2026 SWW Poster Abstracts - Tuesday, 28 April, 2026

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1. Data assimilation of Ground-based VLF Sensors for Spatially Resolved D-region HF Absorption Maps

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The Earth's ionosphere is classically broken into 3 distinct regions: the D-region (50-90 km), the E-region (90-150 km), and the F-region (150-500 km). Radio signals propagating through the ionosphere can, depending on frequency, become attenuated and refracted based on the altitudinal electron density profile. High Frequency (HF, 3-30 MHz) and Very High Frequency (VHF, 30-300 MHz) radio bands used in airline communication refract through the D-region plasma to establish a link. Substantial changes to D-region electron density as a result of space weather effects like solar flares can induce a radio blackout, especially in the HF frequency band. High-energy particle precipitation from Earth's radiation belts can create localized regions of increased electron density. Measuring these local patches of increased electron density is challenging given the altitude range of the D-region. To accomplish this task, we present AVID, the Array for VLF Imaging of the D-region. AVID covers a region ~1500 km x ~2500 km and tracks 22 overlapping Very Low Frequency (VLF, 3-30 kHz) transmit-receive paths. These VLF radio waves efficiently reflect off the D-region plasma and propagate for 1000s of kilometers allowing a long-range probe into the D-region. To untangle spatial dynamics in the D-region, a data assimilation technique called a local ensemble transform Kalman filter (LETKF) is presented, including a discussion on simultaneous estimates of the "state" (ionosphere) and systematic biases.

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3. In-Situ Wind, Temperature, and Pressure Data at 50-100 km Altitudes

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Recent work has demonstrated sunlight-powered photophoretic flight of centimeter-scale perforated structures under near-space conditions, establishing a new class of aircraft capable of sustained operation in the mesosphere. These platforms exploit thermally-induced rarefied gas flows to fly at pressures between 30 and 100 km altitudes, a region that remains poorly observed despite its critical role in space weather coupling between the neutral atmosphere and ionosphere. Building on experimental and modeling results reported in Nature, we describe how photophoretically levitating platforms can be adapted as scientific tools for space weather research. Passive devices can function as atmospheric tracers, enabling direct measurements of wind speed and direction through optical or radar tracking over spatial and temporal scales inaccessible to sounding rockets. Larger

devices could loft payloads on the order of 100 mg, allowing in-situ measurements of variables including pressure, temperature, and ion concentration in the mesosphere and lower thermosphere. Because lift is generated without fuel, batteries, or photovoltaics, these platforms decouple observational persistence from onboard power and enable low-cost distributed sampling of a traditionally inaccessible altitude. We discuss demonstrated flight conditions, projected payload capacities as a function of altitude, deployment concepts using balloons or sounding rockets, and outline how photophoretic near-space platforms could complement satellite, radar, and ground-based measurements in future space weather observation.
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4. SEUSHI: A novel compact instrument for early flare and CME alerts

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Understanding the initiation of solar flares and coronal mass ejections (CMEs) is essential for improving forecasts of extreme space weather. Soft X-ray (SXR) and Extreme Ultraviolet (EUV) observations provide critical diagnostics of the highly dynamic solar corona; however, significant measurement gaps persist despite decades of observations. The Solar Extreme Ultraviolet Spectrograph and High-energy Imager (SEUSHI) is being developed to address these gaps by combining multi-pinhole SXR imaging with grazing-incidence EUV spectroscopy on a shared CMOS sensor. SEUSHI delivers spatially resolved temperature and emission measure maps at 1 arcminute resolution and 5 second cadence to identify Hot Onset Precursor Events (HOPEs), which provide early alerts of flares. Additionally, high-cadence (100 Hz) readouts of selected image rows enable photon-counting spectroscopy over 1–4 keV with ~0.1 keV energy resolution, to investigate elemental abundance evolution in active regions, a key diagnostic of coronal heating. SEUSHI also provides high-resolution EUV spectra measurements across the 17–34 nm range with ~0.2 nm spectral resolution for studies of coronal dimming and generation of early alerts for Earth-directed CMEs. SEUSHI is designed with low power, mass, and volume requirements, making it suitable for small satellite platforms. A technology demonstration version of SEUSHI is currently under development for flight aboard the Solar Dynamics Observatory Extreme Ultraviolet Variability Experiment calibration sounding rocket. This poster presents the instrument design, development, and calibration. Successful demonstration on the sounding rocket platform is an important step towards the opportunity to fly SEUSHI on future satellite missions and thus to improve space weather operations.

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5. An application for specifying space weather radiation impacts to aviation using real time REACH data

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The goal of this work is to more accurately define the regions that are hazardous to aviation due to space weather related radiation and turn that knowledge into an application that delivers actionable information to users. Our method for achieving these improvements relies on incorporating real time data from a network of dosimeters known as the Responsive Environmental Assessment Commercial Hosting (REACH) system that monitors radiation from a low altitude satellite constellation. By combining measurements from a large number of satellites, global radiation maps can be produced showing the regions impacted by high energy particles streaming from the sun during a space weather event. The radiation from these events is partly absorbed by Earth's atmosphere reducing it to negligible levels on the ground; however, at airline altitudes it still poses a potential health hazard to flight crew and frequent flyers that may be subjected to multiple events and accumulate a significant dose over time. To mitigate this hazard, the NOAA Space Weather Prediction Center (SWPC) with guidance from the Federal Aviation Administration (FAA) CARI-7 aviation radiation model issues advisories to the International Civil Aviation Organization (ICAO). The alerts indicate the intensity and geographic regions where radiation is expected to be high. Airlines use this information to divert flights to lower altitudes or latitudes to reduce exposure. Currently, the expected geographic extent of the radiation is based on a statistical compilation of measurements. This statistical model tends to be conservative which may cause unnecessary flight diversions, delays, and increased cost.
Here we present our progress towards developing a method and application to define the high radiation regions based on the REACH dosimeter data rather than the maps derived from historical statistics. We evaluate different methods for filling in global maps using data from 14 satellites. We compare the radiation at airline altitudes based on these new radiation maps to those currently used for alerts during a few significant space weather events. Finally, we discuss plans to incorporate the data into a real time application to deliver the high radiation maps to users.

