# VIIRS NPP Ocean Color Products at NOAA CoastWatch – A First Look

K. Hughes[1] (PRINCIPAL GOVERNMENT INVESTIGATOR),
H. Gu[3], P. Keegstra[2], Y.S. Kim[3], S. Ramachandran[2], M. Soracco[3], R. Vogel[3]
[1]NOAA/NESDIS/STAR, [2]SP-Systems Inc, [3]SMRC Inc.

Following the launch of the Suomi NPP satellite CoastWatch has routinely processed the VIIRS NPP data in near real time mode for two possible choices of the ocean color algorithms made available to us, to produce Ocean Color products. One is the IDPS OC3V empirical algorithm and the other is CoastWatch's implementation of NASA OBPG's L2gen, which is also currently being used for our heritage products from MODIS on Aqua and Terra and in the past for SeaWiFS and MERIS data streams. For both algorithm streams, current experimental products (Chlor_a, nLw, Chlorophyll Anomaly) are produced for all CoastWatch regions for the CONUS area at full resolution, and additional L3 and L4 products will be created for daily Global coverage at a reduced spatial resolution of 4km. In addition, global data at full native resolution, divided into 24 sectors, will also be made available via a THREDDS server. The L3 and L4 global reduced resolution experimental products will be distributed via the STAR web server initially and later from the CoastWatch and OceanWatch web servers familiar to our current operational users when the products are declared operational after their initial assessment. We also present results from the preliminary Quality Assessment of the Ocean Color products (Chlor_a, nLw) from VIIRS NPP addressing our operational end user requirements. The QA approach includes comparison of VIIRS data with NASA MODIS climatology. There is an ongoing effort to engage operational users with VIIRS data as a replacement for MODIS for the HAB (Harmful Algal Bloom) bulletin issued by NOAA/NOS for the Gulf of Mexico region off the Florida coast. Other potential operational users of the VIIRS NPP ocean color data are NCEP/EMC for their ocean modeling activities and forecast, for fisheries modeling by NMFS Pacific basin users, and for ecological modeling by the NOAA Chesapeake Bay Office.

## Products

At CoastWatch we ingest both SDR and EDR data from VIIRS. The SDR and EDR data are from the NOAA IDPS system. One of the two flavors of VIIRS processing at CoastWatch is the native IDPS EDR which is further recast as CWhdf format, and L3 and L4 NOAA Unique Products are created for our users. The second stream uses the NOAA SDR and processes them using NASA L2gen software. These EDRs are also converted to CWhdf and L3 and L4 products. The daily products are at native resolution of the sensor at 750 m. We also create daily Chlorophyll Anomaly products for the Gulf of Mexico region used by our NOS users for their Harmful Algal Bloom bulletins. The current regions produced at CoastWatch are the CONUS areas, with the intent to process Global data at native resolution divided into 24 sectors. We also plan on producing 7-day geometric mean composites at native and at reduced resolution, calendar monthly composites at native and reduced resolution as well as daily global composites at 4km reduced resolution.

### 750m daily CONUS coverage
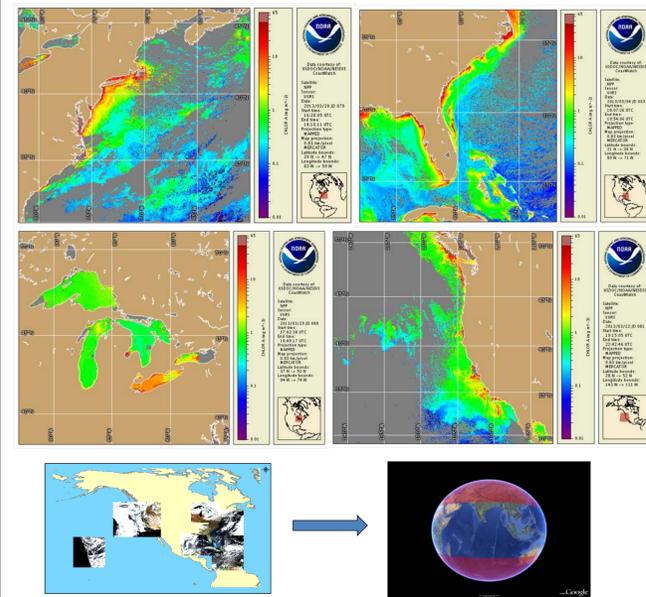


For VIIRS-NPP and future JPSS VIIRS missions C1 & C2 CoastWatch has plans to do full global coverage at 750m in 24 sectors, and daily composites at 4km resolution for the globe.

