Space Weather: US Observing Infrastructure

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NOAA Satellite and Information Service

United Nations/United States of America Workshop on the International Space Weather Initiative

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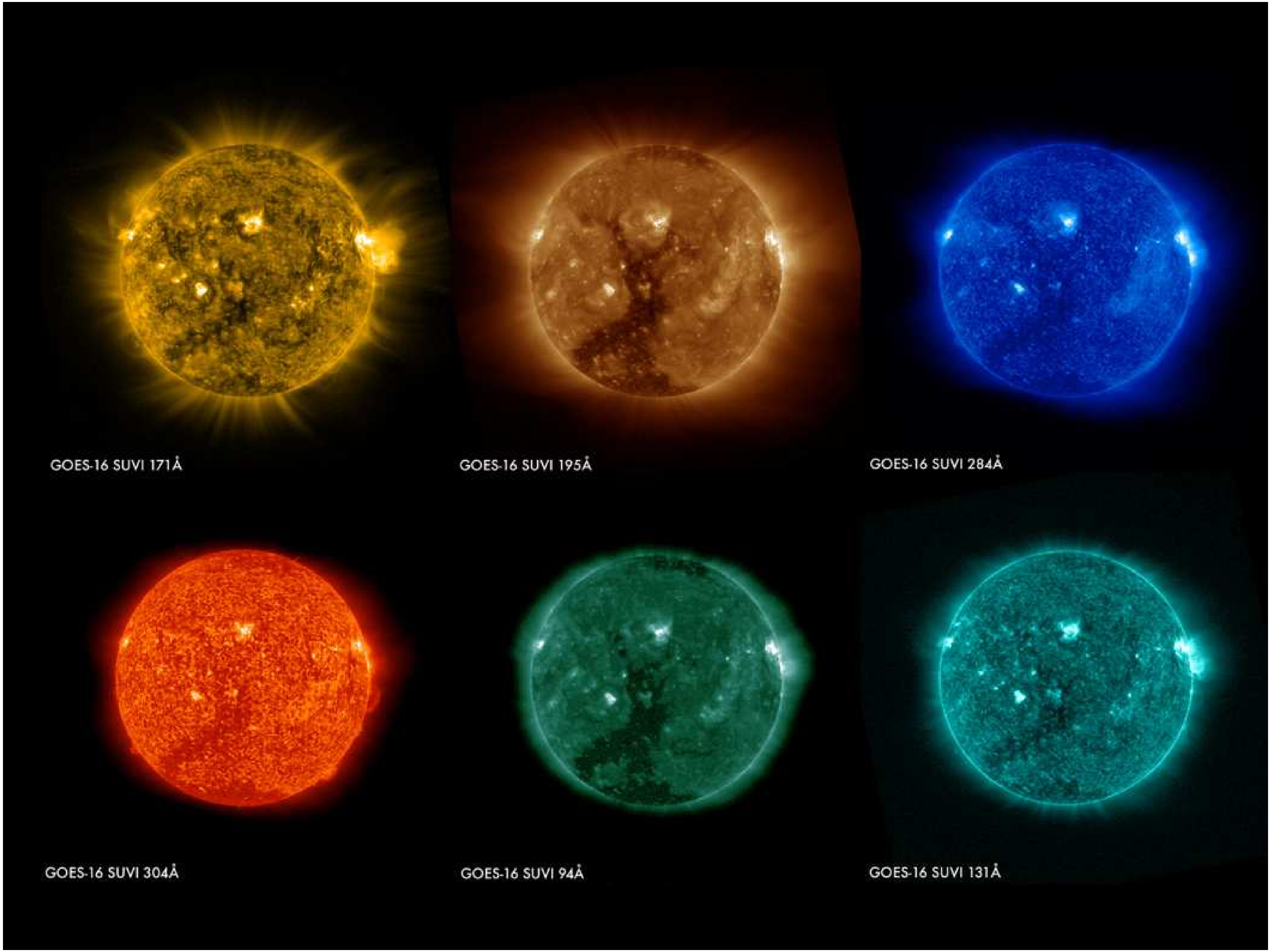
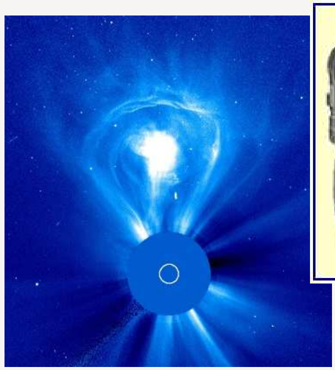
Space Weather Observing System

