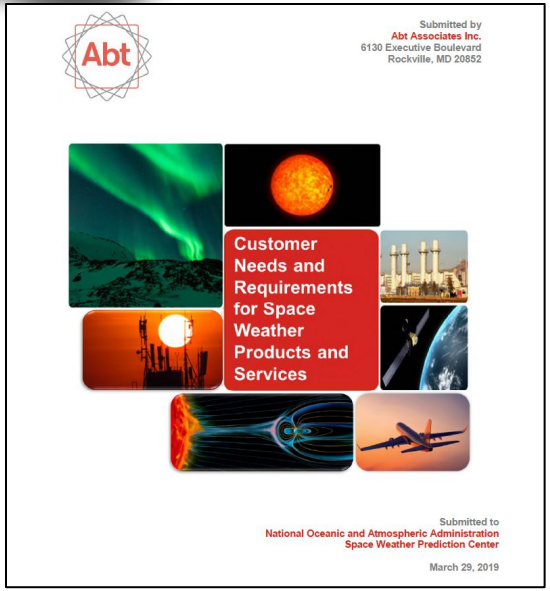
Space Weather Prediction Center Highlights

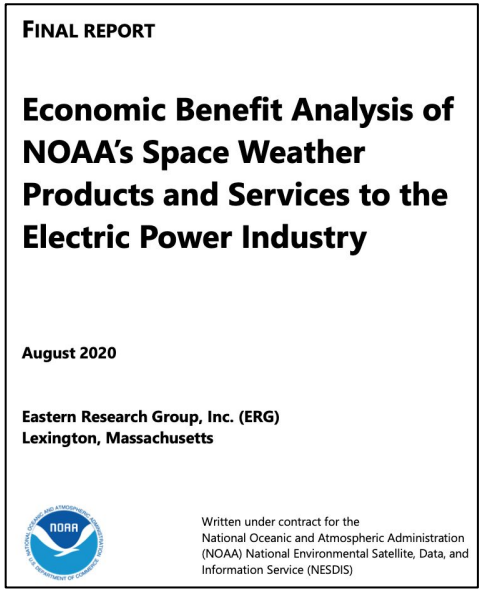
Committee on Solar and Space Physics
Clinton Wallace, Director SWPC
Tue, 12 Oct 2021

Safeguarding Society with Actionable Space Weather Information

Customer & Enterprise Partnerships Engagement: Needs and Requirements – Recent Reports



https://www.swpc.noaa.gov/sites/default/files/images/FINAL%20SWPC%20User%20Needs%20Report-1.pdf



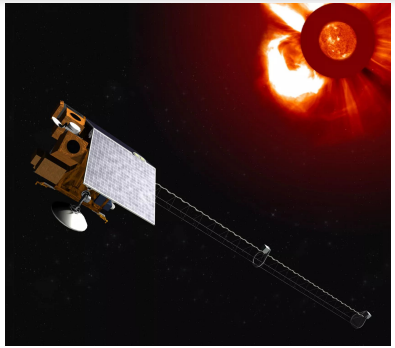
https://www.nesdis.noaa.gov/sites/default/files/SpWx%20Economic%20Benefit%20Analysis%20-%20Electric%20Power_Final%20Report%20V2_August%202020.pdf

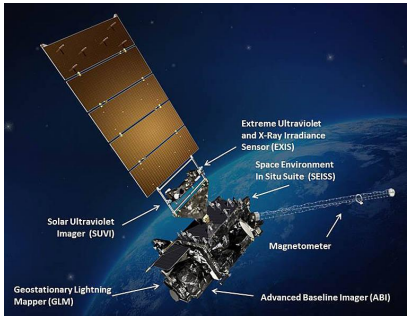
https://www.nap.edu

NOAA's Space Weather Follow-On (SWFO) – L1, DSCOVR, and Geostationary Operational Environmental Satellite (GOES)

SWFO-L1:

- Launch schedule: February 2025
- Coronagraph, solar wind plasma, magnetic field, suprathermal protons and electrons