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6. From the Sun to Social Media: How Aurora Chasers Use Space Weather Data

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The public availability of space weather data and growing interest in aurora photography have expanded the use of real-time data and geomagnetic forecasts among aurora chasers. While important to critical infrastructure, real-time solar wind, geomagnetic indices, magnetometer data, and model outputs are now routinely used for planning and decision-making by the aurora photographers and tour guides. However, in practice, data interpretation and modelling limitations, including measurement latency and cadence, single-point upstream sampling, model uncertainty, and the complex coupling between solar wind drivers and magnetospheric response, may not be fully appreciated by the aurora chasers. Common misinterpretations arise from reliance on indices (e.g., Kp, Dst) as predictors of local visibility, treating global probabilistic auroral oval maps as indicators of specific sky conditions, or anchoring on specific forecast outputs (e.g., CME ETA, predicted Kp) despite their inherent uncertainty.

This poster discusses how some of the operational and research space weather data products are typically used in the aurora-chasing community, both hobby and professional, outlines key sources of uncertainty, and identifies common misinterpretations. Real-world interpretation behavior can provide valuable insight into public understanding of forecast uncertainty and improve communication strategies in space weather for the general public, as well as critical infrastructure stakeholders. Identifying common gaps in the interpretation of space weather data and forecasts can inform changes in public-facing product design and guide collaboration between operational centers, researchers, industry, and non-industry users of space weather data.

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7. Measuring Doppler Velocities Using SDO/EVE MEGS-A During a Flare

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The Extreme ultraviolet Variability Experiment (EVE) is one of three instruments onboard the Solar Dynamics Observatory (SDO). The Multiple EUV Grating Spectrographs (MEGS) A channel of EVE measures wavelengths between 5-37 nm. MEGS-A had a nearly 24-hour observation capability at a high cadence of 10 seconds during its lifetime from May 2010 to May 2014. This creates an extensive catalogue of flares. In this study we analyze EVE's Level 0B data product, raw spectral images that have shown to have higher resolution than the Level 2 product (Gonzalez et al. 2024), to measure Doppler velocities of various ions during a solar flare. This analysis is conducted during the whole lifetime of the flare. We are able to compare flow velocities of different ions and understand how they evolve over time. Future work will lead us to create a catalog of flare velocities using MEGS-A.

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8. Radiation Exposure at Aviation Altitudes: Machine Learning Analysis and Cosmic Ray Muon Measurements

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Cumulative exposure to ionizing radiation at aviation altitudes poses significant health risks for aircrews and, at higher altitudes, astronauts. Physics-based models are commonly used to estimate radiation levels during flight; however, they often do not fully capture the rapidly varying and complex nature of atmospheric radiation, limiting real-time prediction accuracy. To address this limitation, we explore machine learning (ML) approaches to improve the analysis and nowcasting of aviation radiation.

Using newly compiled, ML-ready aviation radiation datasets (publicly available at https://dmlab.cs.gsu.edu/rdp/), we train supervised ML models to identify nonlinear relationships between geospace environmental parameters and measured radiation dose rates. Our results show that a gradient boosting (XGBoost) model trained on the concurrent properties of the geospace environment improves radiation prediction accuracy by approximately 9% compared to the considered physics-based NAIRAS-v3 model. Feature importance analysis and Shapley Additive Explanations (SHAP) indicate key geospace parameters, including solar and polar field variations, that play a dominant role in controlling radiation variability at flight altitudes.

In a complementary observational study, we examine the role of secondary cosmic-ray muons in aviation radiation environments below 15 km altitude. Atmospheric muon flux measurements obtained from a CubeSat prototype developed by the Nuclear Physics Group at Georgia State University are analyzed alongside radiation doses modeled by NAIRAS-v3. Correlation studies reveal a strong positive linear relationship between muon counts per minute and modeled radiation dose rates (μSv/h), indicating a statistically significant association between these variables.

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9. Design of a Scalable Low-Cost Readout System for the Global gLOWCOST Cosmic Ray Muon Detector Network

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The gLOWCOST (global low cost cosmic ray muon detector network for monitoring of dynamic changes in space and terrestrial weather) project operates an expanding international array of more than twenty muon detectors across ten countries on five continents to provide continuous measurements of cosmic ray variations linked to space and terrestrial weather. Sustaining long-term, reliable observations across such a geographically distributed network requires detector systems that are scientifically capable yet low-cost, robust, and adaptable to diverse environmental conditions.

This work presents the design and iterative development of a custom readout system engineered to support the large-scale deployment of low-cost cosmic-ray detectors. The system integrates a Raspberry Pi with a dedicated readout module incorporating low-noise preamplification, digitally controlled SiPM bias generation, FPGA-based pulse discrimination, and real-time digital counting. Over multiple hardware and firmware generations, the design has evolved to address practical challenges encountered during global field deployments, including electronic noise and temperature-dependent gain variations inherent to SiPM sensors.

A key advancement in the latest generation is an active temperature-compensation mechanism that dynamically adjusts SiPM bias voltage in response to environmental temperature changes. This feature markedly improves count-rate stability and overall detector reliability, particularly in locations lacking controlled laboratory conditions. The resulting readout system provides a scalable and cost-effective solution for expanding ground-based cosmic-ray monitoring and strengthens global efforts to track space-weather-driven variations in cosmic-ray flux.
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10. gLOWCOST Cosmic Ray Muon Detector Network Response to the Space Weather Events of November 2025 and January 2026

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The gLOWCOST (global LOW–COst cosmic ray muon detector network for monitoring of dynamic changes in Space and Terrestrial weather) cosmic ray muon detector network—led by Georgia State University—provides continuous, ground?based monitoring of space weather using a globally distributed array of low?cost detectors. The network currently comprises more than 20 detectors across 10 countries. Most stations operated stably during the significant geomagnetic storms of November 2025 and January 2026, enabling clear observations of associated Forbush decreases. In addition, detectors located in North America registered the Ground?Level Enhancement (GLE) event that occurred in November 2025. The Forbush decrease amplitudes ranged from approximately 0.5% to 4.5% during the November events and from 2% to 7% during the January event.
A major strength of the gLOWCOST network is its ability to capture these disturbances on a global scale,

facilitating comparative analyses across sites with different latitudes, longitudes, altitudes, and geomagnetic cutoff rigidities. The current study is focusing on calculations of the primary median energies corresponding to each detector site. This capability will broaden the range of primary energies sampled by the network, providing complementary coverage to existing ground?based cosmic?ray observatories and enabling improved characterization of space weather events in terms of their energy dependence.