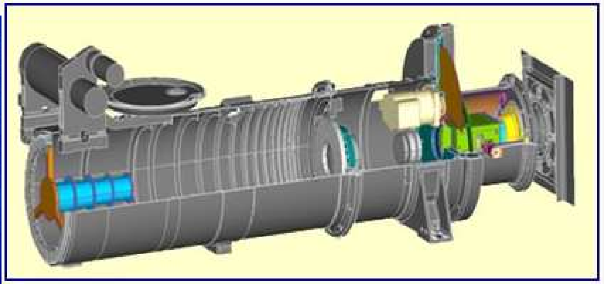

GOES-16 SUVI 171Å
GOES-16 SUVI 195Å
GOES-16 SUVI 284Å
GOES-16 SUVI 304Å
GOES-16 SUVI 94Å
GOES-16 SUVI 131Å

Space Weather R2O Examples

CORONAGRAPHS

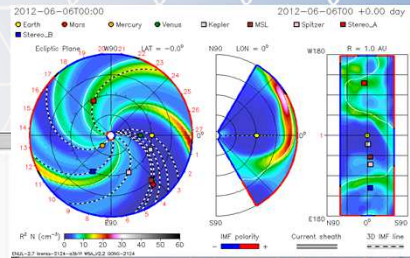


LASCO on SOHO

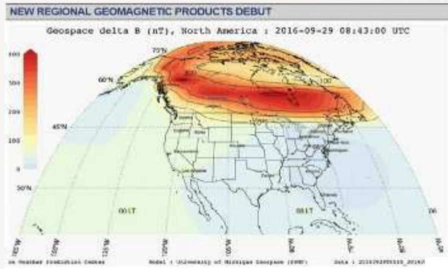


Compact Coronagraph on SWFO Mission

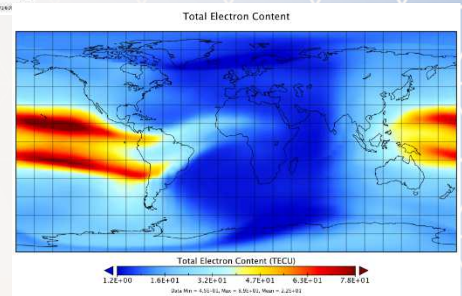
MODELING



WSA-ENLIL (CME impacts)



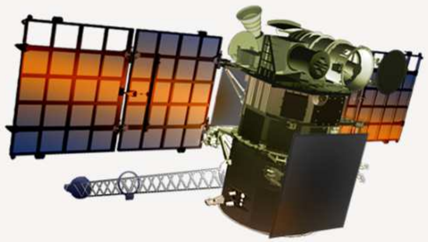
Geospace Model



WAM/IPE (Ionosphere)

IN-SITU L1 OBSERVATIONS

ACE



DSCOVR

Space Weather Forward Observatory

Mission Objectives

Establish operational capability and continuity of space weather observational requirements with multiple platforms; primary operational objectives:

Observe coronal mass ejection (CME) parameters, direction
Produce CME characteristics for input into operational heliospheric propagation code

Measure solar wind magnetic field, thermal plasma, and energetic particles
Enable space weather watches and warnings, forecasting and predictions of geoeffectiveness

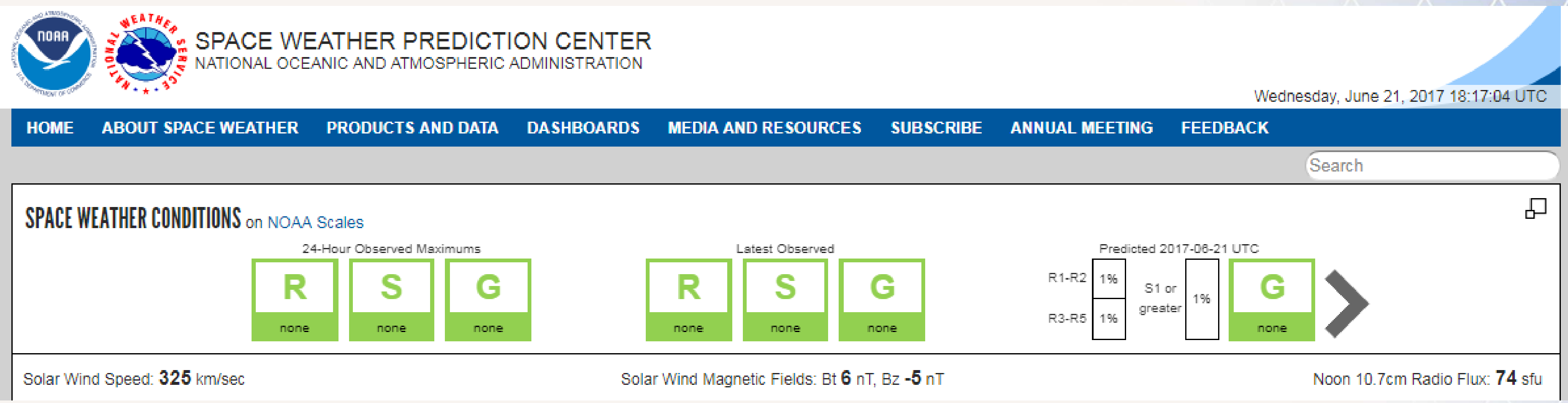
Mission Overview

- Nominal launches: 2022, 2027
- Nominal orbit: L1 ~ 1.5 million kilometers from earth towards sun
- Total Mission Life: 10 years

