Update from the NOAA Space Weather Prediction Center

Presented to CGMS-53 SWCG meeting - Updates on space weather activities - agency reports

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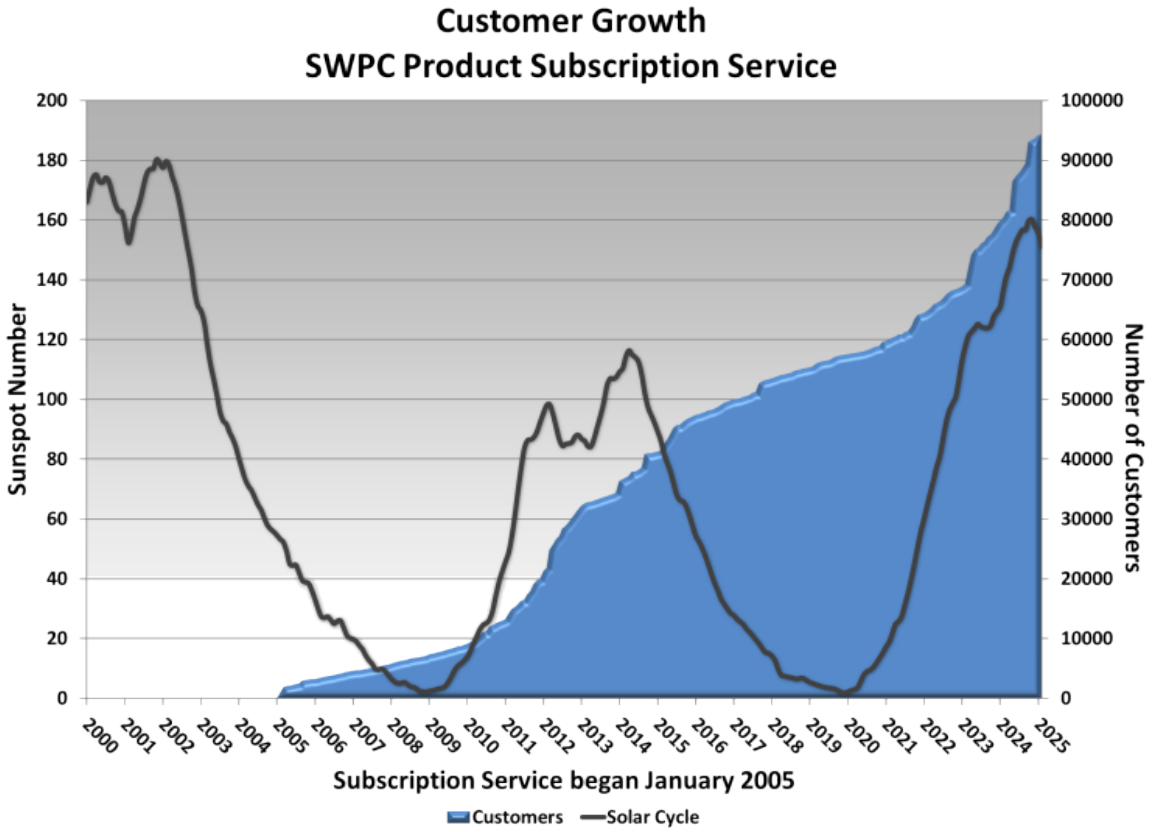
Executive summary of the NOAA SWPC Update

