Continuity of Critical Space Weather Measurements

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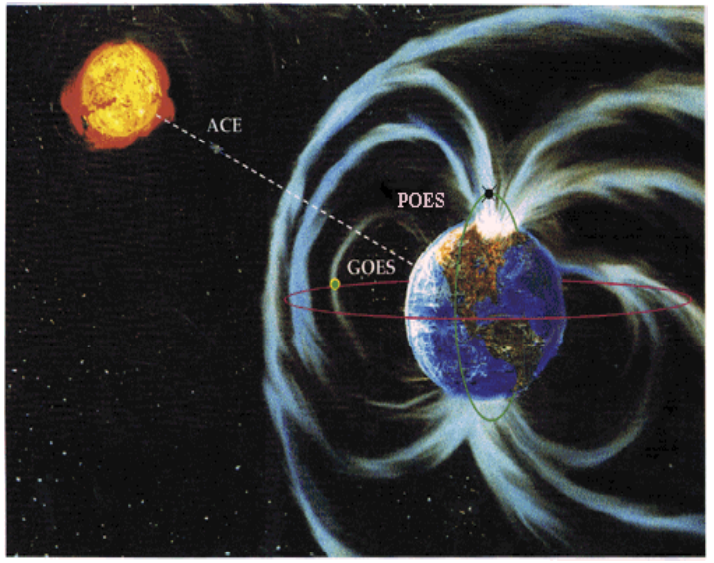
NOAA Space Weather Requirements

- NWS Space Weather Prediction Center requires multiple space weather measurements
  - Issues alerts and warnings to NOAA and other users of harmful space weather events, affecting power utilities, communications, navigation, aircraft, satellites, and space exploration



- NESDIS Satellite Operations requires in situ measurements of the space environment
  - Monitors health and safety of the satellites and sensors

- NOAA requirements for space weather measurements are documented in the NOAA Consolidated Observation Requirements List and satellite mission documents (e.g., GOES Level-1 and NPOESS IORD II)

NOAA Space Weather Requirements

Measurements	Current and Planned Capabilities	
Solar Imagery	GOES NASA SOHO NASA STEREO GOES-R	Solar X-Ray Imager (SXI) Extreme UV Imaging Telescope (EIT) Extreme UV Imager (EUVI) Solar Ultra Violet (UV) Imager (SUVI)
Solar Wind (Plasma, geomagnetic storms)	NASA ACE	Magnetic Field, Plasma, and Ion Sensors
Coronal Mass Ejection Imagery	NASA SOHO NASA STEREO	Coronagraph Coronagraphs & All-Sky Imagers
X-Ray and Extreme UV Radiances	GOES 10, O/P GOES N/O/P GOES-R	X-Ray Sensor (XRS) Extreme UV (EUV) Extreme UV and X-Ray Sensors (EXIS)
Near-Earth Environment: Electric / Magnetic Fields and Particles; Ionospheric Conditions	GOES, POES, METOP DMSP COSMIC NPOESS	Space Environment Monitor (SEM) SEM including Auroral Imager GPS Radio Occultation Sensor (GPSRO) Space Environment Monitor (SEM-N)

Current Planned

Challenges

- Solar wind and Coronal Mass Ejection (CME) imagery
  - Reliance on NASA ACE research satellite for solar wind data
    - 2-year satellite mission, launched in 1997, provides the only reliable 15-45 minute warnings of space weather storms about to hit Earth
  - Reliance on NASA Solar and Heliospheric Observatory (SOHO) and Solar TErrestrial RElations Observatory (STEREO) research satellites for CME data
    - Both were 2-year satellite missions; SOHO launched in 1995 and STEREO launched in 2006
    - CME imagery can provide 1-4 day warning of impending space weather storms
  - No established operational follow-on missions for either Solar Wind or CME data

Challenges

- Space Environment Sensor Suite (SESS) capabilities
  - Sensors were demanifested from NPOESS, and replaced by Space Environment Monitor (SEM-N)
  - These fewer and less capable sensors caused the following impacts on NPOESS-era requirements and products
    - auroral boundary, auroral energy deposition, and suprathermal to auroral particles products would be retained
    - energetic ions and medium energy charged particles would be degraded
    - auroral imagery, electric fields, electron density profile, geomagnetic field, in-situ plasma fluctuation and temperature, ionospheric scintillation, and neutral density profile products would be lost

CSESMO

- The Committee for Space Environmental Sensor Mitigation Options (CSESMO), under the National Space Weather Program (NSWP) and OFCM is responding to the Oct 08 Office of Science and Technology Policy (OSTP) request for Solar wind observing continuity and NPOESS space environmental sensing mitigation options.
  - Initial results briefed at CSESMO meeting on May 8th
    - Three Solar Wind continuity Options (DSCOVR Refurbishment; Commercial Data Buy, Government Developed Satellite)
    - NPOESS Mitigation Options being developed
    - Cost analysis underway
  - Status report to be presented to OSTP in mid-June via NSWP Council meeting
  - Study results to be reported in the Fall 2009 timeframe

CSESMO – Solar Wind

- Solar wind and CME
  - NOAA issued a Request for Quote on FedBizOpps in August 2008 to study commercial solutions for Solar Wind and CME continuity
    - Awarded contracts to Space Services Incorporated and ORBCOMM for technical feasibility and price validation studies
    - Studies received Dec 2008, to be considered as part of final analysis of options
  - NOAA and USAF funded NASA-Goddard to study feasibility of refurbishing DSCOVR solar wind mission in Fall 2008
    - Final report received in Feb 2009, made publicly available in May
  - Final decision on options for solar wind and CME to be made in concert with CSESMO recommendations
    - DSCOVR (Air Force or NOAA launch)
    - New government satellite
    - Commercial buy
    - Some combination of above

CSESMO - SESS

- SESS activities underway
  - Prioritizing DoC and DoD IORD-II requirement
  - Analyzing alternatives to meet deficiencies caused by demanifestation
- Options under consideration
  - Leverage continuing ground and space resources
    - NEXION (Ground)
    - SDO/POES (Solar)
    - DMSP
    - GPS TEC (Ground)
    - NPOESS SEM-N
    - Others
  - Assessing high Technology Readiness Level (TRL) solutions for space sensing capabilities
    - GPSRO (e.g. COSMIC-2)
    - Accelerometer
    - Polar-orbiting UV Imagers
    - Thermal Plasma Suite
    - Geostationary UV Imager
    - Satellite Magnetometer
    - Others
  - Examining space architectures ranging from high cost/max capability to low cost/minimum capability

Summary

- Space Weather measurements are extremely important to NOAA's mission and to the Public
- Legacy requirements being met via GOES, POES, DMSP, METOP, ACE, SOHO, and STEREO
- Efforts underway to expedite long-term options for continuity (CSESMO)