Headquarters U.S. Air Force

Integrity – Service – Excellence

Unified National Space Weather Capability
Air Force Partnerships and Program Update

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4 June 2013

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Approved for Public Release – Distribution Unlimited

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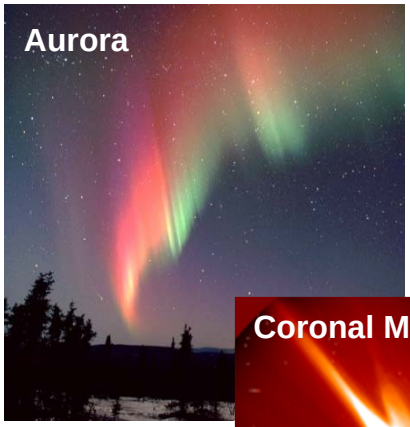
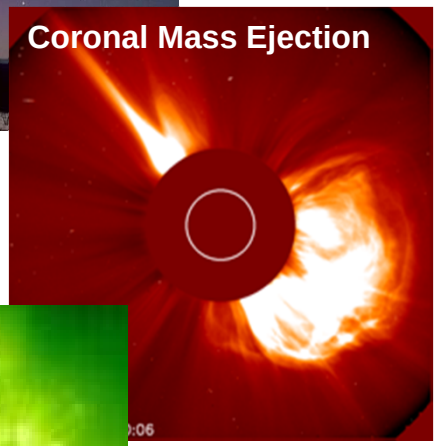
Overview

- Common Challenges & UNSWC Drivers
- AF Weather Mission & Partnerships
- Space Weather Collection
- Products & Services
- Way Ahead





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Our Common Challenges & UNSWC Drivers

- **Space Weather is a "Total Team Sport"… from Research to Ops**
  - Unified National Space Weather Capability leverages and optimizes the nation's space weather expertise and capabilities
  - Streamline process to transition research into operations
- **Expand and leverage each other's collection capabilities:**
  - Ground-Based: Optical, Radio, Geomagnetic, and Ionospheric
  - Space-Based: Ionospheric, Magnetospheric, Radiation Belts, & Solar Wind
- **Improved products and dissemination:**
  - Move from climate-based to physics-based models
  - Net-centric capability: integrate space environment data into C4ISR systems
- **Deliver Ops Focused Exploitation Tools:**
  - Must be operationally relevant and easily understood
  - An operational imperative to rapidly respond to "Solar Threat" of the day
  - Build net-centric technologies for system-of-systems