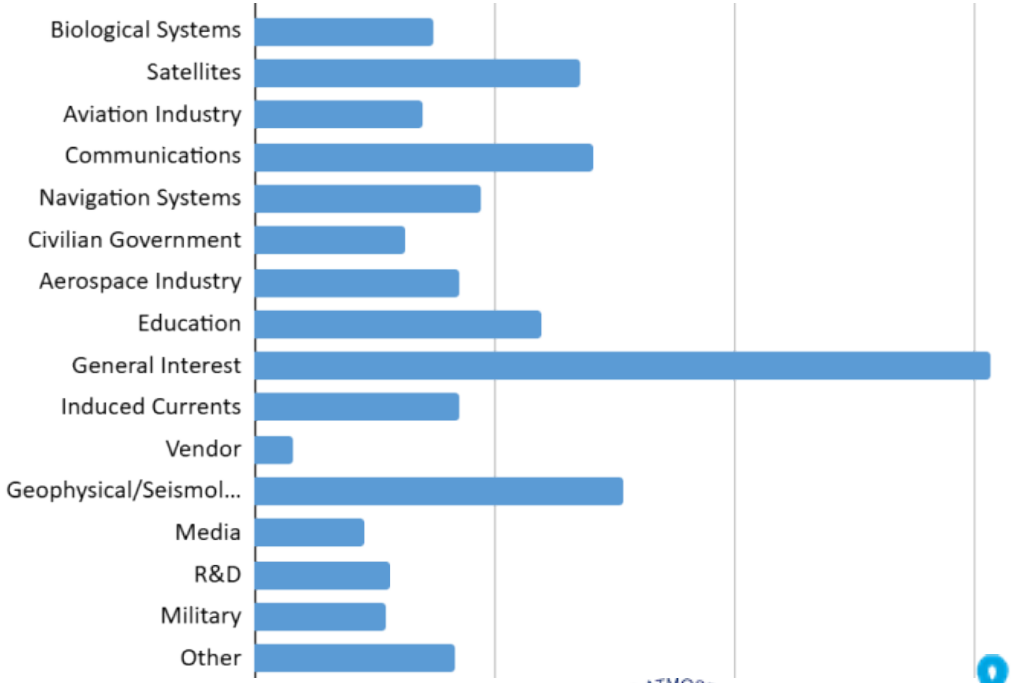
Key activities at NOAA's Space Weather Prediction Center (SWPC)

- Customer engagement.
  - Space Weather Advisory Group's "User Needs" survey.
  - National Academies' Decadal Survey.
  - Revising the NOAA Space Weather Scales for clarity, relevance, and usability.
  - Testbed facility completed and first on-site exercise scheduled.
- New observations and products.
  - GOES-19 satellite and the CCOR-1 coronagraph.
  - Continued development of the SWFO-L1 satellite and ground system.
  - Other new space weather prediction products and models.
- Operational improvements.
  - Achieved and maintained ISO 9001:2015 quality certification
  - Enhanced the Alternate Processing Site for improved system resilience.
- Space weather activity at solar maximum.
  - The Gannon Storm, the first G5 event in 20 years.
  - Underscored the economic and operational impacts of space.

SWPC Customer Growth

- 90,000+ users receiving alerts, watches, and warnings through its Product Subscription Service (PSS).
- Breakdown by sector (note some subscribers fall into multiple sectors).





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Customer Requirements

- Space Weather Advisory Group (SWAG) “User Needs” survey (September 2024).
  - Themes: Regionalization and Impacts; Education and Testbeds; and Data Archives, Access, and Automation.
  - Broken into seven user sectors.
  - SWPC internal review of findings and recommendations is ongoing.

- National Academies of Science (NAS) “Decadal Survey” (December 2024).
  - Sets top priorities in solar and space physics for the next decade.
  - Identifies space weather and societal impacts alongside research priorities.
  - SWPC has begun the process of analyzing this report.

- Revision of the NOAA Space Weather Scales (Ongoing).
  - Aimed at improving clarity, relevance, and usability for end-users.
  - Input from hundreds of end-users, conference attendees, Federal Register responders, and participants at international roundtables.
  - Next: Analyze the data and summarize findings to consider in implementing the suggested revisions.

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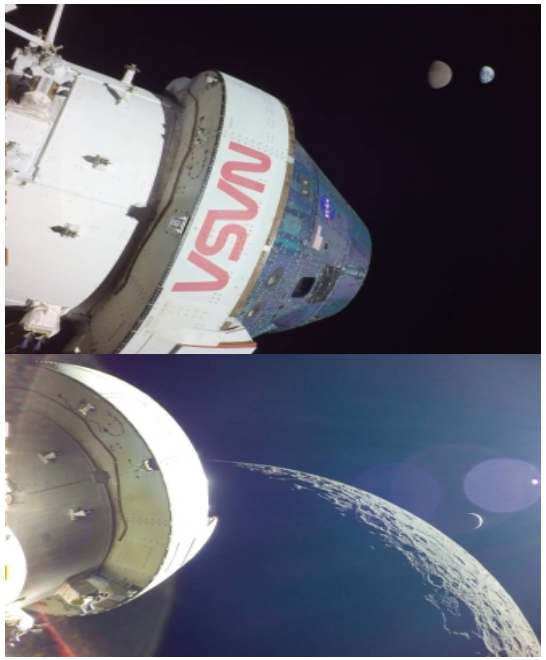
Customer Engagement – Space Weather Prediction Testbed (SWPT)

- The physical facility in Boulder, Colorado was completed.
  - First in-person exercise at the facility planned for two sessions in April and May.
  - Supports planning and coordination for the Artemis II mission.

