Supporting diverse Pacific NW marine data access needs via the NANOOS Visualization system (NVS) and data services

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Salish Sea Ecosystem Conference / Salish Sea Marine Ecosystem Data Collation and Management panel.
2018 Apr. 4, Seattle
What is IOOS?

• The Integrated Ocean Observing System (IOOS) in the U.S. is a national-regional partnership working to provide new tools and forecasts to improve safety, enhance the economy, and protect health.

• Integrated ocean information is available in near-real-time, as well as retrospectively.

• Easier and better access to this information is improving our ability to understand and predict coastal events and conditions (e.g., waves, acidification, etc.).

• Such knowledge is widely used and needed...!
Coastal U.S. IOOS:
17 Federal Agencies; 11 Regional Associations
CONSISTENT NATIONAL CAPABILITY

Regional Associations

Observations
Forecasts/Modeling
Data Management
User Products
Outreach

Leverage and Link

DIVERSE LOCAL STAKEHOLDERS

engages DIVERSE LOCAL STAKEHOLDERS to assure CONSISTENT NATIONAL CAPABILITY.
NANOOS Visualization System: Rationale and Goals

- Disparate suite of web sites available to the public (serving a wide range of data).

- Regional needs: seamless delivery of coastal, estuarine and ocean data to stakeholders within the NANOOS domain (+external partners, other IOOS RA’s, and national/international programs).

- NANOOS currently provides access to 47 different types of variables, and in total ~200 ‘assets’ & 10 model/forecast overlays.

  Effective delivery of these data and product feeds can lead to:
  - greater situational awareness (local and regional scales);
  - improved access to and understanding of environmental variables/conditions; and,
  - enable development and access to short- and long-term time-series.

- Overall goal: to aid our understanding of climate variability, safety, operations, and lead to improved resource management and regional productivity.
A Challenge - Many stakeholders and many potential data providers/sources

| State agencies (e.g. ODFW, WADOE, DSL, etc.) |
| Federal agencies (NOAA, NWS, FEMA, US Coast Guard, etc.) |
| Cities and Counties |
| Ocean engineering (instruments, wave energy, telecommunication) |
| NGO’s |
| Ports |
| Bar pilots |

| Fishers (recreational and commercial) |
| Shellfish growers |
| Recreational boaters |
| Tribes |
| Geotechnical consultants |
| Universities/researchers |
| Schools (K-12) |
| Public-at-large |
| Scientists |
| and many others... |
A Challenge - Many Data Types & How to Display Complex Data Effectively

Overlays (Satellite, Models, & other geospatial data)

NANOOS RCOOS

Existing assets to be sustained in partnership:
- Existing coastal and estuarine buoys
- Existing fixed mooring estuarine buoys
- Existing glider tracks
- Existing long-range (180 km range) HF radar site
- Existing standard-range (50 km range) HF radar site
- Port X-band wave radar
- Beach and shoreline assessment. Includes multiple sites where nearshore bathymetry is being collected
- Puget Sound ferry box
- Existing glider tracks (OOI)
- OOI moorings

Federal assets:
- NDBC buoys
- CDIP buoys
- NOS Tide gauges
- CMAN station

Shelf moorings & gliders
Shorelines & Bathymetry
http://nvs.nanoos.org - On version 5.5 (Apr 2018); v 1 released Nov. 2009
### Areas of Emphasis

<table>
<thead>
<tr>
<th>Topic</th>
<th>Image</th>
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</thead>
<tbody>
<tr>
<td>Climate</td>
<td><img src="image" alt="Climate" /></td>
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<tr>
<td>Coastal Hazards</td>
<td><img src="image" alt="Coastal Hazards" /></td>
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<tr>
<td>Ecosystem Assessment</td>
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<tr>
<td>Fisheries &amp; Biodiversity</td>
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<tr>
<td>Maritime Operations</td>
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</table>

