

Analysis of Online Data

A tool for student-centered inquiry in oceanography

COSEE Oceanography Workshop 2014 Ocean Sciences Meeting

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http://myweb.facstaff.wwu.edu/applej2/OS2014_OnlineData.zip



Goals (Outcomes?)

1. Think differently about the utility and accessibility of online data sources as a teaching tool.
2. Become familiar with some of the sources of online data for marine and coastal ecosystems.
3. Explore resources, collect data, and examine patterns in these datasets.
4. Link online data to learning outcomes in oceanography and marine science.
 - Provide “data enhanced learning experiences”
 - Inquiry-driven, evidenced-based conclusions

Oceanography concepts we will investigate

- Upwelling varies in strength throughout the year.
- Vertical structure of the water column (e.g. stratification) is influenced by upwelling.
- Temperature and salinity in coastal waters is highly variable and influenced by river flow, upwelling, tidal exchange, and other factors.
- Dissolved oxygen concentrations vary throughout the day and year and are influenced by temperature, circulation, and photosynthesis.

Kudela et al 2009

SPECIAL ISSUE ON COASTAL OCEAN PROCESSES

ECOSYSTEM RESPONSE

New Insights into the Controls and Mechanisms of Plankton Productivity in Coastal Upwelling Waters of the Northern California Current System

BY RAPHAEL M. KUDELA, NEIL S. BANAS, JOHN A. BARTH,
ELIZABETH R. FRAME, DAVID A. JAY, JOHN L. LARGIER, EVELYN J. LESSARD,
TAWNIA D. PETERSON, AND ANDREA J. VANDER WOUDE

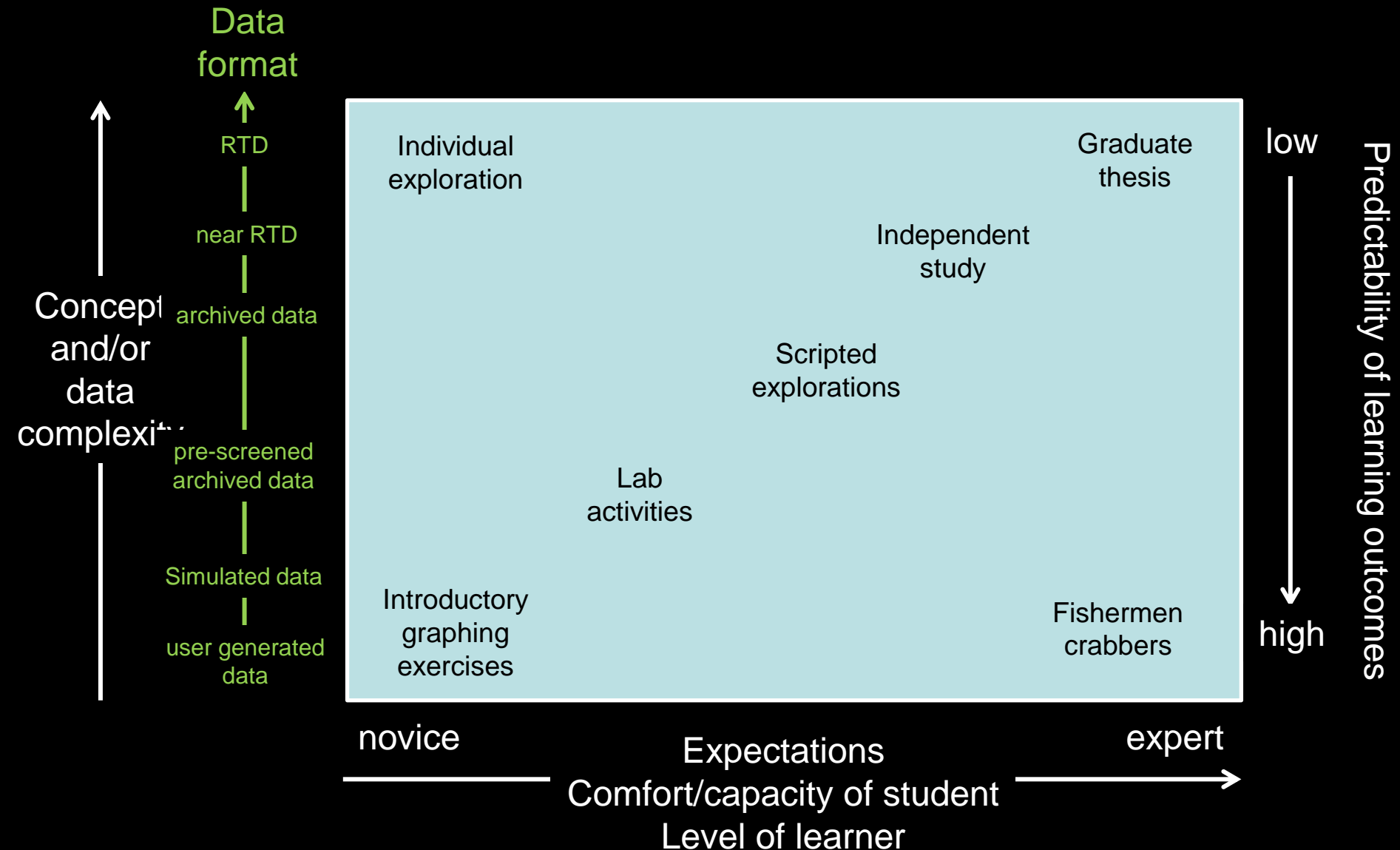
ABSTRACT. During the lifetime of the National Science Foundation's Coastal Ocean Processes program, four experiments were conducted on the US West Coast in the northern California Current System. Although each project had a unique scientific focus, all four addressed the mechanisms causing eastern boundary current systems in general, and the California Current System in particular, to be biologically rich, from phytoplankton to apex predators. Taken together, findings from these projects provide new insights into the canonical view that upwelling systems are simple wind-driven "conveyor belts," bringing cold, nutrient-rich waters to the well-lit surface ocean where biological organisms flourish. We highlight new insights and advances gained from these programs, including recognition that (a) elements other than nitrogen, particularly iron, may limit the base of the food chain, and (b) the source of these nutrients is not solely a result of wind-driven Ekman transport. The importance of retentive features has clearly emerged, whether these are associated with topography, bathymetry, or more transient features such as river plumes. These new insights into the drivers and fate of this high biological productivity should greatly improve current and future generations of ecosystem models and provide a better understanding of the unique physical-biological coupling that makes the California Current System so rich.