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11. Exploring SEP Dynamics in Ground-Based Riometer Datasets

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Solar energetic particle (SEP) events pose radiation hazards to aviation crews and passengers. As such, the International Civil Aviation Organization (ICAO) issues radiation advisories supported by the U.S. Federal Aviation Administration (FAA) CARI-7A aviation dose rate model. These advisories divide the globe into 30 degree latitude by 15 degree longitude bins. The coarse nature of the spatial binning has the potential to exaggerate the location and extent of SEP impact, which can lead to overly cautious and/or broad advisories in regions that may not locally exceed radiation thresholds. One approach to refining these advisories to finer spatial bins is to utilize sensor fusion techniques with ground-based assets capable of observing SEP dynamics. In this poster I utilize the University of Calgary's expansive riometer network across Canada to directly measure the ionospheric region of impact for SEP events. I examine the characteristics of electron and proton flux measurements from the GOES mission, and use those in conjunction with ground-based riometers to study whether these datasets can be confidently used to improve the spatial and temporal resolution of SEP impacted areas. The ultimate goal of this work is to explore if (and how) ground assets can potentially constrain the geographic and temporal extent of operational radiation advisories.

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13. Expanding and Enhancing the SWAN-SF Benchmark Flare Forecasting Dataset

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The Space Weather Analytics for Solar Flares (SWAN-SF) benchmark dataset has proven to be an invaluable resource to the flare forecasting community. Containing carefully cross-checked HMI magnetogram data for over 4,000 active regions and 10,000 flaring events, SWAN-SF has enabled researchers to efficiently train, test, and validate their predictive models with confidence. However, since its release in 2020, the dataset has seen no significant updates. As a result, the goal of this work is threefold: first, we plan to temporally expand the existing dataset through 2025 to include the most recently available HMI active region patches (HARPs); second, we aim to incorporate shear angle-weighted HMI parameters, which emphasize magnetically stressed regions, potentially offering additional predictive capabilities beyond the existing parameters; and third, we intend to integrate texture-based parameters derived from extreme ultraviolet images taken by SDO/AIA to provide a complementary perspective to the magnetogram features. The purpose of these updates is to enable researchers to investigate how flare forecasting is impacted across two solar cycles and to improve prediction accuracy near the limbs. This pipeline establishes the framework for a continuously updated SWAN-SF dataset. Our methodology, along with some preliminary results, will be presented here.

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14. First Detection of gamma-ray enhancement during the 2025 November 11 GLE by Detectors located at Antarctic and Arctic Stations

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The ground-level enhancement (GLE) on 11 November 2025, designated as GLE#77 (OULU GLE database), was associated with an intense X-class solar flare, a fast halo coronal mass ejection (CME) and a strong solar energetic proton (SEP) event. This GLE is studied using ground-based NaI(Tl) gamma-ray detectors at Arctic and Antarctic stations, together with neutron monitor data and proton measurements from the GOES-18 satellite. The event was detected simultaneously by gamma-ray detectors near the poles in both the Northern and Southern Hemispheres, and the observed enhancements are consistent with the increases recorded by neutron monitors. The analysis reveals two distinct peaks in gamma-ray and neutron monitor data: a prompt peak at 10:38 UT and a delayed peak at 13:08 UT. The prompt peak was observed even at high-rigidity neutron monitor stations (low latitudes), whereas the delayed peak was not detected at stations with geomagnetic cutoff rigidity greater than 6 GV. The timing of these peaks corresponds well with proton flux enhancements measured by GOES-18 at energies >150 MeV for the prompt peak and 12-99 MeV for the delayed peak. These results indicate that the GLE amplitude strongly depends on geomagnetic cutoff rigidity, while showing a weak dependence on the solar zenith angle.
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15. Measuring Pitch Angle Distributions of Superthermal Electrons Using Coded Aperture Imaging

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Understanding the dynamics of superthermal electrons requires high-resolution measurements of their pitch angle distributions. These measurements serve as an important proxy for validating magnetic fields, including the heliospheric magnetic field for mapping space weather to solar source regions, or planetary magnetic fields for identifying reconnection signatures and particle trapping dynamics. Such measurements are typically recorded by electrostatic analyzers, which are often large, heavy, and limited by low angular resolution. This project presents the design and development of a novel particle detector system that utilizes coded aperture imaging to achieve real-time, high-resolution pitch angle measurements. By leveraging a Timepix-based detector, the instrument is significantly smaller and lighter than traditional analyzers, making it highly suitable for resource-constrained platforms such as CubeSats. We present the design considerations for the coded aperture mask and its integration with the detector. To validate the instrument's geometric response, we utilize Geant4 simulations to model the coded aperture imaging process and predict performance. We describe the experimental setup within a plasma vacuum chamber, including the integration of an electron source gun and the development of a custom instrument housing. These laboratory efforts provide a first-pass evaluation of the design, validating the coded aperture technique as a compact, high-performance alternative for future space-based plasma measurements.
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18. Storm-time Dst forecast: An innovative approach

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A reliable long term space weather forecast of geomagnetic storms (? 3 days) is critical for safe operation of national and commercial assets in space. Dst and Kp are the two of the most used indices for storm monitoring and serve as inputs of many space weather models. However, the current state of the art Dst or Kp forecast models (mostly machine learning algorithms) can only provide good storm-time prediction for a few hours. Here we report a physics-based pattern recognition algorithm to predict storm-time Dst evolution from 1 hour to ~4.5 days ahead of the time of the latest observed Dst. The algorithm just needs a few observed Dst data. It has been tested for a few isolated storms and shows a good agreement between predicted and observed Dst with correlation coefficients up to ~0.9 and errors as low as ~5-10 nT. This indicates that the algorithm is feasible and reliable. We also identified some caveats and improvements for our future work, such as predicting storm-time storms and determining the conditions for storm watch, alert and warning.

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19. The NASA Living with a Star Focus Science Team (LWS/FST) "Moving Beyond F10.7"

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Solar Extreme-Ultraviolet (EUV) flux is a dominant heating and ionization source for the Ionosphere – Thermosphere – Mesosphere (ITM) system. Studies of the ITM often rely on the F10.7 index (solar radio flux at the wavelength of 10.7 cm) as a primary solar driver. However, it is currently known that this index does not directly describe the solar input in the EUV wavelength range below 102.5 nm that is directly responsible for much of the ionization of the thermosphere.

EUV data from numerous satellite observations (e.g., SOHO/SEM, TIMED/SEE, SDO/EVE, GOES/EXIS), new indices (e.g., S10.7, Y10.7, Mg II, Lyman-Alpha) and new proxies from solar irradiance models (SIP, E10.7, FISM2 EUV, CODET) have become available within the last two decades. These indices and proxy measures can better characterize solar energy input to the thermosphere than the traditionally used F10.7 index.

