Air Force Weather Agency

Fly - Fight - Win

AFWA Space Wx & CCMC Collaboration

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Overview

- Space weather operations at AFWA
- CCMC-AFWA Collaboration
- AFWA interests
- AFWA concerns
- AFWA space weather on Google Earth and Google Sun Demo
- Summary

AF Space Weather Support

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- **Space Weather Operations Center (SpaceWOC)**
  - Space weather to support to all DoD operations
  - Solar observatories
  - Satellite and ground-based sensors
- **Space Weather Technology Transition**
  - Transition new technology to forecasters
  - Acquisition of new sensors/data/software
- **Partnerships**
  - Inter and intra-service, labs, universities, private sector
  - Examples: NWS (SWPC), AFRL (SWFL), CCMC, NRL, USU, JHU/APL, etc

Warfighter Impacts

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X-Rays, EUV, Radio Bursts

- SATCOM Interference
- Radar Interference
- HF Radio Blackout
- Geolocation Errors
- Satellite Orbit Decay

Scintillation

- Degraded SATCOM
- Dual Frequency GPS Error
  - Positioning
  - Navigation
  - Timing

Proton Events

- High Altitude Radiation Hazards
- Spacecraft Damage
- Satellite Disorientation
- Launch Payload Failure
- False Sensor Readings
- Degraded HF Comm (high latitudes)

Geomagnetic Storms

- Spacecraft Charging and Drag
- Geolocation Errors
- Space Track Errors
- Launch Trajectory Errors
- Radar Interference
- Radio Propagation Anomalies
- Power Grid Failures

Impact Mitigation

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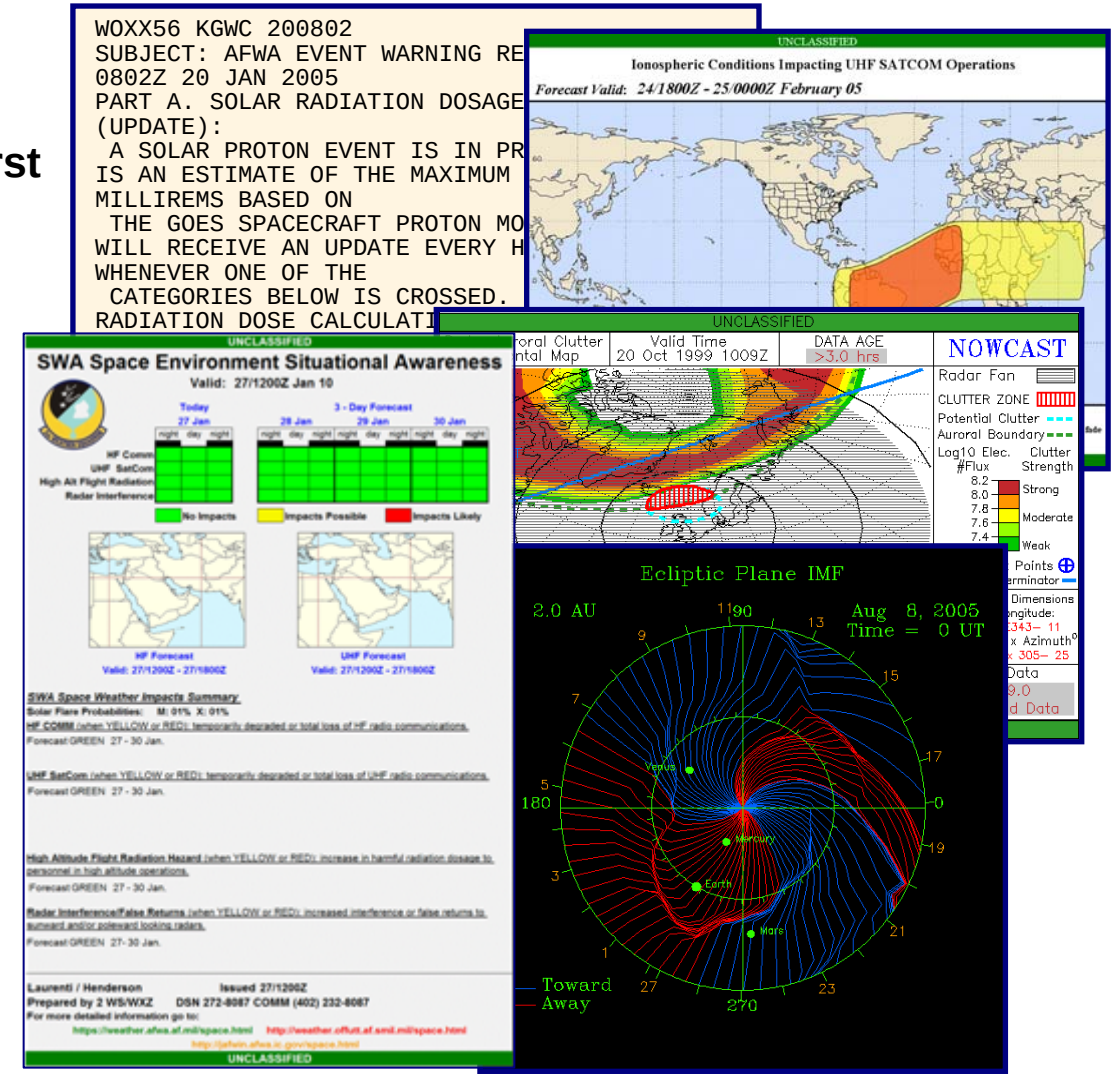
- **Warnings**
  - Geomagnetic Activity
  - Solar Event, Flare, Radio Burst
  - Energetic Particle/Charging
  - Short Wave Fade
- **Specification & Forecast**
  - Solar analysis
  - Ionosphere
  - Magnetosphere
  - Solar Wind
- **Products**
  - Radar Auroral Clutter
  - HF/UHF impacts
  - GPS Error
  - HF/UHF Point-to-Point
  - Ap/F10 Forecast
  - Anomaly Assessments



