

## NPP Data and Services

Tom Schott<sup>1</sup>, Stacy L. Bunin<sup>2</sup>, Jim Yoe<sup>1</sup>, Geof Goodrum<sup>1</sup>, Jim Silva<sup>1</sup>

<sup>1</sup> NOAA/NESDIS, Suitland, Maryland

<sup>2</sup> Noblis, Falls Church, Virginia

### 1. Introduction: NPP and NDE

Though the National Polar-orbiting Operational Environmental Satellite System (NPOESS) program is being re-structured, the NPOESS Preparatory Project (NPP) remains slated for launch in 2011. The NOAA NPOESS Data Exploitation (NDE) project will provide real-time operational civilian users with access to NPP observations. Through NDE, users can receive polar-orbiting satellite data to maintain their current mission capability, or take advantage of the improved and expanded suite of products that NPP sensors will make possible. NDE will tailor the generic NPP environmental, sensor, and temperature data records (xDRs) received from the Interface Data Processing Segment (IDPS) to satisfy user-required attributes for data format, coverage, product frequency, and map projection. In addition, NDE will apply value-added science algorithms to certain xDRs to generate NOAA-unique products (NUPs) that meet NOAA-unique mission requirements.

### 2. NPP Instrumentation

Four NPP sensors will be used to collect atmospheric, land, and ocean data globally for meteorological and climatological applications. These instruments are the Cross-track Infrared Sounder (CrIS), the Advanced Technology Microwave Sounder (ATMS), the Visible/Infrared Imager/Radiometer Suite (VIIRS), and the Ozone Mapping and Profiler Suite (OMPS).

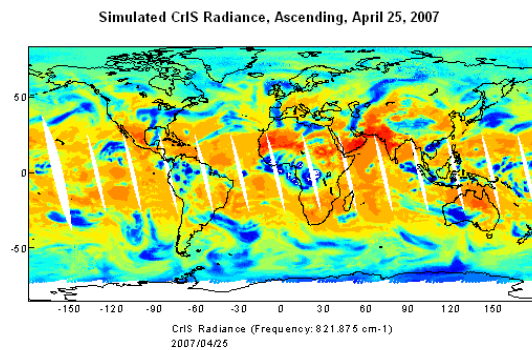
### 3. NDE Product Development

NDE's tailoring toolkit will reformat the suite of xDRs ingested from the IDPS from the native HDF5 into user-required formats including NetCDF4, BUFR, and GRIB2, to facilitate assimilation into Numerical Weather Prediction models. NDE will create a NUP only if there is a documented NOAA requirement for a capability not met by the xDRs and resources are available to develop and implement the product. Since continuity of current capabilities from legacy polar satellites (POES, EOS and DMSP) is of the highest priority, initial NUPs will be atmospheric soundings, microwave surface and precipitation products, and derived sea surface temperature products. However, NOAA will also exploit new sensing capabilities from NPP. Subsequent NUPs for which science algorithms are being developed or considered include polar winds, green vegetation fraction and health, blended total precipitable water, atmospheric chemistry data records, and improved ocean color.

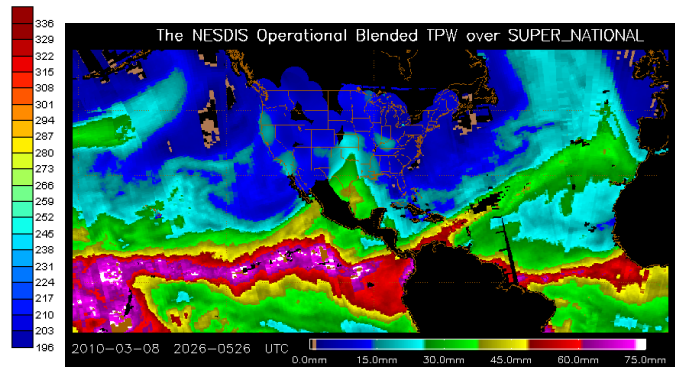
#### 3.1 CrIS/ATMS

Hyperspectral infrared data improve knowledge of temperature, moisture, and ozone, for weather and climate applications. NDE will generate hyperspectral products from CrIS data collocated with the ATMS field of regard while using the VIIRS instrument for cloud clearing. These products will provide continuity for similar data currently available from Aqua AIRS/AMSU-A and Metop IASI/AMSU-A.