## Validation



Daily Composite Images (MODIS top; VIIRS bottom)

Monthly Composite (MODIS top; VIIRS bottom)
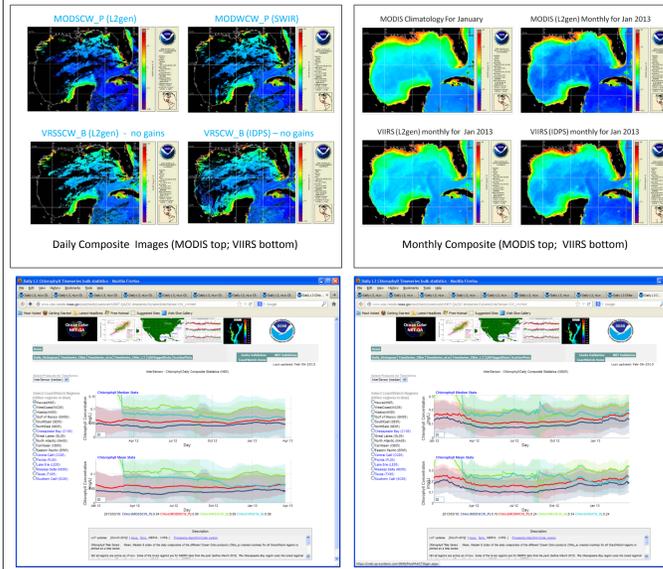
Daily composite Chlorophyll values further averaged for 30 days to smooth out the noise, indicate the IDPS retrievals on average being closer in retrieved values to the current operational MODIS products for the last few months.

### Comparison with MODIS multi-year Climatology
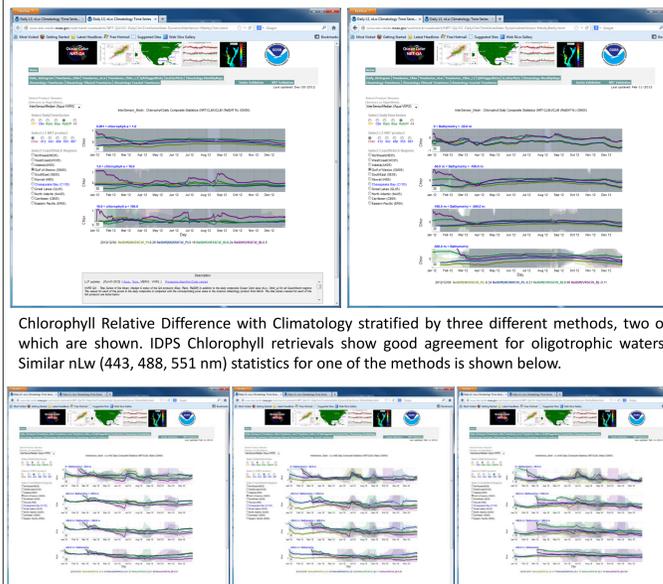


Chlorophyll Relative Difference with Climatology stratified by three different methods, two of which are shown. IDPS Chlorophyll retrievals show good agreement for oligotrophic waters. Similar nLw (443, 488, 551 nm) statistics for one of the methods is shown below.

