Space Weather Workshop
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Poster Abstracts

Bisi, Mario (Science & Technology Facilities Council - Rutherford Appleton Laboratory)*EPOSTER
Poster Number: S27
Poster - LOFAR4SpaceWeather (LOFAR4SW): Increasing European Space-Weather Capability with Europe's Largest Radio Telescope

Authors: Mario M. Bisi (1), René Vermeulen(2), Richard A. Fallows (2), Nicole Vilmer (3), Hanna Rothkaehl (4), Joris Verbiest (5), Peter T. Gallagher (6), Michael Olberg (7), Maaijke Mevius (1), and Stuart C. Robertson (1).

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Abstract: The Low Frequency Array (LOFAR) is one of a relatively-new breed of radio-astronomy instruments. It covers a wide bandwidth in radio frequencies (10-250 MHz) with both a high temporal and spatial resolution using a large number of stations distributed across Europe. LOFAR consists of a dense core of 24 stations within a ~4km diameter, 14 stations spread further afield across the northeast area of The Netherlands, and a further 13 stations spread internationally (six across Germany, three in northern Poland, and one each in France, Ireland, Sweden, and the UK). Further international sites are under preparations, which will then expand LOFAR even further across Europe. LOFAR is one of the world's most-flexible radio instruments with capabilities that enable studies of several aspects of space weather to be progressed beyond today's state-of-the-art. However, in its present setup, it can only be used for space-weather purposes on a campaign bases. This is where observing time has to be competed for alongside astronomy and all other types of radio observations requested.

LOFAR For Space Weather (LOFAR4SW) is a new Horizon 2020 (H2020) INFRADEV design study, commenced December 2017, to undertake investigations into upgrading LOFAR to allow for regular space-weather monitoring observations in parallel with normal radio-astronomy and scientific operations. The LOFAR4SW project will engage with stakeholders to plan for a facility that produces unique research data with key impact on advanced predictions of space-weather events affecting crucial technological

infrastructures of today's society. Space weather is a global threat with varied local, regional, and continent-wide impacts.

Some key example science for space-weather advancement that would be carried out with a fully-implemented LOFAR4SW system include the following… (i) Observations of interplanetary scintillation (IPS – the scintillation of distant, compact radio sources due to variations in density throughout the inner heliosphere) which can be used to probe the solar wind and the passage of Coronal Mass Ejections (CMEs). (ii) Observations of heliospheric Faraday rotation to test if the "holy grail" of magnetic-field parameters (particularly of CMEs) can be regularly obtained throughout the inner heliosphere and implemented into space-weather forecast models. (iii) Wide-bandwidth observations of ionospheric scintillation from all stations in the array, which will significantly expand upon the single-station, single-frequency GNSS datasets, thus offering an opportunity to explore more completely, the large-to-small plasma scales in the presence of different scattering regimes. And (iv), wide-band solar dynamic spectra to explore the dynamic Sun with a particular emphasis on radio bursts pertaining to the onset, eruption, explosion, and propagation of space-weather causing events.

In this presentation, we summarise the key aspects of the LOFAR4SW design study, progress to date, and some of the longer-term goals envisaged for LOFAR to become one of Europe's most-comprehensive space-weather observatories, shedding new light on several aspects of the space-weather system, from the Sun to the solar wind to the ionosphere.

Bonadonna, Michael (OFCM)
Poster Number: G1
Poster - The National Space Weather Program: 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 at Boulder)
Poster Number: M2
Poster - Development of a Bow-tie Inversion Technique for Real-time Processing of the GOES-16 SEISS MPS-HI Electron Channels and Comparison of the Resulting Fluxes with the GOES-13 MAGED and EPEAD Electron Channels

Authors: J. V. Rodriguez, 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 MPS-HI electron channels cover the energy range 50 keV – 4 MeV. The conversion of raw MPS-HI electron telescope counts to fluxes is based on 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 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 geometric factors calculated through the GEANT4 model simulation results, and then inverted back to fluxes using the bow-tie inversion technique. The retrieved electron spectra are then compared to the original CRRES proxy spectra to assess the accuracy of the technique. The resulting effective energies/geometric factors are finally used to convert the MPS-HI electron counts to fluxes. The same bow-tie technique is used to calculate effective energies and geometric factors for the GOES-13 MAGED ME1-ME5 (30-600 keV) and EPEAD E1-E3 (>0.8, >2 and >4 MeV) electron channels. The GOES-16 MPS-HI first returned data on 08 January 2017, and the GOES-13 data stopped

flowing to SWPC on 14 December 2017, four days before GOES-16 became the official GOES-East satellite. We compare the fluxes from the two spacecraft over several months in 2017 to determine the applicability and utility of the bow-tie analysis.

Cade, Trey (Baylor University)
Poster Number: M15
Poster - Performance of the Kp Index During Magnetic Storms

Authors: Courtney Turner

Abstract: The Kp Index, created by Julius Bartels in 1949, is a well-know, established measure of geomagnetic storm intensity and is used in numerous settings for a variety of purposes, many of them directly related to operational requirements and national infrastructure concerns. As a driver for physical models of the space environment, and as an important measure for protection of the national power grid, it is important to understand the nature of the Kp index and how accurately it corresponds to the assumptions made about how it characterizes the level of geomagnetic activity. With Kp being the primary means used to determine storm intensity, it is critical that the index be a reliable indicator of storm strength. By investigating Kp's consistency in representing the intensity of storms, we can determine how reliable of a measure it is. In addition, Kp is assumed to be a quasi-logarithmic index, but this is based on methods of derivation and therefore little work has been done to verify this assumption based on comparing derived values to physical parameters. This research explores these issues.

Califf, Sam (NOAA/NCEI)
Poster Number: M1
Poster – GOES-16 Magnetometer Calibration and Validation

Authors: Sam Califf, Paul Loto'aniu, Rob Redmon

Abstract: The Geostationary Operational Environmental Satellites (GOES) have been providing continuous geomagnetic field measurements for over 40 years. While the primary purpose of GOES is operational, the magnetometer data are also widely used in the scientific community. We are currently validating the GOES-16 magnetometer through comparison to models and other GOES spacecraft. GOES-16 has known bias issues that are difficult to objectively quantify, but recent advances in magnetic field model assimilation offer a potential solution to this problem. In addition to discussing the ongoing calibration work, we also present observations of geomagnetic activity by GOES-16 and early measurements from the recently launched GOES-S spacecraft to highlight the scientific value of these new space weather instruments.

Cherkos, Alemayehu (Addis Ababa University)*EPOSTER
Poster Number: G6
Poster - Effect of viscosity on propagation of MHD waves in astrophysical plasmaEffect of viscosity on propagation of MHD waves in astrophysical plasma

Authors: S. B. Tessema

Abstract: We determine the general dispersion relation for the propagation of magnetohydrodynamic (MHD) waves in an astrophysical plasma by considering the effect of viscosity with an anisotropic pressure tensor. Basic MHD equations have been derived and linearized by the method of perturbation to develop the general form of the dispersion relation equation. Our result indicates that an astrophysical plasma with an anisotropic pressure tensor is stable in the presence of viscosity and a strong magnetic field at considerable wavelength.

Copeland, Kyle (Federal Aviation Administration)
Poster Number: S23
Poster - Conversion of the FAA's Solar Radiation Alert Systems to CARI-7

Authors: Kyle Copeland, Ph.D.

Abstract: The Federal Aviation Administration’s Civil Aerospace Medical Institute Aeromedical Research Division has operated an advisory Solar Radiation Alert System (SRAS) since 2002. This report describes the third and latest significant upgrade of the system software, known as Maps of Ionizing Radiation in the Atmosphere (MIRA). While retaining all the expected standard outputs from SRAS and its most recent successor, the Enhanced SRAS (ESRAS), the revisions include a complete conversion to using CARI-7 for calculations of solar and galactic cosmic radiation dose rates, an extension of standard output to a vertical cutoff rigidity of 15 GV, and the development of a new capability to automate e-mailing of alert messages and related files to potential users. New calculations are compared with older results for times during the September 10, 2018 ground level event (GLE 72) and a time of relative inactivity 2 weeks later.

Cruz, Alfredo (CU-Boulder)
Poster Number: I3
Poster - Investigation into Proton-Induced Conductivity and Related Space Weather Effects

Authors: Alfredo Cruz, Stan Solomon, Liam Kilcommons, Delores J. Knipp, and Tomoko Matsuo

Abstract: Sparked by a rejuvenated interest in precipitating protons, especially during storm times, there is opportunity to use Defense Meteorological Satellite Program (DMSP) particle data for an in-depth analysis of 'proton-induced' conductivity. This effort will take full advantage of decades of DMSP ion spectra currently archived at the National Center for Environmental Information. Protons have been known to contribute roughly 15% of the total precipitating energy deposition, although their contribution during storm times has still not been fully addressed. Even the most current ionospheric models only consider ionizations induced by precipitating electrons, implying that protons may have a more profound impact on the electrodynamics of the high-latitude ionosphere than what has been perceived in the past. Meurant et al. [2003], Zhang et al.

[2008], and Yahnina et al. [2008] have shown significant shocked proton-auroral effects during the onset of geomagnetic storms with strong compressions. Knipp et al. [2017] has also recently suggested that precipitating protons may have a correlation with the initial onset of nitric oxide (NO) production observed during shock-led storms. The goal of this project is to develop an ionospheric conductivity model using Stan Solomon's GLobal airglOW (GLOW) code that properly conveys the unique characteristics of precipitating protons and is computationally feasible enough to be used in modern global models of the upper atmosphere.

Darnel, Jonathan (NOAA-NCEI/University of Colorado)
Poster Number: S2
Poster - Observations by the Solar UltraViolet Imager of the September 10, 2017 X8.2 Flare

Authors: Darnel, Jonathan M.; Seaton, Daniel B.

Abstract: We present observations of a powerful solar eruption, accompanied by a X8.2 solar flare, fromNOAA Active Region 12673 on 2017 September 10 by the Solar Ultraviolet Imager (SUVI) on theGOES-16 spacecraft. SUVI, with its large field-of-view, offers observations unique in the field of EUV solar imagery. These observations include the detection of an apparent current sheet associated with magnetic reconnection in the wake of the eruption and evidence of an EUV wave at some of the largest heights ever reported. This event as seen by SUVI is suggestive of the magnetic breakout model ofsolar eruptions. We describe the SUVI data and discuss how the scientific community can accessSUVI observations of the event.

DeForest, Craig (University of Colorado)
Poster Number: S10
Poster - PUNCH: a Space-Weather-Relevant SMEX mission for 2022

Authors: C.E. DeForest and the PUNCH Team

Abstract: The Polarimeter to UNify the Corona and Heliosphere is a proposed NASA Small Explorer mission planned for launch in 2022, that will carry out deep-field imaging of the solar wind and its transient phenomena as they depart the corona and cross the inner heliosphere.
PUNCH's primary science goal is to identify the cross-scale processes that unify the corona
and heliosphere; but the mission is highly relevant to the space weather enterprise. PUNCH will produce deep-field, 3D images of the entire inner heliosphere on a few-minute
cadence, tracking CMEs and their internal structure while avoiding pitfalls
associated with unpolarized stereoscopy. PUNCH 3D structural analysis of CMEs, in particular,
bridges the current measurement gap between photospheric magnetogram data and direct prediction of CME leading-edge Bz.

PUNCH contains four white-light cameras, one per spacecraft: a conventional externally-occulted
Narrow Field Imager (NFI) coronagraph based on CCOR, and three separate wide-field imagers (WFIs) based on STEREO/HI. All four cameras are operated synchronously and have significant field of view overlap, producing images that are automatically merged on the ground into a 90° wide field of view centered on the Sun. PUNCH tracks wind flow, turbulence, CMEs, CIRs, and other shocks as they evolve in the solar system, with 4 minute cadence and 10x higher photometric sensitivity than any prior mission. PUNCH is fully capable of supporting space weather nowcasting/forecasting in a quasi-operational low-latency mode with frequent ground passes, although its primary mission is scientific.

de Koning, Curt (University of Colorado)
Poster Number: S13
Poster - Ensembles, CME Mass, and Space Weather Forecasting

Authors: Michele Cash

Abstract: On 2012 July 23 a large and fast CME was observed by both STEREO spacecraft and by SOHO.