Partnerships in Sensing, Forecasting, and Exploiting…the Way Forward

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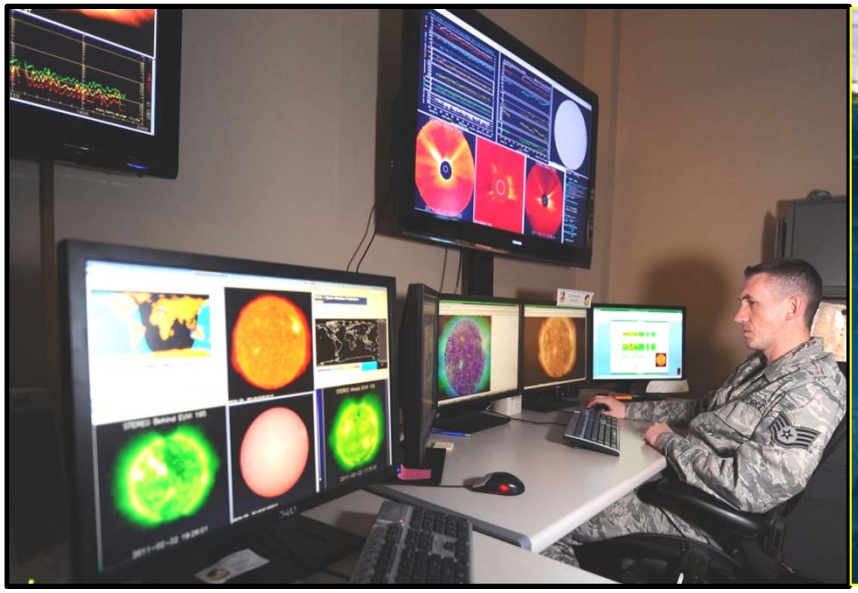
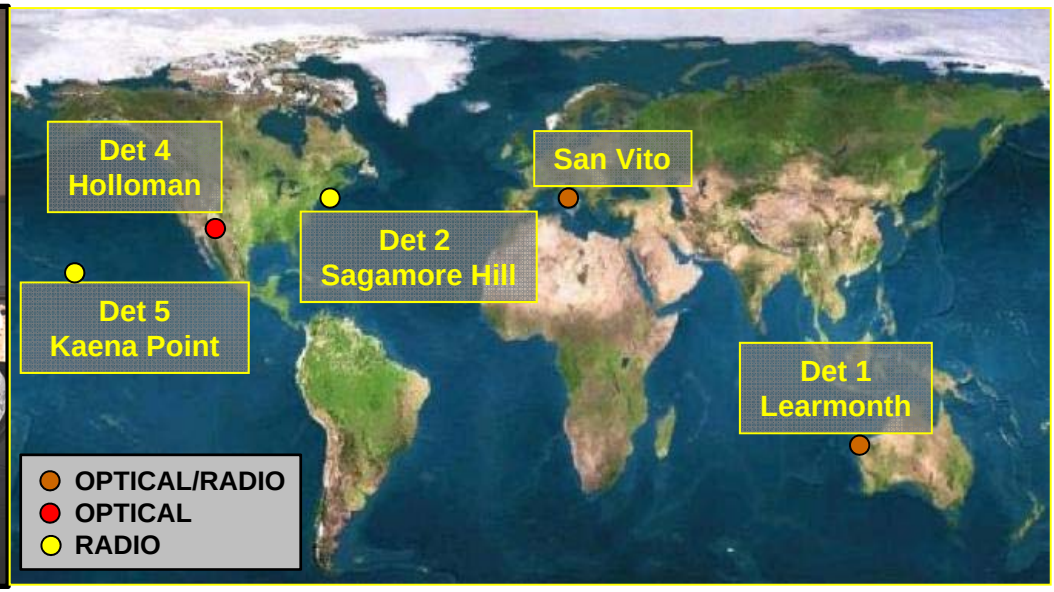
Air Force Space Weather Mission/Units

- Space Weather Operations Center (SpaceWOC) located at Air Force Weather Agency HQ, Offutt AFB, Nebraska provides mission-tailored analyses, forecasts and warnings of system-impacting space weather to national agencies, DoD operators, warfighters and decision makers
  - 2nd Weather Squadron Detachments provide 24/7 radio and optical solar observations to AFWA, SWPC, and foreign partners worldwide





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AF Space Weather Partnerships

40+ Years Providing Support for Warfighters

Environmental Inputs (DoD, Civil, International)

