

Headquarters U.S. Air Force

Integrity – Service – Excellence

DoD Space Weather Activities Partnerships and Program Update



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Overview

- **The Challenge**
- **DoD Space Wx Services**
- **Space Weather Data Collection & Forecasting**
- **Way Ahead**

- **AFW-WEBS Demo**



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The Challenge for All of Us

- **Space Weather is a “Total Team Sport” ... From Research to Ops**
- **Expand collection capabilities:**
 - **Ground-Based: Optical, Radio, Magnetic, and Ionospheric**
 - **Space-Based: Ionospheric, Magnetosphere, Solar Wind, & Radiation Belt**
- **Solve the tough forecasting problems:**
 - **Physics-based model improvements**
 - **Move from now-casts to “true” forecasts ... easier said than done!**
- **Deliver Ops Focused Exploitation Tools:**
 - **An operational imperative to rapidly respond to the “Solar Threat” of the day**
 - **Must be easily understood and operationally relevant**
 - **An absolute must if we are to move science into operations and protect our Nation’s valued assets and technologies**

Team, Sense, Forecast, and Exploit...the Way Forward

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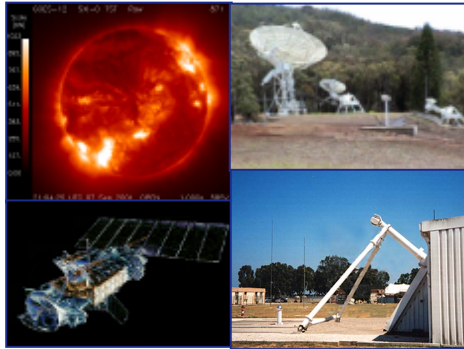


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DoD Space Weather Services

40+ Years Providing Support for Warfighters

Environmental Inputs
(DoD, Civil, International)



Data Received/Models Run



AFWA's
2nd Weather
Squadron
Space Weather
Flight
(DoD's Space
WX Providers)

Key Partnerships

Teamwork



Space Weather
Prediction Center



Community
Coordinated
Modeling Center



Air Force
Research
Laboratory



Naval Research
Laboratory

All Levels of
Support



Department of Defense Users

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Space Weather Space-Based Sensing

Exploit Current Capabilities

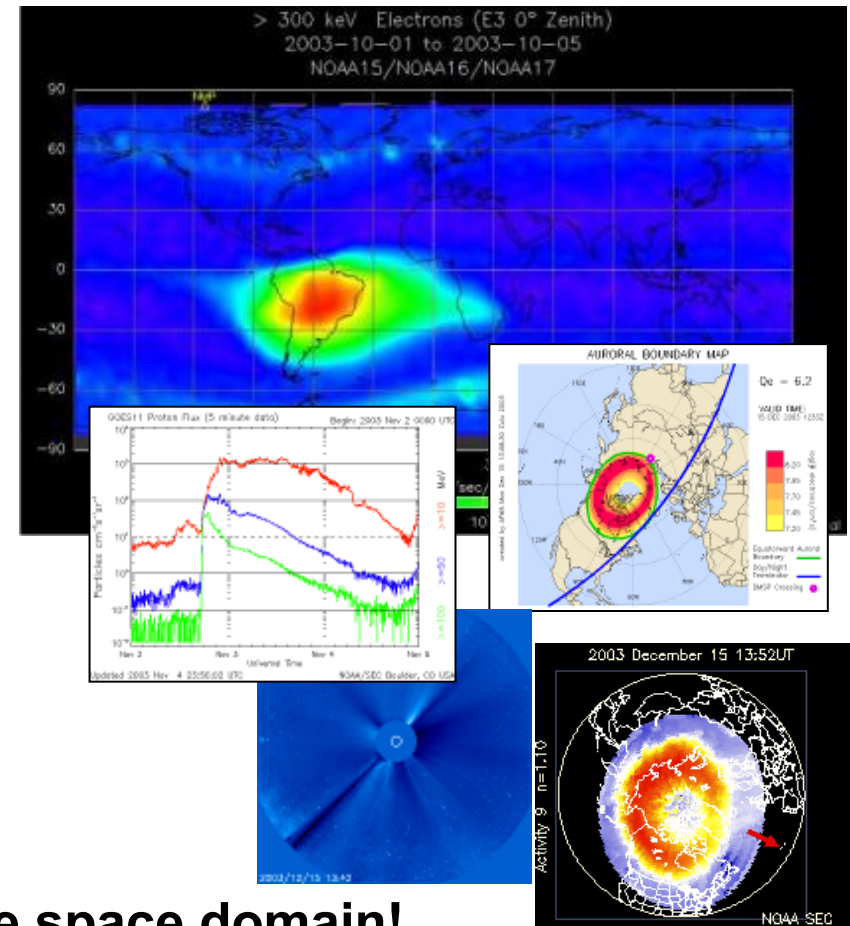
- DMSF, GOES, POES, SOHO, ACE
- STEREO, SDO, COSMIC & C/NOFS
- Non-traditional sources