The overarching goal of this FST is to develop the ability to reliably specify and predict the effects of solar variability on the ITM system. Specific objectives include: 1) identifying new and/or improved EUV indices for driving model predictions of ITM structure; 2) improved understanding of how particular portions of the EUV spectrum influence specific aspects of ITM structure (e.g., ionospheric profile shape, thermospheric composition, density, or temperature); and 3) exploring new EUV observations characterizing the interactions between the ionosphere and thermosphere. Studies that validate predictions of ITM properties in response to rapid variations in EUV (e.g., from solar flares) will be necessary to evaluate the success of alternatives to F10.7.

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20. Recreating the enhanced neutron environment of GLE 77 at TRIUMF

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On Armistice Day (11th November) 2025, the largest ground level enhancement (GLE) for 20 years was observed by ground level neutron monitors and high-altitude detectors. Increases in ground level neutron flux during GLE 77 peaked at around 175% at Antarctic stations. At higher altitudes increases in neutron flux are even greater, with both models and measurements indicating an order of magnitude increase at commercial flight levels, and even more for high-altitude aircraft. Commensurate increases in single event effects (SEE) rates in avionics would be expected as a result.

The neutron irradiation facility (NIF) at TRIUMF recreates an atmospheric-like neutron spectrum over a wide intensity range. This provides a unique capability to test aircraft electronics in a simulated GLE environment, rather than scaling measured error rates from either an accelerated test facility or long-duration experiments on the ground. NIF's flux range encompasses the 2025 Armistice Day event and events several orders of magnitude larger that have been observed indirectly via cosmogenic isotope records. GLE 77, though large by recent standards, is estimated to be only ~2% of the intensity of GLE 5, which occurred 70 years ago on 23rd February 1956 and remains the largest event ever directly measured. The relatively benign period of solar activity that has been experienced over the last few decades will eventually come to end. Given the inherent lack of warning associated with GLEs, resilience through ground testing is essential to mitigating their impact on aviation.
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21. Supporting Space Weather Forecasting with Wide Field EUV Imaging

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Tracking of solar eruptions for NOAA's space weather forecasting activities will primarily leverage the GOES-R Solar Ultraviolet Imagers (SUVI) and Compact Coronagraphs (CCor) on the Space Weather Follow-On (SWFO) mission to the L1 Lagrange point and on the GOES-U satellite in geostationary orbit. However, SUVI's FOV ends around 1.7 Rs, while CCor's begins above 3.7 Rs (GOES-U) or 3.0 Rs (SWFO). Thus the NOAA instrument suite leaves a key observational gap, in which eruptions that originate near the solar surface are well-known to evolve, and CME shock acceleration of particles occurs. Wide field EUV imaging (to 3Rs) will allow forecasters to directly connect observations of CMEs in coronagraphic FOVs to their sources just above the solar surface, and to fully characterize their evolution of CME kinematics during a critical phase where events experience complex accelerations, which will help to refine modes of CME arrival time and impact at Earth. Additionally, the ability of a wide-field EUV imager to detect the onset of CME-associated shocks provides powerful diagnostic capability for the drivers of solar energetic particle events.

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22. The WSA Dashboard: Current and Future Capabilities

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The Wang-Sheeley-Arge (WSA) model is a combined empirical and physics-based model of the corona and solar wind. It has been operational at the U.S. National Weather Service (NWS) since 2011, and its predictions are now routinely used to assist with making forecasts worldwide. In addition to its usefulness as a space weather prediction tool, it is also widely used for basic research purposes. Recently, the model’s real-time predictions have been made publicly available via an online tool (see links below) called the WSA Dashboard with a focus on forecaster needs. Additionally, the WSA team is now working to build an online archive of current and past predictions designed to support basic and applied research. This paper provides an overview of the WSA Dashboard followed by a discussion of potential modifications to it that will allow it to also serve the research needs of the space weather and basic research communities. Suggestions and feedback are highly encouraged!
CCMC version: https://ccmc.gsfc.nasa.gov/wsa-dashboard/
Development beta version: https://wsa-dashboard.helioanalytics.io/
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23. Toward Operational Readiness: A Conceptual Framework for Real-Time Space Weather Impact Reporting and Test Capability Within the FAA

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Space weather events — including solar flares, coronal mass ejections, and ionospheric disturbances — pose a growing operational risk to civil aviation's communication and navigation infrastructure. Despite documented disruptions to HF radio, GPS/GNSS, SATCOM, and VHF/UHF systems during the December 2023 X2.8 flare and the May 2024 Gannon Storm, the National Airspace System (NAS) currently lacks a standardized, real-time

framework for detecting, characterizing, and communicating space weather impacts to operational users.
This poster presents a conceptual framework for a Real-Time Communication and Navigation Impact Reporting and Test Capability within the FAA, addressing four core functions: (1) real-time monitoring and impact detection integrating NOAA/SWPC data streams, FAA WAAS network outputs, and oceanic ARTCC operational logs; (2) structured dissemination of impact assessments to traffic managers, controllers, dispatchers, and flight crews through existing NAS pathways; (3) a simulation-based test capability at the FAA William J. Hughes Technical Center for Advanced Aerospace to evaluate alerting thresholds and procedural responses independent of live solar events; and (4) post-event analysis to validate models and refine operational thresholds over time.
We describe a data architecture leveraging existing FAA, NOAA, NASA, USAF, and international datasets and outline a phased development path from a near-term pilot dashboard at the ATCSCC to a NAS-wide predictive capability. A governance model centered on a Space Weather Impact Program Office, an interagency Working Group, and a 24/7 NAS Space Weather Cell addresses the cross-organizational coordination this capability requires.
This work supports Aviation Sector Recommendations from the 2024 National Survey of User Needs for Space Weather and provides an operational roadmap for translating space weather science into actionable impact intelligence for aviation.

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24. Full-disk H-alpha Spectroheliograph development for GONG: Preliminary results

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We present the design and preliminary test results of a full-disk spectroheliograph instrument under development as a potential upgrade to the GONG system. This instrument aims to enhance the current GONG H? system by enabling full-disk Dopplergram observations, thereby facilitating the study of filament dynamics in relation to eruptive events.
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25. Verification of SWPC Kp, Ap, and F10.7cm Forecasts

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Providing accurate operational forecasts for the impacts of space weather events is of critical importance to end users such as operators of satellites, the electric grid, and commercial aviation. NOAA’s Space Weather Prediction Center (SWPC) releases daily forecasts of the Kp and Ap index, which measure the variability of the earth’s geomagnetic field, and F10.7 solar radio flux, which is used as a proxy for solar UV and EUV emissions. We conduct a forecast verification study comparing the skill of these SWPC forecasts to unsophisticated baseline models.