Thinking about the data/learner relationship

*What are the varied relationships learners and
scientists can have with data?*

*How does this influence our teaching tools and
strategies?*

Visualizing the space of working with data



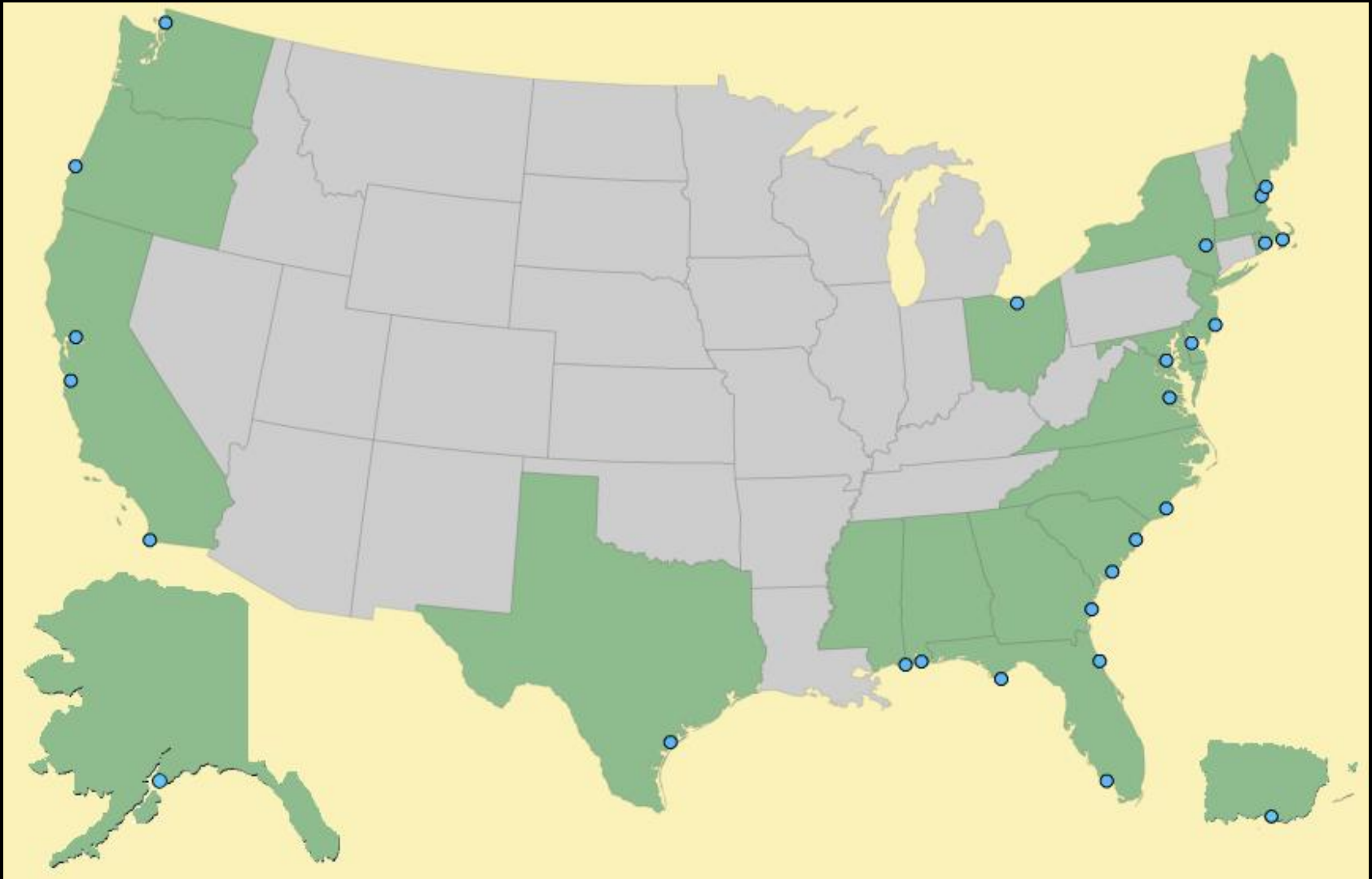
Motives for engaging learners with online data

