scattering Brightness Observations

Authors: Jason E. Kooi, Erica Q. Liu and Steven R. Spangler

Abstract: Observation of Faraday rotation (FR) is one of the best remote-sensing techniques for determining the strength and structure of the coronal magnetic field. FR is the rotation of the plane of polarization that results when linearly polarized light passes through a magnetized plasma and is proportional to the path integral through the plasma of the electron density and the line-of-sight component of the magnetic field. Understanding the coronal magnetic field is critical because it is the dominant energy source for producing the solar wind and energetic solar activity (e.g., solar flares and coronal mass ejections); however, separating the contribution of the plasma density from the line-of-sight magnetic field is challenging. In addition to radioastronomical FR observations, one should obtain white-light coronagraph images from the Large Angle and Spectrometric Coronagraph (LASCO) C2 and C3 instruments to determine the Thomson-scattering brightness, providing a means to independently estimate the plasma density and determine its contribution to the observed FR. We provide an updated analysis of the FR data first reported in Ingleby et al. (ApJ, 668, 520, 2007) by incorporating measurements of the Thomson-scattering brightness to provide new estimates for the magnitude of the coronal magnetic field necessary to reproduce the majority of their FR observations.

Kress, Brian (NOAA-NCEI/CIRES)
Poster Number: M7
Poster - GOES-16 Solar and Galactic Proton Sensor (SGPS) Status Report

Authors: B. T. Kress, J. V. Rodriguez, and A. Boudouridis

Abstract: GOES-R series instrumentation includes two Solar and Galactic Proton Sensor (SGPS) units (east and west facing), measuring protons with energies from 1 MeV to >500 MeV in 14 energy channels. SGPS has been collecting data since January 8th 2017. This status report will include interesting new science data from SGPS and some instrument issues.

Lee, I-Te (Central Weather Bureau)
Poster Number: I7

Poster - Investigating FORMOSAT-7/COSMIC-2 impacts on space weather monitoring

Authors: Mark Cheng, Phil Huang, J. Y. Liu

Abstract: For the past decade, FORMOSAT-3/COSMIC (F3/C) constellation has provided ionospheric electron density profiles with high vertical resolution through radio occultation measurements. Since F3/C launched, the Taiwan Analysis Center for COSMIC (TACC) has been setup up by the Central Weather Bureau (CWB) in Taiwan to process the daily F3/C measurements, and to reconstruct the three-dimensional ionospheric electron density structures between 200-800 km altitudes hourly. The reconstructed products made it possible to monitor the electron density variations. Recently, the number of daily sounding is less and less so that difficultly to make reliable products. A follow-on mission, named Formosa Satellite-7/Constellation Observing System for Meteorology, Ionosphere and Climate-2 (FORMOSAT-7/COSMIC-2, hereafter shortened to F7/C2), is designed to receive US GPS and Russian GLONASS signals. Six constellation satellites will be launched into a lower inclination orbits about 24-28.5degrees around 520-550 km altitude to provide more occultation soundings over the magnetic equatorial region and lower latitude ionosphere. In this paper, observing system simulation experiments are conducted to investigate the impact of F7/C2 on ionospheric weather monitoring. Results will show impacts which only using observations, and improvements after assimilating the F7/C2 observations into a numerical model.

Lindsey, Charles (NorthWest Research Associates) EPOSTER
Poster Number: S7
Poster - Seismic Mapping of the Sun's Far Hemisphere and its Applications in Space-Weather Forecasting

Authors: Charles Lindsey, Joseph Werne, and Frank Hill

Abstract: Magnetic regions in the Sun's near hemisphere exert a major impact on space weather at Earth. Magnetic regions in the far hemisphere appear to exert relatively little immediate impact. But, because the Sun rotates, large active regions in the far hemisphere inevitably cross into the near hemisphere within a period of about two weeks. The effects of this on space weather can be quite sudden. A large active region having gestated unseen for up to two weeks in the far hemisphere for up to two weeks can, in principle, double the EUV irradiance at Earth within a few hours of crossing the Sun's eastern limb. Monitoring of the Sun's far hemisphere therefore becomes crucial to realistic forecasting of space-weather on time scales ranging from a few days to a few weeks. For the past several years, this need has been well served by NASA's twin STEREO spacecraft, which, since 2011, have been in positions to view the entirety of the Sun's far hemisphere directly in the EUV spectrum. Beginning in about 2019, STEREO coverage of the far hemisphere will begin to diminish, as both of the STEREO spacecraft drift back to Earth's side of the solar system. There will be considerable periods in the succeeding decade during which solar seismology will be the only resource for detecting and accurately locating large, newly emerging active regions anywhere in the Sun's far hemisphere. We will review the development of seismology of the Sun's far hemisphere from the 1990s to present. We will summarize recent developments in seismic sensing of the Sun's far hemisphere, describing its basic capabilities and limitations as a tool for detecting and locating new emerging magnetic flux in the Sun's far hemisphere and forecasting its subsequent transit across the Sun's eastern limb. We will also offer projections on coming improvements in far-side solar seismology of likely value to space-weather forecasters.

Lopate, Clifford (University of New Hampshire)
Poster Number: M20
Poster - The GOES-16 Energetic Heavy Ion Instrument Proton and Helium Fluxes for Space Weather Applications

Authors: C. Lopate and J. J. Connell

Abstract: The Energetic Heavy Ion Sensor (EHIS) was built by the University of New Hampshire, subcontracted to Assurance Technology Corporation, as part of the Space Environmental In-Situ Suite (SEISS) on the new GOES-16 satellite. The EHIS measures energetic ions in space over the range 10-200 MeV for protons, and energy ranges for heavy ions corresponding to the same stopping range. For the GOES Level 1-B and Level 2 data products, protons and helium are distinguished in the EHIS using discriminator trigger logic. Measurements are provided in five energy bands. The instrumental cadence of these rates is 3 seconds. However, the primary Level 1-B proton and helium data products are 1-minute and 5-minute averages. Protons and helium, comprising approximately ~99% of all energetic ions in space are of great importance for Space Weather predictions. We discuss the preliminary EHIS proton and helium data results and their application to Space Weather.

Loucks, Diana C
Poster Number: I25
Poster-Impact of High-latitude Ionospheric E Region Enhancements on Global Positioning System Scintillations in the Alaskan Sector

Authors: Diana Loucks (University of Colorado, Boulder)

Abstract: With the continuing reduction in seasonal Arctic sea ice extent, increase in ship traffic above the Arctic Circle is expected, and will increase the overall communication and navigation footprint in the region. Ionospheric behavior in the polar regions can significantly impact Ultra High Frequency (UHF) transmissions including degradation of Global Positioning System (GPS) position solutions and communications interruptions. To address these operational concerns, a need arises to identify and understand the ionospheric structures that lead to disturbed conditions in Arctic latitudes. This research focuses on determining those structures that occur within the confines of the Alaskan high-latitude sector, and comparing their local relative importance to that across the broader northern high-latitudes. The goal is to identify correlative features between GPS scintillation, electron densities and electron density gradients, as seen by ground GPS receivers in Alaska and the Poker Flat Incoherent Scatter Radar (PFISR), as well as other instruments and models available for context. Several case studies are examined, specifically global and local geomagnetically disturbed times that allow for the isolation of ionospheric sources associated with GPS scintillation. Upon determination of known scintillating structures, primarily E and F region phenomena, the relative importance of each is compared in terms of the frequency, duration, and extent of operational impact. These results are then compared across the broader high-latitude region to gain insight into the timing and location of physical mechanisms that drive GPS scintillations in the Arctic. Analysis indicates that E region auroral activity is of primary concern in Alaska. This differs from the northern European sector where F region auroral blobs structured by precipitating particles are the primary causal structures. Geomagnetic conditions vary greatly across the Arctic, so contrasting elements between sectors is not surprising. Although further modeling and studies are required to understand why the differences exist, the observed differences themselves give limited insight into potential causes. The uniqueness of this work lies in the broader multi-instrument approach, and the manner in which GPS visibility at PFISR drives the beam configurations used for a given experiment. This approach can be transitioned to future work conducted across other high-latitude sectors.