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26. Analysis of the January 2026 G4 Geomagnetic Storm through Multi-Instrument Observations

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On January 19, 2026, geomagnetic conditions reached NOAA G4 levels starting at 18:00 UT, corresponding to a severe geomagnetic storm. This event is generally attributed to a coronal mass ejection (CME) associated with a long-duration X1.9 class solar flare on January 18. While the NOAA/SWPC WSA-Enlil model predicted the onset of near-Earth environmental disturbances at approximately 22:00 UT, observational evidence reveals that the CME impacted the magnetosphere significantly earlier. To investigate this discrepancy, this study integrates multi-instrument observations and modeling tools, including the pyCAT (Python-based CME Analysis Tool, a next-generation CME analysis tool developed by NOAA/SWPC and the UK Met Office), STEREO-A/IMPACT and PLASTIC, and e-CALLISTO radio spectra. We analyze the propagation dynamics and identify potential factors contributing to the unexpectedly high CME velocity. The primary goal is to enhance operational awareness of these critical factors, thereby extending the lead time required for critical infrastructure protection and operational preparedness across various sectors.
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27. Space weather and VSO 2.0

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For over twenty years, the Virtual Solar Observatory (VSO) has provided a consistent interface for searching, filtering, and downloading a wide range of Heliophysics data, including data supporting space weather forecasting. Developed originally in Perl and utilizing the Simple Object Access Protocol (SOAP), a new VSO, VSO 2.0, is being developed. This new version of the VSO is written predominantly in Python and uses the Representational State Transfer (REST) architecture. Our new approach has a strong focus on metadata, which will lead to services that provide access to data headers to facilitate metadata searches and even metadata analysis. In addition, the new VSO will allow much easier definition of search presets for datasets, such as space weather datasets (e.g., LASCO, GONG, NRT AIA, and NRT HMI), as well as user-defined presets. In this poster, we briefly describe the technologies used to build the new VSO and some of the capabilities of VSO 2.0 to facilitate timely access to near-real-time data critical for space weather forecasting.
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29. Science and Beyond: Capturing the Full Spectrum of Heliophysics Mission Impact Through End User Engagement

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Heliophysics missions serve a variety of stakeholders beyond the scientific community, including space weather forecasters, commercial space operators, mission planners, and national security entities. Our missions provide the environmental awareness and technical resilience required for humanity's expanding presence in space. Currently, stakeholder needs are not fully documented and supported by Heliophysics missions. This presentation examines how systematically identifying, engaging with, and supporting these end users can transform our understanding of mission value. We explore methods to enhance operational capabilities for space weather prediction and better support human exploration through Artemis and commercial space expansion by documenting their comprehensive societal impact through structured end user inventories and formal liaison relationships. A dual focus approach of scientific merit alongside operational utility allows Heliophysics missions to fully recognize their critical role.
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30. Heliophysics Digital Resource Library: Unlocking the Power of Heliodata
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The Heliophysics Digital Resource Library (HDRL) serves as a critical bridge between NASA's rich heliophysics data resources and the operational space weather community. This presentation showcases how HDRL integrates mission data streams, standardizes metadata practices, and provides unified access points through the Heliodata web platform to support timely space weather forecasting and analysis through community open-source software. By implementing consistent data formats, addressing latency requirements, and optimizing delivery mechanisms, HDRL enables forecasters, commercial operators, and exploration planners to access expert-curated resources. The presentation highlights recent enhancements to user interfaces that connect end users to Heliophysics mission assets. Through these coordinated efforts, HDRL transforms passive data archives into active observational resources, directly supporting national space weather resilience, Artemis mission planning, end user capabilities, and acceleration of scientific discovery.
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32. Operational Real-Time CME Arrival Prediction Using the SUSANOO System at NICT
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Accurate and timely prediction of coronal mass ejection (CME) arrival is essential for space weather services. At the National Institute of Information and Communications Technology (NICT), we operate the SUSANOO space weather prediction system as part of NICT's 24/7 space weather forecast service. SUSANOO is a physics?based CME arrival prediction framework based on global magnetohydrodynamic (MHD) simulations (Shiota and Kataoka, 2016) and is operated in real time to support monitoring and warning activities. This poster presents the structure of the SUSANOO CME arrival prediction system and its recent operational performance. We evaluate SUSANOO predictions for significant space weather events in November 2025 and January 2026. Prediction performance is assessed in terms of lead time, arrival time accuracy, and consistency with in?situ solar wind observations, illustrating the capabilities and limitations of an operational MHD?based CME arrival prediction system.
We also summarize the observational data supporting SUSANOO. Coronagraph observations from CCOR1 onboard GOES?19 have been incorporated into the operational workflow for CME detection and characterization. Preparations are ongoing for the future use of CCOR2 onboard the SOLAR?1 (SWFO?L1) mission to ensure continuity of coronagraph observations.
NICT has constructed a dedicated ground?based antenna and is currently receiving SOLAR?1 radio signals on a daily basis. Coordination between NICT and NOAA regarding data reception and transfer is ongoing.
This poster highlights the role of an operational MHD simulation-based system in real?time CME arrival prediction.

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33. Polarity?Resolved Magnetograms Derived from GONG Far Side Helioseismic Maps for Space Weather Applications

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Reliable space-weather forecasting requires continuous monitoring of solar active regions across the entire Sun. However, direct magnetic observations are limited to the Earth-facing hemisphere, leaving the far side of the Sun largely unobserved until active regions rotate into view. Helioseismic far-side mapping from the Global Oscillation Network Group (GONG) has enabled the detection of large active regions on the hidden hemisphere for more than two decades, but these detections have lacked the critical magnetic information needed for operational forecasting and heliospheric modeling. In this work we present a method for reconstructing polarity-resolved magnetograms of far-side active regions using GONG helioseismic phase-shift measurements. This approach identifies the bipolar magnetic structure by analyzing the spatial substructures within the helioseismic signal and locating the polarity inversion boundary through the longitudinal variance profile of the detected regions. The east–west polarity ordering is then determined using Hale's polarity rule for the current solar cycle. This technique enables the first estimation of the magnetic polarity configuration of far-side active regions before they rotate onto the Earth-facing disk, providing new information that can be incorporated into global solar magnetic maps and coronal models. Such far-side magnetic estimates can improve boundary conditions for models used in forecasting solar-wind and other heliospheric parameters. The ability to infer the magnetic structure of emerging or decaying active regions days before they become visible offers potential benefits for space-weather situational awareness, including improved context for flare- and CME-producing regions and better initialization of operational models that depend on global photospheric magnetic maps. These results represent an important step toward achieving full-Sun magnetic mapping, a key capability for advancing operational space-weather forecasting.