- Testbed website (testbed.swpc.noaa.gov).
  - Provides a way to collaborate on experimental products with remote partners.
  - Updated with new functions and test products.
  - Process to deploy new test products has been streamlined.

- Work has begun to build a cloud-based back end to the Testbed.



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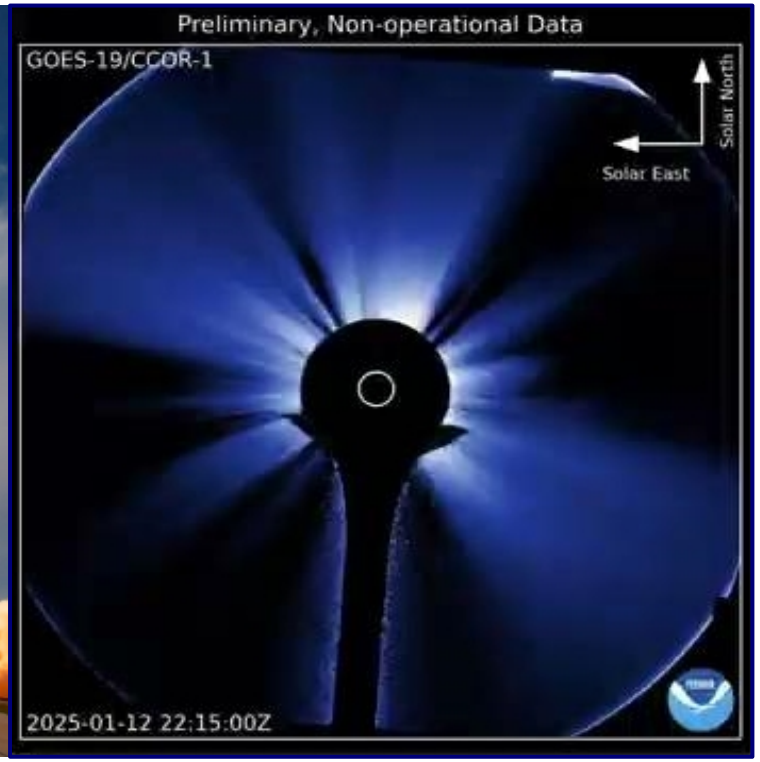
Integration of New Observations…

- GOES-19 - launched June 25, 2024.
  - Standard space weather sensors.
  - Adds Compact Coronograph 1 (CCOR-1, new).
  - Successful Post-Launch Testing (PLT).
  - Operations planned to begin April 4th.



- CCOR-1 - first operational coronagraph.
  - Performance has been extensively analyzed.
  - Opportunities to refine the data products including characterizing and correcting artifacts.
  - Excellent resolution, dynamic range, and latency.
  - Forecaster tools being updated.

- Space Weather Follow-On Lagrange 1 (SWFO-L1) - Launch NET September 2025.
  - Real-time processing development led by SWPC.
  - Development is on schedule.
  - Hosts CCOR-1

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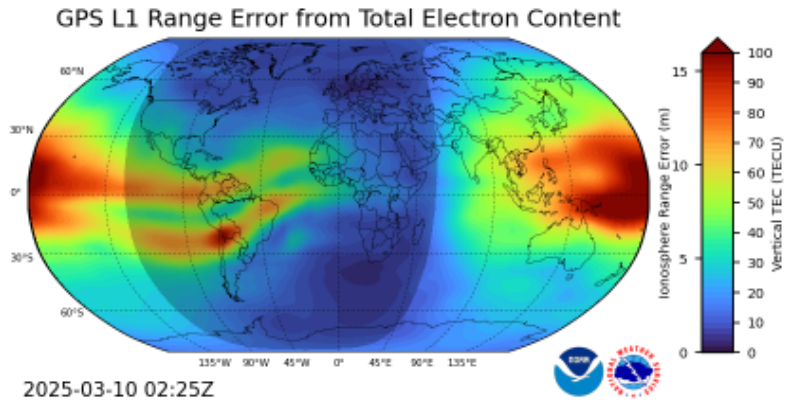
….and Products