Luo, Bingxian (Ntional Space Science Center)
Poster Number: M18
Poster - Two empirical models for short-term forecast of Kp

Authors: S. Liu, J. Gong

Abstract: In this paper, two empirical models are developed for short-term forecast of the Kp index, taking advantage of solar wind - magnetosphere coupling functions proposed by the research community. Both models are based on the data for years 1995 to 2004. Model 1 mainly uses solar wind parameters as the inputs while model 2 also utilizes the previous measured Kp. Finnaly, model 1 predicts Kp with a linear correlation correlation (r) of 0.91, a prediction efficiency (PE) of 0.81, and a root-mean-square (RMS) error

of 0.59. Model 2 gives an r of 0.92, a PE of 0.84, and an RMS error of 0.57. The two models are validated through out-of-sample test for years 2005 to 2013, which also yields high forecast accuracy. Compared with previous Kp models reported in literatures, time delay between geomagnetic activity and solar wind parameters at the Earth due to the magnetosphere's response time are taken into consideration in the modelling. Statistically, the time delay in the models turns out to be about 30 min. By introducing this term, both the accuracy and lead time of the model forecast are improved. Through verification and validation the models can be used in operational geomagnetic storm warnings with reliable performance.

Maruyama, Naomi (NOAA/SWPC)
Poster Number: I23
Poster – Transitioning a Coupled Whole Atmosphere (WAM) and Ionosphere-Plasmasphere-Electrodynamics (IPE) Model into Operations at NOAA

Authors: Naomi Maruyama, Tim Fuller-Rowell, Rashid Akmaev, Rodney Viereck, Tzu-Wei Fang, Mariangel Fedrizzi, Mihail Codrescu, Valery Yudin, Zhuxiao Li and Phil Richards

Abstract: In an effort to model the space weather system from the Sun to Earth, NOAA is transitioning three separate physical model components. These include the WSA-ENLIL solar wind propagation model, the Michigan Geospace model of the magnetosphere, and a coupled model of the whole atmosphere and the ionosphere-plasmasphere-electrodynamics (WAM-IPE). The first two of these components have already been transitioned to operations at NOAA, and the third component is due to be tested in an operational real-time setting in September 2017. WAM is a whole atmosphere extension of the National Weather Service (NWS) Global Forecast System (GFS) operational weather model, extending the top boundary from 60 km in GFS to ~600 km in WAM. WAM can also be run with the NWS Gridpoint Statistical Interpolation (GSI) data assimilation scheme in order for WAM to follow real changes in tropospheric weather. The WAM model is coupled to a new Ionosphere-Plasmasphere-Electrodynamics (IPE) model, using the Earth System Modeling Framework (ESMF) and the National Unified Operational Prediction Capability (NUOPC) layer, under the NOAA Environmental Modeling System (NEMS). IPE is a time dependent, three-dimensional model of the ionosphere and plasmasphere developed through a collaboration between University of Colorado, George Mason University, NOAA Space Weather Prediction Center (SWPC), NOAA Global Systems Division (GSD), NCAR HAO, and NESII. WAM provides the thermospheric properties of wind, composition, and temperature to the IPE, and can respond to changes in terrestrial weather propagating upward and influencing the thermosphere. IPE in turn provides time dependent, global, three-dimensional plasma densities for nine ion species, electron and ion temperatures, and both parallel and perpendicular velocities of the ionosphere and plasmasphere. IPE reproduces not only the climatology of global TEC observations, but the model also responds to changes in solar wind conditions during geomagnetic storms, and to terrestrial lower atmosphere changes, such as during sudden stratospheric warmings (SSW). The model follows the storm time redistribution of plasma in the ionosphere and plasmasphere during an SSW, and the evolution of storm enhanced densities (SEDs) during a geomagnetic storm. In this presentation, an overview of the WAM and IPE model development and current status is presented. Furthermore, the configuration expected to be transitioned in September will be described. It is important to establish this baseline configuration, which will gradually be improved over the coming years.

Meehan, Jinni (Utah State University)
Poster Number: I13
Poster - The Inference of the Topside Ionosphere Over Millstone Hill during the 2002 Incoherent Scatter Radar Campaign

Authors: Jennifer Meehan, Jan Sojka

Abstract: The distribution of electron density in the ionosphere and its altitude dependence in the topside ionosphere (scale height) is important for ionospheric empirical modeling and ionospheric studies, and for practical applications such as the time delay correction of radio waves propagating through the ionosphere.

Bottom-side ionospheric profiles are readily available from ionosondes but the observation of the topside ionosphere is still challenging. Over the years, researchers have gathered information and developed several different methods to analyze the topside ionosphere, including: coherent scatter radar observations of underdense electron density irregularities, ISR probing, topside sounders onboard satellites, in situ rocket and satellite observations such as Global Positioning System (GPS) and occultation measurements. However, despite numerous data techniques to characterize the topside ionosphere the knowledge of the behavior of the topside ionosphere and its subsequent scale heights remains a challenge. Due to ionospheric scale heights being a key ionospheric parameter because of its intrinsic connection to ionospheric dynamics, plasma temperature and composition we evaluate whether or not topside information be gained by an analysis of GPS total electron content (TEC) and bottomside electron density profiles observed by ionosondes. We found a new way to represent how much TEC is allotted for the topside ionosphere that successfully determined TEC using ionosonde data containing only bottomside information. The results are compared to the Millstone Hill Incoherent Scatter Radar (ISR) observations from the 2002 data campaign.

Meier, Matthias M. (German Aerospace Center)
Poster Number: S25
Poster - A Space Weather Index for the Radiation Field at Aviation Altitudes

Authors: Matthias M. Meier & Daniel Matthiä

Abstract: The additional dose contribution to the radiation exposure at aviation altitudes during Solar Particle Events (SPEs) has been a matter of concern for many years. After the Halloween storms in 2003 several airlines began to implement mitigation measures such as rerouting and lowering flight altitudes in response to alerts on the NOAA S-scale regarding solar radiation storms. These alerts are based on the integral proton flux above 10 MeV measured aboard the corresponding GOES-satellite which is operated outside the Earth's atmosphere in a geosynchronous orbit. This integral proton flux has, however, been proved to be an insufficient parameter to apply to the radiation field at aviation altitudes without an accompanying analysis of the shape of the energy spectrum. Consequently, false alarms and corresponding disproportionate reactions ensued. Since mitigating measures can be quite cost-intensive, there has been a demand for appropriate space weather information among responsible airline managers for about a decade. Against this background, we propose the introduction of a new Space Weather index D, based on dose rates at aviation altitudes produced by solar protons during solar radiation storms, as the relevant parameter for the assessment of corresponding radiation exposure (J. Space Weather Space Clim. 4 A13 (2014), DOI: http://dx.doi.org/10.1051/swsc/2014010).