AFWA-CCMC

- **Excited about collaboration and want to expand**
- **New forecaster tools via Integrated Space Weather Analysis (iSWA)**
  - **Data/model displays (responsive & user friendly!!!)**
  - **Interactive ENLIL+Cone model**
  - **Model Comparisons/Validation**
  - **CCMC Oval display (Fok RC) against Hardy and Ovation (DMSP) Ovals, and POES display**
  - **GAIM data sensitivity study**
  - **“Ensemble” displays**
- **AFIT student projects/research**

AFWA Interests

- Ground-based sensing and real-time data collection/database
- Coupled models and environmental characterization
- Standardized visualizations (easy to compare models)
- Real-time assimilative, full-physics models
- Validation and verification (determine best of breed)
- Ensemble techniques (error characterization)
- 5-day magnetospheric/ionospheric forecasts

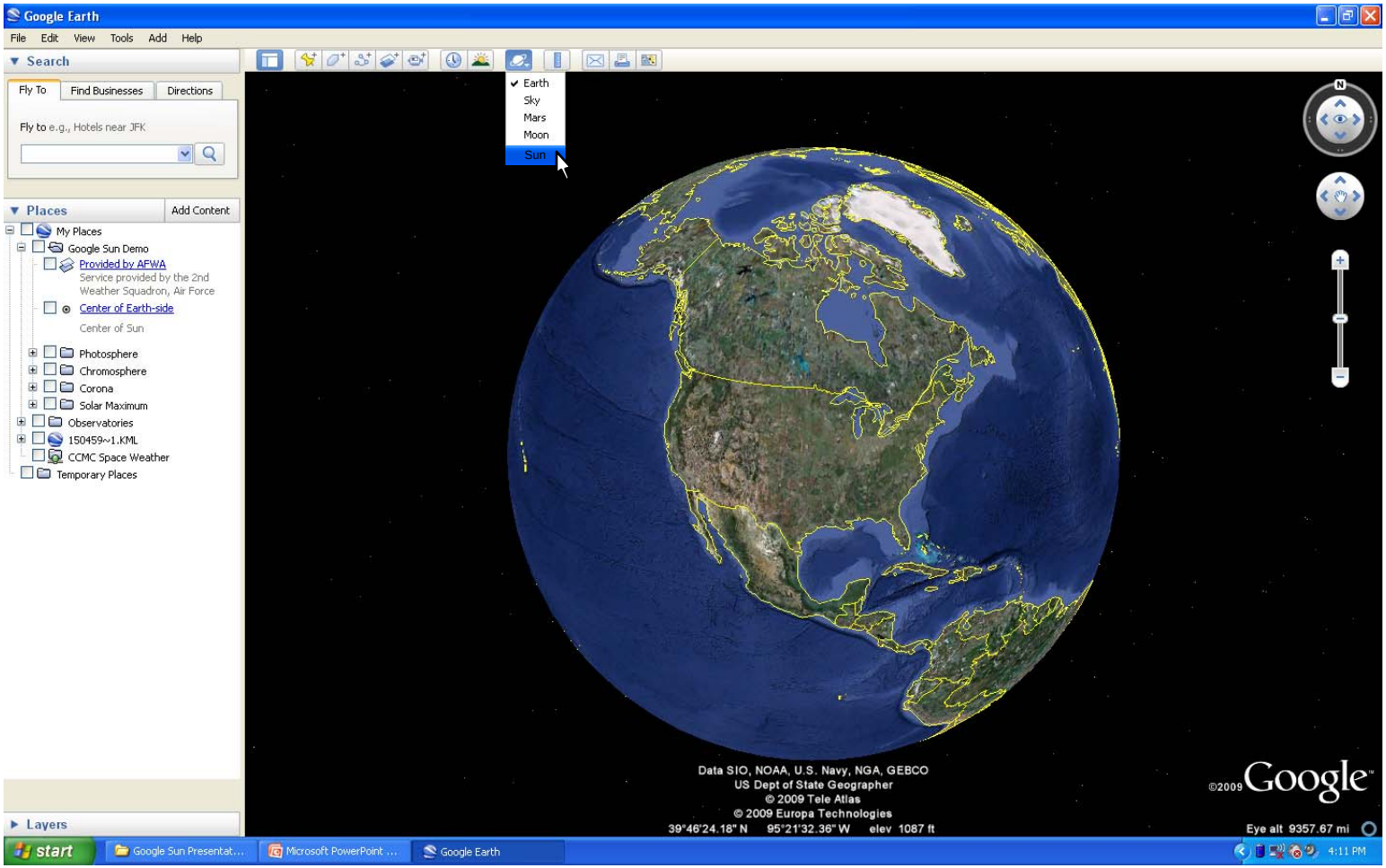
AFWA Concerns

- Information assurance (IT police)
- IMF/magnetospheric nowcast/forecast
- Space weather training & expertise at AFWA
- 5-day forecasted impacts require solar forecasting
- Crying wolf too often
- Weak Solar Cycle 24 maximum

Summary

- CCMC-AFWA one of several ongoing collaborations that is key to advancing AF space weather capabilities
  - AFWA forecasters providing feedback and tip-off
  - CCMC providing displays, model output and expertise
- Research to operations must be a team effort
- Space weather impacts are important to DoD operations, space weather modeling/forecast is a key mission for AFWA

Demo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Questions?