- Formulate and test hypotheses with real data
- Interact with data like scientists
- Practice working with oceanographic/ecological data
- Manipulating and de-mystifying large data sets
- Provide self-guided inquiry of RT ecological processes
 - Shorter structured activities or larger scale research papers
- Upgrade typical descriptive term papers
 - Conduct place-based investigations of local ecosystems
 - Investigate spatial, temporal, seasonal, climatic patterns
- Investigate the ocean without being at the ocean
- When coupled with single-event field sampling, online data takes on a life of its own and becomes less abstract.

Online Data Sources

- National Estuarine Research Reserve System (NERRS) System Wide Monitoring Program (SWMP)
 - <http://cdmo.baruch.sc.edu/>
- Northwest Association of Networked Observation Systems (NANOOS) Visualization System
 - <http://nvs.nanoos.org/>
- USGS Real Time River Flow Data
 - <http://waterdata.usgs.gov/nwis/rt>
- NOAA Tide Predictions
 - http://tidesandcurrents.noaa.gov/tide_predictions.html
- Upwelling Indices (PFEL)
 - <http://www.pfeg.noaa.gov/products/pfel/modeled/indices/upwelling/upwelling.html>

National Estuarine Research Reserve System (NERRS)



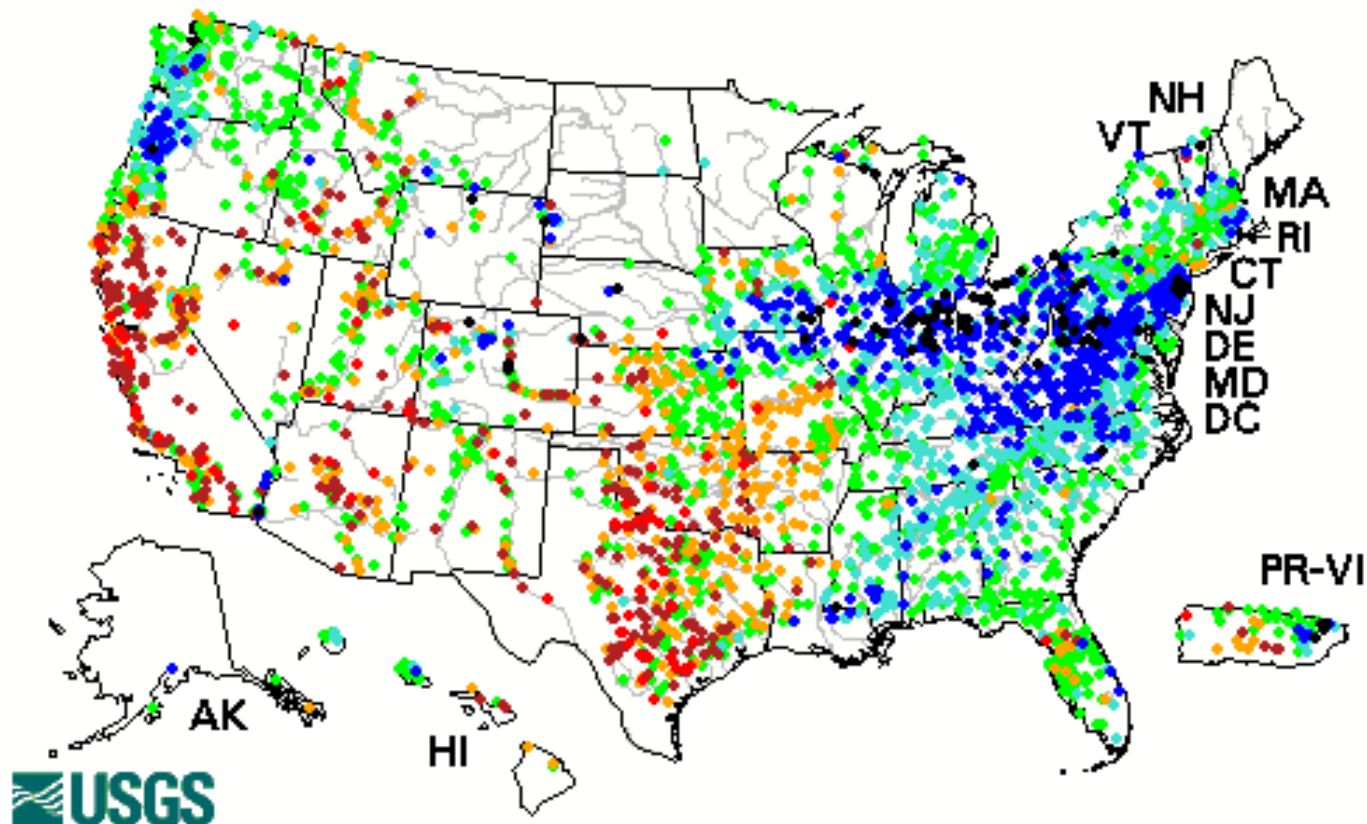
Regional Ocean Observing Systems



USGS Real-time flow data

Daily Streamflow Conditions

Saturday, February 22, 2014 12:30ET



A map of North America, including the United States, Mexico, and parts of Central America. The map is overlaid with numerous red pushpins, indicating a high density of data points, particularly along the West Coast of the United States and the Gulf of Mexico. State and national borders are clearly marked, and major geographical features like the Great Lakes and the Gulf of Mexico are labeled. The map also shows parts of Central America, including Belize, Guatemala, and Honduras.

PFEL Upwelling Indices

Centralized Data Manage... x NVS - Apps x USGS Current Water Data f... x Tide Predictions - NOAA ... x Upwelling Index Products ... x Graphs of Upwelling Indic... x Pandora Internet Radio - L... x

www.pfeg.noaa.gov/products/pfel/modeled/indices/upwelling/NA/daily_upwell_graphs.html

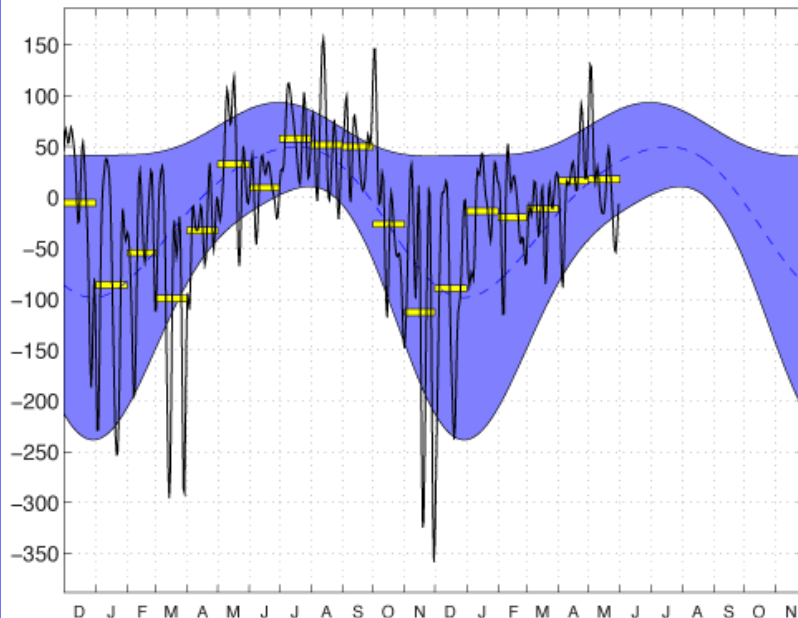
Most Visited WWU Email ESC1101 Pandora 23 Calendar Gmail Google Drive Web4U