De la Luz, Victor (Universidad Nacional Autonoma de Mexico)*EPOSTER
Poster Number: I13
Poster - azTEC: TEC Maps Near to Real Time over Mexico

Authors: Maria Sergeeva, Mario Rodríguez, Américo González-Esparza, Esmeralda Romero

Abstract: In this work we introduce a new product of the National Laboratory of Space Weather (LANCE): azTEC, TEC maps near to real time over Mexico. azTEC is computed each 15 minutes using around 40 GPS station on mexican territory from two ground networks: TlalocNET and the mexican National Seismological Service network. The maps are produced by US-TEC that is an operation product at the Space Weather Prediction Center (SWPC), which is a product developed through a collaboration between the National Geodetic Survey, National Oceanic and Atmospheric Administration SWPC, and the Cooperative Institute for Research in Environmental Sciences of the University of Boulder, Colorado. US-TEC was modified in the Center of Supercomputing of LANCE to be operational with the mexican Repository of Space Weather (RICE). The result is a new product that allow us for first time compute the electronic content of the atmosphere over Mexico near to real time.

Denton, Michael (Space Science Institute)
Poster Number: M14
Poster - A Flux Model of the Inner Magnetosphere

Authors: Mike HendersonJuan Rodriguez

Abstract: A Flux Model of the Inner Magnetosphere: Improved Energy and Spatial CoverageSince its development our electron/ion flux model has been successfully utilized by a variety of groups in the community with a science, operations, and commercial focus. The goal of this new project is to advance the model by extending the spatial coverage to ~2-7 Earth radii, and extending the energy coverage to >2 MeV. The project will build on the framework and methodology of the current model that delivers forecasts of the ion and electron fluxes at geosynchronous orbit (GEO) [Denton et al., 2015; Denton et al., 2016]. Here we discuss plans for the future model development using data from GOES/MAGED, GOES/MAGPD, LANL/MPA, and RBSP/HOPE and RBSP/MagEIS.

Destefano, Anthony (NASA/Marshall Space Flight Center)
Poster Number: S20
Poster - The Probability of False Go/No-Go Determined by GOES Proton Flux: Proposed Launch Constraints for Avoiding Damaging Solar Energetic Particle Events

Authors: Anthony Destefano, Michael Goodman, Robert Suggs

Abstract: Most space-bound hardware needs to be designed to withstand space weather events to some degree. Long-term predictability of space weather events, such as solar flares or coronal mass ejections, are still a matter of theory so designers should assume a worst case event for their specific environment. In our analysis, we show preliminary results of the probability of encountering a false/true go/no-go based on a threshold launch and design proton environment. The goal in choosing a threshold launch environment is to avoid the chance of exceeding the design environment during vulnerable parts of the mission. Operationally, this method cannot predict damaging space weather but can aid in avoiding space weather events that are already occurring. The GOES proton flux database is used as a proxy for the heavy ion fluxes, which impart a greater threat because of larger single event upsets and effects. Our use of protons as a proxy for heavy ions is justified on the basis of the correlation between their fluxes shown by a qualitative comparison of GOES proton integral fluxes at > 10 MeV and ACE/SIS heavy ion integral fluxes.

Eccleston, Paul (STFC - RAL Space)
Poster Number: S11
Poster - Definition of the remote-sensing package for ESA's Lagrange mission

Authors: P. Eccleston, J. Davies, S. Kraft & the Lagrange remote-sensing consortium

Abstract: The space weather element of ESA’s Space Situational Awareness (SSA) programme was established to address the increasing risks of solar effects on human technological systems and health. Within its current Period 3, the SSA programme has been extended to include the additional Lagrange (LGR) element that is targeted towards

the development of an operational space weather mission to the L5 Lagrange point. Under the auspices of LGR, a number of Phase A/B1 studies are already underway; these studies cover the remote-sensing payload, the in-situ payload, and the overall system (including design of the spacecraft itself). Having provided a brief overview of the LGR programme, we will review the requirements, and present the baseline designs, of those instruments that are to be considered as part of the remote-sensing instrument phase A/B1 study - namely the Photospheric Magnetic Field Imager (PMI), the EUV Imager (EUVI), the Coronagraph (COR) and the Heliospheric Imager (HI). We will discuss the instrument control and processing philosophy, in terms of a shared Instrument Processing and Control Unit (IPCU) albeit in conjunction with a dedicated PMI processor, and the progress towards defining a baseline architecture for an End-to-End simulator for the whole instrument package.

Eparvier, Francis (University of Colorado)
Poster Number: S8
Poster - The September 2017 Flares in EUV and Soft X-Ray Irradiance from GOES and other Platforms

Authors: F.G. Eparvier, P.C. Chamberlin, A.R. Jones, T.N. Woods, M. Snow, D.L. Woodraska, E.M.B. Thiemann, D. Didkovsky, J.P. Mason, J.L. Machol, R.A. Viereck

Abstract: The intense solar flaring period in early September 2017 originating from NOAA AR 12673 was observed in the EUV and soft X-rays (XUV) by an unprecidented number of space-borne instruments. Not only were these observations made from Earth-orbit (including, but not limited to: GOES-13 and -15 XRS, the new GOES-16 EXIS and SUVI, SDO EVE and AIA, and TIMED SEE), but also from other vantage points in the solar system (including STEREO EUVI, and MAVEN EUVM, both on the other side of the Sun as Earth), giving us a full-Sun view of the events in the EUV and XUV. We will present an overview and analysis of the EUV irradiance variations from the active region evolution and flares originating from it.

Eparvier, Francis (University of Colorado)
Poster Number: S9
Poster - The Magnesium II Index: Continuing Progress on the Facular Proxy in the GOES-R Era

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

Abstract: The Magnesium II core-to-wing ratio is an important proxy for solar magnetic activity, and it has been measured on a daily basis since 1978. The newest set of measurements are from the Extreme ultraviolet and X-ray Irradiance Sensors (EXIS) on the GOES-R series. The first EXIS was launched in late 2016 and will become operational later this year. The new measurement is at 3 second cadence and very high signal-to-noise ratio. This poster will show the capabilities of the new series of instruments and some initial results.

Fiori, Robyn (Natural Resources Canada)
Poster Number: I7
Poster - Improved Modelling of Shortwave Fadeout with 30 MHz riometer data

Authors: R. A. D. Fiori, L. Nikitina, D. H. Boteler

Abstract: Bursts of enhanced electron density in the ionospheric D-region due to photoionization by X-ray radiation from solar X-ray flares leads to a fadeout of short wave signals, potentially causing a loss of high frequency radio communication in affected regions. D-region absorption is typically monitored using riometer instruments which typically operate at 30 MHz. There are well established relationships for modelling the absorption anticipated during a SWF event based on the solar X-ray flux. These relationships are examined using the Natural Resources Canada riometer network which provides a unique opportunity to study SWF over a wide spread in latitude (45.4° to 82.5°) for a 90° band of longitude. Based on observations from an event on 11 March 2015, current methods for modelling SWF are shown to severely underestimate absorption. We devise an improved SWF model which corrects this underestimation. Improved modelling provides a better estimate of the peak absorption and its duration above threshold levels anticipated to impact HF radio communication.

Fritz, Amanda (Millersville University of Pennsylvania)
Poster Number: S34
Poster - Earth-Affecting Coronal Mass Ejections Using A Magnetically-Driven Model

Authors: Amanda Fritz

Abstract: Results from the Erupting Flux Rope (EFR) model will be presented that simulates the propagation of (CME-like) responsible for appreciable disturbances at 1 AU. Therefore, the model calculates the expansion of a flux rope in three orthogonal directions based on physical forces: apex expansion, transverse expansion, and minor radial expansion. The model provides two new important predictions: (1) estimates of the magnetic field strength and orientation of the CME Bz component at 1AU (2) estimates of the arrival time of the magnetized CME ejecta. The model calculates the evolving magnetic field of a CME ejecta (in three dimension Bx, By, Bz), pressure, temperature, density and Dst index in relation to the initial geometry of the CME at the Sun and height-time data measured directly in white-light images.

Fry, Ghee (NASA Marshall Space Flight Center)
Poster Number: I8
Poster - Crowd-Sourced Radio Science at Marshall Space Flight Center

Authors: Ghee Fry, Jesse McTernan, Rob Suggs, Linda Rawlins, Linda Krause, Dennis Gallagher and Mitzi Adams

Abstract: Marshall Space Flight Center (MSFC) scientists and engineers are currently collaborating with Amateur Radio enthusiasts (hams) and citizen scientists to investigate radio wave propagation and ionospheric variability. Recent developments in Amateur Radio have enabled global, real-time reporting of high-frequency (HF) radio-propagation conditions. New digital communication modes facilitate the automatic reporting of point-to-point radio HF radio signal reports (called spots). In addition, automated web-based aggregators developed by hams are collecting spots, and archiving and displaying signal paths to paint a real-time picture of evolving radio propagation conditions. Aggregators include the Reverse Beacon Network (RBN) and the Weak Signal Propagation Reporter (WSPR) Network (WSPRnet), among others. During the August 21, 2017 total solar eclipse, we investigated the utility of the RBN and WSPRnet to record and archive changes in HF radio propagation. We positioned two field stations in the path of eclipse totality: an RBN receiver node in Clarksville, TN and an RBN transmitter node north of Hopkinsville, KY. We also operated a WSPR transmitter at the Marshall Amateur Radio Club station at MSFC (97% totality). We transmitted on and monitored the Amateur Radio 40-meter (7.0 MHz) and 80-meter (3.5 MHz) bands, and analyzed reception reports archived on the RBN and WSPRnet websites. Post eclipse analysis showed that lower-HF propagation paths, normally closed during the day due to D-region ionospheric absorption, opened up during the eclipse as expected, validating the utility of RBN and WSPR data sources. We interpreted these changes in terms of evolution of ionospheric conditions as the eclipse unfolded. Based on our eclipse experiences, we are expanding our radio science activities to investigate the utility of RBN, WSPR and other modes to assess ionospheric impacts due to space weather. MSFC also engaged in STEM outreach activities, where students sponsored by the Interactive NASA Space Physics Ionosphere Radio Experiments (INSPIRE) Project and Elite Space Camp students were recruited to participate in very-low frequency (VLF) radio observations during the 2017 Solar Eclipse. We set up an INSPIRE VLF3b receiver (about 300Hz to 12,000kHz) at a location remote from electrical power lines near Guthrie, KY for the field experiment. Students monitored natural VLF noise during the eclipse near midday on August 21, and at the same location on other days both at midday and just after sunset. The objective was to contrast observations made at this one location during the eclipse, and on other days to determine whether the Moon's shadow caused enough of a change in the local ionosphere to bring about nighttime-like VLF radio noise. This noise is known to include tweeks and whistlers, in addition to the nearly omnipresent spherics all caused by lightning. We report on the results of our HF and VLF investigations, MSFC's ongoing radio science activities and plans for the future.

Gentile, Louise (Air Force Research Laboratory)
Poster Number: I9
Poster - AFRL Field Campaign During the 21 August 2017 Solar Eclipse

Authors: AFRL Field Campaign Team

Abstract: AFRL conducted a field campaign in August 2017 around the time of the solar eclipse over the continental United States. Three DPS4D Digisondes were deployed

from Georgetown, South Carolina to Key West, Florida. Two additional digisondes at the University of Florida Gainesville and Eglin AFB also supported the campaign. The goal was to investigate oblique propagation and its assimilation into ionospheric models. Preliminary observations from the eclipse day of the campaign are presented.

Ghoddousi-Fard, Reza (Natural Resources Canada)*EPOSTER
Poster Number: I14
Poster - High latitude GPS and GLONASS 1Hz phase rate measurements during geomagnetic storms: Case studies

Authors: Reza Ghoddousi-Fard, Paul Prikryl, Knut S. Jacobsen, Tibor Durgonics, François Lahaye

Abstract: Ionospheric irregularities over high latitudes are driven by coupling processes between the solar wind and the Earth's magnetic field. This includes polar cap patches that can also be considered a part of the coupling process. At auroral latitudes, the ionosphere is primarily structured by energetic particle precipitation, particularly during auroral breakups and substorms. Intense auroral emissions can cause ionospheric irregularities with a wide range of spatiotemporal scales. Several studies based on GNSS observations confirm that phase disturbances are primarily a night time phenomenon over auroral latitudes whereas they shift to polar latitudes during local noon hours. However, during geomagnetic storm periods GNSS phase disturbances may present complex spatiotemporal distributions.