Data Received/Models Run

Tailored Support

Teamwork

Key Partner in Operations

Space Weather Prediction Center

Partnership with DoD, Government, and Educational Labs Critical

Air Force Research Laboratory

NASA

Naval Research Laboratory

Department of Defense

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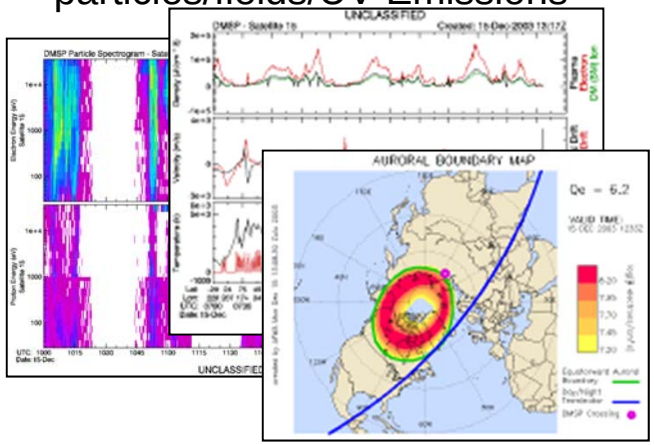
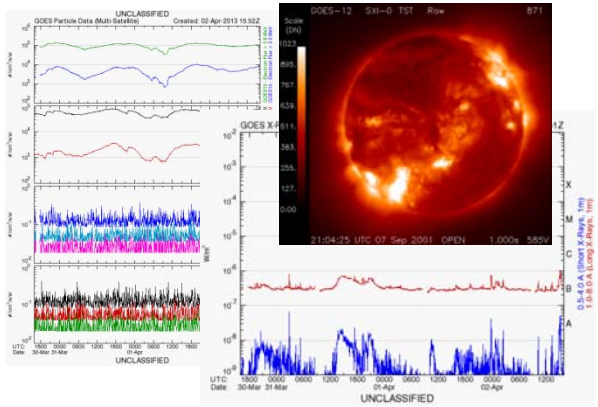
Space Weather Collection

Space-Based Environmental Monitoring

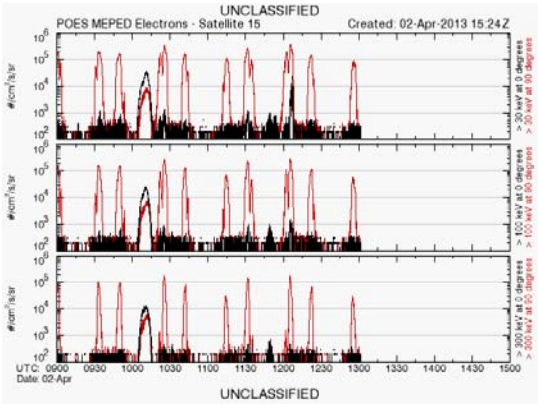
Defense Meteorological Satellite Program (DMSP)
– particles/fields/UV Emissions



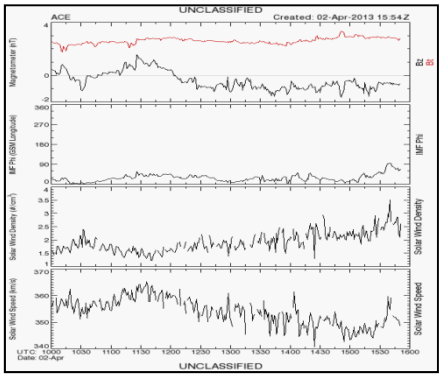
Geostationary Operational Environment Satellite (GOES)
– X-ray, particles and fields



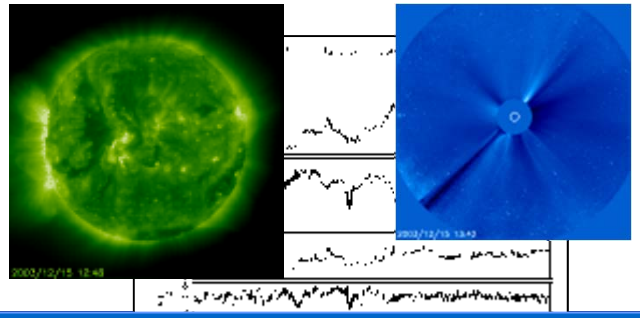
Polar-Orbiting Environmental Satellite (POES) - particles



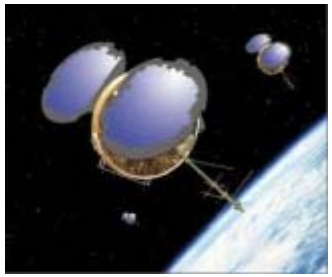
Advanced Composition Explorer (ACE) – solar wind



Solar Heliospheric Observatory (SOHO) – CME tracking
Solar Dynamics Observatory (SDO)
– evaluating for solar flare patrol