### Quick Links

<table>
<thead>
<tr>
<th>Link</th>
<th>Image</th>
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<tbody>
<tr>
<td>NVS</td>
<td><img src="image" alt="NVS" /></td>
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<tr>
<td>Earthquake and Tsunami</td>
<td><img src="image" alt="Earthquake and Tsunami" /></td>
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<tr>
<td>IOOS Pacific Region Ocean Acidification</td>
<td><img src="image" alt="IOOS Pacific Region Ocean Acidification" /></td>
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<tr>
<td>J-SCOPE</td>
<td><img src="image" alt="J-SCOPE" /></td>
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<tr>
<td>Manuals for Real-Time Quality Control</td>
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Data Explorer

NANOOS Northwest Association of Networked Ocean Observing Systems

Additions & Updates

<table>
<thead>
<tr>
<th>Station</th>
<th>Details</th>
<th>Updated</th>
</tr>
</thead>
<tbody>
<tr>
<td>HMSC Newport</td>
<td>Station is offline since 6/22 due to sensor malfunction. It will likely be a few months before station is back online.</td>
<td>6 Jul 2017</td>
</tr>
<tr>
<td>OSU CB-06</td>
<td>New NANOOS shelf mooring deployed 6/10, 6 nm off Coos Bay / Cape Arago as relocation of now-decommissioned NH-10 mooring. Measures (in near-real-time) weather, temp, &amp; salt (1.5 m), and currents. PMEL air &amp; water CO2, and 1-m temp. &amp; salt also deployed.</td>
<td>5 Jul 2017</td>
</tr>
<tr>
<td>OSU NH-10</td>
<td>The NH-10 mooring has been relocated to a new location offshore of Coos Bay, designated as CB-06. See the OOI CE02SHSM mooring for continued data near the NH-10 station location.</td>
<td>5 Jul 2017</td>
</tr>
<tr>
<td>CMOP Saturn02</td>
<td>Mooring was redeployed in early June. NVS harvesting is now restored, with an updated weather and water sensor configuration for this multi-depth asset.</td>
<td>23 Jun 2017</td>
</tr>
<tr>
<td>Taylor-PCGSA Dabob</td>
<td>Sensor are back online starting on June 14, after a gap due to instrument problems and maintenance.</td>
<td>31 Jun 2017</td>
</tr>
<tr>
<td>NDBC Washington</td>
<td>Buoy deployed and data released on 5/31/2017; but continuous data transmission started on Jun. 5. Buoy location was updated (previous deployment position was 42.612 N, 130.537 W).</td>
<td>7 Jun 2017</td>
</tr>
</tbody>
</table>
Air Temperature

Map showing air temperature data with various temperature readings in different locations. The map covers a region including Portland, Beaverton, and other areas in Oregon and Washington. The temperature readings range from 57°F to 91°F.
WA Department of Health
Seasonal Shellfish Monitoring Network
The latest water measurements at the NEMO Observatory site where the Environmental Sample Processor is located 13 miles off La Push, Washington. Data are updated in near-real time. These products are provided to help understand where toxic algae may be moving and the conditions that may influence toxic blooms.

Species Abundance

*Pseudo-nitzschia australis*

*Pseudo-nitzschia multiseries*

*Pseudo-nitzschia fraudulenta*

*Pseudo-nitzschia pungens*

Species Present / Not Detected

*Alexandrium Species*

*Heterosigma akashiwo*

Toxins

Domoic Acid Concentration

**Pseudo-nitzschia pungens** (*Abundance*)

Quantitative cell abundances of *Pseudo-nitzschia pungens*. This species can sometimes produce domoic acid which can cause amnesic shellfish poisoning.
Forecast Origin Dates


The J-SCOPE forecast system for Washington and Oregon coastal waters presents preliminary results for the 2018 upwelling season. The CFS forecast indicates continued La Niña conditions until late spring, with more neutral conditions heading into the summer. In comparison to the climatological data, during the summer upwelling season (May - August), coastal regions are forecasted to have slightly higher sea surface temperatures (SST) with slightly lower temperatures subsurface. Bottom oxygen is forecasted to be lower over much of the region during the upwelling season. Chlorophyll concentrations vary spatially but mostly approach climatology. Bottom Ω is forecasted to be undersaturated throughout the upwelling season, with the exception of supersaturated conditions on shallow Washington shelves. Surface Ω is forecasted to be supersaturated throughout the upwelling season for all coastal areas.