Meredith, Nigel
Poster Number: M2
Poster - Extreme Relativistic Electron Fluxes in the Earth's Outer Radiation Belt: Analysis of INTEGRAL IREM Data

Authors: Nigel P. Meredith, Richard B. Horne, Ingmar Sandberg, Constantinos Papadimitriou, and Hugh D. R. Evans

Presented by: Ingmar Sandberg

Abstract: To assess the vulnerability of the satellite fleet to so-called "killer" electrons (relativistic electrons with E > 500 keV) it is essential to estimate reasonable worst cases and estimate the flux levels that may be reached once in 10 and once in 100 years. In this work, we present results of an extreme value analysis of the relativistic electron fluxes in the Earth's outer radiation belt using measurements from the ESA Radiation Environment Monitor (IREM) on board the INTEGRAL spacecraft from 17 October 2002 to 31 December 2016. The analysis is applied on de-convoluted IREM electron fluxes, cross-calibrated with Van Allen MagEIS data. The 1 in N year electron fluxes are determined as a function of energy and L* and may serve as benchmarks against which to compare other extreme space weather events and to help assess the potential impact of an extreme event.

Nagatsuma, Tsutomu (National Institute of Information and Communcations Technology)
Poster Number: M5
Poster - Cross-calibration of high-energy electron observations at geostationary earth orbit

Authors: Kaori Sakaguchi, Hideki Koshiishi

Abstract: Cross-calibration of high-energy electron observations obtained from individual satellites are quite essential procedure for reconstruction of high-energy electron distribution at geostationary earth orbit (GEO). To compare high-energy electron data from individual satellite, we should find the period where the L*-value (drift shell) is the same. Because the magnetic dipole axis is not aligned with the rotational axis of the Earth, L*-value of each GEO satellite is changing depending on the longitude of GEO and magnetic local time. In addition, L*-value of each GEO satellite also changes depending on geospace disturbances. We have compared Himawari-8 high-energy electron (SEDA-e) data with GOES 15 high-energy electron (MAGED and EPEAD) data during the same L*-value of both satellites with quiet geomagnetic condition. This result shows quite good correspondence of both observation, and factor of sensitivity can be estimated. Our previous study showed seasonal dependence of sensitivity difference between high energy electron sensor onboard Himawari and that onboard Kodama. We found that this seasonal dependence might be caused by the north-south drift of the Kodama's orbit. Previous study, we assumed that the orbit of Kodama is aligned with GEO. This result suggests that the detailed orbit information is important for cross-calibration. Based on this cross-calibration procedure, we can produce particle distribution at GEO. An example of particle distribution at GEO will be shown.

Nishioka, Michi
Poster Number: I6
Poster – A new ionospheric storm scale based on TEC and foF2 statistics

Authors: Michi Nishioka, Takuya Tsugawa, Hidekatsu Jin and Mamoru Ishii

Presented by: Mamoru Ishii

Abstract: National Institute of Information and Communications Technology in this paper, we propose the I-scale, a new ionospheric storm scale for general users in various regions in the world. With the I-scale, ionospheric storms can be classified at any season, local time, and location. Since the ionospheric condition largely depends on many factors such as solar irradiance, energy input from the magnetosphere, and lower atmospheric activity, it had been difficult to scale ionospheric storms, which are mainly caused by solar and geomagnetic activities. In this study, statistical analysis was carried out for total electron content (TEC) and F2 layer critical frequency (foF2) over Japan for 18 years from 1997 to 2014. Seasonal, local-time, and latitudinal dependences of TEC and foF2 variabilities are excluded by normalizing each percentage variations using their statistical standard deviations. The I-scale is defined by setting thresholds to the normalized numbers to seven categories: I0, IP1, IP2, IP3, IN1, IN2, and IN3. I0 represents a quiet state, and IP1 (IN1), IP2 (IN2), and IP3 (IN3) represent moderate, strong, and severe positive (negative) storms, respectively. The proposed I-scale can be used for other locations, such as polar and equatorial regions. It is considered that the proposed I-scale can be a standardized scale to help the users to assess the impact of space weather on their systems.

Nndanganeni, Rendani Rejoyce South African National Space Agency)
Poster Number: G5
Poster - Investigating the impact of space weather on the aviation sector in South Africa

Authors: Author: R. R. Nndanganeni, email: rnndanganeni@sansa.org.za, SANSA Space Science, Hermanus, South Africa.

Co-Authors: M Tshisaphungo, email: mtshisaphungo@sansa.org.za,SANSA Space Science, Hermanus, South Africa.
G. Fisher, gregf@atns.co.za, ATNS, Tower Road, Cape Town International Airport, South Africa.

Abstract: The impact of space weather on systems within the aviation sector has been long recognised globally, however there has been no study undertaken to date that covers the Southern African region. South Africa is experiencing a growing interest and awareness of the regional impact from space weather events, and this has now spread to the aviation sector where users are becoming more aware of the potential risk that space weather can pose. In addition, the International Civil Aviation Organisation (ICAO) have passed the recommendation that space weather information be included as part of all flight plans starting in 2018. The South African National Space Agency (SANSA) operates a Regional Warning Centre for space weather over Africa and as such has developed regional expertise in the impact of space weather and is in a position to create awareness of space weather information requirements within the national aviation sector. Currently, SANSA has partnered with the Air Traffic and Navigation Service (ATNS), and together ATNS and SANSA are in a position to coordinate and identify relevant information required on user requirements from various players within the aviation sector. This includes but is not limited to the data, statistics and information on aviation events (that do not have known causes), user concerns, impacts of regional importance, and applicable legislative requirements, and or changes.
In South Africa the key areas for the aviation sector that have been identified to be impacted by space weather are, amongst others: High frequency communications (HF); Ground and air based navigation systems (e.g. ATNS's VSAT, Multi Sensor Trackers, VNAV, RVSM), radiation exposure. Preliminary results focusing on one or more of these identified key areas, as well as targeted areas for investigation will be presented in this workshop.

Oh, Daehyeon (National Meteorological Satellite Center)
Poster Number: M14
Poster - The Korean Space wEather Monitor (KSEM): The First Space-based Magnetometer on the Eastern Hemisphere

Authors: Daehyeon Oh, Jinha Lee, and and Hyesook Lee

Abstract: KMA is going to load KSEM (the Korean Space wEather Monitor) on the new geostationary meteorological satellite GK-2A which will be launched 2018. One of the main purposes of KSEM is measuring the magnetic field of the eastern hemisphere. The magnetic cleanness of the spacecraft itself is one of the most critical tasks of a space-based magnetometer. SOSMAG (Service Oriented Spacecraft Magnetometer), provided by ESA, enables detection of the AC field variations from the spacecraft body, without a meters-length boom. The first flight model of SOSMAG is being built for the KSEM/GK-2A and will provide AC-cleaned magnetic field data with a proper sensitivity and time resolution. Monitoring the magnetic field condition under the influence of solar wind is one of the essential observations for space weather forecasting. A geomagnetic field is well known to have asymmetric dynamics, but NOAA's GOES series only cover the western hemisphere. By filling the another side of the magnetic field, KSEM will play an important role to improve model accuracy and perform more reliable space weather forecasting.

Olson, David (Los Alamos Nationa Laboratory)
Poster Number: M1
Poster - Observed statistics of electron flux events related to spacecraft charging at geosynchronous orbit

Authors: David K. Olson, Brian A. Larsen, Miranda L. Lynch, and Bryan P. Weaver

Abstract: Spacecraft charging is correlated with elevated electron flux levels. Electron flux events (periods where fluxes are above a specified threshold) exhibit statistical patterns that may be exploited for predicting periods where spacecraft at geosynchronous orbit are susceptible to surface charging. LANL-

GEO data spanning an 11 year period is analyzed to examine the patterns and trends of observed electron flux events at geosynchronous orbit. Analysis shows that flux events end by a hard cut-off at a specific local time with yearly trends over a solar cycle.