Future

- DSCOVR (ACE Follow-on)
- COSMIC-II
- AMPERE
- Radiation Belt Storm Probe
- Non-traditional sources

Advocacy and Partnering

- Need partnerships to collect from the space domain!
- CSESMO ... proposed national space-based sensing architecture



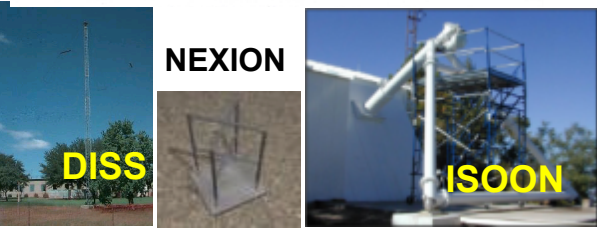
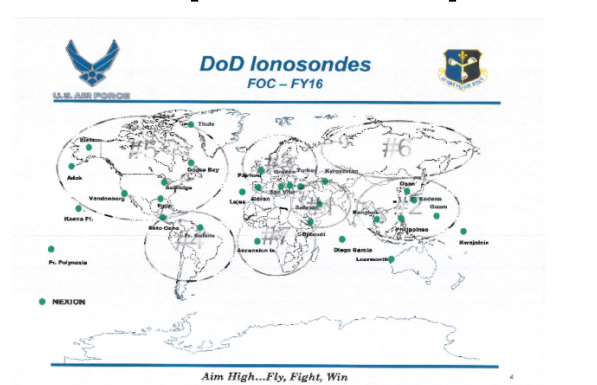


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Space Weather Ground-Based Sensing

AF and other agencies collect space weather data from ground-based sensors

- Sensors include SOON, RSTN, DISS, NEXION, SCINDA
- Data from many government & non-government sources, USGS Magnetometer, TEC (JPL), GONG, NGDC and others ... Data partnerships are crucial

