NPOESS Preparatory Project Validation Program for the Cloud and Aerosol Data Products

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Overview

The National Polar-orbiting Operational Environmental Satellite System (NPOESS) Program, in partnership with NASA, will launch the NPOESS Preparatory Project (NPP), a risk reduction and data continuity mission, prior to the first operational NPOESS launch. The NPOESS Program, in partnership with Northrop Grumman Aerospace Systems (NGAS), will execute the NPP Validation program to ensure the data products comply with the requirements of the sponsoring agencies.

Data from the NPP Visible/Infrared Imager/Radiometer Suite (VIIRS) will be used to produce Environmental Data Records (EDRs) for aerosol and clouds, specifically Aerosol Optical Thickness (AOT), Aerosol Particle Size Parameter (APSP), and Suspended Matter (SM); and Cloud Optical Thickness (COT), Cloud Effective Particle Size (CEPS), Cloud Top Temperature (CTT), Height (CTH) and Pressure (CTP), and Cloud Base Height (CBH). The Aerosol and Cloud EDR Validation Program is a multifaceted effort to characterize and validate these data products.

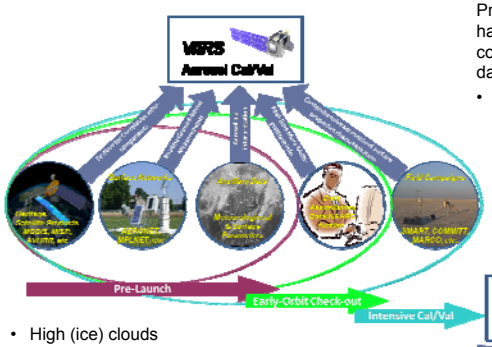
The program involves systematic comparison to heritage data products, e.g., MODIS, and ground-based correlative data, such as AERONET and ARM data products, and potentially airborne field measurements. To the extent possible, the domain is global. The program leverages various investments that have and are continuing to be made by national funding agencies in such resources, as well as the operational user community and the broad Earth science user community. This presentation will provide an overview of the approaches, data and schedule for the validation of the NPP VIIRS Aerosol and Cloud environmental data products.

Approach

The Validation Program for the Cloud and Aerosol EDRs combines heritage experience from previous science and operational missions to fully characterize the data product performance to demonstrate specification satisfaction for the Contractor and operational viability for the Customer.

The key strategic activities necessary to accomplishing the Plan's objectives are as follows:

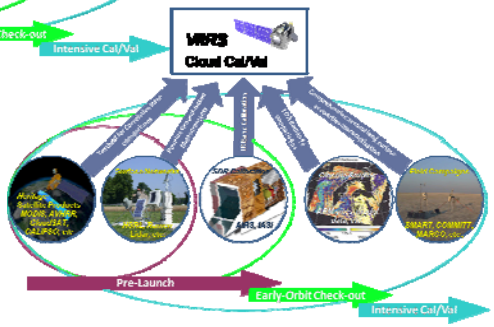
- Build a team of subject matter experts (SMEs) calling on representatives from the Customer/User and science communities to leverage heritage knowledge and tools as well as on-going activities, and to assure understanding and implementation of customer mission success criteria.
- Coordinate and collaborate closely with the SDR team to assess/validate SDRs in the mission's Early Orbit Checkout Phase.
- Identify and develop ground-truth field data resources necessary for activities in the Intensive Validation and Long-term Monitoring Validation phases of the mission, where the latter overlaps NPOESS.
- Develop strong collaborative relationships with the NASA Atmosphere PEATE for pre-launch assessment and post-launch validation.
- Partner with other agencies to plan post-launch field campaigns to target needed measurements that are not currently available from field sites.



Priority Targets for atmosphere validation have been identified to cover the range of conditions that will best characterize the data products:

- Aerosol composition and height dependence
  - Dust, smoke, urban, sea salt
  - Open ocean, coastal, dark vegetation, bright land, mixed land, ice

- High (ice) clouds
  - Cumulonimbus, cirrus, mixed phase, especially with open ocean background and inhomogeneous land backgrounds. It is important to assess synoptic cirrus as well as convectively-generated cirrus such as tropical anvils, which are very different.
- Low clouds
  - Stratus, stratocumulus, cumulus, with open ocean background, and inhomogeneous land backgrounds



Team Members

Aerosol Validation Team

Name	Organization	Sponsor
David Starr	NASA/GSFC	IPO
John Eylander	AFWA	AFWA
Christine Hsu	NASA/GSFC	IPO & NASA
Sid Jackson	NGAS	NGAS
Istvan Laszlo	NOAA/STAR	IPO
Alexei Lyapustin	Land EDR Team, UMBC	IPO
Mike Plonski	NGAS	NGAS
Jeffrey S. Reid	NRL	NRL
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Cloud Validation Team

Name	Organization	Sponsor
David Starr	NASA/GSFC	IPO
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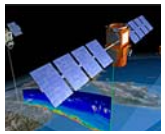
John Eylander	AFWA	AFWA
Andrew Heidinger	NOAA/CIMSS	IPO
Robert Holz	SSEC/Univ WI	IPO & NASA
Thomas Kopp	Imagery/VCM Lead; Aerospace Corp.	IPO
Jay Mace	U. Utah	IPO
Paul Menzel	SSEC/Univ WI	IPO
Steve Platnick	NASA/GSFC	NASA EOS
Mike Plonski	NGAS	NGAS
Eric Wong	NGAS	NGAS

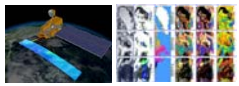
Examples of Correlative Data

CALIPSO



http://www-calipso.larc.nasa.gov/about/

MODIS Data Products



http://modis-atmos.gsfc.nasa.gov/MOD06_L2/sample.html

AERONET

Activities

Pre-Launch
- Define team and partnerships,
- Develop plan (define responsibilities, identify available and needed data and computing resources)
- Characterize algorithm performance using Proxy data (CALIPSO, CloudSAT, MODIS)
- Build tools, such as comparison statistics programs, and databases for correlative match-ups
- Develop PEATE comparison capabilities

Early Orbit Check-out
- Examine PEATE-processed SNO-matched comparisons between MODIS, AVHRR and NPP radiance, cloud, and aerosol products
- Monitor sensor performance by analyzing quality of aerosol data

Intensive Cal/Val
- Repeat global pre-launch analyses and look for anomalies between heritage and NPP algorithms (e.g. HIRS, AVHRR, MODIS)
- Validate aerosol products through comparisons with ground-based AERONET and SURFRAD, and intersatellite comparisons with MODIS, Glory, and CALIPSO
- Generate global product performance statistics
- Perform automated statistical regional and global comparisons of EDRs versus heritage satellite data products and available ground-based "truth" observations.
- Provide definitive assessment of error characteristics of EDRs with emphasis on the identification of error sources and dependencies, with the expectation of a detailed estimate of the error budget, and understanding of error sources
- Demonstrate that operational viability is satisfied
- Participate in focused field campaign for IR calibration and comparison LIDAR cloud products
- Compare IR radiance measurements to those of CrIS

Long-Term Monitoring
- Transition applicable tools and techniques to Operations and Sustainment team for monitoring product performance
- Monitor product performance and correct when needed
- Monitor sensor performance and analyze impact on product performance

Phases of the Cal/Val Program