GRAPHS OF UPWELLING INDICES OVER THE LAST 18 MONTHS

For 15 Positions Along the North American West Coast

Solid lines denote the daily Upwelling Index. The daily indices have been smoothed using a 3-day, 3rd order, forward-reverse Butterworth filter. The dashed curve is a biharmonic fit to the daily upwelling indices for the period 1967-1991. The shaded area around the biharmonic curve denotes one standard error, calculated for each Julian day. The yellow bars denote monthly mean of the Upwelling Indices based on the daily values. The units are metric tons per second per 100 m of coastline (or equivalently cubic meters per second per 100 meters of coastline). These units may be thought of as the average amount of water upwelled through the bottom of the Ekman layer each second along each 100 m of a straight line directed along the dominant trend of the coast on a scale of about 200 miles.

Smoothed Daily UI at 45N 125W from Dec 2011 to May 2013



Bakun Index Values from NOAA/NMFS/PFEG for: 45N 125W

Values are daily average of wind-driven crossshore transports computed from FNMOG six-hourly surface pressure analyses. Indices are in units of cubic meters per second along each 100 meters of coastline. -9999 indicates missing value. Positive numbers indicate offshore transport. Day is based on PST.

YYYYMMDD Index

19670101	30
19670102	-111
19670103	-46
19670104	28
19670105	0
19670106	-9
19670107	-99
19670108	-77
19670109	-220
19670110	-132
19670111	-17
19670112	-140
19670113	-17
19670114	-48
19670115	1
19670116	30
19670117	1
19670118	-184
19670119	-576
19670120	-173
19670121	-48
19670122	-180
19670123	-117
19670124	-68
19670125	-117
19670126	-259
19670127	-388
19670128	-157
19670129	-69
19670130	-3
19670131	-99
19670201	-74
19670202	-54

System Wide Monitoring Program (SWMP)



Telemetry station at Masonboro Island, NC



North Inlet Winyah Bay, SC

NERR SWMP Data Hub



NATIONAL ESTUARINE RESEARCH RESERVE SYSTEM

Centralized Data Management Office

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Data Export System



View / Download Data

Real Time Monitoring Data

Choose Reserve... ▾

Chesapeake Bay, VA 04/30/11 08:30 AM



Air Temperature: 15.7 °C (60 °F)
Water Temperature: 21 °C (70 °F)
Wind Speed: 1.7 m/Sec (04 mph)
Salinity: 0.2 PPT
Dissolved Oxygen: 7.7 mg/L

CDMO News

The CDMO currently houses over 35,500,000 water quality, meteorological, and nutrient records from the 27 estuaries throughout the United States.

We have just launched our new web site. Please leave us your [comments and suggestions](#).

Want to export data or graph data? If so, check out our new [Data Export System!](#)



NATIONAL ESTUARINE RESEARCH RESERVE SYSTEM

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Data Export System

The DES was developed to provide the majority of users with quick and easy access to SWMP data. The DES utilizes a map-based interface and offers single station exports, yearly authenticated file downloads (these may include non-standard nutrient parameters), charting, and a current conditions display for real-time stations.

[To launch the Data Export System, click here.](#)



Advanced Query System

The AQS was developed to specifically address the data delivery needs of those end-users looking for large amounts of data exported in a format that can be easily imported and manipulated for data analysis. The AQS offers three different query options allowing for mass downloads of annual files, customized queries for specific parameters and multiple stations in the same file, and an option to merge water quality, meteorological and nutrient datasets.