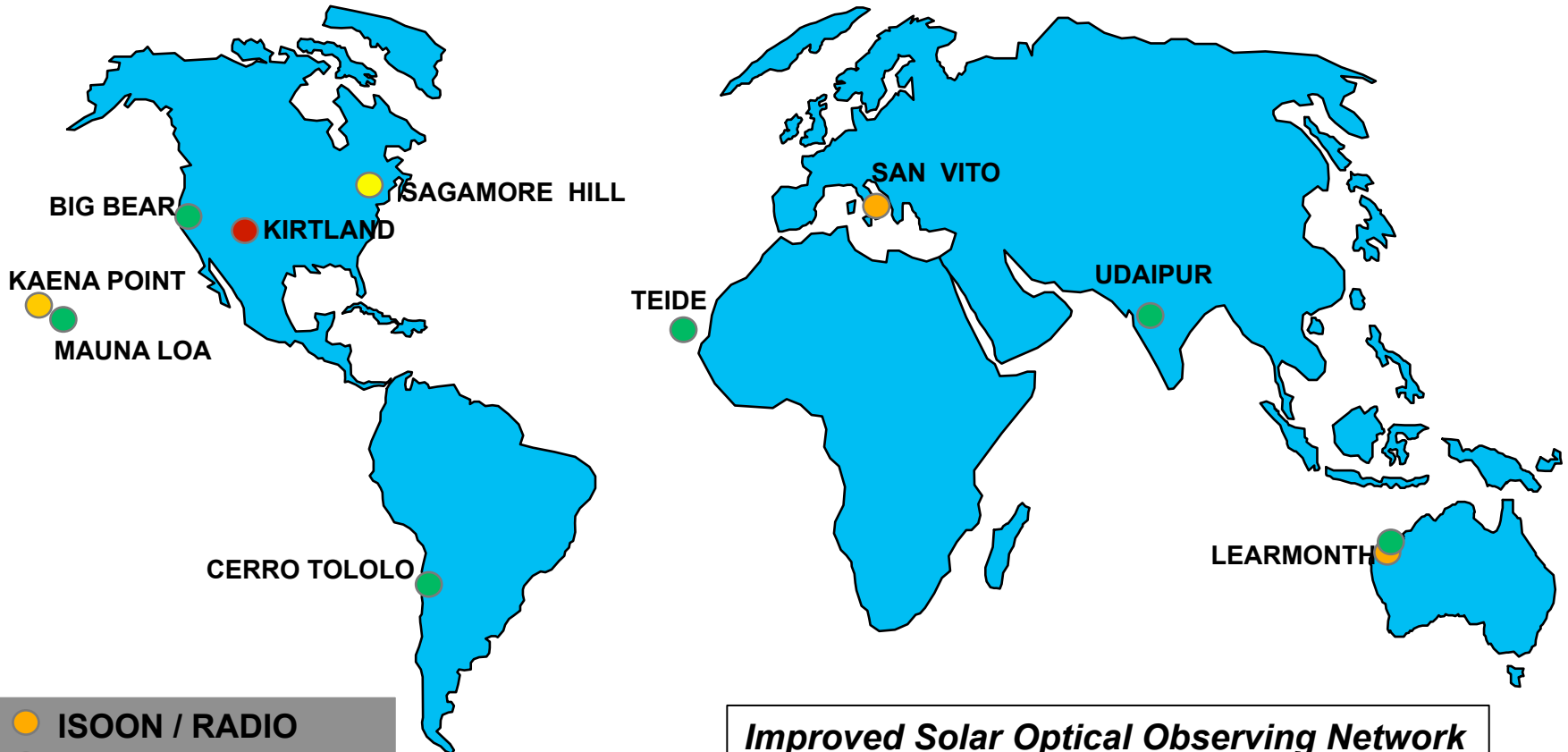


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Investing in a Global Observing Network



- ISOON / RADIO
- ISOON ONLY
- RSTN (RADIO) ONLY
- RESEARCH ISOON
- GONG

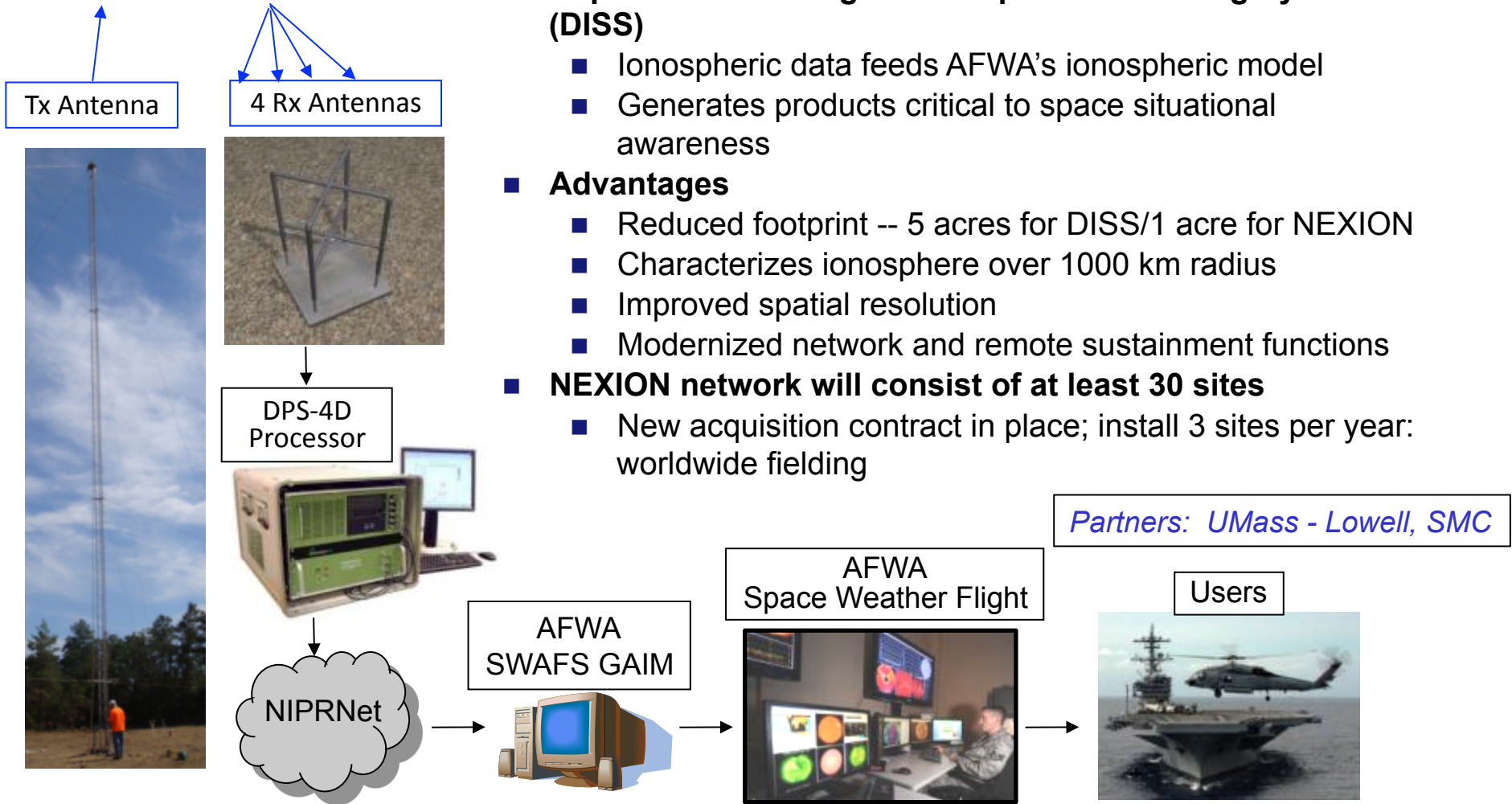
Improved Solar Optical Observing Network
• Upgrades/remoting finished by 2017
Global Oscillation Network Group
Radio Solar Telescope Network
• Remoting finished by 2015