Plunkett, Simon (Naval Research Laboratory)
Poster Number: S2
Poster - Imaging the Corona with Solar Probe Plus and Solar Orbiter

Authors: R.A. Howard, C.M. Korendyke, A. Thernisien, D. Chua, D.G. Socker, D. Wang, N.B. Rich, M.T. Carter, A. Vourlidas, J.P. Van Duyne, D.R. McMullin, P.C. Liewer

Abstract: The Solar Probe Plus (SPP) mission will be humanity's first visit to the atmosphere of our nearest star, the Sun, when it is launched in July 2018. The payload includes the Wide Field Imager for Solar Probe Plus (WISPR) that will record unprecedented visible light images of the solar corona and the inner heliosphere from vantage points as close as 7 million kilometers (9.86 solar radii, or 0.05 AU) from Sun center. No mission or instrument of any type has ever gone this close to the Sun. WISPR will discover – in this never-before explored region of the heliosphere – the fundamental nature of coronal structures and the source regions of space weather as the SPP spacecraft flies through them. The Solar Orbiter mission, scheduled for launch in February 2019, will carry a complement of ten remote sensing and in-situ instruments (including a heliospheric imager, SoloHI) to within 0.28 AU at its closest perihelion. But in contrast to SPP the orbital inclination will be modified by Venus fly-bys to reach 34 degrees heliolatitude, enabling views from above and below the ecliptic plane. In this presentation, we will describe the SPP mission and the unique science to be obtained with the WISPR instrument. We will also discuss some of the opportunities for synergistic observations with the Solar Orbiter mission.

Redmon, Robert (NOAA)
Poster Number: M13
Poster - New GOES High-Res Magnetic Measurements: Characterization of ULF Waves

Authors: R.J. Redmon, T.M. Loto'aniu, P.J. Chi, A. Abdelqader, H.J. Singer, A. Boudouridis, M. Tilton

Abstract: This presentation describes the development of a new 20+ year archive of science-quality, high-cadence geostationary measurements of the magnetic field from eight NOAA spacecraft (GOES-8 through GOES-15) and preliminary scientific results using these data. The era of NOAA operational observations of the geomagnetic field started with SMS-1 in May 1974 and continues to this day with GOES-13-16 (on-orbit). GOES magnetic observations provide an early warning of impending space weather, are the core geostationary data set used for the construction of magnetospheric magnetic models, and can be used to estimate electromagnetic wave power in frequency bands important for plasma processes. Many science grade improvements are being made across the GOES archive to unify the format and content from GOES-8 through the new GOES-R series (launched November 19, 2016). A majority of the 2 Hz magnetic observations from GOES-8-12 have never before been publicly accessible due to processing constraints. Now, a NOAA Big Earth Data Initiative project is underway to process these measurements starting from original telemetry records. Overall the new archive will include vector measurements in geophysically relevant coordinates (EPN, GSM, VDH), comprehensive documentation, highest temporal cadence, best calibration parameters, recomputed means, updated quality flagging, full spacecraft ephemeris information, a unified standard format and public access. We are also developing spectral characterization tools for estimating power in standard frequency bands (up to 1 Hz), and detecting ULF waves related to field-line resonances. We present the project status and initial findings, including in-situ statistical and extreme ULF event properties, and case studies where the ULF oscillations along the same field line were observed simultaneously by GOES near the equator in the magnetosphere, the ST-5 satellites at low altitudes, and ground magnetometer stations. For event studies, we find that the wave amplitude of poloidal oscillations is amplified at low altitudes but attenuated on the ground, confirming the theoretical predictions of wave propagation from the magnetosphere to the ground.

Reed, Willow (Laboratory for Atmospheric and Space Physics, University of Colorado, Boulder)
Poster Number: S13
Poster - Flare Response of the FUV Continuum

Authors: Willow Reed, Martin Snow

Abstract: Solar flares are energetic events on the Sun that radiate at all wavelengths. However, the spectral distribution in the ultraviolet of this energy is not well known. Using data from the SOLar-STellar Irradiance Comparison Experiment (SOLSTICE) on the SOlar Radiation and Climate Experiment (SORCE), we looked into how the spectral distribution in the Far Ultraviolet (FUV) irradiance spectrum (115 nm to 180 nm) is affected by X-class flares. In particular, we looked at the response of the FUV continuum to the flares from 2003 to 2013.

Rodriguez, Juan (University of Colorado)
Poster Number: S23
Poster - Satellite and Ground-Based Observations of Solar Energetic Particle Event Onsets: a Comparison of Two Critical Observational Platforms

Authors: Jing He and Juan V. Rodriguez

Abstract: Solar energetic particles (SEPs) propagating to Earth cause airline communication blackouts, radiation hazards for astronauts and airline passengers, and upsets in as well as degradation of spacecraft electronics. The NOAA Space Weather Prediction Center uses observations from the Geostationary Operational Environmental Satellites (GOES) to monitor SEPs. This satellite-based system for monitoring SEP events is complemented by a network of ground-based neutron monitors (NMs). Detections of SEPs by NMs, also called ground level enhancements (GLEs), are particularly important for mitigating radiation dosage to airline passengers and crew during a SEP event. A previous study by Kuwabara et al. (Space Weather, v. 4, S10001, 2006) concluded that a NM network could detect GLE onsets ~10-30 minutes earlier than GOES. However, their study did not account for differences in the instruments, the time resolution of the data, and the alert protocols.
Using newly-available high-resolution data from GOES 8-12 and NMs, we analyzed 17 GLEs from 1997-2012 and conducted a more 'apples-to-apples' comparison of these two systems' relative GLE detection times using 1-minute-cadence data. We reproduced Kuwabara et al.'s results for NM onsets using their real-time onset-detection technique (which involves a moving trailing average), then applied the same technique to the GOES observations, tuned to the different background noise levels such that false alerts are minimized. We compared the NM and GOES onset times and discovered that they did not differ as drastically as Kuwabara et al. claimed. Moreover, there was no significant local time dependence of the GOES onset times. The median difference between GOES and NM onsets was 0 minutes, with the 80th percentile of the differences (GOES lagging NMs) being 3 minutes. Weaker GLEs tended to have more varied onset time differences, whereas stronger GLEs yielded smaller onset differences. Based on the expected travel times of relativistic protons and on the nature of the technique used, we conclude that the differences between GLE onset times derived from NM and GOES observations using a similar real-time technique are mainly due to noise.

Ruangmei, Johnny (NSDMA, Home Department, Govt of Nagaland)
Poster Number: G12
Poster-Algorithms to predict erratic weather

Authors: Johnny Ruangmei, Kikon Noyingbeni

Abstract: Due to Climate Change the erratic weather is adversely affecting the small nation.

Schennetten, Kai (German Aerospace Center)

Poster Number: S27
Poster - Operational Instruments for Measuring SWx Radiation Impacts at Aviation Altitudes

Authors: Kai Schennetten, Daniel Matthiä, Matthias M. Meier, Michael Wirtz

Abstract: The interaction of cosmic radiation with constituents of the atmosphere creates a secondary particle field which contributes to the radiation exposure of aircrew and passengers. The assessment of this exposure can be achieved by model calculations and measurements. Reliable measurements of dose quantities in the complex radiation field at aviation altitudes require qualified radiation measuring instruments operated under well-defined flight and SWx conditions. A set of several types of such radiation detectors has been used on commercial airline flights as well as on research aircraft by the German Aerospace Center (DLR) for many years. The goal of these measuring flights has been the acquisition of high quality dose data for scientific investigations and operational radiation protection purposes. The detector types used, i.e. Hawk, a tissue equivalent proportional counter (TEPC), Liulin, a silicon semiconductor detector, LB 6411-Pb, a neutron probe, and bubble detectors are introduced.