Networks of continuously operating high rate geodetic-quality GNSS receivers observing multi-constellations provide a critical advantage to study small-scale ionospheric irregularities. In this presentation, high rate (1Hz) GPS and GLONASS phase rate measurements during geomagnetic storms in July 16-17 and September 7-8, 2017 are studied over high latitudes. These geomagnetic storms, caused by coronal mass ejections, resulted in instances of Auroral Electrojet (AE) index exceeding 1500nT and 2000nT respectively. Dual frequency measurements of geodetic-quality GNSS receivers over Canada, Norway and Greenland are processed to derive a proxy phase scintillation index. Receiver and constellation specific background phase noise are evaluated and taken into account to compare and combine GPS and GLONASS phase rate measurements. The resulting GNSS proxy phase scintillation indices as a function of time and latitude are correlated with ground magnetic observations and AE indices. This is aimed for studying the intensity and spatiotemporal distribution of GNSS phase disturbances as the storms evolve.

[NRCan Contribution number: 20170377]

González, José Juan (Universidad Nacional Autonoma de Mexico)
Poster Number: S18
Poster - Development of a Magnetohydrodynamic (MHD) model in non-local thermodynamic equilibrium (NLTE) to study the upper solar atmosphere

Authors: Victor De la Luz

Abstract: In this paper, we develop a MHD model in the NLTE approximation by coupling the Newtonian CAFE MHD code (González-Avilés et al. 2015) with PakalMPI (De la Luz et al. 2010). Newtonian CAFE solves the ideal and resistive MHD equations considering a fully ionized plasma. On the other hand, PakalMPI solves the ionization states using the NLTE approximation for Hydrogen, electronic densities and H-. The resulting code solves the MHD equations and calculates the densities of the different species using the NLTE approximation in each time-step. As a first application of the code, we study the contribution of the different ionization states in the case of an equilibrium solar chromosphere described by the C7 model (Avrett & Loeser 2008).

Gopalswamy, Nat (NASA Goddard Space Flight Center)
Poster Number: S19
Poster - FRED: Flux Rope from ruption Data

Authors: S. Akiyama, S. Yashiro, and H. Xie

Abstract: We report on a new technique that can construct a coronal mass ejection (CME) flux rope (FR) from eruption data at the Sun: photospheric line-of-sight magnetogram of the source region, post-eruption arcades in the corona, and white-light CME images. A flux-rope fit to the white-light CMEs gives the geometric properties of the CME. The FR magnetic properties are derived from the fact that the observed reconnection flux in the source region is the same as the poloidal flux of the FR that originates as a consequence of the reconnection process. Thus the FRED (Flux Rope from Eruption Data) technique fully defines the coronal flux rope. Assuming that the FR is force free and self-similarly expands, we can get the FR properties at any point in the heliosphere. Comparing the coronal and interplanetary properties of a large number of flux ropes, we show that the FRED technique results in realistic predictions of the FR magnetic field components at 1 AU making it a useful space weather prediction tool. Numerical simulations of CME propagation with a FR input derived from the FRED technique have been shown to result in better space weather predictions.

Guedes dos Santos, Luiz Fernando (NASA - Goddard Space Flight Center/ IACS - Catholic University of America)
Poster Number: S12
Poster - Measuring CME angular width and angular position

Authors: Teresa Nieves- Chinchilla (NASA-GSFC/IACS-CUA)

Abstract: Coronal mass ejections (CMEs) are large-scale explosions of magnetic field and plasma from the Sun's corona and the primary drivers of terrestrial space weather. The fastest CMEs can reach Earth in 1-5 days expanding in size as they travel due to their strong entrained magnetic fields. Single viewpoint observations require many assumptions to model the 3D CME dynamic and kinematic evolution. Using Earth-directed ICME events and different STEREO viewpoints we examine when some events

show over-expansion, significant deflection and/or rotation during their propagation. To that effect, we analyze the initial stages of CMEs using coronagraphs observations and tracking the changes in the features throughout the heliosphere. Methods of measuring, tracking CMEs in the corona and inner heliosphere have been developed using hemispheric observations such as LASCO, STEREO or contribution of both. Developing a new semi-automated methodology to compare STEREOs images is providing interesting results and showing the implications of the assumptions of radial propagation and self-similar expansion.

Hosseini, Poorya (University of Colorado Denver)
Poster Number: M9
Poster - Investigating Magnetospheric Wave-Particle Dynamics with Ground based Observations

Authors: Poorya Hosseini, Mark Golkowski, Vijay Harid

Abstract: Solar driven phenomenon causes relativistic particles that form the Earth's radiation belts. The distribution of this energetic particles is extremely variable, with the trapped flux changing by several orders of magnitude on timescales of a few hours to days. These energetic particles pose a significant hazard to satellites and astronauts in the near-Earth space environment.
Additionally, the Earth’s magnetosphere hosts a large number of wave modes, which interact with the high energy particles of the Earth’s radiation belts. One of the most dominant players is believed to be magnetospheric whistler mode waves. These interactions can lead to pitch-angle scattering of these energetic particles where a portion of the particles would fall into the loss cone lowering the altitude of their mirror point to a level where they are absorbed by the atmosphere. The exact generation processes of these wave-particle interactions are not well understood but are known to be coupled to the energy dynamics behind space weather.
Although the availability of spacecraft observations has improved rapidly in recent years, providing higher resolution data of magnetospheric emissions or energetic particles in the radiation belts, ground based observation of these emissions are still an important tool. Ground based receivers let researchers investigate a specific L shell of the magnetosphere over a long duration with the capability of higher storage capacity essential for certain long-term and statistical studies of wave properties. We show recent theoretical and numerical results for concurrent observation of whistler mode and triggered emissions.

Housseal, Sara (Millersville University of Pennsylvania)
Poster Number: G8
Poster - Aurorasaurus and Meteorology Student Contributions to Communicating Space Weather

Authors: Sara Housseal

Abstract: Undergraduate student involvement with the Aurorasaurus project provides experience and creates a larger public audience. Aurorasaurus is a citizen science project

that uses Twitter to report auroras from the ground up. The project focuses on using different communication outlets to share information on auroras with the goal being to learn how far reaching aurora can be with different solar storms, and test our prediction of the intensity. The students help share space weather information and the auroral sightings from professionals and amateurs alike. There are three main areas of student involvement which consist of writing a newsletter on behalf of the project, creating blog posts, with the upcoming post focusing on the use of Aurorasaurus for meteorologists, and most importantly keeping the Twitter page active with tweets pre-aurora, post-aurora, and retweeting and interacting with follows during the aurora.

Hurlburt, Neal (Lockheed Martin ATC)
Poster Number: S1
Poster - reliminary results from imaging the far corona in EUV: SUVI Extended Corona Observations

Authors: Dan Seaton, Lawrence Shing, Greg Slater, Margaret Shaw, Ralph Seguin, Robin Minor, Calvin Nwachuku

Abstract: Direct imaging of the solar corona well beyond the fields of views of existing EUV instruments has recently been demonstrated by SDO/AIA and Proba/SWAP off-pointings. They demonstrate that there is a measurable signal out to almost 2.5 Rsun. These encouraging results inspired the SUVI team to investigate even wider fields of view, to over 4 Rsun. The Lockheed Martin SUVI team in conjunction with NOAA and NASA collected data using the SUVI instrument on GOES-16 at six different pointings over approximately one hour to assess the feasibility of direct imaging the outer corona. This was done twice during the week of February 12, 2018, with two programs involving different patterns and exposures. There is signal in the longer exposures out to the edge of the extended FOV, even though the Sun and its corona were in quiet states at the time. We present preliminary results and some thoughts on future directions.

Jackson, Bernard (University of California, San Diego)*EPOSTER
Poster Number: S32
Poster - Iterative heliospheric tomography analyses using time-dependent 3-D MHD models as kernels

Authors: Hsiu-Shan Yu, P. Paul Hick, Andrew Buffington, Dusan Odstrcil, and Nick Pogorelov

Abstract: The members of our group at the University of California, San Diego have developed an iterative remote-sensing time-dependent three-dimensional (3-D) reconstruction technique which provides volumetric heliospheric maps of density, velocity, and magnetic field. This technique, applied in near real time for over 15 years with a kinematic model approximation, currently fits data from ground-based interplanetary scintillation (IPS) observations and forecasts both the background solar wind and space weather events. This modeling concept extends volumetric data from an inner boundary placed above the Alfvén surface out to the inner heliosphere. We now use

this technique to drive 3-D MHD models at their inner boundary and generate output 3-D data files that are fit to remotely-sensed observations, and iterated. To facilitate this process, we have developed a traceback from input 3-D MHD volumes to yield an updated boundary in density, temperature, and velocity, which also includes magnetic-field components. Here we show examples of this analysis using IPS data and the ENLIL 3D-MHD and the University of Alabama Multi-Scale Fluid-Kinetic Simulation Suite (MS-FLUKSS) heliospheric codes. In addition to providing good forecasts of space weather, these analyses can refine poorly-known 3-D MHD variables (i.e., density, temperature), and parameters (gamma) by fitting heliospheric remotely-sensed data between the region near the solar surface and in-situ measurements obtained near Earth.

Jones, Andrew (University of Colorado)
Poster Number: S3
Poster - Solar EUV irradiance measurements from GOES-16

Authors: Andrew Jones

Abstract: The space weather suite of instruments on the new series of GOES-R satellites includes a new EUV spectrometer. These spectrometers make line-irradiance measurements, that form the input to an operational proxy-model that produces an EUV spectrum.
Rather than talking about the model though, I will talk about the irradiance measurements that the GOES-16 -EXIS instrument is taking.

Jones, Andrew (University of Colorado)
Poster Number: S15
Poster - Machine Learning for Space Weather

Authors: Stephane Beland, Wendy Carande, James Craft, Andrew Jones, Kim Kokkonen, Laura Sandoval, Doug Smith

Abstract: We will discuss the plans we have at LASP for applying machine learning to the prediction of solar eruptive events

Jones, Jim (Northrop Grumman)
Poster Number: I12
Poster - Thermospheric Effects on Low Earth Orbit

Authors: James C. Jones

Abstract: Earth's Thermosphere is the operating environment for satellites in Low Earth Orbit (LEO). A combination of repeated weak solar cycles and carbon dioxide enhanced thermospheric cooling is reducing density at LEO altitudes, which reduces atmospheric drag, and exacerbates the debris problem by allowing spacecraft and debris to remain in orbit for much longer durations. Knowledge of these effects allows for decisions to enforce debris mitigation measures, improve orbit selection methodologies, improve

neutral density specification models, and improve atmospheric drag computations for conjunction analysis and reentry.

Keebler, Timothy (Millersville University of Pennsylvania)
Poster Number: G9
Poster - Space Weather Academic Network (SWAN)

Authors: Timothy Keebler, Colin Eberwein

Abstract: The newly-formed Space Weather Academic Network (SWAN) serves as an interface for colleges and universities with programs, curricular components, or interests in space weather. SWAN provides a locus for multi-institutional collaboration and cooperation and promotes the broad and emergent field of space weather through education and engagement across the scientific community. Through SWAN, students will be able to network and share research opportunities and internship experiences. The network helps to inform the public about space weather and promotes undergraduate and graduate education in related fields, while providing cohesion in an educational niche. We are currently seeking additional partner institutions to increase the scope of the network.