34. Cost Benefits Analysis of NOAA's Space Weather Next Program

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NOAA's Office of Space Weather Observations (SWO) recently completed a cost-benefit analysis for the Space Weather Next (SW Next) program. SW Next is designed to ensure the continuity of space-based observations necessary to sustain operational space weather monitoring and forecasting capabilities at NOAA's Space Weather Prediction Center (SWPC) starting in the 2030s and beyond. The program will also introduce enhancements beyond current capabilities to better serve industries impacted by space weather. SW Next is a program comprising multiple flight and instrument projects, as well as partner and commercial data, that together provide comprehensive knowledge of the sun, the space environment, and the upper atmosphere.

As part of the program's formulation, SWO, in collaboration with NOAA's Chief Economist, conducted a detailed study to identify the economic and societal benefits associated with SW Next observations. Value is derived from the ability of end-user communities to mitigate detrimental space weather impacts by utilizing timely and accurate space weather information in their operational decisions.

Value chains were constructed to understand how user communities derive this value. These chains trace how SW Next sensors will feed into the event-driven products issued by SWPC and ultimately inform user decisions. This trace is key to understanding the program's value and crucial for tracing user-needed improvements back to model and sensor performance. The valuation of these benefits builds upon past studies to develop a Monte Carlo model simulating the occurrence and impacts of space weather events of various magnitudes. The quantification of the return on investment in the SW Next program informs formulation decisions for future projects and demonstrates the value of the program.

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35. The H3lioViz R2O2R Project: a web application using co-production to enhance both research and operations

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A recent report highlighted the challenges of establishing a reciprocal flow of concepts and tools between research and operations (R2O2R). Here we present a successful R2O2R project in heliosphere modeling and space weather forecasting.

H3lioViz (pronounced "he-lio-viz") is a web application that visualizes the 3D outputs of the Enlil heliosphere model through a streamlined browser interface. By leveraging cloud computing, users can interact with the large data cubes that remain in the cloud while comparatively small rendered images are sent to the browser. This enables relatively fast visualization on any computer and multiple users can explore the same data simultaneously, without the need for specialized software or high-performance hardware.

H3lioViz harnesses the sophisticated 3D rendering capabilities of ParaView with a pared-down interface featuring the elements researchers and operational forecasters deemed most essential. Users can easily save and share views and settings via a URL link, supporting collaboration, training, forecasting, and research.

The application code has been deployed to the SWPC testbed for internal use by forecasters, while a public site (https://swx-trec.com/h3lioviz) allows anyone to explore the latest model runs. Researchers can investigate historical simulations, while operational forecasters can analyze and contextualize current predictions, ultimately improving space weather forecasting.

Key factors in the project's success include close co-production with users, an iterative development cycle with live demonstration deployments, and containerized code deployed in the SWPC testbed.
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36. Advancing Space Weather Research-to-Operations and Operations-to-Research (R2O2R) at the National Oceanic and Atmospheric Administration (NOAA): Progress, Lessons Learned, and Path Forward

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The National Oceanic and Atmospheric Administration (NOAA) National Environmental Satellite, Data, and Information Service (NESDIS) Office of Space Weather Observations (SWO) is actively involved in fostering partnerships and technology investments to advance NOAA's space weather observational and data system capabilities. This allows NOAA to leverage external expertise and investments, enhancing its ability to meet mission goals and provide valuable space weather products and services to the users and the public. These technology maturation projects aim to advance new and innovative instrument and data technologies developed by other agencies, industry, and academia. Once proven, these technologies then may be integrated into NOAA's space weather operational environment to enhance space weather monitoring and forecasting capabilities. Through the lifecycle of the projects, SWO actively brings outside researchers and NOAA's Space Weather Prediction Center (SWPC) scientists together through regular cadenced meetings to align project goals and scopes with specific requirements for operational use. These include Research-to-Operations (R2O), sharing updates, and seeking feedback from operation to research to enhance quality and usability of space weather data and services, i.e., Operations-to-Research (O2R). However, transitioning research findings and prototypes into operational use is not without challenges. This presentation will highlight NOAA's contributions to space weather Research-to-Operations and Operations-to-Research (R2O2R) enterprise, give a status of on-going activities, share lessons learned, and offer thoughts on path forward.

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37. A Detection and Reporting System for Spacecraft Hazards

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Near real-time monitoring, attribution, and resolution of spacecraft anomalies and failures is critical to the success of any space mission. The Detection and Reporting System (DARS) provides the capability to detect disruption of spacecraft activity by utilizing a combination of AI and physics on spacecraft telemetry. While originally developed to detect PNT, cyber, optical, and other threats to a mission, DARS is now being integrated with the Spacecraft Environmental Anomalies Expert System – Flow Charts tool (SEAES-FC). The combination of these systems will allow spacecraft operators to rapidly triage satellite anomalies regarding space environment hazards from charged particles. AI models within DARS may also be able to correlate expected space weather hazards to variability within spacecraft telemetry, providing additional space situational awareness to both the mission and the broader space enterprise.