The forecast system predicts the timing of the spring transition from downwelling to upwelling, the cumulative upwelling index, sea-surface temperature (SST), primary production, chlorophyll stock, dissolved oxygen, and sardine habitat. The forecast for 2018 is composed of three model runs that make up an ensemble. Each model run is initialized at a different time (January 5, January 15, January 25), and has complementary forcing files from the large scale model CFS. The details of the wind forcing for each model run can be found on the California Current Indicators tab. For each of the predicted quantities listed above, we report the ensemble average anomaly as well as the relative uncertainty within the ensemble, which is defined as the standard deviation of the ensemble divided by the mean of the ensemble and is reported as a percentage of the mean. All of these quantities are reported as monthly averaged anomalies from our new January-initialized reforecast climatology, which spans 2009 - 2017. An anomaly is an indication of how different conditions are to what they have been in the past. For more information about anomalies, please see the NANOOS Climatology App. These predicted quantities are key indicators for the California Current Integrated Ecosystem Assessment report.
Geospatial web services in action

ERMA | Environmental Response Management Application
Pacific Northwest

Sea Surface Temperature
Water Temperature Daily Average, Upper 3 meters (NANOOS)

Water Temperature (°C)

8 10 12 14 16

ID location (lat,lon): 47.38434,-123.01138 - Mozilla

Water Temperature Daily Average, Upper 3 meters (NANOOS)
NANOOS Situational Awareness Maps
Water Temperature Daily Average, Upper 3 meters
ORCA-UW monitoring site (Salish Sea): Profiling Buoys at Tuanoh - Hood Canal
- Value: 18.0 °C (n=12)
- Interval mid-point: Aug 8, 2016 12:00:00 PM
Geospatial web services in action *(sort of)*
IOOS Catalog
Based on standard-compliant, distributed service endpoints

95 datasets found for "NANOOS"

SG108-20130923T1728
Seaglider La Push NANOOS line, Washington. Glider covering a 200km SW-NE transect off La Push (Olympic Peninsula), Washington, as part of the Northwest Association of Networked...

SG187-20100716T1208
Seaglider La Push NANOOS line, Washington. Glider covering a 200km SW-NE transect off La Push (Olympic Peninsula), Washington, as part of the Northwest Association of Networked...

https://data.ioos.us
IOOS Biological Data Training Workshop

Summary: IOOS Biological Data Workshop Home page

Thursday, February 8 – Friday, February 9, 2018
University of Washington, Seattle, Washington

Organized by IOOS, NANOOS and OBIS-USA

Workshop Overview

This workshop builds on the successful partnership between the U.S. Integrated Ocean Observing System (IOOS) and the Ocean Biogeographic Information System (OBIS-USA) in coordination with IOC’s OceanTeacher Global Academy, and OBIS international to develop a community of practice around the management and analysis of marine biological data. It will provide hands-on training in a computer lab setting and is intended to educate participants on the benefits, goals, technology and process to standardize biological data (and associated physical or chemical data) and make it accessible via OBIS and IOOS, including the MBON Portal. The workshop will also expose participants to OBIS, IOOS and MBON applications for using those data.

See the Workshop Details and Instructions page for additional information about the workshop, including the location, hotels, and workshop preparations.

Scope

- IOOS and OBIS standards and tools for biological data
- Web services for data access
- Darwin Core, WoRMS (taxonomy) and metadata standards
- Hands-on data exercises

Outcomes

- Expand the IOOS and OBIS network of collaborators
- Improve marine biogeographic data quality

https://ioos.github.io/BioData-Training-Workshop/
Code Gallery

http://ioos.github.io/notebooks_demos/code_gallery/

1. Installing the IOOS conda environment
2. Opening netCDF files - hints from AODN
3. Unidata Jupyter notebook gallery
4. Extracting and enriching OBIS data with R
5. USGS-R examples
Thank you!

emiliom@uw.edu

http://www.nanoos.org
http://nvs.nanoos.org