Prospective Instruments

- Solar wind plasma
- Magnetometer
- Particle Spectrometer
- Compact Coronagraph
- Optional contributed

Space Weather Prediction Center (SWPC)



R – radio interference   S – solar radiation   G – geomagnetic activity

Located in **Boulder, Colorado**
Website: **www.swpc.noaa.gov**

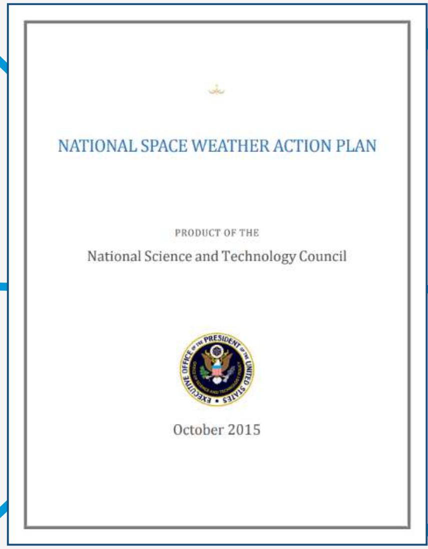
Backups

Space Weather Action Plan Goals

Goal 1: Establish Benchmarks for Space-Weather Events

Goal 2: Enhance Response and Recovery Capabilities

Goal 3: Improve Protection and Mitigation Efforts


NATIONAL SPACE WEATHER ACTION PLAN

PRODUCT OF THE

National Science and Technology Council

October 2015

Goal 6: Increase International Cooperation

Goal 5: Improve Space-Weather Services through Advancing Understanding and Forecasting

Goal 4: Improve Assessment, Modeling, and Prediction of Impacts on Critical Infrastructure

GOES R: Space Weather Sensor Improvements

- **Solar Imagery:**
  - **Moving from X-ray to EUV wavelengths, higher resolution, higher cadence (Improved identification of solar features and better forecasts of impacts at Earth)**
- **Solar X-Ray and EUV Irradiance:**
  - **Larger dynamic range (won't saturate for large flares. Extreme event capabilities)**
  - **Higher accuracy (calibrated at NIST for improved specification and forecasts of impacts)**
  - **Flare location (Quad diode provides fast identification of flare location for improved inputs into models)**
  - **Broader spectral coverage at higher spectral resolution (more accurate inputs into atmosphere/ionosphere models)**
- **Energetic Particle Sensor:**
  - **Expanded energy range (diagnosing spacecraft surface charging)**
  - **Improved electron energy and angular resolution (diagnosing satellite internal charging)**
  - **Improved solar proton energy resolution (Improved Solar Radiation Storm Characterization)**
  - **Heavy ion coverage expanded (diagnosis of satellite single event upsets)**
- **Magnetometer:**
  - **Higher sampling rate and lower frequency cut-off (more accurate data to use in models)**

NOAA/NEDIS Space Weather Platforms

- GOES-16: Continuing the 43 yr record of solar observations from GEO. GOES-R Series to continue with 4 satellites well into 2030s
  - Solar disk images from X-ray to EUV wavelengths
  - Flare location: quad diode provides fast identification of flare location
  - Broader spectral coverage with higher spectral resolution for more accurate inputs into atmosphere/ionosphere models Particle Sensor
  - High energy particles with expanded energy range for improved analysis of spacecraft surface charging and to diagnose satellite internal charging
  - Solar protons for improved Solar Radiation Storm characterization
  - Heavy ions for improved diagnosis of satellite single event upsets
- DSCOVER: NOAA's first operational deep space mission, at L1
  - Solar wind characteristics from L1: bulk solar wind density, velocity, magnetic field (enables 15 - 60 min warnings)
  - Presently using NASA/ESA SOHO CME images to define the inner boundary of the operational CME propagation code derived from science research (1-3 day warnings of Earth arrival of CMEs, including shape, density, velocity and direction)
  - L1 solar wind characteristics used in the Univ. of Michigan MHD magnetospheric model to determine the geoeffectiveness of the space weather storms
- All data delivered to Space Weather Prediction Center Real-time, 24/7

SWPC Customer Growth