Constellation Observing System for Meteorology, Ionosphere & Climate (COSMIC)
– Ionospheric specification



AF Weather relies upon a network of DoD and partner systems

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C/NOFS Update

- Launched Apr 2008 as an Advanced Concept Technology Demonstration (ACTD)
  - C/NOFS program provided unprecedented insight into ionosphere, to include new techniques & improved skill for forecasting scintillation impacts
- Re-entry estimated to occur in Jun 2016
- On 15 Apr 2013, SMC/SD issued a Warning Order (WARNORD) notifying C/NOFS stakeholders of intention to cease operations and execute End of Life actions for C/NOFS due to lack of funding
  - The WARNORD identified needed funding, and associated timelines, to sustain the satellite and prevent End of Life actions
- AFRL has provided sufficient funds to keep satellite alive through end of FY13
- FY14 and beyond is uncertain
  - Working group under the Unified National Space Weather Capability exploring interagency solution

SMC/SD is the Space Development & Test Directorate for Headquarters Space & Missile Systems Center

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Space Weather Collection

Ground-Based Environmental Monitoring

- DoD sensors include:
  - Solar Optical Observing Network (SOON) [AN/FMQ-7] and Radio Solar Telescope Network (RSTN) [AN/FRR-95 & A/F24U-10]
  - Next Generation Ionosonde (NEXION) [DPS-4D]
  - Scintillation Network Decision Aid (SCINDA)
- Also exploit data from many government & non-government sources: magnetometer (USGS), ionosonde (various), TEC (JPL), Neutron Monitors (University of Delaware), Penticton (Canada), and others

USGS

AF Weather relies upon a network of DoD and partner systems

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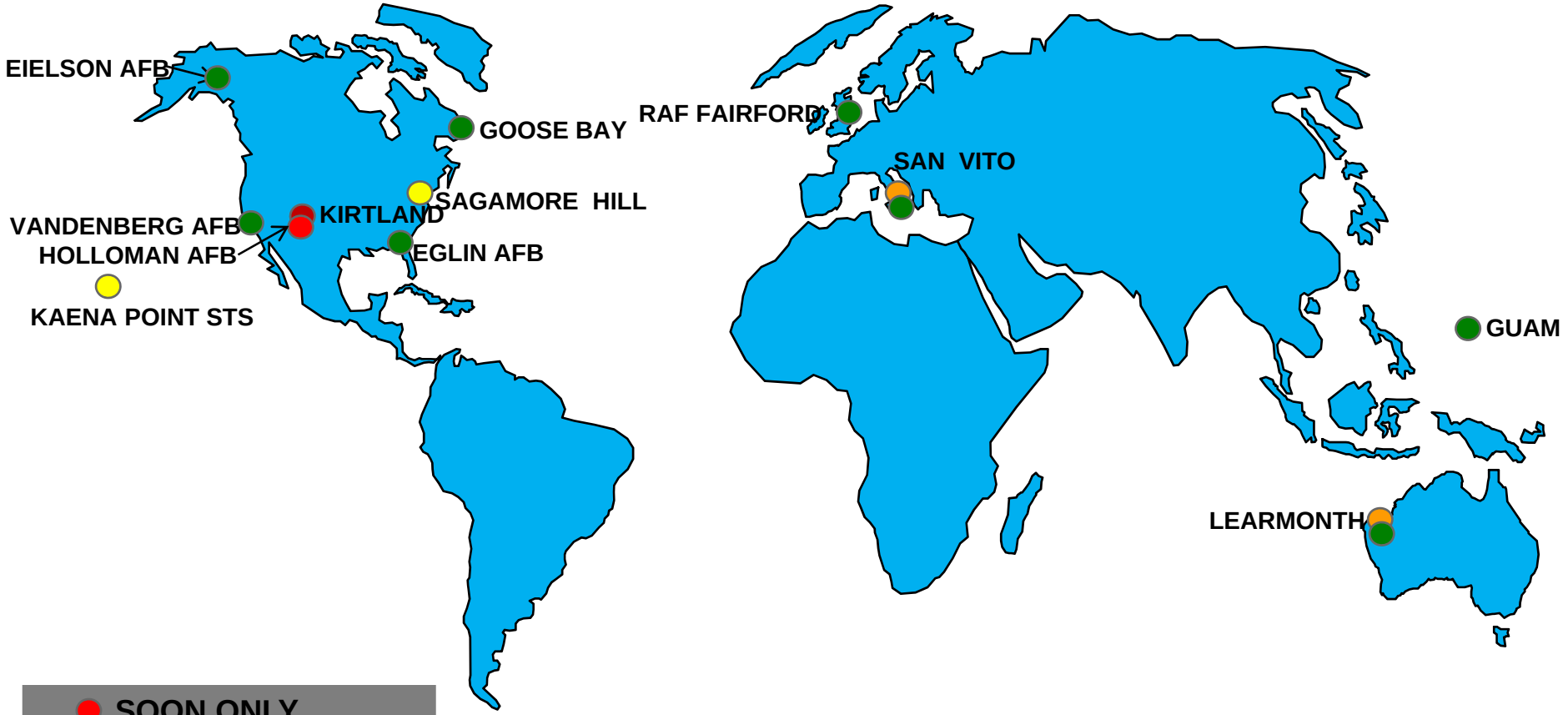
Air Force Weather Global Observing Network