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Next Generation Ionosonde NEXION

IONOSPHERE



■ Replacement for Digital Ionospheric Sounding System (DISS)

- Ionospheric data feeds AFWA's ionospheric model
- Generates products critical to space situational awareness

■ Advantages

- Reduced footprint -- 5 acres for DISS/1 acre for NEXION
- Characterizes ionosphere over 1000 km radius
- Improved spatial resolution
- Modernized network and remote sustainment functions

■ NEXION network will consist of at least 30 sites

- New acquisition contract in place; install 3 sites per year: worldwide fielding

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Space Weather Analysis and Forecast System (SWAFS)

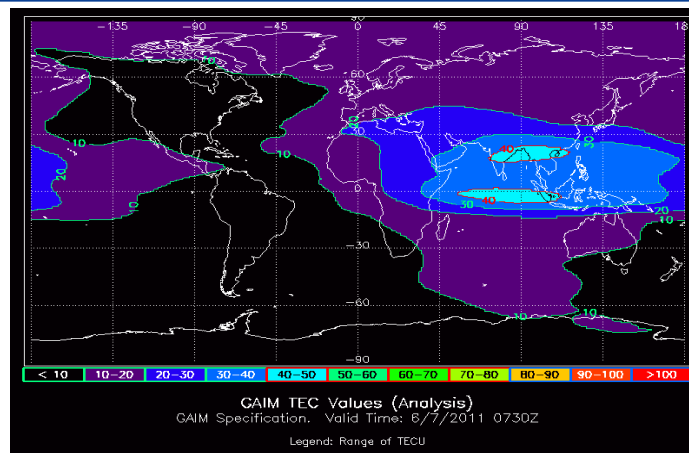
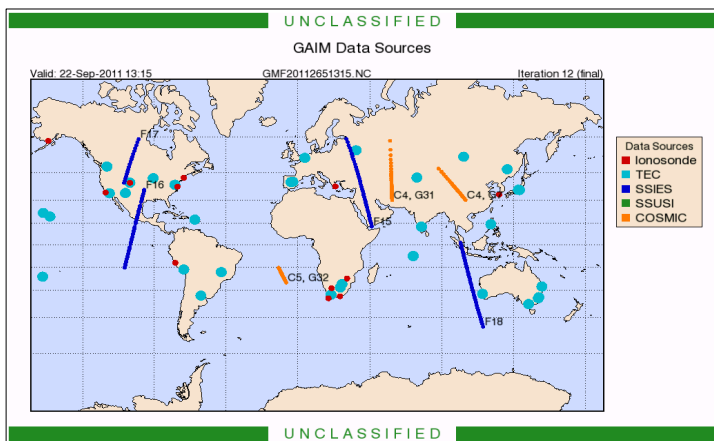
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2011