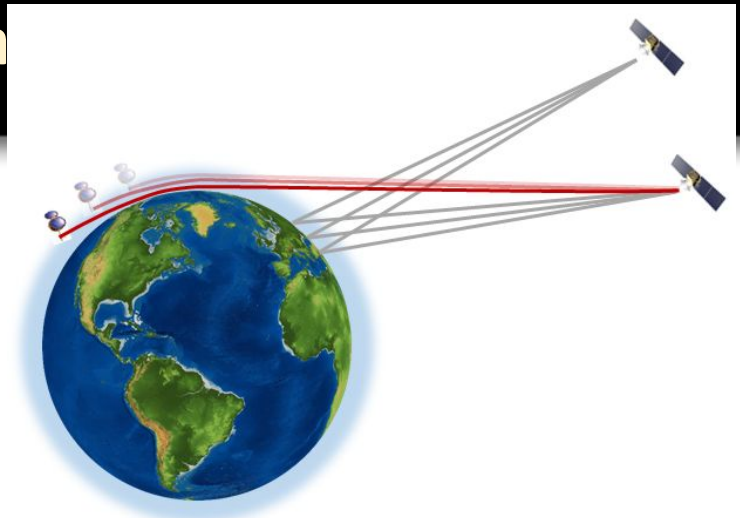
GOES-17:

- August 24, 2021: GOES-17 – Operational space weather data available
- Solar Ultraviolet Images
- Extreme Ultraviolet and X-ray Irradiance Sensor
- Space Environment In-Situ Suite (electrons, protons, heavy ions)
- Magnetometer

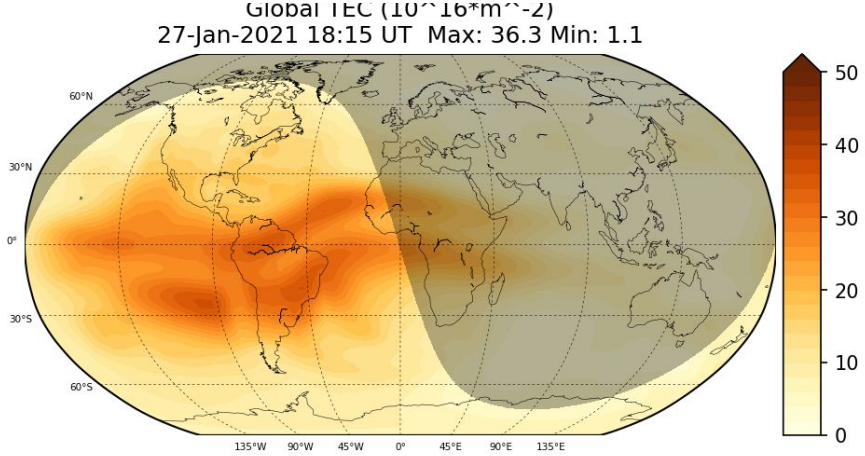
- GOES 16, 17 Operational at SWPC
- DSCOVR –operational at L1
- GOES-T launch target is February 2022
- GOES-U launch target is April 2024
- GOES-U will include a Compact Coronagraph

Elsayed Talaat – NESDIS Follows with Satellite Program details

Commercial Weather Data

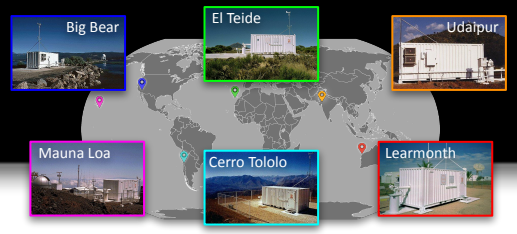


- NOAA is purchasing GNSS radio occultation data from private companies
- March 17 – September 16, 2021 - GeoOptics
- September 17 – March 16, 2022 - Spire
- SWPC is evaluating data in a global, data-assimilative ionosphere model –



- Radio occultation data are consistent with ground-based measurements
- Positive impact expected where ground-based measurements are not available (i.e., oceans)