Kelbert, Anna (U.S. Geological Survey)
Poster Number: M11
Poster - Geoelectric field estimation and power-line integration using a 3D electrical conductivity model of the United States

Authors: Anna Kelbert, Christopher C. Balch, Greg M. Lucas, E. Joshua Rigler

Abstract: Estimation of ground-level geoelectric fields has been identified by the electrical power industry as a key capability in assessment and mitigation of the impacts of space weather on electrical power infrastructure. One approach to estimation of ground-level geoelectric fields in the United States is to employ the best available three-dimensional Earth conductivity models (Meqbel et al., 2014; Yang et al., 2015; Murphy & Egbert, 2017 and others). These models are the results of regional magnetotelluric inversions based on NSF's Earthscope USArray impedances (Schultz et al., 2006-2018). The work on the 3D conductivity models is ongoing as new USArray data are obtained, and new methods for improved magnetotelluric inversion are developed. Here, we describe the initial USGS compilation of 3D electrical conductivity models for the United States. We analyze the high-resolution gridded Earth impedances obtained in selected regions of the United States, and discuss the effects of impedance grid resolution on the electric fields integrated along power lines, which serve as proxy for geomagnetically induced current (GIC) amplitude. Our approach also allows us to analyze the effects of magnetotelluric distortion due to the small-scale near-surface anomalies on the GIC proxy. This analysis feeds into the development of operational Geoelectric Field Maps at NOAA's Space Weather Prediction Center (SWPC), a system for close to real-time estimation of spatially variable ground-level geoelectric fields. Initial experimental capability is now available to the public at SWPC's website. The deployment of these

maps represents a significant advance in the specification of space weather hazards compared to what was previously available, i.e. global geomagnetic indices, providing the electrical power industry with a tool to assess regional space weather hazards in close to real-time (no more than a several mins data latency). Nonetheless, the developers are keenly aware of limitations and uncertainties of current capabilities and highlight key priorities needed for future improvements. We encourage the community to make use of these operational tools to assist us in cross-comparison and validation.

Kouassi, Nguessan (Université Felix Houphouet Boigny Abidjan-Cote d'Ivoire)
Poster Number: M12
Poster - Geomagnetically Induction effects related to impulsive Space Weather events at low latitudes

Authors: Nguessan KOUASSI ,Vafi DOUMBIA, Boka KOUADIO

Abstract: We examined the influences of geomagnetic activity on the Earth surface electric field variations at low latitude. The induced effects of space weather related geomagnetic disturbances in the EEJ influence area in West Africa are examined. In that purpose, variations of the North-South (Ex) and East-West (Ey) components of geo-electric field are analyzed, along with that of the three components (H, D and Z) of geomagnetic field during the geomagnetic storm of 17/02/1993 and the solar flare of 04/04/1993. On the Basis of the ground conductivity model in this region, the Geomagnetically induced current (GIC) was estimated from the geo-electric field variations observed during the considered geomagnetic disturbances.

Kress, Brian (NOAA-NCEI and CIRES at CU Boulder)
Poster Number: S21
Poster - Observations of 2017 Solar Particle Events from Particle Detectors On-Board NOAA's Newest Space Weather Monitor

Authors: Brian T. Kress, Juan V. Rodriguez, Athanasios Boudouridis, and Bronislaw Dichter

Abstract: NOAA's newest Geostationary Operational Environmental Satellite, GOES-16, was launched on 19 November 2016. GOES-R series space weather instrumentation includes two Solar and Galactic Proton Sensor (SGPS) units (east and west facing). SGPS measures protons with energies from 1 MeV to > 500MeV in 14 differential energy channels. During 2017, solar activity associated with co-rotation interaction regions (CIRs) and several Solar Energetic Particle (SEP) Events provided opportunity for cross calibration of SGPS with GOES-13, -14, and -15 Energetic Particle Sensor (EPS) observations. This presentation will give an overview of SGPS SEP observations during 2017, including the 14-15 July 2017 and September 2017 solar particle events.

Lauer, Chris (NOAA, Space Weather Prediction Center)
Poster Number: G4
Poster - SWPC Dissemination Modernization

Authors: Steven Hill, Marcus England, Kiley Gray, Steven Hill, Ben Rowells

Abstract: SWPC will be modernizing its dissemination services to improve customer service by moving to more modern, scalable technologies. We will be enhancing our Twitter services @NWSSWPC to add automated text products currently issued via email with our Product Subscription Service (PSS). We will also be expanding our web-based data service to include a broader suite of observation, guidance, and forecast products. In this poster, we first summarize customer needs and current dissemination methods. Then we look more specifically at “push” and “pull” methods in use now, along with their limitations. Finally, we describe the enhancements to Twitter and the data service. The first of these changes, as well as more detailed plans, are presented. We welcome feedback as we deploy these changes and refine them to best meet your needs.

Leka, KD (NWRA)
Poster Number: S16
Poster - Operational Flare Forecasting Benchmarks and Initial Performance Comparisons

Authors: KD Leka, S.-H. Park, K. Kusano, and the Third International Flare Forecasting Team (J. Andries, G. Barnes, S. Bingham, S. Bloomfield, A. McCloskey, D. Falconer, M. Georgoulis, J. Jing, Y. Kubo, K. Lee, S. Lee, L. Mays, J. Mun, S. Murray, T. Hamad Nageem, R. Qahwaji, M. Sharpe, R. Steenburgh, G. Steward, M. Terkildsen

Abstract: It is the end of a magnetic cycle, and we recently asked two questions: (1) "How well do operational flare forecasting methods presently work?" and (2) "What is needed to quantitatively answer that question to begin with?" We present here select preliminary results from a recent workshop, "Benchmarks for Operational Solar Flare Forecasts" held at the Institute for Sun-Earth Environmental Research (ISEE) in Nagoya, Japan, in late 2017. Numerous operational methods (including NOAA/SWPC, MetOffice, NICT, Mag-4, ASAP, ASSA, A-EFFORT, BoM/FlareForecast, ASSA, AMOS, DAFFS, and MCSTAT) were tested in a head-to-head performance exercise. Results are quantified using standard validation metrics, with a preference for metrics based on the probabilistic forecasts (rather than categorical results which are impacted by probability thresholds). We discuss how to best assess the relative performance of different methods, and present an initial analysis of general method attributes, addressing questions centered on ``which approaches lead to improvement in operational performance, and which approaches do not?"

Support for the workshop and this analysis is acknowledged from the Nagoya University/ISEE Center for International Collaborative Research (CICR).

Lindsey, Charles (NorthWest Research Associates)*EPOSTER
Poster Number: S31
Poster - New Space-Weather Forecasting Applications of Seismic Monitoring of the Sun's Far Hemisphere

Authors: Charles Lindsey, Joseph Werne, Alina Donea

Abstract: A major spin-off of helioseismology in the advent of the Solar Heliospheric Observatory was the ability to monitor large active regions in the Sun's far hemisphere. This is accomplished today by the computational application of basic principles in wave optics to helioseismic observations of the Sun's near hemisphere by NASA's space borne Solar Dynamics Observatory (SDO) and by NOAA's ground-based Global Oscillations Network Group (GONG). These are available as a supplement to direct EUV observations from NASA's twin STEREO spacecraft, which view the Sun directly from the far side of the Solar system. STEREO will soon begin to lose its far-side vantage as its spacecraft drift back into the Earth-side of the solar system.

The helioseismic monitor is clearly sensitive to strong magnetic fields. However, like EUV intensities, helioseismic signatures are independent of the sign of the polarity of the fields which give rise to them. Nick Arge (now at NGSFC), Carl Henney (AFRL) and colleagues introduced techniques using the Hale Polarity Law to project signed magnetic polarity distributions from EUV observations. With Gordon McDonald (NMSU, Las Cruces) they have successfully extended these techniques for application to helioseismic signatures. Their methods match individual helioseismic signatures with simple magnetic bipoles consistent with the Hale Law. Our study explores the extension of these projections to more complex magnetic configurations composed of two or more such bipoles. More realistic such assessments of magnetic regions born in the Sun's far hemisphere would facilitate projections of the global coronal magnetic field. This would lead to improved forecasting of coronal holes and associated high-speed streams on a time scale of 1--3 weeks after the appearance new seismic signatures in the far hemisphere. More realistic signed-magnetic-flux distributions could also lead to improved forecasts of solar EUV irradiance on times scales of 1--14 days.

Loucks, Diana (United States Military Academy)
Poster Number: I6
Poster - GPS L1 Scintillation Detection Using a Novel 3-Dimensional PFISR Mode

Authors: Diana Loucks, Geoff Crowley, Scott E Palo, Roger Varney, Ashton Reimer, Donald Hampton, Marcin Pilinski

Abstract: A novel operating mode for PFISR has been refined to support the study of GPS L1 scintillations arising from electron density gradients over Alaska. Previous analyses have indicated a strong correlation between auroral impact ionization and GPS scintillation using PFISR derived electron density data along the GPS line of site, in conjunction with digital all-sky imagery. This analysis combines all three techniques to determine both gradient parameters as well as the most likely ionospheric source, including a conjunction analysis between GPS signals and known PFISR beams. Radar experiments were conducted with a three-dimensional approach using a central beam along the GPS line of site surrounded by four beams in a cross pattern to detect ionospheric conditions within +/- 2º of the central beam. Digital all-sky imagery where

available was used to confirm the auroral activity present. This approach was used to study numerous scintillation events during an observation campaign covering eight winter months across 2017 and 2018. Initial results indicate a continued trend of scintillation events linked to primarily E region enhancements.

Lucas, Greg (USGS)*EPOSTER
Poster Number: M17
Poster - Calculating realistic voltages across the US power grid utilizing measured impedances and magnetic fields

Authors: Greg M. Lucas, Jeffrey J. Love, Anna Kelbert, Paul A. Bedrosian, E. Joshua Rigler

Abstract: Space weather induces significant geoelectric fields within Earth's subsurface that can adversely affect electric power grids. The complex interaction between space weather and the solid Earth has traditionally been approached with the use of simple 1-D impedance functions relating the inducing magnetic field to the induced geoelectric field. Ongoing data collection through the NSF EarthScope program has produced empirical impedances across much of the continental US that we can now use.
In this work, impedances are convolved with magnetic field variations, obtained from USGS magnetic observatories, during a geomagnetic storm. This convolution produces geoelectric fields within the earth. These geoelectric fields are then integrated across power transmission lines to determine the voltage generated within each power line as a function of time during a geomagnetic storm.
The voltages generated within the electric power grid will be shown for several historic geomagnetic storms. In combination with grounding resistance data and network topology, these voltage estimates can be utilized by power companies to estimate geomagnetically-induced currents throughout the network. These voltage estimates can provide information on which power lines are most vulnerable to geomagnetic storms, and assist power grid companies investigating where to install additional protections within their grid.

Maruyama, Naomi (NOAA/NWS)*EPOSTER
Poster Number: I15
Poster - Impact of Lower Atmospheric Forcing on Storm Time Response of the Ionosphere-Plasmasphere-Magnetosphere Coupling

Authors: Joe Schoonover, George Millward, Tzu-Wei Fang, Tim Fuller-Rowell, Adam Kubaryk, Zhuxiao Li, Houjun Wang, Rashid Akmaev, Valery Yudin, Bob Oehmke, Cecelia Deluca, Raffaele Montuoro, Weiyu Yang, Mark Iredell, Sam Trahan, Jacques Middlecoff, Mark Govett, Mariangel Fedrizzi, Rodney Viereck, Mick Denton, Michael Henderson, Yuki Obana, Toshi Nishimura, Marc Hairston, Anthea Coster, Phil Richards, Jimmy Raeder

Abstract: This study aims to evaluate the impact of whole atmospheric coupling on storm time response in the ionosphere and plasmasphere during geomagnetically

disturbed periods. The influence of coupling to terrestrial weather during storm time has drawn little attention. There are some unresolved questions: Whether or not the geo-effectiveness of magnetic storms could be changed when the upper atmosphere has been pre-conditioned by the lower atmospheric forcing; How does the lower atmospheric forcing modulate the recovery to a quiet level from a disturbed level? Recently, we have coupled the Ionosphere-Plasmasphere-Electrodynamics (IPE) model with the Whole Atmosphere Model (WAM) to investigate the connection between terrestrial and space weather. This presentation focuses on how some typical storm time phenomena in the ionosphere and plasmasphere are affected by the inclusion of forcing from below during geomagnetically active periods in simulations performed using the coupled WAM-IPE model. The presentation focuses on such phenomena as (1) temporal and spatial evolution of the Storm Enhanced Density (SED) plumes/Tongue of Ionizations (TOIs); (2) hemispheric asymmetry in SED plumes/TOIs; (3) Ionosphere-Plasmasphere-Magnetosphere Coupling via plumes and refilling, for the two St. Patricks' day storms in 2013 and 2015. The impact of lower atmospheric forcing is evaluated by comparing results with and without including forcing from below. Furthermore, the presentation discusses how the lower atmospheric forcing can influence the differences in storm time response in the ionosphere and plasmasphere.