Schooley, Alicia (University of Michigan)
Poster Number: S6
Poster - Now-casting Interplanetary Coronal Mass Ejections using Heavy Ion Charge Distributions

Authors: Alicia Schooley, Susan Lepri, Michael Liemohn

Abstract: Enhancements in high charge states of heavy ions has been shown to consistently occur within Interplanetary Coronal Mass Ejections (ICMEs). The presence of these ions is due to increased ionization attributed to enhanced heating during the initiation and release of ICMEs. We present a retrospective study using in-situ data from the Solar Wind Ion Composition Spectrometer (SWICS) on the Advanced Composition Explorer (ACE), and assess the feasibility of using solar wind heavy ion charge distributions of Iron, Carbon and Oxygen to now-cast the arrival of ICMEs at L1.

Seaton, Daniel (University of Colorado)
Poster Number: S14
Poster - First Results from the Solar Ultraviolet Imager on GOES-16

Authors: Daniel B. Seaton, Chris Edwards, Dnyanesh Mathur, David Sabolish, Ralph Seguin, Margaret Shaw, Lawrence Shing, Greg Slater, Gopal Vasudevan

Abstract: The Solar Ultraviolet Imager, launched November 19, 2016, on the GOES-16 spacecraft, is the first in a line of four identical instruments that will image the Sun''s atmosphere in the extreme ultraviolet for the next 20 years. SUVI''s six passbands — 94, 131, 171, 195, 284, and 304 Å — provide images of the solar chromosphere and corona over a temperature range from about 50,000 K to 10 million K, tracking phenomena such as solar prominences, coronal holes, active regions, and dynamic events such as solar eruptions and flares. SUVI is distinguished among other EUV solar images by its relatively large 53×53 arcmin field of view, an asset that may be of particular value for the study of the process of magnetic reconnection that powers solar flares. SUVI is presently undergoing its initial calibration, and we expect data to be regularly available to the scientific and space weather communities by September 2017. Here we present an overview of the instrument and some preliminary results, and describe the SUVI data products and pathways for data access.

Seki, Daikichi (Kyoto University) EPOSTER
Poster Number: S5

Poster - Increase in the amplitude of line-of-sight velocity of the small scale motion as the precursor of filament eruptions

Authors: Hiroaki Isobe, Kenji Otuji and Kumi Hirose

Abstract: Filaments, the dense cooler plasmas in the solar corona, often become unstable and erupt into the interplanetary space as coronal mass ejections (CMEs). The CMEs may cause geomagnetic storms that result in various societal and economical impacts such as blackouts and satellite anomalies, so that it is important to predict when filament eruptions will occur. From the space weather point of view, monitoring filaments as the progenitor of CMEs has a following advantage that we can monitor not only flares from active regions but also the eruptions from quiet regions that may also cause severe geomagnetic storms. The aim of this study is to investigate the characteristics of eruptive filaments that can be used as the precursor of eruptions.
For this purpose, we analyzed the solar full disk images captured by Solar Dynamics Doppler Imager(SDDI) installed on Solar Magnetic Activity Research Telescope(SMART) at Hida Obser- vatory, Kyoto University. SDDI can obtain solar full disk images in 73 wavelengths between Hα center-9˚A and Hα center+9˚A per 0.25˚A with the time resolution of about 15 seconds. Therefore this instrument can observe unprecedented detailed line-of-sight velocities of filaments. Focusing on this feature, we calculated the filament's line-of sight velocities for each pixel of the images by utilizing Beckers' cloud model from before the eruption, and made the histogram of the num- ber of the pixels versus line-of-sight velocities for each pixel. As the result, we found that the variance of the histogram started to increase before about one hour. This fact means that an increase in the amplitude of line-of-sight velocity of the small scale motions in the filament was observed before the onset of the eruption. This result can be possibly used as the precursor of filament eruptions and contribute to the prediction of CMEs.

Shen, Xiaochen (Shandong University)
Poster Number: M12
Poster - Statistical study of the storm-time radiation belt evolution during Van Allen Probes era: CME- versus CIR-driven storms

Authors: Mary Hudson, Allison Jaynes, Quanqi Shi, Anmin Tian, Seth Claudepierre, Mu-Rong Qin, Qiu-Gang Zong, Wei-Jie Sun

Abstract: Van Allen Probes with a near equatorial plane orbit and more than four year's accumulation of the data give us a good chance to statistically study the storm-time radiation belt trapped electrons evolution. The superposed epoch analysis shows that (1) CME storms have more electron flux enhancement in the vicinity of L*=3 for energy channels below 1 MeV than CIR storms; (2) CME storms have more electron flux enhancement in the vicinity of L*=4 and 5 in the energy channels above 1 MeV than CIR storms; (3) CIR storms have more electron flux enhancement in the vicinity of L*=4 and 5 in the energy channels below 1 MeV than CME storms; (4) intense CME induce more than 50 times flux enhancement for the energy channel around 400 keV in the vicinity of L*=3; (5) intense CIR induce more than 50 times flux enhancement for the energy channel around 200 keV in the vicinity of L*=4.

Smith, David (Utah State University)
Poster Number: I14
Poster - High-frequency radio wave absorption

Authors: D. A. Smith, J. J. Sojka

Abstract: Polar Cab Absorption (PCA) events are triggered by highly-energized solar particles gaining access to upper regions of Earth's atmosphere at high latitudes. These energized particle can be the result of solar flares and coronal mass ejections. Generally, PCA events are associated with significant attenuation of high-frequency radio signals propagating through the ionosphere via paths over polar regions. The ability to predict oncoming PCA events and assess their severity in real-time is of great concern. Hence, an understanding of PCA events and their effects is critical. As a first step in understanding the mechanisms of PCA events, a thorough review of high-frequency radio wave absorption was initiated. Apparently, most of the HF absorption takes place in the D-region. A review of radio wave propagation, ionospheric properties, D-region characteristics, suitable absorption equations, as well as a set of simplifying assumptions were investigated. It was found that by applying these assumptions, signal loss due to absorption can be approximated with excellent results. The poster is a report of those findings and a road map of this research to improve first-principles-modeling and specifications of PCA impact on HF absorption.

Snow, Martin (University of Colorado)
Poster Number: S18
Poster - Magnesium II index measurements from SORCE SOLSTICE and GOES-16 EUVS

Authors: Snow, M., Machol, J., Eparvier, F., Jones, A., and Woods, T.

Abstract: The solar magnesium II core-to-wing ratio has been a well-studied proxy for chromospheric activity since 1978. Daily measurements at high spectral (0.1 nm) resolution began with the launch of the Solar Radiation and Climate Experiment (SORCE) in 2003. The next generation of measurements from the Extreme Ultraviolet Sensor (EUVS) on the Geostationary Operational Environmental Satellite 16 (GOES-16) will add high time cadence (every 30 seconds) to the observational Mg II irradiance record. We present a comparison of the two measurements during the period of overlap.