CrIS/ATMS products will include channel radiances such as those depicted in Figure 1, principal components (compressing 1305 radiances into ~85 independent values), cloud cleared radiances, ozone retrievals, and retrievals of carbon dioxide, carbon monoxide, methane, and nitric acid. Additional products from CrIS/ATMS will include cloud top pressure and cloud fraction; stability products such as convective available potential energy, lifted index, and convective inhibition; and surface emissivity.



**Figure 1 (left). Simulated CrIS radiances.**



**Figure 2 (right). Data from NPP's ATMS will be blended into the current operational TPW product.**

### 3.2 ATMS

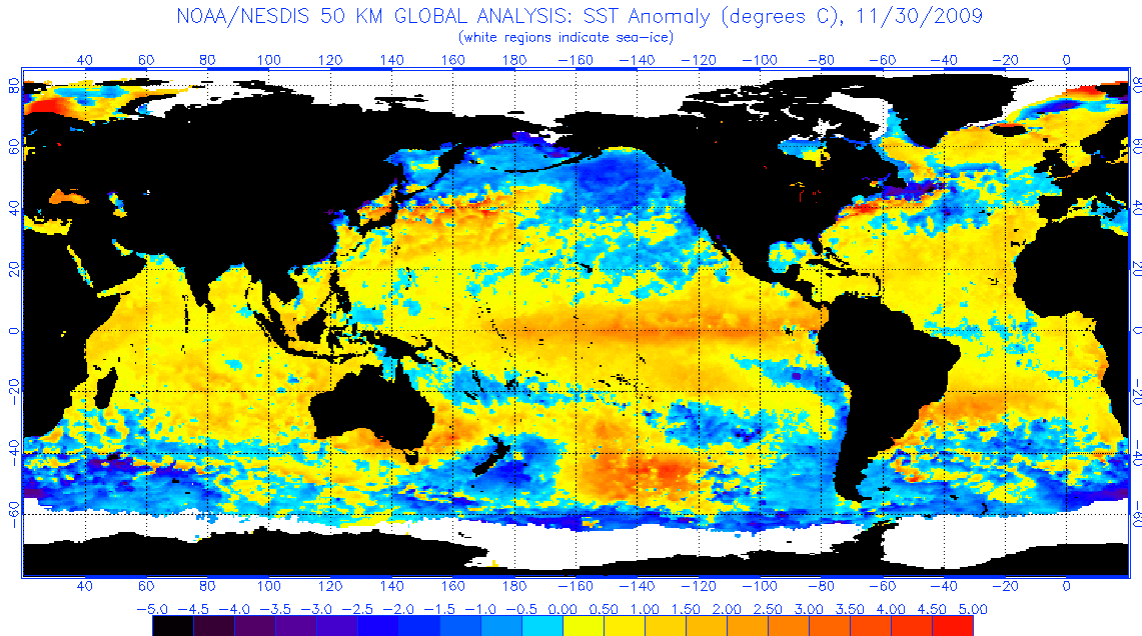
Products from microwave instruments are generated for all weather and surface conditions. Microwave products are used to improve NWP models, provide estimations of rainfall, provide long-term continuity to monitor El Niño, water cycle changes, and long-term climate, and to nowcast tropical cyclones using microwave imagery. Products will include temperature and moisture profiles, land surface temperature and emissivity, snow water equivalent, snow cover, sea ice concentration, cloud liquid water, total precipitable water (TPW), ice water path, instantaneous rain water path, and rain rate. These global products will continue to enhance NOAA's weather forecasting and climate monitoring capabilities. ATMS products provide for continuity with POES and Metop AMSU-A and MHS products.