Matson, Liza (USAFA)
Poster Number: I1
Poster – The Falcon Space Weather Sensor (FalconSWS) for Polar Earth Orbits

Authors: Brandon A. Pierce, Liza K. Matson, Carlos A. Maldonado, and Matthew G. McHarg

Abstract: The Falcon Space Weather Sensor (FalconSWS) is a miniature sensor suite designed to measure charged particle distributions in the ionosphere using a parallel plate electrostatic analyzer (ESA). The ionosphere is typically defined as the layer of the Earth's atmosphere that is ionized by solar and cosmic radiation existing at altitudes from 100 to 1000 km. One of the main contributors of the collected currents on spacecraft surfaces during transit of the auroral regions in polar earth orbits (PEO) is the energetic precipitating electrons trapped in Earth’s magnetic field lines. Satellites in polar earth orbits can undergo rapid surface charging to potentially hazardous levels, affecting multiple aspects of the satellite’s ability to function nominally, as they are exposed to the energetic electron flux. High spacecraft potential differences of several hundreds of volts relative to the ambient plasma can occur as spacecraft transit the auroral regions and these potential differences have been shown to be the cause of many spacecraft anomalies due to resulting electrostatic discharges. FalconSWS is designed to detect auroral electrons in the lower end of the energy spectrum from 0 to 3keV in PEO. The design, development, and testing of the prototype electron detector has been conducted at the Space Physics and Atmospheric Research Center (SPARC) at the United States Air Force Academy. Numerical and computational analyses using SIMION has led to successful initial analysis and design of the instrument discussed in this work. A charged particle detector such as the FalconSWS fills a critical role as the last of the (Defense Meteorological Satellite Program) DMSP satellites approach their end of effective mission life. It is critical to continue gathering

data about the space environment in an effort update environmental models by collecting more refined in-situ data. Additionally, with the small size of FalconSWS, it has been developed as a rugged, mass-producible survey instrument for a wide range of potential spacecraft. The numerical analysis and SIMION simulations have been completed, along with the final build of the prototype; therefore, the FalconSWS instrument will now begin functional testing against a known energetic electron source. The functional testing will be conducted using a Kimball Physics FRA-2X1-2 flood electron gun capable of producing a mono-energetic electron beam. The FalconSWS will be cross-calibrated against a flight qualified integrated miniaturized electrostatic analyzer (iMESA) in order to further validate the experimental results. The iMESA has extensive flight heritage and has flown on MISSE-7, FalconSAT-2, FalconSAT-3 and is currently flying on STPSAT-3. Validating FalconSWS against flight hardware will provide further confidence in its ability. Based on the current data from the simulations made to date, we are confident moving forward with a new instrument designed to help continue to characterize the space environment.

Matthiä, Daniel (German Aerospace Center (DLR))
Poster Number: S22
Poster - Solar cosmic ray dose rate assessments during GLE 72 using MIRA and PANDOCA

Authors: Daniel Matthiä, Kyle Copeland, Matthias M. Meier

Abstract: Exposure from cosmic radiation at aviation altitudes can be elevated during solar energetic particle events compared to the omnipresent galactic cosmic ray background. The largest of these events can be measured on ground as so-called Ground Level Enhancements (GLE). GLE 72, which occurred 10 Sept. 2017, was the more recent of the two solar particle induced ground level enhancements in solar cycle 24 in which GLEs have been unusually rare. Larger GLEs can significantly increase ionizing radiation dose rates at aviation altitudes for hours to days, leading to concern among crewmembers. One way to provide real time monitoring and preliminary evaluation of solar particle events, including GLEs, in regard to effective dose rates at aviation altitudes is to use real time measurements of the cosmic ray intensity, for instance GOES proton measurements, in combination with numerical models for the calculation of radiation exposure at aviation altitudes. In this work, the PANDOCA and MIRA models which have been developed for this purpose are compared. PANDOCA has been developed by the German Aerospace Center (DLR) and can be applied both to galactic cosmic radiation and solar energetic particle events. MIRA is based on CARI-7A and part of the latest Solar Radiation Alert System (SRAS) of the U.S. Federal Aviation Administration.
For GLE72, the models consistently predict increases in the radiation exposure at aviation altitudes, i.e. below 50000 ft, which were on the order of or below the galactic cosmic ray background. Increases in dose rate were limited to high latitudes as the primary solar particles were strongly suppressed by the geomagnetic shielding.

McCloskey, Aoife (Trinity College Dublin, Ireland)
Poster Number: S17

Poster - Flare Forecasting & Sunspot Group Evolution

Authors: Aoife E. McCloskey, Peter T. Gallagher, D. Shaun Bloomfield

Abstract: Previously, McIntosh white-light classifications of sunspot groups and their historical flare rates have been used to calculate Poisson probabilities for flare forecasting. However, no operational flare forecasting method has yet to take into account temporal evolution in sunspot classifications. Here, we examined the temporal evolution of sunspot group McIntosh classifications and calculated average flare rates for the following 24-hour periods. These flaring rates were then used as the basis for a new evolution-dependent forecasting method (MCEVOL). The performance of this method was evaluated and will be presented via the application of standard forecast verification measures, along with direct comparison to the previous point-in-time McIntosh forecasting method. In addition to this, we have explored the application of modern machine learning techniques as an alternative to Poisson-based probabilities for this method and preliminary results will be presented.

McCollough, James (Air Force Research Laboratory)
Poster Number: M3
Poster - DSX Space Weather Experiments (SWx): Capabilities and Science Plans

Authors: W. R. Johnston, J. P. McCollough, Y.-J. Su, and M. J. Starks

Abstract: The Air Force Resarch Laboratory's Demonstration and Science Experiments (DSX) mission will be launched in early 2018 to investigate wave-particle interactions and the particle environment in medium Earth orbit (MEO). It includes the Space Weather Experiment (SWx) package of five particle instruments which will collectively observe electrons from 30 eV to 10 MeV and protons from 30 eV to 400 MeV. DSX will conduct concentrated study of dynamics of the slot region using pitch-angle resolved electron measurements together with separate wave measurements. The Low Energy Electrostatic Analyzer (LEESA), with 5 angular zones for electrons and ions from 30 eV to 50 keV, has highly flexible programmable operating modes which will support study of fine structure and dynamics in the MEO wave plasma environment. We will review SWx observation plans and expected sampling.

Mertens, Chrisopther (NASA Langley Research Center)
Poster Number: S24
Poster - Recent Updates and Improvements to the Nowcast of Atmospheric Ionizing Radiation for Aviation Safety (NAIRAS) Model
Authors: Christopher J. Mertens

Abstract: The NASA Nowcast of Atmospheric Ionizing Radiation for Aviation Safety (NAIRAS) model is a real-time, global, physics-based model for predicting exposure to cosmic radiation to air travelers from both galactic and solar sources. Tabular and

graphical data products from the prototype operational NAIRAS model are available via its public web site. The transport of cosmic radiation through the atmosphere is modeled in NAIRAS using the High Charge (Z) and Energy Transport (HZETRN) code. The transport procedures in NAIRAS have been recently updated by transitioning from HZETRN version 2010 to version 2015. The most important update in HZETRN2015 for the application of the NAIRAS model is the inclusion of pion-initiated electromagnetic cascade processes. The improvements to the NAIRAS model predictions, as a result of updating to the HZETRN2015 code, are quantified by comparing to various aircraft measurements and measurements obtained from the Radiation Dosimetry Experiment (RaD-X) flight campaign.

Mojica, Jonh (Utah State University)
Poster Number: G5
Poster - Tests of Radiation Damage Threshold of Raspberry Pi Zero in LEO Environment for OPAL CubeSat Project

Authors: Jonh Carlos Mojica Decena, JR Dennison, Brian Wood, Ryan Martineau, Michael J. Taylor

Abstract: The use of CubeSats for space research has become of great interest in part due to the use of inexpensive microprocessors or commercial of the shelf (COTS) components. Design of electronics that can maintain full functionality over the duration of the mission requires careful determination of the space radiation environment and total ionizing dose (TID) delivered to the components in different orbits. Larger, more expensive, or longer mission satellites tend to use more expensive components than the ones used in CubeSat to assure reliability. Radiation survivability of a Raspberry Pi Zero was studied with the USU Space Survivability Test Chamber to simulate the space radiation using 0.2 to 2.5 MeV beta radiation from a Sr90 source. These tests determined the amount of ionizing radiation that the memory and processor units can be exposed to before they exhibit radiation-induced damage or stop working altogether. The results were used to determine how much shielding the processor would need to work reliably over the mission lifetime. These results will be used for the USU-led OPAL CubeSat, which will incorporate a Raspberry Pi as its basic processor unit and data collector, to determine if this inexpensive microcomputer will survive the TID received during its 1-2 years mission in LEO, or up to >200 krad TID.
*Supported through partial funding from an URCO grant from the USU Office of Research and Graduate Studies.

Panasenco, Olga (Advanced Heliophysics)*EPOSTER
Poster Number: S33
Poster - The Solar Wind from Pseudostreamers and their Environs: Opportunities for Observations with Parker Solar Probe and Solar Orbiter

Authors: Marco Velli (UCLA), Aram Panasenco (UCLA), Roberto Lionello (PSI)

Abstract: The solar dynamo and photospheric convection lead to three main types of structures extending from the solar surface into the corona - active regions, solar filaments (prominences when observed at the limb) and coronal holes. These structures exist over a wide range of scales, and are interlinked with each other in evolution and dynamics. Active regions can form clusters of magnetic activity and the strongest overlie sunspots. In the decay of active regions, the boundaries separating opposite magnetic polarities (neutral lines) develop specific structures called filament channels above which filaments form. In the presence of flux imbalance decaying active regions can also give birth to lower latitude coronal holes. The accumulation of magnetic flux at coronal hole boundaries also creates conditions for filament formation: polar crown filaments are permanently present at the boundaries of the polar coronal holes. Mid-latitude and equatorial coronal holes - the result of active region evolution - can create pseudostreamers if other coronal holes of the same polarity are present. While helmet streamers form between open fields of opposite polarities, the pseudostreamer, characterized by a smaller coronal imprint, typically shows a more prominent straight ray or stalk extending from the corona. The pseudostreamer base at photospheric heights is multipolar; often one observes tripolar magnetic configurations with two neutral lines - where filaments can form - separating the coronal holes. Here we discuss the specific role of filament channels on pseudostreamer topology and on solar wind properties. 1D numerical analysis of pseudostreamers shows that the properties of the solar wind from around PSs depend on the presence/absence of filament channels, number of channels and chirality at thepseudostreamer base low in the corona. We review and model possible coronal magnetic configurations and solar wind plasma properties at different distances from the solar surface that may be observed by Parker Solar Probe and Solar Orbiter.

Panasenco, Olga (Advanced Heliophysics)*EPOSTER
Poster Number: S26
Poster - Predicting the Orientation of the Bz Component of CMEs

Authors: Marco Velli (UCLA)

Abstract: We present a step-by-step procedure to forecast the magnetic field vector B and more specifically the Bz component associated with the passage of the Coronal Mass Ejections (CMEs) at 1 AU via observational and modeling efforts. This is a fundamental component in determining the geoeffectiveness of Interplanetary (I)CMEs. We discuss a detailed observational and modeling investigation of pre-eruptive filament channels and filaments (prominences at the limb), the source regions of CMEs on the sun, to determine the direction of the tangential component of the magnetic field in the source region before CMEs (chirality), its evolution during CME deflection and rotation when filaments erupt.

We analyze the local and global magnetic background near the CME source region to predict the
possible changes in the CME orientation during the essential early stages of the eruption when
magnetic pressure and tension of the surrounding field are still significant compared to that in the

CME. The question we will answer: What is the direction of the magnetic field vector B in a preeruptive system, with emphasis on the axial field, and how does it evolve in the early stages of
eruption in the low corona?