Sokolova, Olga (Peter the Great St. Petersburg Polytechnic University)
Poster Number: M19
Poster - Method of Primary Evaluation of Power Grid Robustness to Geomagnetic Disturbance

Authors: Olga Sokolova, Dr. Nikolay V. Korovkin

Abstract: Geomagnetic disturbance (GMD) is a typical high impact low frequency event. They have the potential to cause widespread or catastrophic impact on economy's sectors and to reach its maximum with little indications. The primary avenue of catastrophic damage caused by GMD is through a power system infrastructure. This, in turn, can impair the operation of other critical infrastructures. Thereby, primary actions for infrastructure protection have to be implemented within power grid sector.
GMD differs power grid parameters over the large territory and may result in simultaneous loss of more than *N-1* network elements. Thereby, mitigation measures used for reduction of impacts of more common contingencies are not suitable. The choice of actions has to be done in accordance to “cost-benefit” criteria.
By synthesizing diversified statistical data about GMD impacts on power grids, the author concludes that "high risk" zones are expanding, i.e. power grids, which used to be robust to GMD effects are becoming vulnerable. The author proposes to study the power grid susceptibility to GMD effects by analyzing the impact of diverse critical factors. It is convenient to subdivide critical factors into four different groups: GMD parameters, power grid parameters, power system equipment parameters, and awareness. Thereafter, stability of particularly weak power grids to GMD effects can be studied using the classical methods of power system low-signal and dynamic stability analysis.
The proposed method is approbated in Unified Power System of Russia. The chosen parameters for comparison reflect the choice of critical factors, i.e. the installed power system equipment type and the equipment yielding, voltage level, transmission line length, grid topology, operation mode, geographical location, ground conductivity, transmission line path, data on power grid mis-operation due to unidentified technical issues, etc. The Siberian Unified power grid is identified as the one that may experience highest

negative GMD impact.

Spann, Jim (ST01) EPOSTER
Poster Number: I5
Poster - The Scintillation Prediction Observations Research Task (SPORT):

Authors: James Spann1, Charles Swenson2, Otavio Durão3, Luis Loures4, Rod Heelis5, Rebecca Bishop6, Guan Le7, Mangalathayil Abdu 4, Linda Krause1, Clezio Denardin3, Lidia Shibuya4, Joseph Casas1, Shelia Nash-Stevenson1, Polinaya Muralikrishana3, Joaquim Costa3, Marcelo Banik de Padua3, Cristiano Wrasse3, G. Fry1
1 NASA/MSFC, 2 USU, 3 INPE, 4 ITA, 5 UTD, 6 Aerospace, 7 NASA/GSFC

Abstract: The Scintillation Prediction Observations Research Task (SPORT) is a 6U CubeSat mission to address the very compelling but difficult problem of understanding the preconditions leading to equatorial plasma bubbles. The scientific literature describes the preconditions in both the plasma drifts and the density profiles related to bubble formations that occur several hours later in the evening. Most of the scientific discovery has resulted from observations at the Jicamarca Radio Observatory from Peru, a single site, within a single longitude sector. SPORT will provide a systematic study of the state of the pre-bubble conditions at all longitudes sectors to allow us to understand the differences between geography and magnetic geometry.
SPORT is an international partnership between NASA, the Brazilian National Institute for Space Research (INPE), and the Technical Aeronautics Institute under the Brazilian Air Force Command Department (DCTA/ITA). It has been encouraged by U.S. Southern Command (SOUTHCOM) to foster increased cooperation and ties between academics, civilian space programs and the militaries. NASA Marshall Space Flight Center is coordinating this investigation by overseeing the launch to orbit and the flight instruments, which are being built by the Aerospace Corporation, University of Texas Dallas, Utah State University, and NASA Goddard Space Flight Center. The Brazilian partners are contributing the spacecraft, observatory integration and test, ground observation networks, and mission operations and data management. The science data will be distributed from and archived at the INPE/EMBRACE regional space-weather forecasting center in Brazil, and mirrored at the NASA GSFC Space Physics Data Facility (SPDF).
This talk will present an overview of the SPORT mission, observation strategy, and science objectives to improve predictions of ionospheric disturbances that affect radio propagation of telecommunication signals. The science goals will be accomplished by a unique combination of satellite observations from a nearly circular middle inclination orbit and the extensive operation of ground based observations from South America near the magnetic equator.

Steele, Christopher (USAFA)
Poster Number: 14
Poster - Measuring the Ionosphere: Calibration of the Integrated Miniaturized Electrostatic Analyzer on STPSat3 with Digisonde Data

Authors: Steele, Christopher; Werkley, Anne; Mcharg, Matthew; Wilson, Gabe; Maldonado, Carlos; Putz, Victor; Balthazor, Richard

Abstract: Senior cadets from the United States Air Force Academy present research done with the Space Physics and Atmospheric Research Center. The Integrated Miniaturized Electrostatic Analyzer (IMESA) on the Space Test Program's STPSat3 gathers in situ plasma data at an altitude of 500km. Digisonde measurements of the ionosphere are used to calibrate the IMESA ion density data. Digisonde measurements are extrapolated to the operating height (500km) of the IMESA with an α-Chapman function. Finally, data processing methods on over three years of IMESA data are discussed.

Steward, Graham (Space Weather Services, Australia)
Poster Number: S8

Poster - Automatic recognition of complex magnetic regions on the Sun in SDO magnetogram images and prediction of flares: Techniques and Results for the revised flare prediction program Flarecast

Authors: Graham Steward, Vasili Lobzin, Iver Cairns, Bo Li, and David Neudegg

Abstract: In the present paper, solar magnetograms provided by the Helioseismic and Magnetic Imager (HMI) on-board Solar Dynamic Observatory (SDO) spacecraft are used to identify active regions automatically by thresholding the line-of-sight component of the solar magnetic field. The flare potential of the regions is predicted by locating potential active regions with strong-gradient polarity inversion lines (SPILs) and estimating 18 physically relevant parameters of these regions. In particular, parameters of interest include the sum of north-south gradients, sum of east-west gradients, length of SPIL, and total integrated magnetic flux. For deterministic prediction of flares, analysis for thresholding of single parameters and different combinations, which include up to 4 parameters, are presented and compared. If the false alarm rate does not exceed 10% (20%), the probabilities for correct prediction of X-ray flares of class M and greater, M5 and greater, and X in the 24 h window are 71% (86%), 84% (96%), and 94% (100%), respectively. These probabilities are for the best 4-parameter technique found. A technique for probabilistic forecasting was also developed. These deterministic and probabilistic techniques will be implemented in a revised version of the flare warning program, Flarecast, which will be operational in the Australian Space Forecast Centre.

Stitely, Noah (Millersville University of Pennsylvania)
Poster Number: G11
Poster - High-altitude balloon payload design using customizable data acquisition

Authors: Timothy Keebler, Noah Stitely

Abstract: The Millersville University Space Weather Group recently formed under the Millersville University Student Chapter of the American Meteorological Society with interest jointly in conducting high-altitude solar research via balloon and engaging in public outreach related to space weather. Despite its recent genesis, the group is in the late planning and testing stages of the instrumentation for the balloon science payload. This payload aims to use cheap and customizable equipment to aid in the accessibility of near-space and allow for a more unified data collection network. The base of the data collection system will be a small computer, allowing for customization outside existing data loggers. For preliminary flights, an array of radiation probes based on GM tubes and UV sensors will be used to obtain radiation intensity reading for gamma and x-rays in the range of incident solar cosmic ray decay cascades as well as UVA and UVB. Furthermore, the flexible instrument package allows for possible future data transmission through the APRS system to provide data recovery remotely, eliminating the arduous process of payload retrieval. The group anticipates having the preliminary results from our first test flight, which will be used to improve the experimental design in preparation for subsequent launches, including a launch during the 21 August 2017 total eclipse.