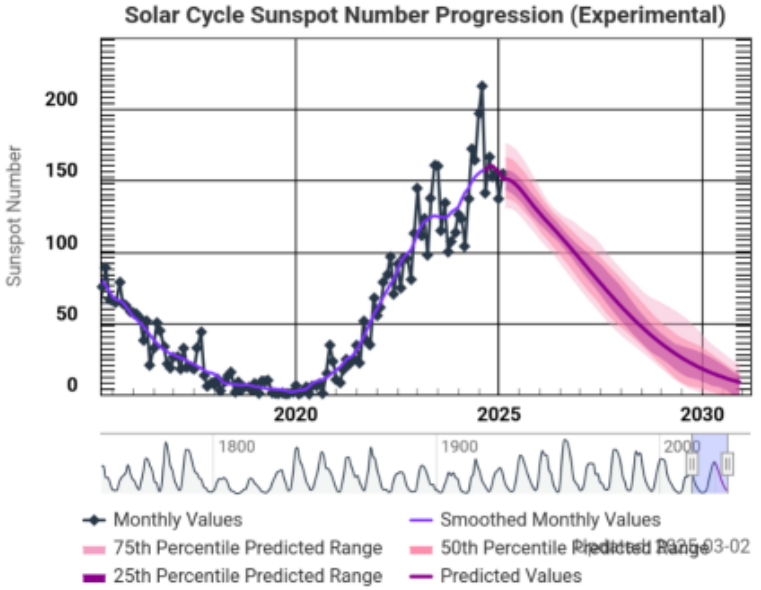
- Global TEC (GloTEC) model deployed operationally.
  - Supported ICAO at SWPC since 2019.
  - Publicly available home for global TEC.
  - Incorporates ground-based and space-based (RO) data.

- Updating Solar Cycle Progression coming to operations.
  - Rolling monthly prediction.
  - Prior version underestimated the solar cycle (issued by Solar Cycle Prediction Panel, 2019).

- GOES >500 MeV protons in operations.
  - Plots on website.
  - JSON in data services.

- Other new products will be released later this year.
  - Energetic Heavy Ions Sensor (EHIS) counts.
  - Solar Ultraviolet Imager (SUVI) flare location.





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Quality and Resilience

- ISO 9001:2015 Quality Management System (QMS) Certification
  - International Civil Aviation Organization (ICAO) requirement.
  - Certified March of 2024, recertified March 2025
  - Zero non-conformities.
  - Multiple areas found to be “highly effective.”
  - SWPC adheres to its quality policy, including a commitment to continuous improvement.

- Enhanced Alternate Processing Site (APS) operations.
  - Geographically distributed data operation sites.
  - Better network integration, training, and procedures.
  - Successful February operations (2+ weeks) from the APS.
  - Minimal service interruptions and no lost data during the transition periods.

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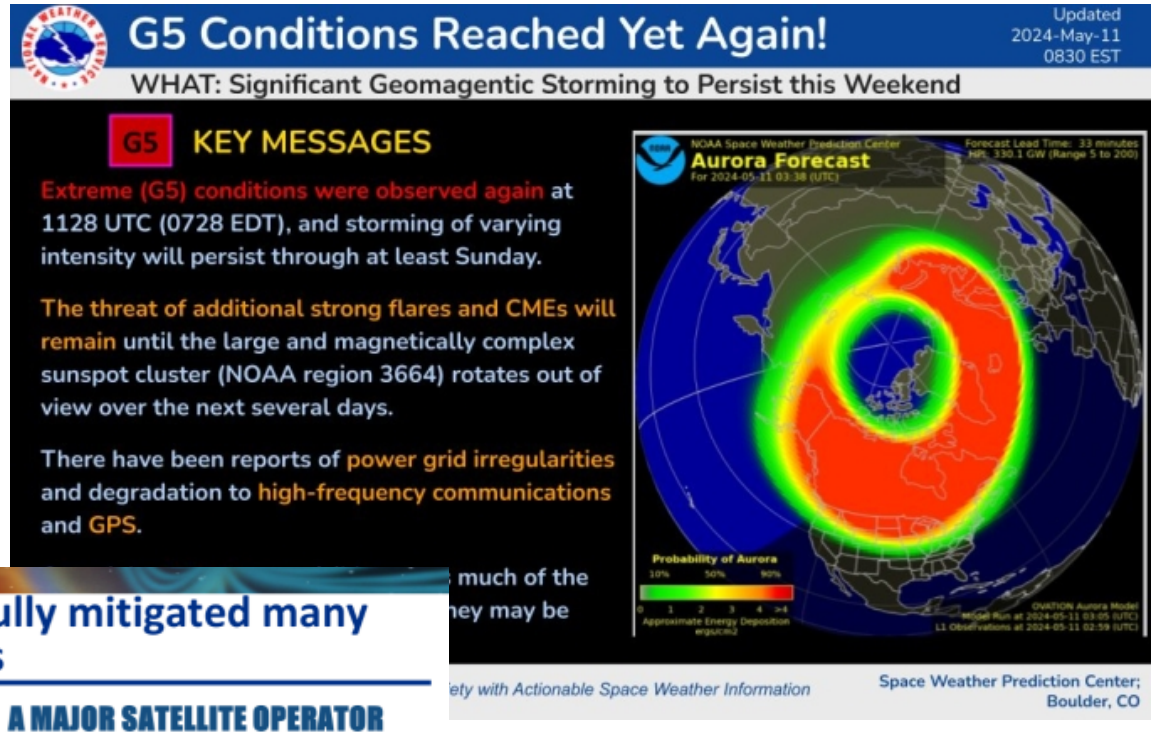
Space Weather Communication