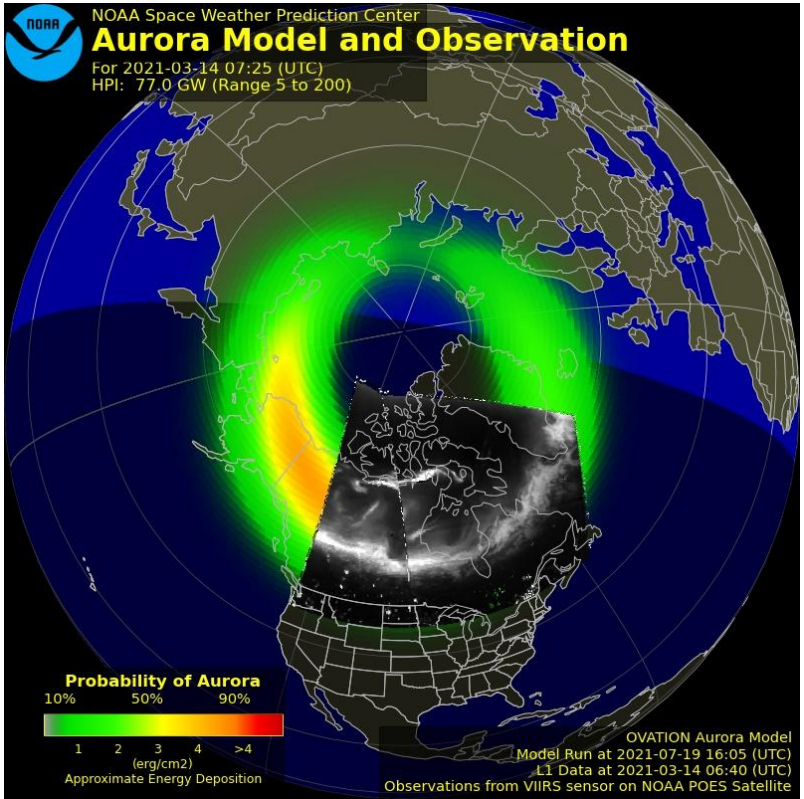
Global Oscillation Network Group (GONG)



- Data processing transitioned from NSF/NSO to SWPC in April
- SWPC and NSO now collaboratively maintaining and monitoring processing
- MOU signed in July for another five years of O&M support
- Next-generation network-developing a plan as called for in NSW-SAP

Auroral Model and Observations: New Proposed Experimental Product

Test version: not all labels correct



- **Oval Variation, Assessment, Tracking, Intensity, and Online Nowcasting (OVATION) Prime empirical model of the intensity of the aurora originally developed at JHUAPL**
- **L1 solar wind observations drive model to produce electron and proton auroral energy input**
- **2021 demonstration compares NOAA VIIRS instrument auroral observations with model results**
- **Supports model validation and user demand for auroral information including auroral zone impacts on communications, navigation, power grids**

Whole Atmosphere Model-
Ionosphere Plasmasphere Electrodynamics

Operational July 21, 2021

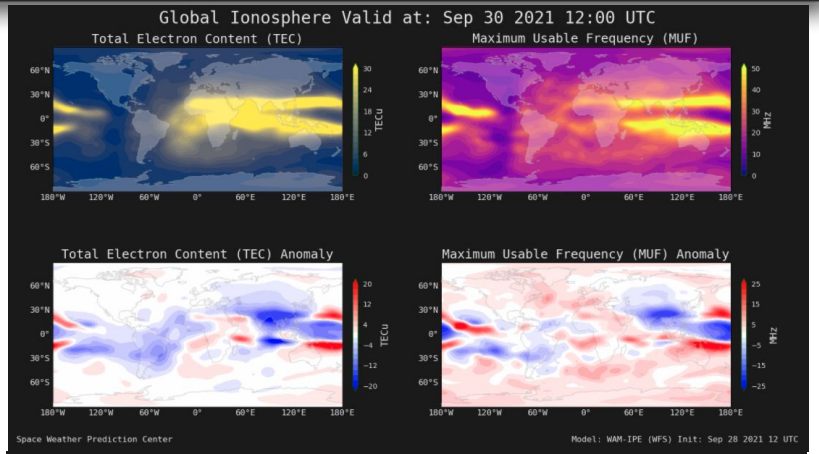
Extends NWS weather model to 600 km

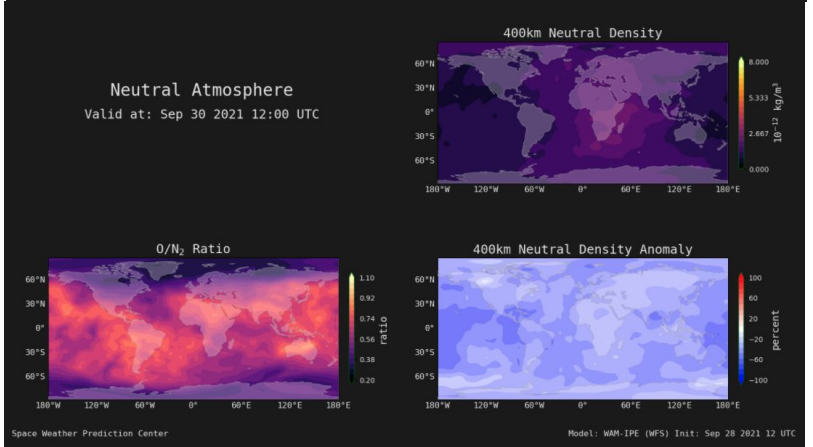
Includes ionosphere/thermosphere electrodynamics and plasma processes