Pankratz, Chris (Univ of Colorado / LASP)
Poster Number: G3
Poster - Facilitating Advancements in Space Weather Data Availability Through a Space Weather Testbed and Data Portal

Authors: James Craft, Thomas Berger, Thomas Baltzer, Fernando Sanchez, Daniel N. Baker, Allison Jaynes, Scot Elkington

Abstract: Society has grown reliant on complex and highly interconnected technological systems, which makes us increasingly vulnerable to the effects of space weather events. An extreme space weather event today could conceivably impact many of the crucial systems we rely on, including disrupting operating earth-orbiting satellites, potential collapse of electrical grids, and impairing navigation, communication, and remote sensing capabilities. Thus, it is imperative that the scientific community address the question of just how severe events might become and to ensure stakeholders have access to the essential data needed for research and decision making. Stakeholders need to be informed by the facts on what might happen during extreme conditions. This requires measurements, models, and associated data products to be available via the most effective data discovery and access methods possible.

Similarly, advancement in the fundamental scientific understanding of space weather processes is also vital, requiring that researchers have convenient and effective access to a wide variety of data sets and models from multiple sources. The space weather research community, as with many scientific communities, must access data from dispersed and often uncoordinated data repositories to acquire the data necessary for the analysis and modeling efforts that advance our understanding of solar influences and space physics on the Earth's environment. The University of Colorado (CU) is a leading institution in both producing data products and advancing the state of scientific understanding of space weather processes, is well positioned to address many of these issues. CU is inaugurating a dedicated Space Weather Technology, Research, and Education Center (SWx TREC) that will serve many of these needs, including implementation of an interoperable data portal intended to more effectively serve the needs of the Space Weather research community, as well as facilitating the advancement of models into production/operational use. In this poster, we will outline the motivating factors for effective space weather data access and present plans and methods for meeting model testing/incubation needs, as well as the data management and access needs of the disparate communities who require space weather data and information.

Parker, Linda (USRA)
Poster Number: M5
Poster - Spacecraft Charging Material Properties Database

Authors: Joseph I. Minow, NASA

Abstract: The NASA Engineering and Safety Center Space Environments Technical Discipline Team is producing a material database to archive and distribute electrical properties of materials required for performing surface charging, internal charging, and radiation transport analyses. Information to be included in the database is collected from a variety of sources including the original NASCAP material property database and new test data from industry, academia, and government laboratories. Examples of relevant material parameters are volume and surface conductivity, dielectric constant, secondary electron and backscatter yields, photoelectric current density, and material density. In addition, full test reports describing the laboratory methods used to obtain the parameters will be archived when available. The goal is to provide a resource for the US and international spacecraft charging community to share the electrical material properties required for conducting charging analyses and spacecraft design. We will present an overview of the material database, as well as information on how to submit material information for inclusion in the database.

Parker, Linda (USRA)
Poster Number: S14
Poster - Comparison of Twin CME using PATH and PAMS

Authors: Gang Li, UAH

Abstract: We present results from both Particle Acceleration and Transport in the Heliosphere (PATH) and Particle Acceleration at Multiple Shocks (PAMS) models for a twin CME scenario. The PATH model follows a CME using a numerical MHD module and solves the Parker transport equation at the shock yielding the accelerated particle spectrum, while PAMS solves the steady-state cosmic ray transport equation at an individual shock analytically to yield the diffusive shock acceleration (DSA) spectrum. We address the injection of an upstream particle distribution into the acceleration process for a two shock system at 1 AU. Only those particles that exceed a theoretically motivated prescribed injection energy, E_inj, and up to a maximum injection energy (Emax) appropriate for quasi-parallel and quasi-perpendicular shocks (Zank et al., 2000, 2006; Dosch and Shalchi, 2010), are injected. Results from PAMS are then compared to observations at 1 AU from the Advanced Composition Explorer (ACE) spacecraft. In addition, we test the concept of electron acceleration at low injection energies for a single and multiple shock system using PAMS and its predecessor for Particle Acceleration at Single Shocks, PASS, using the same method as in Neergaard Parker and Zank, 2012 and Neergaard Parker et al., 2014.

Pettit, Jashua (University of Colorado)
Poster Number: I4
Poster - Comparison of Two Medium Energy Electron Datasets in WACCM

Authors: Josh Pettit, Cora Randall, Ethan Peck, Dan Marsh, Craig Rodger, Xiaohua Fang

Abstract: Precipitation into the atmosphere of protons and electrons from the Sun and radiation belts often leads to changes in chemistry throughout the middle and upper atmosphere. Solar protons have been studied thoroughly over the past few decades, and their effects are fairly well understood. Effects of precipitating electrons are less well understood, and uncertainties are largest for electrons with energies greater than ~30 keV. These electrons are underrepresented in modeling studies today, primarily because valid measurements of their precipitating spectral energy flux are lacking. Observations from the Polar Orbiting Environmental Satellites (POES) Medium Energy Proton and Electron Detectors (MEPED) constitute perhaps the best data set for determining the precipitating flux of electrons with energies between about 30 keV and 1 MeV. The MEPED data have known deficiencies, however, such as contaminating protons in the electron energy channels, poor spectral resolution, and insufficient coverage of the bounce loss cone. Several studies have been conducted to address these issues and produce precipitating electron data sets for use in atmospheric models. This presentation describes simulations from the Whole Atmosphere Community Climate Model (WACCM) that incorporated estimates of the differential spectrum of precipitating electron flux derived from POES measurements and based on the work of Peck et al. [2015] as well as the Coupled Climate Model Intercomparison Project version 6 (CMIP6). All simulations are run from 1 Jan 2004 to 1 June 2004, a time period during which significant energetic electron precipitation occurred. Comparisons between the WACCM results and satellite observations of odd nitrogen, hydroxyl, and ozone are presented.

Poduval, Bala (Space Science Institute)*EPOSTER
Poster Number: G7
Poster - Methods of Improving Space Weather Prediction

Authors: Bala Poduval

Abstract: There exist significant discrepancies between the current predictions of ambient solar wind, arrival times of CMEs and the intensity levels of related space weather events, and the respective observed quantities. Presented in this poster are alternate methods that are capable of predicting these quantities with greater accuracies. While these methods need further improvements, the results obtained so far are very promising. Reviewed in this presentation are some of the significant results obtained and the scope of these methods in future space weather predictions.

Pogorelov, Nikolai (University of Alabama in Huntsville)*EPOSTER
Poster Number: S29
Poster - Towards Real-time Modeling of Solar Atmosphere and Inner Heliosphere with the Multi-Scale Fluid-Kinetic Simulation Suite

Authors: David Hathaway, Tae Kim, Yang Liu, Talwinder Singh, Lisa Upton, and Mehmet Yalim

Abstract: Multi-Scale Fluid-Kinetic Simulation Suite (MS-FLUKSS) is a collection of modules designed to solve the MHD equations coupled with the kinetic Boltzmann equations for neutral atoms and Fokker-Planck equations for non-thermal ions. All simulations are performed on an adaptive mesh refinement grid. We have implemented an approach to model the solar atmosphere and heliosphere using MS-FLUKSS. All simulations are data driven, with the number of physical boundary conditions chosen on the bases of the number of characteristics entering the computational region. Two options can be used. One of them employs boundary conditions in the lower corona and is supposed to use synchronic vector magnetograms from SDO/HMI. Another approach places the inner boundary on a critical sphere, where the radial solar wind velocity exceeds the fast magnetosonic velocity. We have implemented a flux-rope method to insert coronal mass ejections (CMEs) into our model. The choice of CME parameters is made by analyzing multi-viewpoint CME images from SOHO and STEREO. Numerical simulations are presented that compare our results to other models and observational data.

Rigler, E. Joshua (USGS)
Poster Number: M13
Poster - Interpolating Geomagnetic Observations

Authors: Fiori, Robyn A. D.; Pulkkinen, Antti; Wiltberger, Michael; Balch, Christopher

Abstract: The use of geomagnetic data in space weather operations has historically been limited to near real-time measurements made at specific magnetic observatories, or to global magnetic indices (e.g., Kp, Dst, etc.). However, modern technological systems (e.g., electrical power grids, directional drilling platforms) increasingly require information about ground magnetic disturbance as a geographic distribution. We test and compare purely empirical and physics-inspired geomagnetic vector interpolation techniques using simulated observations from the Lyon-Feddar-Mobarry (LFM) geospace general circulation model. The same model also provides simulated ground “truth” on a regular dense grid, which in turn allows realistic error estimates to be made in between geographically sparse input coordinates. Multivariate regression analysis is used to obtain “vector correlations”, and optimal linear transformations (i.e., rotation, scale, translation) required to reconcile predictions and observations. We find that the physics-inspired interpolation techniques generally perform better given geographically sparse inputs.

Roelant, Patrick (Millersville University of Pennsylvania)
Poster Number: S35
Poster - Comparison of Atmospheric High Energy Radiation Profiles During a Coronal Mass Ejection and Quiet Sun

Authors: Patrick Roelant

Abstract: High altitude balloon launches are used to investigate radiation profile changes in the upper atmosphere after a Coronal Mass Ejection (CME). This was achieved by

launching a high-altitude balloon after a CME was detected and around the time that the high energy particles were predicted to arrive at Earth. There was also a launch during a relatively quiescent period to establish a baseline for the radiation profile during more active periods. The balloon carried a radiation payload that was designed by the Millersville Space Weather club; this equipment had been used before by the club to measure radiation changes through the atmosphere. This payload is capable of measuring gamma ray, X-ray, UV-A, and UV-B, along with terrestrial weather measurements using a Vaisala RS41-SG radiosonde. Launching these 600-gram high-altitude balloons is the primary way to measure a vertical change in radiation, with a focus on the Pfotzer Maximum altitude. Measurements of the high-altitude effects of a CME on Earth's atmosphere are important to assess the risk of high altitude operations, helping make decisions about aviation safety and providing information on near-Earth system responses.

Sakaguchi, Kaori (National Institute of Information and Communications Technology)
Poster Number: M4
Poster - The SECURES Project: Space Environment Customized Risk Estimation for Spacecraft

Authors: Yasubumi Kubota, Tsutomu Nagatsuma, Mamoru Ishii

Abstract: Spacecraft electrostatic discharge (ESD) is one of the major causes of satellite anomaly. SECURES is a project for modeling space environment and estimating risk of ESD on the individual spacecraft. The risk of ESD anomaly depends not only on the space environment, but also on each spacecraft's structure and materials. Therefore, it is not easy for the operator to judge the risk on own spacecraft based on the space environment information only. To improve this situation, the SECURE project started up by space-environment and spacecraft-charging modeling teams. So far, we have been developed the Radiation belt forecast model and REPPU (RERroduce Plasma Universe) as for deep and surface charging input parameters to MUSCAT (MUltility Spacecraft Charging Analysis Tool). Mission of this projects is the specialized space environment nowcast and forecast at eace spacecraft location, and estimate the risk of ESD anomaly by combining information of space environment and that of satellite materials with a charging model**.**

Shekhar Sapna (Dartmouth College)*EPOSTER
Poster Number: M19
Poster - Predictive Model for the Determination of Spatial extent of Relativistic Electron Precipitation from the Radiation Belts.

Authors: Robyn Millan
Abstract: Several processes occur in the magnetosphere that can lead to influx, energization and
atmospheric loss of particles from the radiation belts. Relativistic electrons in the radiation belts canlead to internal and surface charging that can damage instruments. Hence, the study of the

relativistic electrons is an important aspect of space weather. The loss of electrons into the
atmosphere, known as precipitation, is important for radiation belt dynamics. The estimation of
spatial scales of relativistic electron precipitation (REP) is critical for quantifying the global loss of particles from the radiation belts. However, spatial data is still very sparse, thus little is known about the size of REP events. We are proposing to use machine learning tools and the large repository of National Oceanic and Atmospheric Administration (NOAA) Polar Operational Environmental Satellites (POES) data to estimate both the spatial extent and energy spectrum of relativistic electron precipitation. The result will allow for better quantification of the loss rate which is critical for understanding and forecasting radiation belt fluxes. NOAA POES satellites have been operational for over 15 years providing a network of multiple satellites with identical particle instruments called SEM-2. These satellites provide a large repository of multi-point spatial data which can be used to build predictive models of the spatial extent of REP events. We will also use dynamic solar wind parameters to extend the model to include temporal variations. Such a model will improve the quantification of particle loss from the radiation belts and help us understand the variation of spatial scales with mechanisms driving the precipitation.