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38. Limb?Flare (and beyond-Limb Flare) Prediction with a 4? Full?Heliosphere Framework

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A demonstrated failure mode for operational solar flare forecasting is the inability to forecast flares that occur near, or just beyond, the solar limb. To address this shortcoming, we have developed a “4?” full? heliosphere event forecasting framework and evaluated its classification ability against this specific challenge. A magnetic surface flux transport model is used to generate full?sun maps of the photospheric radial magnetic field from which active regions (ARs) are identified and tracked using a new labeling scheme that (contrary to the NOAA AR numbering) is observer?location agnostic and allows for post?facto modifications. Flare?relevant magnetic parameters couple to a “visibility” index specifying AR location relative to the visible solar limb and hence expected flare detectability. Flare labels are assigned according to peak Soft X?ray flux, and a statistical classification is performed using nonparametric discriminant analysis. We additionally test a version where new or emerging ARs on the far (“invisible”) side of the Sun are incorporated into the model by way of far?side helioseismology. We evaluate the new framework by its performance specifically including the limb areas using Brier Skill Score and ROC Skill Score, finding overall improvement. We find that the number of False Negatives, or “missed” forecasts decreases, and find strong evidence that the additional information provided by the far?side helioseismology can help predict near? and just?beyond?limb flares particularly for East?limb events. While individual components of this framework could be improved, we demonstrate that a known failure mode for solar flare forecasting can be mitigated with available resources.
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39. Intertwining Physics-Based CME Modeling and Machine Learning for L1 Prediction of Interplanetary Magnetic Field

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Understanding Coronal Mass Ejections (CMEs) and their impact on the geomagnetic environment is among the most critical questions of space weather. The recent advances in physics-based CME modeling resulted in the development of extensive simulation datasets covering a broad range of scenarios and allowing data-intensive techniques, such as machine learning, to assist with the exploration and understanding. In this work, we present the machine learning-ready dataset constructed based on the existing grid of the GAMERA-GL simulations of the CMEs propagating in the inner Heliosphere. The dataset has three background solar wind options (corresponding to the solar activity minimum, and its rising and falling phases) and has the Gibson-Low flux rope of varying properties initiated at different locations, resulting in ?23,000 complete simulation runs and ~7.4M unique timeseries of solar wind properties at hypothetical L1 locations. We consider the applications of this dataset to two problems: (1) development of the surrogate model for the CME time series at L1 point, and a related problem of the forecasting of geoeffective CME properties, and (2) development of the inverse model constraining magnetic field properties of the CME close to the Sun based on the L1 time series dynamics and CME geometry. The results highlight how combining the extensive simulation grids and machine learning approach can help us understand the CME dynamics and enhance space weather forecasting.

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40. Space Weather Roundtable asks "Can the US National Space Weather Enterprise Be More Effective?"

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Give us your ideas! The Space Weather Roundtable has held numerous meetings exploring the current state of the National Space Weather Enterprise. The Roundtable includes members from academia, government and commercial space weather service providers, and it is also attended ex-officio by representatives from NOAA, NSF, NASA and the DoD. In pursuit of its mandate from congress, the Roundtable has explored how the Nation might: (1) facilitate advances in space weather prediction and forecasting; (2) increase coordination of space weather research to operations and operations to research; and (3) improve preparedness for potential space weather phenomena.

The Roundtable is currently asking "Can the US National Space Weather Enterprise Be More Effective?", and we are looking for thoughts and opinions from the space weather community. Topics could include:
a) What does the future of the National Space Weather Enterprise look like?
b) What are the roles of NASA, NSF, NOAA and DoD in the future ‘National Space Weather Enterprise’?
c) What are the roles of commercial ‘Space weather service providers’
d) What is the role of Academia
e) The role of CCMC and Space Weather Testbed
f) The R2O2R program
g) Funding for Space Weather Research and technology development
h) Can we improve how space weather-related technology is transitioned to operational status?
i) How can the Space Weather community respond to evolution of the Space Industry?
j) Are there any User Needs that are not currently being met?
k) Any other ideas or topics for discussion?

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41. GONG Operations and Engineering Support

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The U.S. National Science Foundation (NSF) Global Oscillation Network Group (GONG) operations team supports 24/7/365 instrument monitoring. This team monitors the health of the instruments via the GONG Monitor Tool, https://monitor.nso.edu/, and remote login to the site workstations. As part of the operations support, the team travels to each network site for preventive maintenance or emergency repairs. The GONG network maintains two engineering instrument shelters, located in Boulder, CO. The engineering shelters are used for testing repaired hardware prior to re-deployment to the network sites, new hardware & software development, and component acceptance tests. For the initial testing, repairs, and development of electronics, the team uses the Sonora Lab, an electronics copy of a GONG shelter without a light feed.

Prior to the 20th anniversary of the deployment of the GONG network, the NSF approved the funding of a refurbishment project that allowed the project to replace or spare failing and outdated components and subsystems. The scope of the refurbishment project included the replacement of computer workstations, liquid crystal modulators, and cameras. A significant engineering effort was required for replacing the SMD/DALSA 1M60 cameras with the Emergent Vision Technologies HB-1800-S-M cameras. The GONG refurbishment program formally ended with the replacement of the camera at the Tenerife, Spain site in May 2025. The full refurbishment of the Mauna Loa site is pending the reopening of the Mauna Loa Observatory. Now that GONG has passed its 30th anniversary, a higher level of operations and engineering support is anticipated.

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42. The Continuing Role of Scientists in Sustaining the GONG Project

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The U.S. National Science Foundation's (NSF) Global Oscillation Network Group (GONG) facility provides long term, continuous full-disk Doppler velocity, magnetic field, H-alpha and the white-light observations, supported by well-established data processing pipelines. Even after the data pipelines are fully developed and validated, scientists play a critical role in sustaining data center functionality and operational workflows. Their expertise is essential for validating automated outputs, diagnosing and resolving anomalies, and further developing new analysis techniques for improved data products. Scientists also ensure methodological consistency across the network and collaborate with operations teams to maintain data integrity in general, and especially during the repair, replacement and development of instruments. Finally, scientists demonstrate the value of data products through rigorous scientific analyses, providing important support to space weather forecasters and the wider scientific research community. In this presentation, we highlight a few specific examples where scientists have played crucial roles in sustaining the reliability, accuracy, and enhanced the scientific value of these data products.

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43. GONG solar data collection, processing, and distribution

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The Data Center of the National Solar Observatory's Integrated Synoptic Program (NISP) sits at the heart of the GONG project, coordinating the collection, processing, and distribution of 24/7 solar data to the Space Weather forecasting and scientific communities.

In this poster, we provide an overview of the pipelines and data products currently used in Space Weather predictions and other related products. Here we discuss support that the Data Center provides for GONG Network operations and Space Weather forecasting programs, including pipeline development and maintenance, data quality assurance, computer resource management, and facilitated access to GONG data for the scientific community. We also maintain GONG pipelines running at the SWPC Data Center, and generate U.S. Air Force Data Assimilative Photospheric Flux Transport (ADAPT) model maps using GONG data. As a group, we ensure such disparate products as H-alpha images, calibrated magnetograms, Doppler-helioseismology-generated farside maps, and other products are served to the community for both on-time forecasting needs and research applications.