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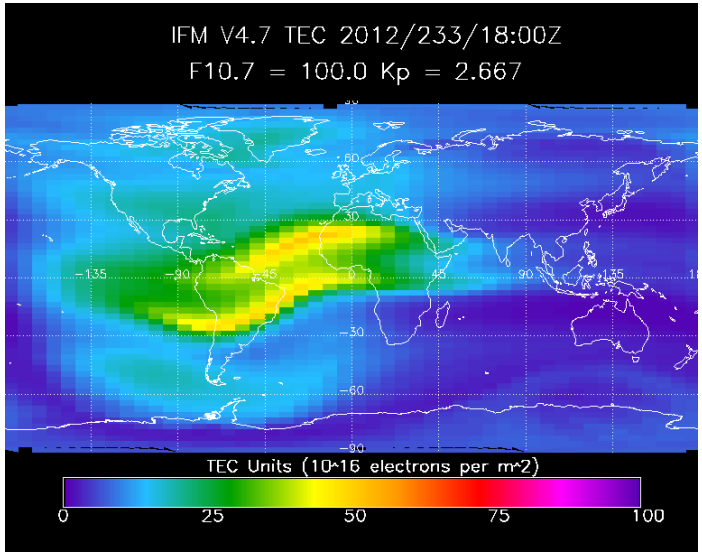
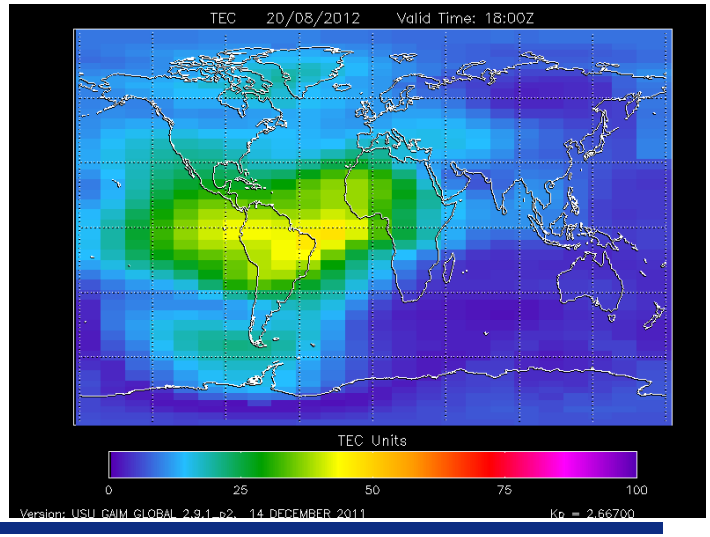
Global Assimilation of Ionospheric Measurements Gauss Markov (GAIM-GM)