- Upgraded GAIM
 - 4-wave ionospheric signature
 - F-17 SSUSI data
 - Assimilated additional NEXION data

Jan 12

- SUN to HP Blade architecture & Linux refresh
- Radiation Belt Environment flux & fluence plots
- Assimilate COSMIC RO TEC data into GAIM



FY12 (Planned)

- Proton warning/monitoring system
- Net-centric data display and dissemination
- Assimilation of F-18 SSULI/SSUSI data into GAIM
- Visualize GONG/SOON imagery w/ 30 day archive
- Integrate D-Region Absorption Prediction upgrade
- Full Physics-GAIM development

Partners: AFSPC / SMC / SWPC / AFRL / NRL / JHU-APL / Utah St & academia / CCMC / NGC / Aerospace

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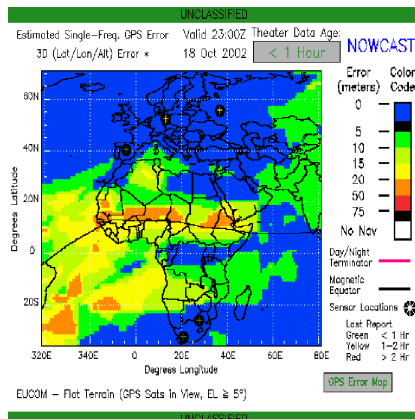


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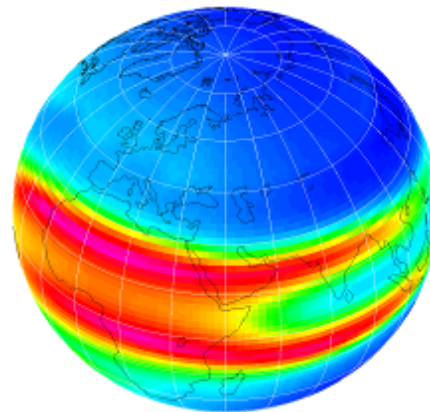
Space Weather Analysis and Forecasting

AFW provides space environmental data, analyses, forecasts, model output, and critical strategic-level products to the warfighter!

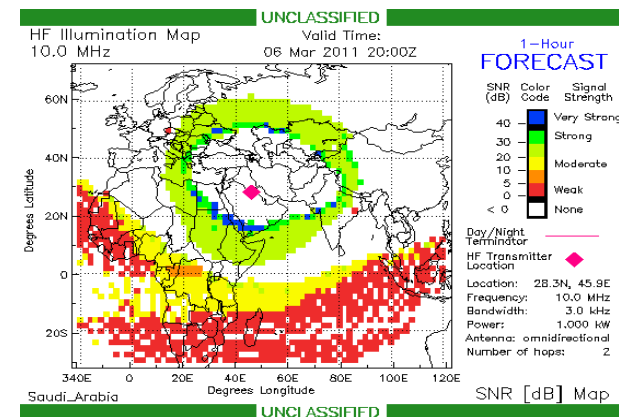
- **Global Assimilation of Ionospheric Measurements (GAIM) Model**
 - Provides 24-hour forecast of ionospheric conditions
 - Follow-on “full physics” upgrade planned for FY14
 - Output used for HF communication and geolocation error analysis