Thiemann, Ed (University of Colorado)
Poster Number: S19
Poster - The GOES-16 Operational EUV Spectral Irradiance Model

Authors: Edward M.B. Thiemann1,Francis G. Eparvier1, Thomas N. Woods1, Andrew R. Jones1, Martin Snow1, Donald L. Woodraska1, William McClintock1, Michael Anfinson1, Rodney Viereck2, Janet Machol3,4, Monica Todirita5, Gustave Comeyne5, and Sivakumara Tadikonda6
(1) Laboratory for Atmospheric and Space Physics, University of Colorado, Boulder, USA (eparvier@colorado.edu), (2) NOAA Space Weather Predictions Center, Boulder, USA, (3) Cooperative Institute for Research in Environmental Sciences, University of Colorado, Boulder,

USA, (4) NOAA National Centers for Environmental Information, Boulder, USA, (5) NASA Goddard Space Flight Center, Greenbelt, USA, (6) Constellation Software Engineering, Annapolis, MD

Abstract: Solar extreme ultraviolet (EUV) radiation, loosely defined as wavelengths ranging from 5 to 125 nm, is the primary energy source to the upper atmosphere away from the poles. It is highly variable, varying by factor of 10 at the shortest wavelengths to 2 at the longer wavelengths, over both the long-term 11-year solar cycle and transient time-scales of solar flares. EUV radiation can disrupt communications and navigation signals and modulate satellite drag. Despite its high variability and technological and scientific relevance, measurement continuity has been historically difficult because it must be done from space and the optics are prone to degradation due to the ionizing nature of EUV radiation. In lieu of measurements, the solar EUV spectrum is modeled using available signals or proxies which are correlated with EUV variability. This poster presents the new GOES-16 EUV and X-ray Irradiance Sensors (EXIS) L1B operational EUV spectral irradiance model produced by NOAA for the space weather community. The EXIS L1B spectral model is an operational, real-time, coarse-resolution EUV spectrum which is derived from the 10 EXIS measurements. The model has a 30 second latency and cadence, and spans the wavelength range from 5 nm to 127 nm. The model spectral resolution from 5 to 115 nm is 5 nm, and there is a single 10 nm bin from 117-127 nm. The model uses the best available measurements to estimate the irradiance in each model bin ,and a spectrum can be produced as long as any one of the EUVS channels (A, B or C) are available. The EXIS model decomposes the EUV irradiance into short and long time-scales, specifically a daily average and some contribution to the daily value at a 30 second cadence. We show that the model uncertainty for daily average irradiances ranges from 1.6 to 5.4 % for the model bins and that model predictions of M-class or greater flares is typically less than 20% for all bins except the 10-15 nm and 95-100 nm bins, which have uncertainties of 68% and 31.8%, respectively.

Tilton, Meg (CIRES / NOAA) EPOSTER
Poster Number: S15
Poster - GOES-16 Space Weather Data: Products and Access

Authors: William Rowland, Stefan Codrescu, Daniel Seaton, William Denig

Abstract: In November 2016 NOAA launched the first in the "R" series of Geostationary Operational Environmental Satellites. This satellite, GOES-16, continues a tradition of almost 40 years of continuous space and solar observations at geostationary orbit. GOES-16 improves upon its predecessors in its ability to measure proton, electron, and heavy ion fluxes. The satellite also offers enhanced remote sensing of the sun through ultraviolet (UV) imagery and X-ray/UV irradiance.
Many users are interested in obtaining GOES-16 space weather data. The spacecraft is currently undergoing Post-Launch Testing (PLT), and scientists have not yet validated many products sufficiently to publish these data. Yet once instruments reach provisional maturity--an August milestone for space-weather senors--L1b space weather data will be available through NOAA's National Centers for Environmental Information (NCEI). This presentation provides an overview of GOES-R space weather data ranging from direct measurements (L0 data) to higher level science (L2+) products developed by NCEI scientists. We will also present planned data access and distribution features. We emphasize our strategy to ensure data discoverability and accessibility, including planned partnerships with NASA's Virtual Solar Observatory and projects like Helioviewer.

Walker, Andrew (Los Alamos National Laboratory)
Poster Number: M3
Poster - DREAM: An operational prototype for radiation belt forecasting

Authors: Andrew Walker, Steven Morley, Brian Larsen, Geoffrey Reeves

Presented by: Steven Morley

Abstract: We present a deployable, operational prototype of the Dynamic Radiation Environment Assimilation Model (DREAM) developed to ingest and process space weather data in real-time to forecast the internal spacecraft charging conditions in the Van Allen radiation belts. DREAM can assimilate local space environment instrument measurements from spacecraft such as the Geostationary Operational Environmental Satellite (GOES), the Global Positioning System (GPS) satellites, and the Van Allen Probes. Using the unidirectional differential electron flux from such spacecraft, DREAM generates a global estimate of the phase space density in the radiation belts which can be used to compute the flux as a function of energy, pitch angle, and time at any arbitrary location in the radiation belts. A satellite "fly through" module can predict the internal charging environment for specific individual satellites. This can be especially useful for determining space weather conditions for spacecraft that orbit in the radiation belts but do not carry space environment sensors.

Wang, Chunqin (National Space Science Center, Chinese Academy of Sciences)
Poster Number: M9
Poster - Observations of geosynchronous energetic particle environment with in situ FY-2G measurements

Authors: Zhang Shen, Yi, Jing Tao, Zhang Huan-Xin, Li Jia-Wei, Zhang Xiao-Xin, Sun Yue-Qiang, Liang Jin-Bao, Wei Fei, Shen Guo-Hong, Huang Cong, Shi Chun-Yan

Abstract: The FY2 series satellites are the principal observational platforms for covering dynamic weather events and the near-earth space environment in China. High energy particle detectors carried on the satellites have provided continuous and simultaneous monitoring of the geosynchronous energetic particle environment. Since FY2G satellite, a new generation of energetic particle detector has been flown. The new generation detector consists of two instruments- also monitoring of geostationary altitude incident flux density of protons, alpha particles, and electrons, which can perform more extensive and precise range of energy levels. The high energy electrons instrument senses incident flux of 200keV to greater than 4MeV high energy electrons with eleven channels. The high energy protons and heavy ions instrument senses incident flux of high energy protons with seven channels from 4MeV to 300 MeV. The paper presents the several representative observations performed from Jan 2015 until Oct 2015 with the new detector aboard of the FY2G satellite. A precise description and preliminary analysis of particle dynamic during disturbances such as magnetic storm、sub-storm and solar eruption suggests that the detector can reach an accurate response to various disturbances and can provide refined particles data. Further comparison of particles dynamic observations of FY2G satellite with GOES series satellites leads us to believe that quite difference exist in particle flux evolvement. It appears that under some conditions the energetic particle fluxes can enter into a coherent level, yet intensive disturbances can cause great difference between observations of the satellites, which can be helpful for data assimilation of multi-satellite as well as further research in more complicated magnetosphere energy particle dynamic.