Shen, Han-Wen (National central university)
Poster Number: M6
Poster - An analysis on geomagnetic activity related with Formosat-2 and Formosat-3 anomalies for space weather operations

Authors: Han-Wen Shen, Jih-Hong Shue , Tsung-Ping Lee

Abstract: When an anomaly occurs in a satellite, it can have an influence on the operation of the satellite and the instruments on board, possibly resulting in a disruption of the satellite operation or some inaccuracy in the data obtained. Therefore, we need to well understand what causes of anomalies so that we can develop an application to predict them earlier and mitigate the impacts. In this study, we classify the satellite anomalies reported from the Formosat-2 (FS2) and Formosat-3/Cosmic (FS3) satellite for different types of anomalies: overrun (data cannot be identi¬fied within a scheduled time interval), overload (two consecutive overruns), and automatic reset operation. After removing the non-space weather events, we analyzed the remaining events in combination with geomagnetic fields and solar wind data. We find that most of the anomalies are associated with a small geomagnetic Bz component on the ground. This feature is more pronounced in high latitudes. In addition, for the overload anomaly events from FS2, we find that a significant increase in the solar wind velocity occurred prior to the anomalies. When the solar wind speed increases, it can bring more high-energy particles into the magnetosphere.

Shen, Xiaochen (Shandong University)
Poster Number: M10

Poster - Foreshock transient-driven magnetospheric ULF waves with clear dawn-dusk asymmetry of wave power

Authors: Quanqi Shi, Boyi Wang, Hui Zhang, Mary Hudson, Yukitoshi Nishimura, Michael Hartinger, Anmin Tian, Qiu-Gang Zong, I. J. Rae, Alex Degeling

Abstract: Foreshock transient is a small-scale (compare to ICMEs or CIRs) phenomenon that generated in the Earth's foreshock region where interplanetary magnetic fields (IMF) are magnetically connected to the bow shock. The effects of foreshock transients on the magnetosphere are still not well understood. Via event analysis, we present that on 25 June 2008, a foreshock transient drives Pc 5 ULF waves inside the magnetosphere with clear dawn-dusk asymmetry of wave power. The Pc 5 waves are mainly occurred in the noon to dusk sector which is consistent with the location of the observed foreshock transient at post-noon MLT. Furthermore, toroidal mode standing Pc 5 waves are identified which suggest that field line resonances are excited by the foreshock transient.

Shi, Yining (University of Colorado Boulder)
Poster Number: I10
Poster - Assimilative Mapping Method for High-latitude Field-aligned Currents (FACs)

Authors: Yining Shi, Delores Knipp, Tomoko Matsuo, Liam Kilcommons, Brian Anderson

Abstract: High-latitude FAC features associated with major categories of solar wind drivers: (1) corotating high-speed streams and (2) transient flow related to coronal mass ejection are characterized by using empirical orthogonal function (EOF) analysis and optimal interpolation method to analyze FACs derived from engineering graded space-based magnetometer data with multi-year global coverage developed from the Iridium constellation made available through the NSF-funded Active Magnetosphere and Planetary Electrodynamics Response Experiment (AMPERE) program.
Dominant modes of variability in high-latitude FACs under different solar wind structures are studied and correlated with external solar wind drivers and internal magnetospheric drivers to help understand the interplay of FACs and those drivers. Inter-hemispheric differences in FACs are found in addition to seasonal effect. Magnetic potential and FAC and their corresponding analysis error are calculated using optimal interpolation in both hemispheres with a 2-min resolution.

Shue, Jih-Hong (National Central University)
Poster Number: M16
Poster - Which interplanetary magnetic field orientation is for the true ground state of the magnetosphere?

Authors: Masahito Nose, Tohru Araki, Toshihiko Iyemore

Abstract: Northward interplanetary magnetic field (IMF) has been well known to be a quiet IMF orientation for geomagnetic activity of the magnetosphere in contrast to a disturbed southward IMF orientation. Radial IMF and zero IMF are other quiet IMF orientations, which are usually less studied in the field of magnetospheric physics. A comparison among the geomagnetic activity for the three quiet IMF orientations has not been performed in the past. Here we use two solar cycles of OMNI solar wind data and the six geomagnetic indices (AE, PCN, PCS, Kp, ASYH, and SYMH) to study which IMF orientation has the quietest geomagnetic activity. We find that the northward or zero IMF orientation is for the quietest, depending upon the type of the geomagnetic indices. The geomagnetic activity for northward IMF is the lowest in the high-latitude AE, PCN, and PCS indices while those for zero IMF is the lowest in the mid-latitude Kp, ASYH, and SYMH indices. The geomagnetic activity for radial IMF was never the lowest because of an extra dayside reconnection that occurs during the period of radial IMF. Geomagnetic activity can be contributed by the direct-driven and loading-unloading processes of the solar wind-magnetosphere interaction. Since the latter process for the quiet IMF orientations is minimum, this study allows us to focus on the former process.

Siddiqui, Tarique (NCAR)
Poster Number: I11
Poster - Dependence of lunar tide of the equatorial electrojet on the winter-time polar vortex, solar flux and QBO

Authors: Yosuke Yamazaki, Claudia Stolle, Hermann Luehr, Juergen Matzka, Astrid Maute, Nick Pedatella

Abstract: The lower atmospheric forcing effects on the ionosphere are particularly evident during extreme
meteorological events known as sudden stratospheric warmings (SSWs). During SSWs the polar stratosphere and ionosphere, two distant atmospheric regions, are coupled through the SSW
induced modulation of atmospheric migrating and non-migrating tides. The changes in the
migrating semidiurnal solar and lunar tides are the major source of ionospheric variations during
SSWs. In this study, we use 55 years of ground-magnetometer observations at Huancayo, Peru
to investigate the composite characteristics of the lunar tide of the equatorial electrojet (EEJ) during SSWs. These long-term observations allow us to capture the EEJ lunar tidal response to the SSWs in a statistical sense. We examine the EEJ lunar tidal response during vortex-split and vortex-displaced SSWs and find that larger lunar tidal enhancements are observed during the vortex-split events. Further, we examine the influence of solar flux conditions and the phases of Quasi-Biennial Oscillation (QBO) on the lunar tide and find that the QBO phases and solar flux conditions modulate the EEJ lunar tidal response during SSWs in a similar way as they modulate the wintertime Arctic polar vortex. This work provides first evidence of modulation of the EEJ lunar tide due to the QBO phase.

Singh, Talwinder (Univ. of Alabama in Huntsville)*EPOSTER
Poster Number: S28
Poster - CME simulations using Gibson-Low flux rope model with input parameters derived from multi-view coronagraph observations.

Authors: Mehmet S. Yalim, Nikolai Pogorelov

Abstract: Coronal Mass Ejections (CMEs) are major drivers of extreme space weather conditions, which is a matter of huge concern for our modern technologically dependent society. Using MHD simulations of CMEs propagating through a background solar wind (SW) are crucial to make accurate prediction models. For this purpose, we need to derive initial CME parameters from observations and make sure they are propagating through a realistic, data-driven background SW. In this study, we use the flux-rope- driven Gibson-Low (GL) model to simulate CMEs. We derive the size parameters of the GL flux rope using the Graduate Cylindrical Shell (GCS) method, which has certain advantages over the existing approaches. This method uses concurrent viewpoints from STEREO A and B/COR, and SOHO/LASCO coronagraphs to determine the size and orientation of a CME flux rope. A flux rope created this way is inserted into an SDO/HMI vector-magnetogram driven SW background obtained with the Multi-Scale Fluid-Kinetic Simulation Suite (MS-FLUKSS). Simulation results agree very well with STEREO/COR, and SOHO/LASCO observations in terms of the CME kinematics and structure. The proposed has strong potential when used in existing and newly developed operational models of space weather.

Smith, David Allen (Utah State University, Center for Atmospheric and Space Sciences)
Poster Number: M22
Poster - Charged Particle Trajectories in the Geomagnetic Field

Authors: David Smith

Abstract: Coronal Mass Ejections (CMEs) are major drivers of extreme space weather conditions, which is a matter of huge concern for our modern technologically dependent society. Using MHD simulations of CMEs propagating through a background solar wind (SW) are crucial to make accurate prediction models. For this purpose, we need to derive initial CME parameters from observations and make sure they are propagating through a realistic, data-driven background SW. In this study, we use the flux-rope- driven Gibson-Low (GL) model to simulate CMEs. We derive the size parameters of the GL flux rope using the Graduate Cylindrical Shell (GCS) method, which has certain advantages over the existing approaches. This method uses concurrent viewpoints from STEREO A and B/COR, and SOHO/LASCO coronagraphs to determine the size and orientation of a CME flux rope. A flux rope created this way is inserted into an SDO/HMI vector-magnetogram driven SW background obtained with the Multi-Scale Fluid-Kinetic Simulation Suite (MS-FLUKSS). Simulation results agree very well with STEREO/COR, and SOHO/LASCO observations in terms of the CME kinematics and structure. The proposed has strong potential when used in existing and newly developed operational models of space weather.

Szabo, Adam (NASA GSFC Code 672)
Poster Number: G2
Poster - Accurate 1 day solar wind forecasting with the Space Weather Flotilla

Authors: Szabo, Adam

Abstract: A mission concept is presented for an affordable system of nine spacecraft orbiting the Sun at ~0.5 AU providing actionable, ~1 day space weather forecasting of solar wind events about to impact Earth. Preliminary design of the spacecraft, instrumentation and launch has been completed by a Goddard team. The space weather forecasting improvements of such a system will be discussed.

Tenishev, Valeriy (University of Michigan)*EPOSTER
Poster Number: M20
Poster - Energetic particle radiation in Earth' magnetosphere and its variability in response to that of the Sun

Authors: Igor Sokolov, Tamas Gombosi

Abstract: Penetrating radiation by energetic particles has a major effect on the human technology in the altitude range above that used by the commercial aviation in the troposphere. In space, exposure to energetic particles often leads to malfunctions and unexpected failures of electronics onboard manned and unmanned spacecraft, and poses a serious health risk for astronauts[1]. Ionizing radiation also has a global impact on Earth' upper atmosphere producing scintillations which affects the navigation systems, and triggering numerous electrochemical reactions resulted in a depletion of the atmospheric ozone.

Though highly reduced by the combined effect of the atmosphere and magnetosphere, energetic particles pose significant health risks not only for astronauts at orbit but also for commercial aviation crewmembers who therefore are considered radiation workers. The National Council on Radiation Protection and Measurements reported that aircrews have the largest average annual effective dose (3.07mSv) of all US radiation-exposed workers [see https://www.cdc.gov/niosh/topics/aircrew/cosmicionizingradiation.html]. All these make capabilities for predicting and real-time nowcasting the radiation level at the commercial aviation altitudes and above critical for assessing the radiation exposure risks and further decision-making.

The work presented here is a step toward developing a new nowcast capabilities for modeling of the radiation environment due to energetic particles in the altitude range starting from the troposphere through LEO, MEO, GEO and up to the magnetopause. The primary focus of this presentation is the solar energetic particle (SEP) and galactic cosmic ray (GCR) proton radiation in Earth' atmosphere down to the troposphere.

Presentation work is focused on 1) modeling of the cutoff rigidity, and 2) characterizing the energetic proton population in the magnetosphere, and 3) that of the energetic proton and secondary neutron populations in the atmosphere down to the troposphere as well as 4) their variability with geomagnetic conditions.