Estimated GPS Error Maps



Ionospheric Impacts



HF Illumination Maps

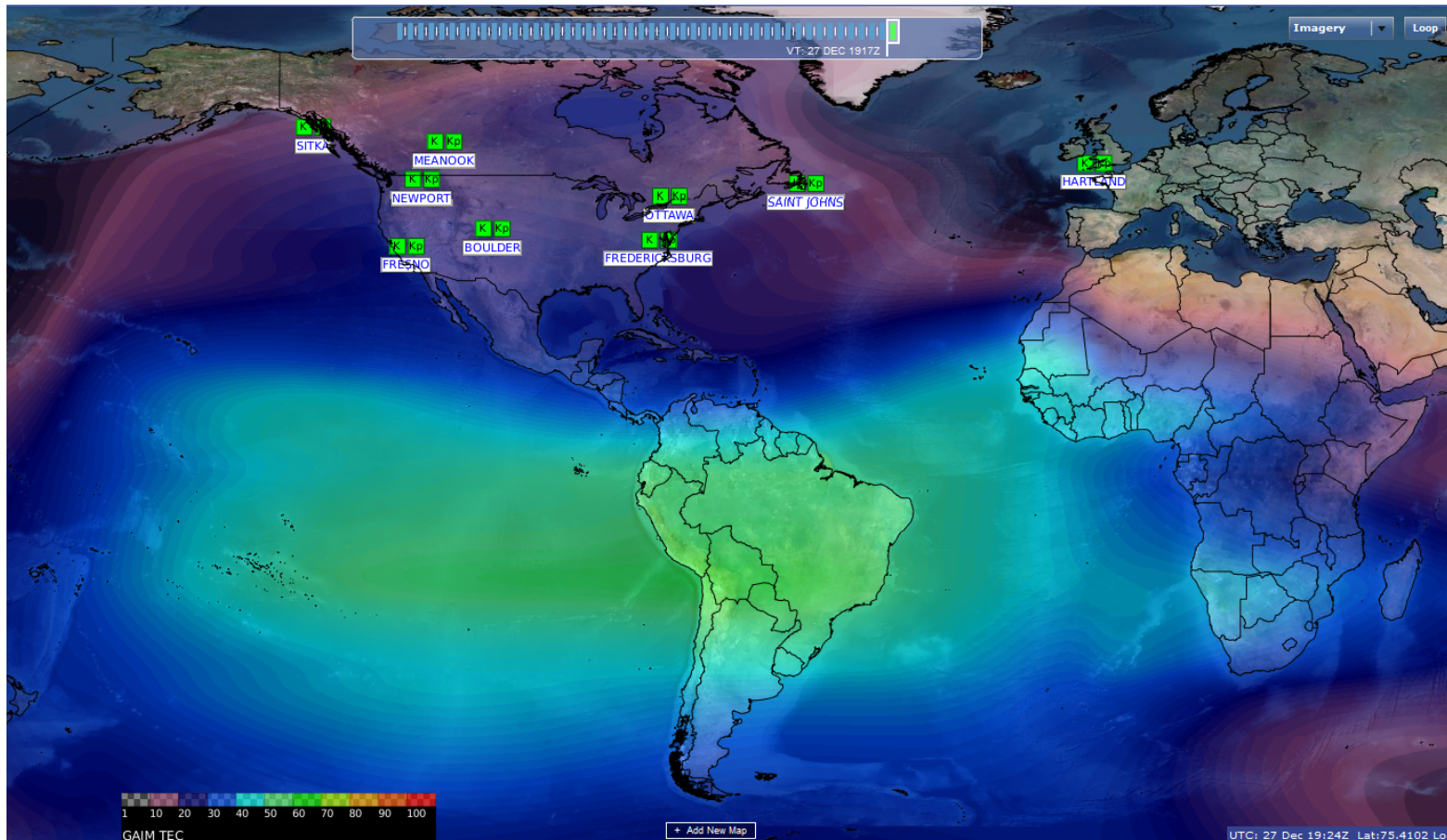
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Air Force Weather Web Services (AFW-WEBS)

- Space weather products in a GIS/Google Earth format





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Space Weather Mission Support Way Ahead

- **Must team for solar max ... and beyond**
 - Plans in place to improve collection, forecasting, & exploitation
 - OFCM, NOAA, NASA, DoD, and other National Partners working together ... e.g. National Space Wx Program Council Integrated Action Plan
 - Collaborate with U.S. & Allied government/civilian agencies to increase sensing capability & reduce costs... NASA, NOAA, NSF, USGS, LANL, and others
- **Invest in collection...**
 - Modernize ground- and space-based sensing capabilities
- **Support national space wx forecasting needs**
 - Physics-based, “true” forecasting
- **Ensure exploitation of space wx expertise for situational awareness in the future**
 - Tailor products to specific missions and operational needs
 - Develop expertise/knowledge among operators and space weather professionals through training

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AF Partnership with CCMC

- **Teaming is essential**
- **Joint advocacy for new sensor capabilities**
- **Model transition from research to ops**
- **Collaborative research/V&V**
- **New visualization and training tools**

Working with National Partners to support National Space Wx needs

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Questions?



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