How NMFS and NOS use JPSS data

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How NMFS and NOS use JPSS data

NMFS: National Marine Fisheries Service
NOS: National Ocean Service
JPSS Instruments

**ATMS**: Advanced Technology Microwave Sounder

**CERES**: Clouds and the Earth's Radiant Energy System

**CrIS**: Cross-track Infrared Sounder

**OMPS**: Ozone Mapping and Profiler Suite

**VIIRS**: Visible Infrared Imaging Radiometer Suite
JPSS Instruments

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Only the VIIRS instrument makes oceanographic measurements, i.e., surface chlorophyll and sea-surface temperature, that are useful to NMFS and NOS.
Relevant Timescales

Bio-Physical Interactions

- Bathymetric features
- Global warming
- Basin scale variability
- El Niño
- Rossby waves
- Seasonal cycle
- Eddies and fronts
- Coastal upwelling
- Barotropic variability
- Internal waves and inertial motions
- Internal tides
- Surface tides

Time Scale

Spatial Scale
The biggest value of VIIRS is that it is part of a longer timeseries.
Examples of VIIRS usage within NOS and NMFS

(mostly from NOAA satellite course participants)
The results of the search for **viirs chl**

42 matching datasets, with the most relevant ones listed first.

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Oceanographic Characterization of Washington State Outer Coast

HABs
- OSU Chl Anomaly
- MODIS Aqua West, Daily

SST Anomaly
- POES AVHRR, Casey and Cornillon Climatology, Global (Monthly Composite)
- Non-Anomaly, SST, VIIRS, Suomi-NPP, Northwest US, 3-Day

Ocean Color
- Ocean Color Scatterometry
- Modeled SSHA

VIIRSN, Suomi-NPP, Global, 4km, Chlorophyll, OCI Algorithm, 8-Day

BLOB
- SST Anomaly, POES AVHRR, Casey and Cornillon Climatology, Global (Monthly Composite)

Upwelling
- Wind Stress, METOP ASCAT, Global, Near Real Time (14 Day Composite)

Currents, Gyres
- NRL HYCOM+NCODA, Apr 2014 to Now, Forecasts, at Surface
Satellite & Subsurface Remote Sensing: potential influence of an upwelling event on HAB dynamics in San Pedro Bay, CA

Gregory J. Doucette, National Ocean Service

**Observations**

- GHRSSST data revealed strong upwelling event at ESP mooring preceding toxic HAB
- VIIRS chlorophyll data consistent with PN HAB associated with upwelling event
- HAB DA toxicity peaked during upwelling relaxation period

**Purple line (1):** peak of upwelling event revealed by GHRSSST data, corresponding to the appearance of cells in HAB genus, *Pseudo-nitzschia* (PN), at ESPmack mooring

**Blue line (2):** peak of domoic acid (DA) concentration following upwelling relaxation & corresponding to high VIIRS chl signature & continued presence of *Pseudo-nitzschia* cells at ESPmack mooring

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**GHRSST DATA (°C)**

- GHRSSST
- VIIRS chl-a
- MODIS chl-a

**GHRSST DATA (°C)**

- GHRSSST
- Total PN

**GHRSST DATA (°C)**

- GHRSSST
- DA

**GHRSST DATA (°C)**

- GHRSSST
- Total PN (cells L^{-1})

**GHRSST DATA (°C)**

- GHRSSST
- Domoic Acid (ng L^{-1})
High resolution (750m) ocean color and SST data from VIIRS will be extremely useful.

Need data in a format that is easy to pull into ArcGIS.
Temporal variability in rockfish reproductive parameters in the Gulf of Alaska

**Objective**

Examine temporal variability in reproductive parameters (maturity, fecundity, reproductive success, and the strength of maternal effects) to see how these changes may be related to environmental variability including sea surface temperature and primary productivity.

These charts show the variability in chlorophyll a concentrations on the same day during two different years (2015 and 2016).
Above: Survey data results overlaid on a static, northern stock pacific sardine habitat map. Future iterations of this product will consist of stitched high-temporal and spatial resolution VIIRS SST and chlorophyll-a data to better match satellite data and CPS survey observations.