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44. GONG: A Global Ground-Based Network for Continuous Solar Observations

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The US National Science Foundation's (NSF) Global Oscillation Network Group (GONG) is a network of 6 robotic telescopes around the globe to provide continuous observations of the Sun. GONG delivers full-disk observations of Doppler measurements, line-of-sight magnetograms, white light and H-alpha images at a cadence of one minute, achieving a median duty cycle of about 0.9 (90% of a 24-hour day) for fully calibrated dataset or 0.95 for quick reduced (space weather operations) data. The data are transmitted in near-real time to NOAA/SWPC and NSO/NISP Data Centers and made available for operational space-weather forecasting and for the broader research community. GONG has been in operation since 1995.

This poster presents a high-level overview of the project and introduces its three major components: network operations, data processing, and science support. Each of these components is described in more detail in coordinated posters. We also discuss current plans for maintaining GONG operations, and its future replacement – the next-generation GONG (ngGONG).
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45. Near Real-Time Monitoring of HF Propagation with SuperDARN Radars

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The Super Dual Auroral Radar Network (SuperDARN) operates on High Frequency (HF) to benefit from refraction in the ionosphere to illuminate plasma irregularities in the F-layer. A by-product of regular operations is information on HF propagation conditions which are useful for establishing communications links. As part of a previous project, we analyzed the impact of solar flares on the dayside ionosphere as seen by SuperDARN radars in Short Wave Fadeout (SWF) events. We have developed a prototype of a system to alert HF users to the occurrence of SWF in the North American sector in near real-time. There are technical challenges with maintaining links to radars in remote locations, but reliability could be improved with more resources. In this presentation we review the capabilities of the near real-time monitoring of HF propagation and the detection of SWFs in a beneficial way to space weather operations and how it relates to the security domain.
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46. Operation-ready: Real time turn-key autonomous ground based magnetometer, FPI and all-sky imager arrays at CPI

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Monitoring space weather events and their effects on the Earth's atmosphere is crucial for the highly technological society we live in today. Effectively monitoring space weather requires an array of sensors that deliver data as fast and accurately as possible. While satellites provide an in-situ and/or a global view, ground based instrumentation provides localized measurements that are essential to measure highly localized events and dynamics. At Computational Physics Inc. (CPI), we have been developing turn-key industrial grade instrumentation to monitor space weather and upper atmospheric dynamics. Currently, we operate 13 magnetometer stations, 2 all-sky imagers and 2 FPIs across the continental US. We have 2 additional FPIs operating in Brazil. Our magnetometers capture real-time magnetic field data with a 1 second resolution. Our FPIs measure the neutral wind from direct Doppler shift measurements of the 630nm airglow with uncertainties less than 0.5 m/s, an acuity unparalleled by any other measurement technique and system currently available. Our all-sky imager has the capability to calibrate and orient itself and deliver images in real-time. Additionally, it can identify objects in the sky. All of our instrumentation runs autonomously and delivers high quality real-time magnetic field, thermospheric temperature and wind (including vertical wind) data, as well as imagery from different heights of the atmosphere. We will be describing our instruments and their capabilities in this poster.
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47. Real-Time Ground-Based Radio Monitoring for Space Weather with OVRO-LWA

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Low-frequency solar radio observations provide a powerful ground-based tool for monitoring eruptive activity in the solar corona. The Owens Valley Radio Observatory Long Wavelength Array (OVRO-LWA) enables high-cadence solar dynamic spectra and imaging over frequencies sensitive to shocks, electron beams, and coronal mass ejections.

We present the real-time capability of OVRO-LWA as a radio facility for space weather applications. This includes near-real-time spectrum and imaging products that can identify type II and type III bursts, track shock propagation, and provide rapid context for flare- and CME-related activity. These radio diagnostics can complement existing monitoring systems by improving the detection and characterization of eruptive solar events. OVRO-LWA demonstrates the potential of ground-based radio imaging spectroscopy as an important component of future space weather monitoring and forecasting.
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48. Upgraded Neutron Monitor–Based Alert System for Ground?Level Enhancements

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The upgraded neutron monitor-based alert system for Ground-Level Enhancements (GLEs) is designed to provide rapid and reliable detection of relativistic solar particle events using real-time measurements from the Simpson Neutron Monitor Network. Its primary objective is to strengthen operational space-weather capabilities by improving the timeliness of radiation-hazard warnings relevant to aviation, satellite operations, and other affected technologies. In this contribution, we present the updated system and assess its performance using GLE ?77 (11 November 2025) as a representative test case. During this event, the alert algorithm issued a trigger 16 minutes before the corresponding SWPC alert based on the GOES >100 MeV proton flux, demonstrating the value of neutron monitor observations for earlier identification of extreme solar energetic particle (SEP) events. This result highlights the complementarity between ground-based and space-based monitoring in operational radiation-alert frameworks. An alpha version of the upgraded system is now available online, and users may subscribe to receive warning and alert notifications, enabling broader community access and operational evaluation. The results demonstrate the system's potential as an effective component of future space-weather alert services for extreme SEP events.

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49. Updating Space Weather Benchmarks for Critical Infrastructure Protection

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Space Weather (SWx) events can severely damage critical infrastructure, resulting in direct or cascading failures across key services such as electric power, communications, transportation water supply, healthcare, and more. Official SWx Benchmark reports were released in 2018 and 2019, with the goal of enhancing awareness of space weather threats to critical infrastructure. The goals of this new program are to (1) review the existing SWx benchmarks and recommendations, (2) develop new benchmarks for a specific set of SWx phenomena, and (3) recommend possible new benchmarks and relevant future modeling and observational data to improve critical infrastructure protection. The APL-led research team will use state-of-the-art first-principles modeling and global observational datasets (from ground- and space-based instruments) to simulate diverse high-consequence events (1-in- 30-year events; 1-in-100-year events; 1-in-300-year events; and 1-in-1000-year events), with a focus on these five SWx phenomena:
1. Induced Geo-Electric Fields
2. Ionizing Radiation
3. Ionospheric Disturbances
4. Solar Radio Bursts
5. Upper Atmospheric Expansion
The science team will communicate regularly with DHS, Sector Risk Management Agencies (SRMA), Commercial Industry, and other relevant Users who may be affected by SWx. This 2-year program will generate

inputs for developing vulnerability assessments and risk estimates, help establish decision points and thresholds for action, improve mitigation procedures, and enhance response and recovery planning for our nation's critical infrastructure owners and operators. This presentation will focus on the basic research component of the effort and also on how the scientific findings and deliverables will ensure meaningful actionable outcomes for Critical Infrastructure Users and Stakeholders.