- Nation's only operational ionospheric forecast model
- IOC at the AFWA in 2006
- Global electron density specification every 15 minutes
- 24-hour forecast produced at the top of each hour
- Available resolutions
  - Global mode (current)
  - High resolution regional mode (available)
- Vertical extent → 1,600 km
- GAIM Full-Physics IOC est fall 2014
  - Finer horizontal resolution
  - Increased vertical extent





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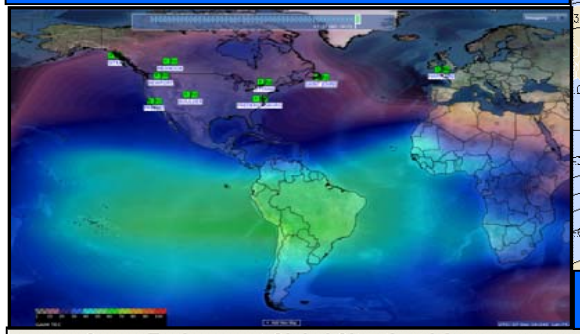
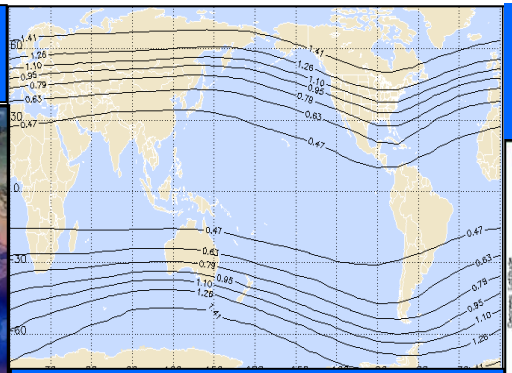
Air Force Space Weather Products & Services

Web Mapping Services for GIS/Google Earth formats

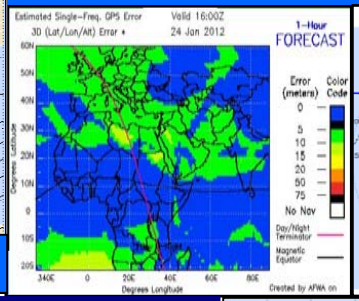


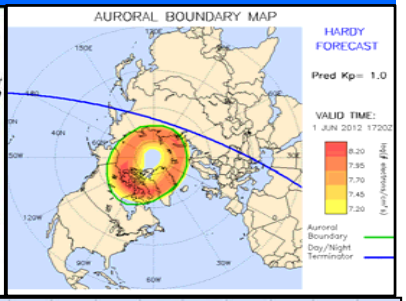


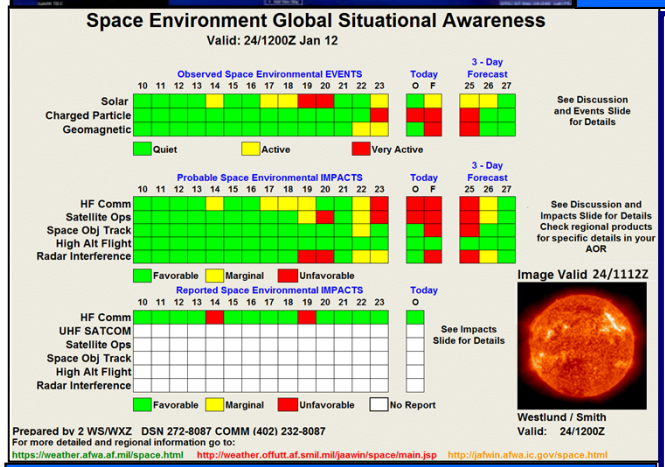
Hi-flyer Radiation Dosage

Space Weather Analysis and Forecast System (SWAFS)