- EVENTS of May 8th through May 12th
- Extensive operational information exchange throughout the event including:
  - Briefings
  - Decision-support
  - Products
  - Messaging
  - Updates to specific sectors
  - Public updates and social media



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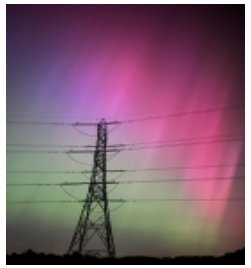
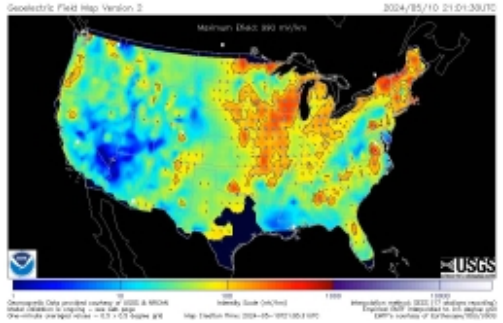
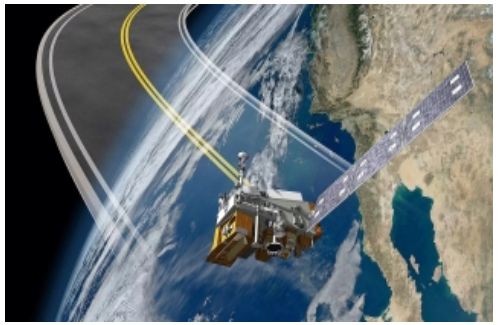
G5 Geomagnetic Storm Impacts: 10-12 May 2024





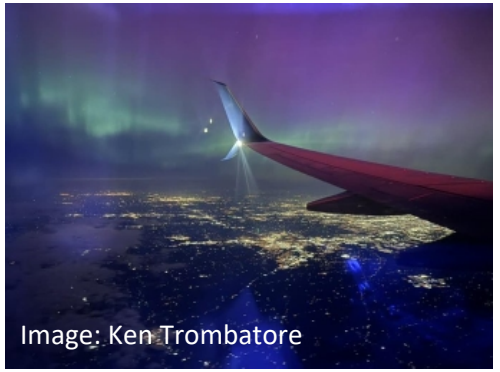


Energy Sector

- US and Canada grid operators took numerous actions to mitigate impacts
- High voltage lines tripped in northern Europe
- UK transformers overheated/alarmed
- New Zealand disconnected northern islands power

Satellite Operations

- ~5000 LEO satellites experienced increased drag, necessitating more frequent station-keeping and collision avoidance burns
- Degraded Starlink service
- Global communications satellite lost sync lock



May 13, 2024

The New York Times

Solar Storm Crashes GPS Systems Used by Some Farmers, Stalling Planting

Aviation

- Trans-oceanic flights rerouted due to High Frequency radio loss
- WAAS used for precision landing and performance-based navigation unavailable for ~15 hrs
- NOTAM advising of comms/nav disruptions

GPS Systems

- Loss of lock on GPS signals
- Range errors
- Both civilian and defense
- Idled Midwest planting

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