Watson, Chris (UCAR) EPOSTER
Poster Number: I10
Poster - Climatology of Small-Medium Scale Ionospheric Plasma Irregularities Observed by FormoSat-3/COSMIC GNSS Radio Occultation Receivers

Authors: Chris Watson, Nick Pedatella

Abstract: Ground and satellite-based Global Navigation Satellite System (GNSS) receiver measurements provide a high-resolution technique for monitoring ionospheric plasma irregularities, including scintillation activity, and non-scintillation-producing ionization structures. Studies involving radio occultation (RO) satellite measurements have shown that observed fluctuations in RO signal phase can be used to resolve the vertical structure of small and medium scale (up to ~50 km) ionospheric irregularities [1,2,3], and provide insight into the mechanisms that generate these irregularities.
GNSS receivers onboard six low-Earth orbiting (LEO) FormoSat-3/COSMIC satellites have provided global RO measurements since 2006. Data products include absolute ionospheric TEC and amplitude

scintillation index (S4) from two precise orbit determination (POD) receivers and associated antennas onboard each satellite. This study investigates the climatology and characteristics (e.g. scale size, magnitude, vertical gradient, altitude) of small-medium scale plasma irregularities, including the diurnal, seasonal, solar cycle, and solar wind/IMF dependence of these characteristics. The climatology and characteristics of both non-scintillation producing irregularities and irregularities with associated scintillation signatures are presented. Statistical analysis of one year of COSMIC data has revealed that irregularities with corresponding scintillation signatures were observed in predominantly low and high latitude regions, while non-scintillation producing irregularities were observed in both mid and high latitude regions. Occurrence and characteristics of scintillation and non-scintillation producing irregularities had a significant dependence on local time, season, solar wind condition, and geomagnetic activity level. This dependence provides insight into the source and generation mechanisms of irregularities observed at particular latitude regions, including gravity wave perturbations and solar wind/magnetospheric sources. Analysis of ten years of COSMIC RO measurements is currently in progress.

Woods, Thomas (University of Colorado)
Poster Number: S16
Poster - GOES-16 X-Ray Sensor (XRS) New Measurements and Validation

Authors: Thomas N. Woods, Francis G. Eparvier, Andrew Jones, Tom Eden, Don Woodraska, Janet Machol, and Rodney Viereck

Abstract: The GOES-16 X-Ray Sensor (XRS) is continuing the long record of solar soft X-ray (SXR) measurements for space weather operations. This XRS uses silicon photodiodes instead of ionization gas cells as the detectors to provide higher sensitivity and in a smaller and lower-power package. The new measurements from GOES-16 XRS are presented along with validation of the irradiances with the GOES-15 XRS and SXR spectra from the NASA MinXSS CubeSat. The GOES-16 XRS and MinXSS results indicate slightly higher irradiance than those from GOES-15 XRS.

Yang, Seung Bum (InSpace Company, Ltd.) EPOSTER
Poster Number: S26
Poster - Service Platform SAFE system(Safety during Aviation Flight Environment from radiation)

Authors: Oh Yun Hee, Kim Tae Young, Choi Myung Jin, Choi Jang Seok and Kim Do Hyeon

Abstract: Recently, there has been a growing interest in aerospace radiation.
There is a lot of aerospace radiation exposure when using Arctic route than general route.
It has also been revealed that the disease is exposure to disease or danger by radiation
ICRP(International Commission on Radiological Protection) classifies flight crews as radiation exposure occupations.
As the frequency of overseas trips increases, the need to introduce a systematic radiation dose management system is increasing. In Korea, SAFE (Safety during Aviation Flight Environment from radiation) system has been developed for systematic management of aerospace radiation dose at the Korean Space Weather Center of National Radio Research Agency.
SAFE is from the 2016 Web, is a public mobile services can also conveniently use the regular travelers and air crew, and Open API for service utilization is provided.Improvements to the SAFE system will not only provide personal radiation management, but will also provide information that airlines may need. Based on the user's authority, various services are provided.Korean airlines receive information on the number of flights by route and average aerospace radiation dose per route. SAFE is in the process of evolving into a service and aerospace radiation management platform.
In this paper, the SAFE service improvement contents and service contents can be confirmed.

Yang, Xiaochao (National Space Science Center, Chinese Academy of Sciences)

Poster Number: M11
Poster - Unusual refilling of the slot region between the Van Allen radiation belts from November 2004 to January 2005

Authors: Xiaochao Yang, Binbin Ni, Jiang Yu, Yang Zhang, Xiaoxin Zhang, and Yueqiang Sun

Abstract: Using multi-satellite measurements, a uniquely strong and long-lived relativistic electron slot region refilling event from November 2004 to January 2005 is investigated. This event occurred under remarkable interplanetary and magnetospheric disturbances. Both empirically modeled and observationally estimated plasmapause locations demonstrate that the plasmasphere eroded significantly during the enhancement phase of this event. The estimated diffusion coefficients indicate that the radial diffusion due to the ULF waves is too low to account for the observed enhancement of slot region electrons. However, the diffusion coefficients evaluated using the distribution of chorus wave intensities derived from low-altitude POES electron observations indicate that the local acceleration induced by chorus could account for the major feature of observed enhancement outside the plasmapause. When the plasmasphere recovered, the refilled slot region was enveloped inside the plasmapause. In the plasmasphere, while the efficiency of hiss scattering loss increases obviously by including unusually low frequency hiss waves, the interaction with hiss alone cannot fully explain the decay of this event, especially at higher energies, which suggests that EMIC waves should contribute to the relativistic electron loss process at such low L-shells for this refilling event. Through a comprehensive analysis on basis of data analyses and numerical calculations, the present study sheds light on the underlying physics responsible for the unusual slot refilling by relativistic electrons, which exhibits the complexity of both radiation belt electron dynamics and associated wave-particle interactions.

Young, Shawn (USAF AFMC AFRL/RVBXR)
Poster Number: S29
Poster – Specifying the Solar Energetic Particle Hazard Inside Geosynchronous

Authors: Shawn Young (AFRL), Brian Kress (CIRES), Christopher Roth (Atmospheric and Environmental Research Inc), Stuart Huston (Boston College), Wm. Robert Johnston (AFRL)

Abstract: Current solar energetic particle (SEP) hazard specifications are based on observations of the interplanetary SEP flux at geosynchronous, however, because of Earth's magnetic shielding they only directly apply to the Earth's geosynchronous and Polar Regions. We are developing methods to specify the SEP hazard everywhere in geospace using a realistic magnetic field model and observations from GEO and LEO satellites, with different techniques optimized for different orbital regimes. Here we report on a comparison using these techniques to map observations made on-board NOAA's POES and GOES satellites to specify fluxes at the magnetic equator inside geosynchronous and compare those specifications to actual CRRES and Van Allen Probes observations.

Wu, Qian (NCAR)
Poster Number: I8
Poster - COSMIC Observation of Ionosphere SAO

Authors: W. S. Schreiner, B. Ho, H.-L. Liu, B. Emery, Liying Qian

Abstract: COSMIC satellite GPS radio occultation (RO) observation showed semi-annual oscillation (SAO) in the ionosphere. NCAR TIEGCM simulations were performed to study the gravity wave Eddy diffusion and tidal effects on the ionosphere SAO. Adding SAO to the Eddy diffusion coefficient in the TIEGCM enhances the ionosphere SAO. According to TIEGCM simulation mesospheric and lower thermospheric tides can reduce the ionosphere density and SAO. Simulation with NCAR WACCM-X

showed reduced ionosphere density compared to the COSMIC observation. The large gravitation constant used in the WACCM-X lowers the overall thermospheric density and reduces the source of the O+ ions. Consequently, the ionospheric density was lower in the WACCM-X simulation compared to the TIEGCM and COSMIC.

Wu, Qian (NCAR)
Poster Number: I22
Poster - Recent Progress in Thermospheric Wind Observations

Authors: Geonhwa Jee, William Ward

Abstract: NCAR/HAO operates several Fabry-Perot interferometers in collaboration with other institutions around the world to observe thermospheric winds, which are critically needed for ionosphere and space weather studies. We present recent progress on these observations. We will show new observational from northern and southern high-, mid-latitudes, and equatorial regions. These observations will be compared with NCAR model simulations.