## Systems

### VIIRS Data Flow between NSOF and NCWCP
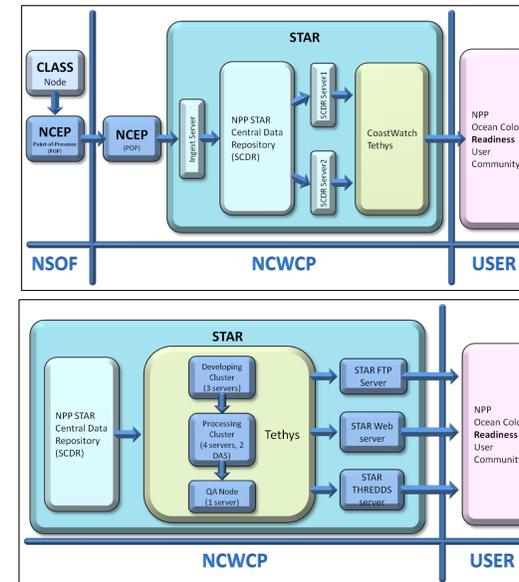


VIIRS global sector products will be distributed through a THREDDS server. To assist in product visualization and granule geographic coverage browse imagery will be available through a VIIRS granule locator tool and the OceanWatch website. The locator tool uses Google Maps to allow the user to pan, zoom, and identify any given granule. Once selected, the actual bounds of the granule and a true color thumbnail are presented to assist in determining the granule's usefulness with respect to clear versus cloudy pixels. Links are also presented to datasets and products generated from the granule. The OceanWatch website will present daily merged products for each global sector. Data for these sectors will be obtained through the THREDDS server hosted by STAR.



VIIRS Granule selector and Display Tool

## Application



**HABs :** Track the location and movement of harmful algal blooms (HABs) using satellite ocean color. Daily anomalies of chlorophyll concentration reveal areas of high phytoplankton presence.
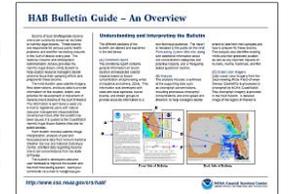
Combining this information with other environmental and in-situ data, NOS issues weekly bulletins and HAB conditions reports for the Gulf of Mexico so that coastal resource managers can assess the impact of the toxic HABs on public health and living resources.

**WQ**: Monitor water quality (WQ) in the Chesapeake Bay using derived products such as total suspended matter (TSM) to measure sediment and contaminant loading from terrestrial runoff. NMFS and Maryland-DNR use TSM to track sediment plumes after natural disasters such as hurricanes or heavy storms to estimate the impact of sediment plumes on living resources such as oyster fisheries and aquatic vegetation.

**EF**: Support ecological forecasting (EF) by incorporating satellite ocean color data in ecosystem models. CoastWatch and NMFS are conducting experiments for utilizing satellite chlorophyll in the Atlantis ecosystem model. If satellite chlorophyll can improve the model accuracy, better forecasts of fisheries stocks will be available for fish stock assessments and living marine resource management.
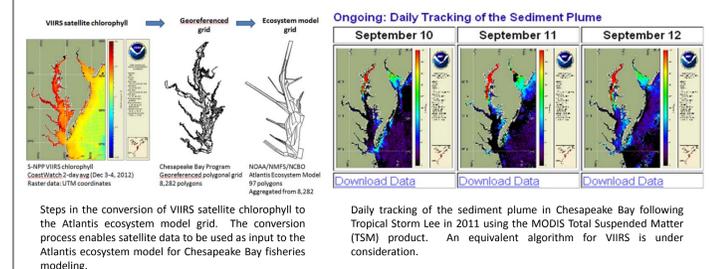


Steps in the conversion of VIIRS satellite chlorophyll to the Atlantis ecosystem model grid. The conversion process enables satellite data to be used as input to the Atlantis ecosystem model for Chesapeake Bay fisheries modeling.

Daily tracking of the sediment plume in Chesapeake Bay following Tropical Storm Lee in 2011 using the MODIS Total Suspended Matter (TSM) product. An equivalent algorithm for VIIRS is under consideration.

**EMC** : Environmental Modeling Center plans to improve the ocean models used in weather forecasting (WF) by incorporating near real-time satellite chlorophyll. Ocean heating by incoming solar radiation is modulated by surface phytoplankton. Global estimates of satellite chlorophyll and light attenuation will improve the upper-ocean heat content and buoyancy flux of the Hycom ocean circulation model used in the NWS Real-Time Ocean Forecast System (RTOFS).