Space Weather

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Our Mission: To provide space weather products and services that meet the evolving needs of the Nation.

Our Vision: A Nation prepared to mitigate the effects of space weather through the understanding and use of alerts, forecasts, and data products.
Three Varieties of Space Weather

93 Million Miles from Sun to Earth

- **Bursts of Electromagnetic Radiation**: 8 minutes
- **Showers of High Energy Particles**: 10-30 minutes
- **Tsunamis of Magnetized Plasma**: 18-96 hours
Three Varieties of Space Weather

- **Bursts of Electromagnetic Radiation**
  - 8 minutes
  - Disruption of GPS and HF Radio Comms

- **Showers of High Energy Particles**
  - 10-30 minutes
  - Satellite upsets and radiation threats to astronauts, air crews

- **Tsunamis of Magnetized Plasma**
  - 18-96 hours
  - Damage to power grids and disruption to polar HF Radio Comms

93 Million Miles from Sun to Earth
Two Types of Phenomena

“SOLAR TSUNAMIS”
CORONAL MASS EJECTIONS

“SOLAR TORNADOS”
SOLAR FLARES

High Energy Particles

Magnetized Plasma

Electromagnetic Radiation
Space Weather Impacts From Electromagnetic Radiation

Electromagnetic Radiation

- Ionizes the upper atmosphere.
- Produces scintillation of radio signals and GPS.

“SOLAR TORNADOS”
Space Weather Impacts From High Energy Particles

“SOLAR TSUNAMIS”
“SPACE TORNADOS”

High Energy Particles
10-30 minutes

Damages sensitive electronics, creates electric discharges, sickens astronauts.
Space Weather Impacts From Magnetized Plasma

Generates Spurious Electric Currents.

“SOLAR TSUNAMIS”

Magnetized Plasma

18-96 hours
Our Nation’s Evolving Needs

Working with White House, Congress, and government leadership.

Coordinating on ways forward to develop and implement mitigation strategies to safeguard critical infrastructure from the impacts of severe space weather.

- Secure High-voltage Infrastructure for Electricity from Lethal Damage Act (SHIELD Act) (11 Feb, 2011)
- Meeting at White House with National Security Staff and OSTP (18 Feb, 2011)
- Op Ed on space weather by Holdren and Beddington (10 Mar, 2011)
- Electric Infrastructure Security Summit (EISS) in Capitol building (11 Apr, 2011)
Space Weather and Emergency Managers

• FEMA Administrator Fugate visits SWPC

• FEMA Region VIII designated as Space Weather Center of Excellence for FEMA

• Workshop on managing space weather disasters in Transatlantic domain with EU/EC and Sweden held in Boulder (Feb 2010)

• SWPC brief FEMA Leadership at FEMA HQ and FEMA Regions

• Space weather warnings now distributed to FEMA National Response Coordination Center NRCC and FEMA Operations Center

Safeguarding Our Nation’s Advanced Technologies
NOAA Space Weather Scales

Radio Blackouts: R1-R5

Electromagnetic Radiation

 Radiation Storms: S1-S5

High Energy Particles

Magnetized Plasma

Geomagnetic Storms: G1-G5

Category 5 Storms and Blackouts are High Impact/ Low Frequency Events

http://www.spaceweather.gov
Combined Space Weather Services for the Nation

Environmental Inputs (DoD, Civil, International)

Data Received

SWPC – space weather data ingest/analysis/prediction and product flow to the civil sector

AFWA – space weather data ingest/analysis/prediction and product flow to the warfighter

AFWA: Space Wx support provider

Teamwork

Observations Requirements

Space / Space Wx Operators

Tailored Products

2 WS Space Weather Flight
More Space Weather Ahead...

The Sun’s Activity Cycle is about 11 years in length.
SWPC’s Goal:
Provide the right information… in the right format... at the right time... to the right people... to make the right decisions