Tobiska, W. Kent (Space Environment Technologies)
Poster Number: S25
Poster - Analytical Representations for Characterizing the Global Aviation Radiation Environment based on Model and Measurement Databases

Authors: W. Kent Tobiska, Leonid Didkovsky, Kevin Judge, Seth Weiman, Dave Bouwer, Justin Bailey, Bill Atwell, Molly Maskrey, Chris Mertens, Yihua Zheng, Margaret Shea, Don Smart, Brad Gersey, Richard Wilkins, Duane Bell, Larry Gardner, and Robert Fuschino

Abstract: NAIRAS climatological and ARMAS statistical databases are presented as polynomial fit equations. Using equations based on altitude (9 – 14 km), L-shell ($1.5 \leq L \leq 10$), and geomagnetic conditions (G0 – G3) an effective dose rate for any location on the planet from a GCR induced environment can be calculated. In addition, a subset of the ARMAS database is represented by a second polynomial fit equation for the GCR+REP induced effective dose rates within a narrow band of L-shells ($2 \leq L \leq 7$) with altitudinal (9 – 13 km) and geomagnetic (G0 – G1) dependency. Three independent databases complement the ARMAS measurement database, i.e., the Czech Liulin aircraft data where direct as well as complimentary comparisons can be made, the ISS Liulin outer and inner radiation belt data for precipitating relativistic electrons, and SEP databases which complement the particle and energy spectra of the GCR and REP primaries that create the ARMAS data. Applications for the NAIRAS and ARMAS databases are i) effective dose rate climatology in comparison with measured weather variability and ii) climatological and statistical weather forecasting. Specific applications for these databases include predicting the radiation environment for regional air traffic management, for airport over-flight operations, and for air carrier route operations of individual aircraft. The business jet community can find extensive utility for flight path planning using the NAIRAS and ARMAS databases since their aircraft typically fly at higher altitudes than the commercial planes and are susceptible to substantially greater radiation hazards**.**

Tsiftsi, Thomai (Universidad Nacional Autonoma de Mexico (UNAM))*EPOSTER
Poster Number: S30
Poster - Statistical analysis of severe solar flare events using extreme value theory

Authors: Thomai Tsiftsi, Victor De la Luz

Abstract: In this work we analyse data from SWPC/NOAA solar flares. For our statistical analysis we model the peak X-ray flux of severe solar flare events employing Extreme Value Theory (EVT) techniques. EVT is a unique, powerful theory based on asymptotic arguments to model and quantify the unusual and stochastic nature of scarce

and rare events. This usually requires extrapolation outside the observed levels so EVT provides us with a rigorous statistical framework for such an extrapolation.

We model the asymptotic distribution of extreme solar flares with a Generalised Pareto Distribution (GPD) taking into account the solar seasonality which is suggested to affect such extreme events both in magnitude as well in frequency. Accurate predictions of extreme solar flare fluxes are given with a good statistical reliability. Furthermore, return levels (estimates of the expected time until an extreme event) are provided. We expect these results to inform development of communication networks, continuity of energy distribution, preparation and protection of satellites in orbit around Earth.

Viereck, Rodney (NOAA Space Weather Prediction Center)
Poster Number: S7
Poster - GOES Solar X-Ray Observations: Continuity vs Accuracy

Authors: Richard Grubb, Janet Machol

Abstract: For 45 years, the solar X-Ray Sensors (XRS) on the GOES weather satellites have been making real-time measurements of the disk-integrated solar x-ray irradiance. These data have been remarkably consistent and contiguous and are the backbone of the NOAA solar flare classification system. When GOES 8 was launched in 1994, it recorded 30% higher x-ray flux values compared to the earlier GOES. But no obvious cause of this offset was ever determined. For the sake of continuity, NOAA decided to adjust the GOES 8 data to match the old. We have been adjusting the XRS data on every GOES since (GOES 8-15). GOES 16 was launched in November of 2016 with a new XRS. The GOES16 XRS has been fully calibrated with a primary calibration source at the National Institutes of Standards and Technology (NIST) so these more recent values are presumed to be the most accurate XRS observation. These new data show that our adjustment of the GOES 8 through 15 XRS data is not correct and that the true solar X-ray values are 30% higher than what has been reported for the last 45 years. In this presentation, we will show how the XRS sensors are characterized how the raw data are transformed into the science units that are presented to the public. We will present a plan on how to accurately present these new XRS values while maintaining continuity with the long record of XRS data.

Wilson, Gabriel (US Air Force Academy)
Poster Number: I2
Poster - Satellite Based Ion Density Measurement Calibration and Validation

Authors: Richard L Balthazor, Carlos Maldanado, Matthew G. McHarg

Abstract: The Integrated Miniaturized Electro-Static Analyzer (IMESA) flying on the STPSat-3 satellite has collected more than three years of ion density data. This instrument is the first in a constellation of at least six instruments. We plan to integrate the data from all IMESAs into an appropriate ionospheric model. Our first step is to validate the IMESA data and calibrate the instrument. In this presentation we discuss our

process for preparing IMESA data and developing the instrument error bounds and noise floor. We also statistically demonstrate the effective instrument data range. We will then compare all the IMESA data with IRI projections calculated based on nearby digisonde measurements.

Winter, Lisa (Los Alamos National Laboratory)
Poster Number: M7
Poster - Background Radiation Models for DIORAMA

Authors: Elinor Mullin
Shawn Tornga

Abstract: The Distributed Infrastructure Offering Real-Time Access to Modeling and Analysis (DIORAMA) software is a powerful tool developed at Los Alamos National Laboratory for simulating phenomena for the US Nuclear Detonation Detection System. Background space environmental models are being implemented for the first time to present more realistic scenarios. We present work on implementing radiation belt electrons and protons, with the AE9/AP9 models. We also incorporate solar energetic particles, produced in solar flares and coronal mass ejections. The time-profiles, particle compositions, and energy spectra of solar events vary widely. Therefore, we characterize the range of properties through observations of past events with NASA, NOAA, and GPS/LANL-GEO particle measurements.

Woodraska, Donald (University of Colorado)
Poster Number: S4
Poster - Degradation Correction Proxy Modeling of GOES-16 EXIS EUVS

Authors: Donald L Woodraska, Francis G. Eparvier, Edward M.B. Thiemann, Thomas N. Woods, Andrew R. Jones, and Martin Snow

Abstract: The GOES-16 EXIS directly measures selected full-disk solar EUV irradiances. Over time these measurements show expected decreases due to degradation effects. Here we investigate a proxy modeling technique using EXIS EUVS-C Mg II to quantify the changes and create a predictive correction to be used in operational level 1b product generation. The model results are compared to on-board measurements and overlapping measurements from other measurements including SORCE SOLSTICE.

Woodraska, Donald (University of Colorado)
Poster Number: S5
Poster - The GOES-16 Operational EUV Spectral Irradiance Model

Authors: Edward M.B. Thiemann, Francis G. Eparvier, Thomas N. Woods, Andrew R. Jones, Martin Snow, Donald L. Woodraska, Janet Machol

Abstract: Solar extreme ultraviolet (EUV, 10-122 nm) radiation is the primary energy source to the lower latitude upper atmosphere. It is highly variable, varying by factors of

2 to 10, depending on wavelength, and 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 requires access to space. 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. Between 5 and 115 nm, the model spectral resolution is 5 nm, and there is a single 10 nm wide 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.

Woodroffe, Jesse (Los Alamos National Laboratory)*EPOSTER
Poster Number: M18
Poster - A Global Perspective on Geomagnetic Disturbances

Authors: Jesse Woodroffe
Michael Henderson

Abstract: Los Alamos National Laboratory is developing a suite of robust simulation tools designed to facilitate the analysis of extreme geomagnetic storms and their potential impact on the security and stability of the power grid. In this poster, I demonstrate some of these tools for a case study of the May 15, 2005 (Dst = -247 nT) severe geomagnetic storm, characterizing the spatial distribution of ground effects and identifying the magnetospheric drivers of the largest geomagnetic disturbances.

Young, Shawn (Air Force Research Laboratory)
Poster Number: M8
Poster - Comparison of MSFM, MSM and Denton models at GEO

Authors: Shawn Young, Robert Hilmer

Abstract: Differential surface charging is a potential hazard faced by spacecraft. This type of charging is the result of electron charge accumulation in the skin of the spacecraft and occurs when there is an imbalance between the inbound and outbound currents. Of

course, this is only truly hazardous if the charge buildup is different on nearby surfaces, creating significant voltages and the potential for arcing. This potential is spacecraft dependent because it will depend on things like spacecraft geometry and material choice, but it also depends
on properties of the local plasma environment. Because of this it is important to have some measure of the local plasma properties when analyzing the environmental hazard for a spacecraft. This is best done using a plasma monitor located on the satellite, but for those satellites that don't have a monitor, a model is the next best thing. Here we report on a comparison of 3 models of the plasma environment at geosynchronous orbit.
The Magnetospheric Specification Model (MSM), the Magnetosphereic Specification and Forecast Model
(MSFM), and the Vsw Bz dependent Denton model.

Yuan, Tianjiao (National Space Science Center)
Poster Number: I5
Poster - Prediction Model for Ionospheric Total Electron Content Based on Deep Learning RNN

Authors: Yuan Tianjiao, Chen Yanhong, Liu Siqing, Gong Jiancun

Abstract: A 24 h ahead forecasting model for ionospheric Total Electron Content (TEC) at Beijing station is established based on the deep learning Recurrent Neural Network (RNN) for the first time. The model implementation requires solar 10.7 cm flux index, geomagnetic index ap, grid map of TEC, solar wind speed and the southward components of interplanetary magnetic field. The predicting results for Beijing station (40 ◦ N, 115 ◦ E) show that the Root Mean Square Error (RMSE) of the disturbed ionosphere TEC predicted by RNN model is lower than that of BPNN (Back Propagation Neural Network) model by 0.49∼1.46 TECU. The forecasting accuracy of ionospheric positive storm by RNN model is increased by 16.8% with solar wind parameters. Furthermore, the RMSE of RNN model of 31 strong TEC storms in 2001 and 2015 are less than those of BPNN model by 0.2 TECU, and the RMSE of RNN model is decreased by 0.36∼0.47 TECU as solar wind parameters are added. The results indicate that RNN model is more reliable than BP model for short-term forecasting of TEC. Moreover, the addition of interplanetary solar wind parameters are helpful for predicting TEC positive storm.

Zhang, Yongliang (Johns Hopkins University / APL)
Poster Number: S6
Poster - Solar EUV flux proxy using multi-frequency solar radio flux

Authors: Yongliang Zhang and Larry J. Paxton

Abstract: We report a new solar EUV (26-34 nm) proxy using solar radio fluxes at six different frequencies (410, 610, 1415, 2695, 4995, 8800 MHz) from ground based observations The radio fluxes (2002-2008) are used to estimate the solar EUV flux under non-solar flare conditions through an artificial neural network (ANN) trained with coincidently observed solar EUV (26-34 nm) fluxes from the SOHO/SEM instrument.

The 1415 MHz flux is the top contributor in the estimated EUV flux while the 2695 MHz (close to the popular F10.7cm or ~2800 MHz) flux has little contribution. Such results are likely due to that the Bremsstrahlung emission (which is closely related to the EUV flux) tends to be dominant at low frequencies (e.g. < 2000 MHz) while the gyro-resonance emission dominates at high frequencies. This is also consistent with a significantly better neutral density modeling using F30cm (1000MHz) versus F10.7cm [Bruinsma, 2015]. The ANN training minimized the impact of non-EUV related variations in the radio fluxes.

Zheng, Yihua (NASA Goddard Space Flight Center)*EPOSTER
Poster Number: M21
Poster - Assessment of Radiation and Plasma Environment Modeling Capabilities

Authors: Yihua Zheng, Natalia Ganushkina, Timothy B Guild, Pier Jiggens, Insoo Jun, Joseph E. Mazur, Matthias Meier, Joseph I Minow, Dave Pitchford, Paul O'Brien, Yuri Shprits, W. Kent Tobiska, Michael A. Xapsos, M. M. Kuznetsova

Abstract: In order to make space weather environment models more useful to engineers and the user community throughout different phases of a satellite lifecycle (mission concept/planning/design/build, launch, operation and anomaly resolution) or assessing radiation effects at aviation altitudes, it is important to track their performance over time with well-defined, user-focused metrics and to maintain active, ongoing communication channels in order to understand each other's needs. To this end, working with experts in both science and engineering areas and the community in general, CCMC has launched the International Forum for Space Weather Modeling Capabilities Assessment (https://ccmc.gsfc.nasa.gov/assessment/). In this presentation, we will report the progress made from our Space Radiation and Plasma Effects Working Team. Two sets of metrics/physical quantities have been chosen with one set that are outputs of space environment models (constituting critical physical parameters/inputs directly relevant to effects quantification) and the other relevant to engineering models of effects. The initial results and follow-on activities will be discussed.