Below: ERDDAP SST is currently being used to separate sardine landings from 2 different stocks to improve stock assessments. This effort will continue into the future.

http://icesjms.oxfordjournals.org/content/68/5/867.abstract

http://icesjms.oxfordjournals.org/content/71/2/328.short
Salmon survival in 2011 – what happened?
Brian Burke
Fish Ecology Division
NWFSC, NOAA Fisheries

Figure 1. Observed and fitted adult spring Chinook salmon returns, with the forecasted and observed returns for fish entering the ocean in 2011.

Figure 2. Chlorophyll concentration in May (2008-2013) in coastal Gulf of Alaska.

Figure 3. Time series of 8-day composite chlorophyll concentrations.

Figure 4. Time series of average April-May chlorophyll concentrations in coastal Gulf of Alaska. The lowest value (2011) suggests that low productivity could have negatively influenced salmon survival that year.
In-situ chlorophyll (chl-a) data was collected during Spring and Fall SEAMAP (Southeast Area Monitoring and Assessment Program) Plankton Surveys conducted by the NMFS Southeast Fisheries Science Center. Surface chl-a was extracted from triplicate 200 ml seawater subsamples at each station using a modified Welshmeyer method and was reported as the average value of the subsamples. 562 observations of in-situ chl-a from the 2012 and 2013 surveys coincided with the operational status of the VIIRS sensor from the Suomi National Polar-Orbiting Partnership (NPP) Mission. Daily observations from 160 in-situ chl-a samples were matched in time and space with VIIRS daily sensor data. In-situ and VIIRS chl-a data were highly correlated (r=0.852). The majority of samples available for comparisons were primarily from open ocean observations with low chl-a values and very few observations from areas of high primary productivity.

NMFS/SEFSC collects chl-a data as part of plankton surveys every spring and fall. They are willing to give their data to the VIIRS cal/val effort if additional data is needed.
Is the distribution of Atlantic sharks correlated with ocean productivity (chl-a)?

Satellite data: VIIRS, Suomi-NPP, Level-3 SMI, Global, 4km, Chlorophyll-a, OCI Algorithm, 8-Day

RC Muñoz, NMFS/SEFSC
Is chlorophyll-a correlated with loggerhead sea turtle distribution?

- VIIRS chlorophyll-a 8-day average for 06-01-2013
- Tracks of tagged loggerhead sea turtles for the same week

Melissa Warden, NMFS/NEFSC
Chlorophyll-a has been shown to influence seabird densities (Martin 2013).

Several species of seabirds can smell dimethyl sulfide (DMS), a compound released by phytoplankton during zooplankton grazing, which may correlate with Chl-a.

Chl-a may then be a useful metric to assess seabird presence, as they seek out productive areas to forage.

Is the distribution of seabirds correlated with ocean productivity (chl-a)?

Joshua Hatch, NOAA/NEFSC, Resource Evaluation and Assessment Division

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NRT Cruise support

- VIIRS chl image generated by NESDIS in support of a SEFSC survey cruise looking for bluefin tuna larvae.
- Images are used to position stations to cover frontal features, small and mesoscale oceanographic features, and to ensure as many different water masses as possible are sampled.
- They requested the images in gray scale.
WhaleWatch

Predicting blue whale whale locations to minimize ship strikes, a key factor limiting their population recovery (they are classified as a threatened species).

Hazen et al., 2016
J. Appl. Ecology
Using remotely sensed products, these surfaces can be predicted in near-real time for use by managers and fishers. A collaborative project between ODU and SWFSC, funded by NASA.

Elliott Hazen et al., NMFS/SWFSC
Take Home Points

• Within NMFS and NOS VIIRS ocean color data is used in a variety of different applications, many of which are not a NRT or 24/7 usage. Examples include:
  − Understanding HAB dynamics (NOS)
  − Characterizing sanctuaries and MPA (NOS)
  − Optimizing assessment surveys (NMFS)
  − Improving Stock Assessments (NMFS)
  − Characterizing Animal Habitat (NMFS)
  − Dynamic Ocean Management (NMFS)

• The biggest value of VIIRS is that it is part of a longer time-series of satellite chlorophyll measurements that extends back to 1997.

• Long-term climate-quality VIIRS ocean color data are needed for NMFS and NOS applications.
Questions?