[To launch the Advanced Query System, click here.](#)



Real Time Data Application

The Real Time Application allows users to view near real time data, real time gauges, and 24 hour graphs with multiple parameters. You may use a bookmarked link to directly access the station of interest, or browse and select your station. The display will update automatically with the latest information as it comes in.

[To launch the Real Time Data Application, click here.](#)

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Data Export System *Powered By The Centralized Data Management Office*

Choose Reserve

Choose Sampling Station

View or Download Data

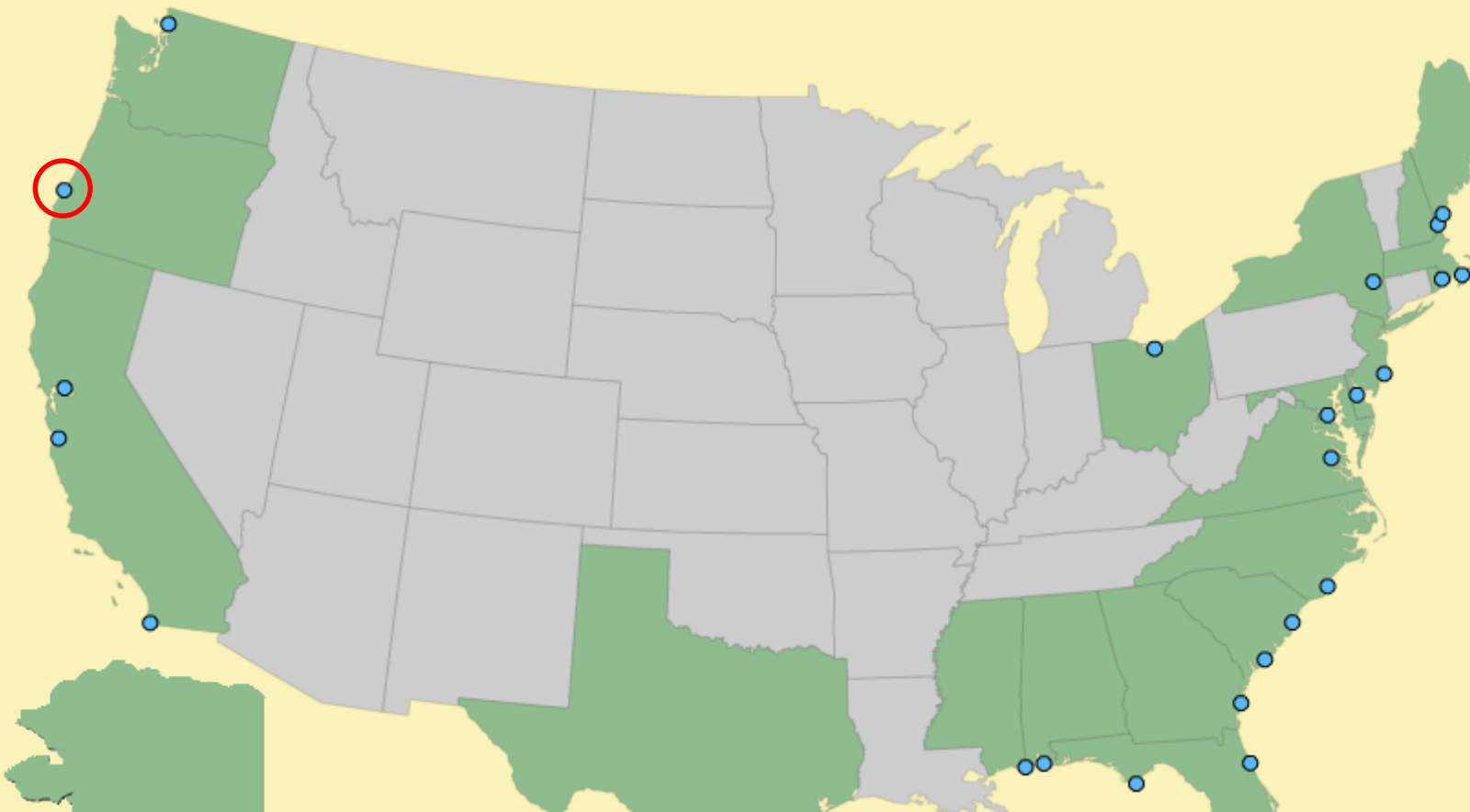
Submit Info

Complete!

Please select a Reserve from the map below:

If you already know the station code, enter it here. If not, choose a Reserve from the map below.