Two-day forecasts

Neutral Density	Temperature
Winds	Ionosphere Plasma Density
Velocity	Temperature
TEC	MUF

https://www.swpc.noaa.gov/products/wam-ipe

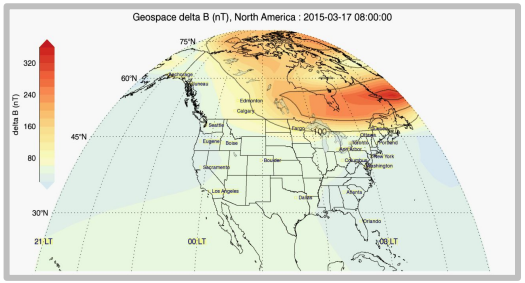




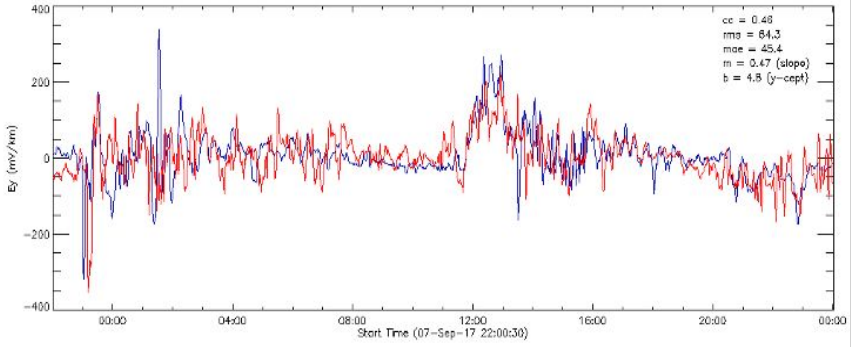
Predicting Regional Geoelectric Fields Supporting Power Grids and other Customers

Predicted ground dB/dt using L1 solar wind
Geospace - Operational at SWPC

Collaboration
University of
Michigan

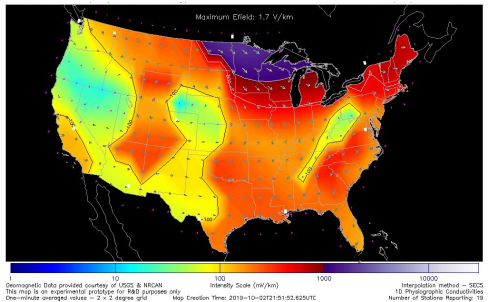


Coupled Geospace/Geoelectric model
Predicted (red) and Nowcast (blue)



Nowcast 1-D Geoelectric field using ground magnetometers – Operational at SWPC

Collaboration
USGS and NRCan



- **Predicted geoelectric field combines dB/dt predictions with geoelectric field calculations**
- **Geoelectric field calculations include Earth conductivity**
- **Excellent agreement in predicted (red) and nowcast (blue) geoelectric field**

- **Co-sponsored NOAA, NASA, NSF**; UCAR organized and diverse organizing committee
- Some Statistics
  - **Registrations: 1095**
    - Includes 193 graduate students and 55 undergraduates
  - 80 oral presentations (including 18 poster lightning talks); 21 chairs
  - 80 posters
  - **International:** 47 Nations **(25% of all Nations)**
- Pre-meeting April 19 **Student networking** session and Student virtual lunch during mtg
- **Diversity, Equity and Inclusion** a high priority (about 41% diversity in oral talks)
- Platforms: Webex, VirtualPosterSession.org

Space Weather Workshop 2022:
April 25-29, 2022 – Boulder
(virtual or hybrid under consideration)

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PROSWIFT Act - Oct 2020

Promoting Research and Observations of Space Weather to Improve the Forecasting of Tomorrow Act

It shall be the policy of the United States to prepare and protect against the social and economic impacts of space weather by supporting actions to improve space weather forecasts including:

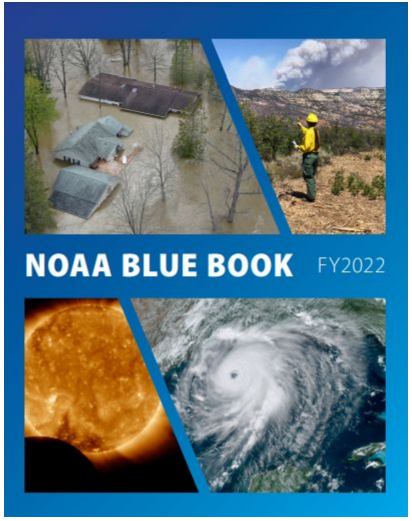
- **Identifying research needs and promoting opportunities for research-to- operations and operations-to-research collaborations**
- **Advancing space weather models**
- **Engaging with all sectors of the space weather community, including academia, the commercial sector, and international partners**

White House responds - President's 2022 Budget

FY 2022 President's Budget requests $5 million for a space weather prediction capability "that will ensure national and global communities are ready for and responsive to space-weather events"

NOAA identified four goals for SWPC to improve model forecasts in 2022:

- **Establish a formal inter-agency R2O2R Framework**
- **Develop and sustain a Space Weather Prediction Testbed**
- **Transition new capabilities onto NOAA's operational infrastructure**
- **Establish two PROSWIFT-directed community collaboration efforts**
  - **Space Weather Advisory Group**



PROSWIFT-directed: Space Weather Advisory Group and Roundtable

Space Weather Advisory Group

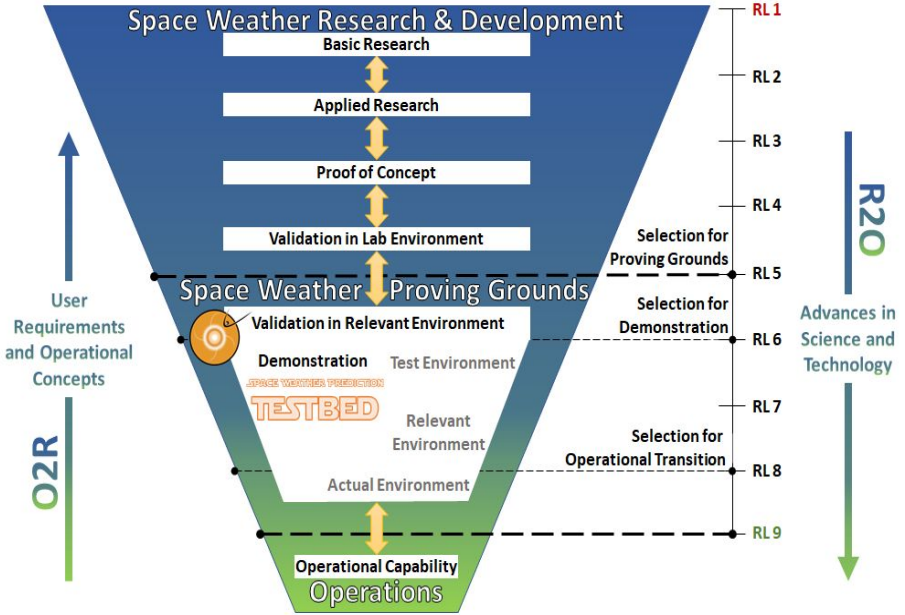
- Advise the SWORM on preparing and responding to space weather
- Enable the coordination and facilitation of R2O2R
- **Commercial Providers:** Gannon, Lautenbacher, Jonas, Tobiska, Duncan
  Academia: Gombosi, Knipp, McIntosh, Elliott, Ho
  End-Users: Olson, Stills, Fugate, Dickinson, Bishop

National Academies Government-University-Commercial Roundtable on Space Weather

- Facilitate communication among SWORM, the academic community, and the commercial space weather sector
- Facilitate advances in space weather forecasting

Space Weather Research-to-Operations-to-Research

- **Multi-agency effort: NOAA, NASA, NSF, DoD**
- **Communicate operational needs**
- **Support applied research to improve numerical models and data utilization**
- **Test and evaluate mature capabilities**
- **Accelerate transition to operations**



Conclusions

Better Forecasts – Improved understanding with new modeling and R2O2R capabilities

Partnerships – Involves the entire US Space Weather enterprise working together with international partners

Outcome – Better information provided to forecasters and key customers for better decisions, enhancing our National resilience