A blended TPW product will use ATMS data, as well as microwave data from other satellites. This single product provides forecasters with a more complete observation of the movement of moisture in the atmosphere and gives the ability to track moisture plumes. This is not possible using individual sensors due to the orbital gaps. The blended TPW product such as is depicted in Figure 2, provides forecasters with continuity on the changing levels of moisture from the ocean areas and helps pinpoint the location of heavy precipitation for use in flood forecasting. It is also used to track tropical waves and their temporal evolution. TPW anomaly products show the departure from climatology and help to quickly identify areas of strong flooding potential or the potential for fire hazards. These products will be generated globally and will also be sectorized into AWIPS regions.

### 3.3 VIIRS

Sea surface temperature (SST) products are used as an input to environmental models and in climate and ecosystem analyses. SST anomaly products (Figure 3) provide early warnings of coral bleaching, assessment of El Niño and La Niña development, and monitor the cooling following hurricane passage. Several derived products will be generated from NPP's VIIRS data, including SST anomalies, hot spots, and degree heating weeks; global and regional SST analyses; global analyses of aerosol optical thickness (AOT); monthly means of SST and AOT; coral bleaching indices and alerts; and blended products.

NDE will generate polar winds from VIIRS for the Arctic and Antarctic from 65 degrees latitude poleward. Tropospheric winds are measured by tracking the motion of cloud features in the overlapping region of three successive orbits. A triplet of images is used to facilitate consistency checking and quality control. Wind products include wind speed, direction, and height at high latitudes.



**Figure 3. Sea surface temperature anomaly products will be generated from VIIRS.**

Green vegetation fraction (GVF) is used as an input to land surface models to provide a better characterization of the surface. NESDIS will evaluate the vegetation environmental data records, compare VIIRS composites to the legacy baseline for consistency, implement algorithm enhancements, and tailor the products for use by NWP models and continuity requirements. NDE's SST, GVF, and other VIIRS-based products will provide mission continuity from the AVHRR on POES and Metop.

#### **4. NDE Data Distribution**

NDE users will subscribe to NPP xDRs and NUPs through a web-based interface. An NDE database will contain the definitions of products, algorithms, product generation rules, files, user profiles, subscriptions, interfaces, and resources. NDE will make products available based upon the rules in each user's subscription. The subscription database will contain a list of xDRs and NUPs, along with their pre-defined tailoring options. Optional parameters that may be selected will include limiting the distribution by spatial coverage area, data quality threshold, file compression type, delivery mechanism, and notification options. During post-launch testing, NDE will ensure that the NOAA user community, including NWS, NOS, and NMFS, has access to priority products to evaluate them and prepare to use them in operations.

#### **5. Summary**

NDE will link the NPP satellite to real-time civilian data users. The NDE Project will begin providing tailored products from NPP to NOAA's user community after the launch and checkout of the satellite. NESDIS has started product development projects to prepare for NPP data and is developing capabilities to process and disseminate those products. The primary focus of NDE will be to ensure that legacy capabilities from POES, EOS, and DMSP are maintained and exploited using NPP data. As new user requirements are defined and validated, NDE will develop and implement additional NPP products.

#### **6. References**

NPOESS Data Exploitation, <http://projects.osd.noaa.gov/NDE/>

Operational Blended Total Precipitable Water, <http://www.osdpd.noaa.gov/bTPW/>

Operational Coral Bleaching Products, [http://www.osdpd.noaa.gov/ml/ocean/coral\\_bleaching.html](http://www.osdpd.noaa.gov/ml/ocean/coral_bleaching.html)

Operational IASI Products, <http://www.osdpd.noaa.gov/IASI/>

Operational MIRS Products, <http://www.osdpd.noaa.gov/ml/mirs/>

Operational Vegetation Products, <http://www.osdpd.noaa.gov/ml/land/vegetation.html>

Polar Winds Products, <http://stratus.ssec.wisc.edu/projects/polarwinds/>