- Models & derived products







Global SA

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WOXX56 KGWC 200802
SUBJECT: AFWA EVENT WARNING REPORT ISSUED AT 0802Z
20 JAN 2013
PART A. SOLAR RADIATION DOSAGE EVENT (UPDATE):
 A SOLAR PROTON EVENT IS IN PROGRESS. BELOW IS AN
ESTIMATE OF THE MAXIMUM RADIATION IN MILLIREMS
BASED ON
 THE GOES SPACECRAFT PROTON MONITORS.  YOU WILL
RECEIVE AN UPDATE EVERY HOUR OR WHENEVER ONE OF THE
 CATEGORIES BELOW IS CROSSED. THE CURRENT RADIATION
DOSE CALCULATION AS OF 0701Z IS 212 MREMS.
 CATEGORIES ARE:
   GREEN = LESS THAN 10 MREMS
   YELLOW = 10 - 99 MREMS
   RED = 100 OR GREATER MREMS
PART B. N/A
PART C. REMARKS:
 ISSUED BY THE AIR FORCE WEATHER AGENCY, OFFUTT
AFB, NE. IF YOU HAVE QUESTIONS OR REQUIRE FURTHER\
 INFORMATION, CALL THE DUTY FORECASTER AT DSN 272-
8087, COMMERCIAL 402-232-8087. INFORMATION CAN ALSO
BE
 OBTAINED AT https://weather.afwa.af.mil UNDER THE
SPACE WEATHER LINK.
FORECASTERS: Bauman/ Otero
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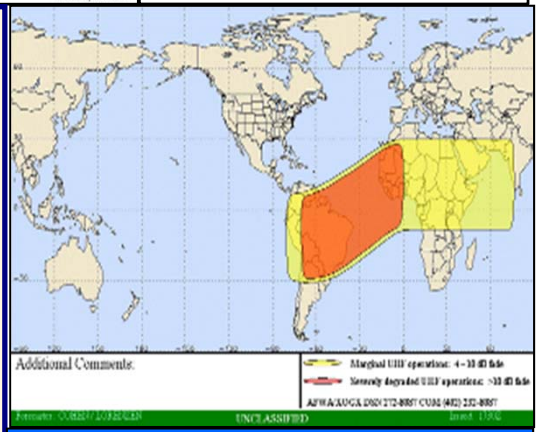
Observed & Forecast Warnings to DoD Forces, Intelligence Community, and Other National Users



Forecaster-In-The-Loop Products (UHF SATCOM Forecast)

40K+ products daily (classified & unclassified)

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Space Weather Mission Support
Way Ahead

- **Unified National Space Weather Capability…interagency partners working together**
  - Continue to team for solar max … and beyond
  - Plan in place to improve collection, forecasting, dissemination, & exploitation
  - Collaborate to increase capability at a reduced cost
- **Invest in collection**
  - Modernize and leverage ground- and space-based sensing capabilities
  - Weather Satellite Follow-on Analysis of Alternatives ongoing
- **Mutually leverage organic, interagency & international sources of data to support operations & resource protection**
- **Support national space weather forecasting needs**
  - Physics-based forecasting
- **Continue toward improved Space Situational Awareness**
  - Tailor products to specific missions and operational needs
    - Communications
    - Satellite health, spacecraft charging
  - Develop expertise/knowledge among operators and space weather professionals through training

Partnerships are critical to nation's space weather capability

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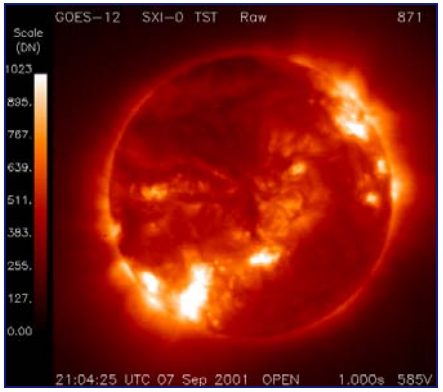
Questions?



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