Submit

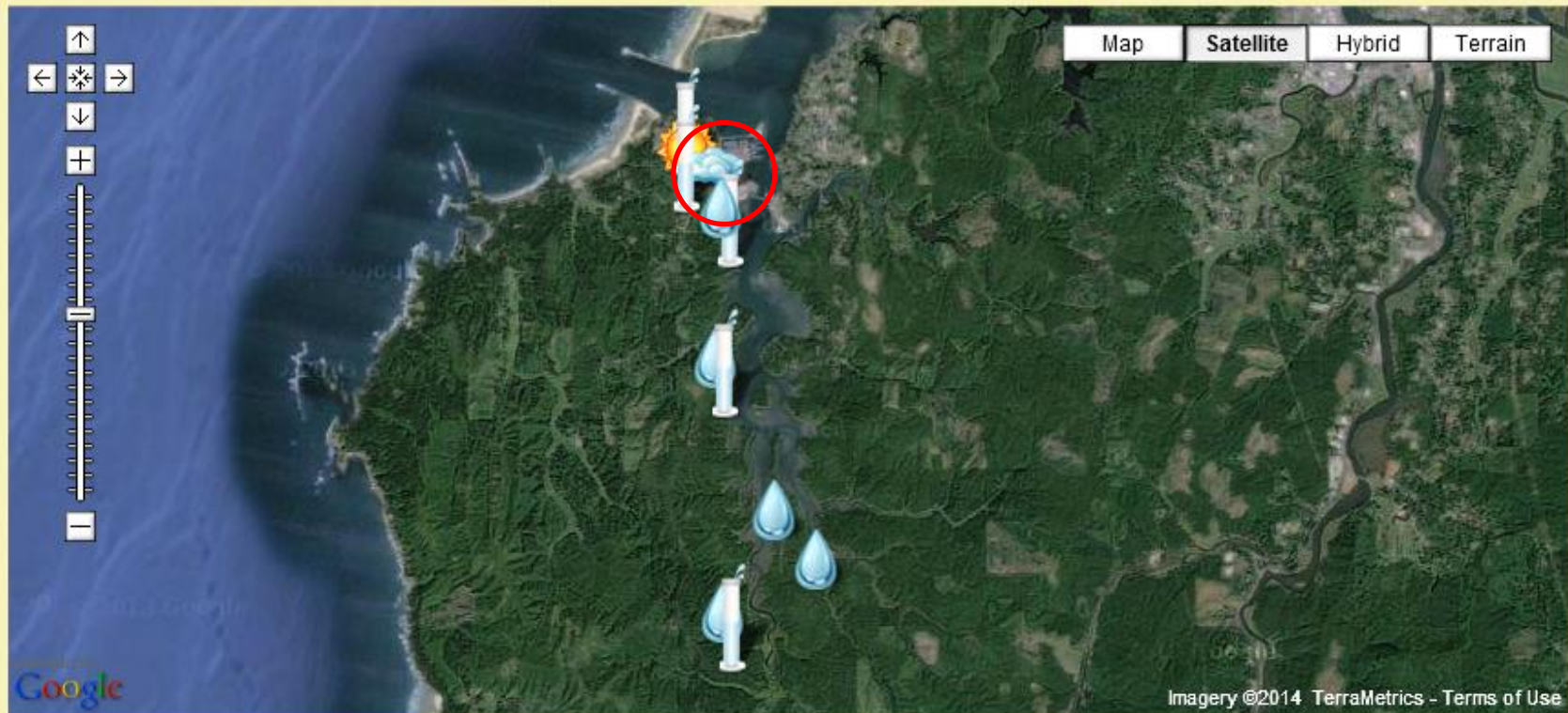


Data Export System Powered By The Centralized Data Management Office[Choose Reserve](#)[Choose Sampling Station](#)[View or Download Data](#)[Submit Info](#)[Complete!](#)**Please select a sampling station from South Slough, OR:**

Filter sampling stations by data type:

All Stations

Station Name	SWMP	Real Time ▼	Status	Data Type	Station Code
Elliot Creek	P	Yes	Active	water quality	EC
Winchester Arm	P	Yes	Active	water quality	WI
Valino Island	P	Yes	Active	water quality	VA
Charleston Bridge	P	Yes	Active	water quality	CH
Charleston Met Station	P	Yes	Active	water quality	CM

Your Station Selection: Choose above

Data Export System

Powered By The Centralized Data Management Office

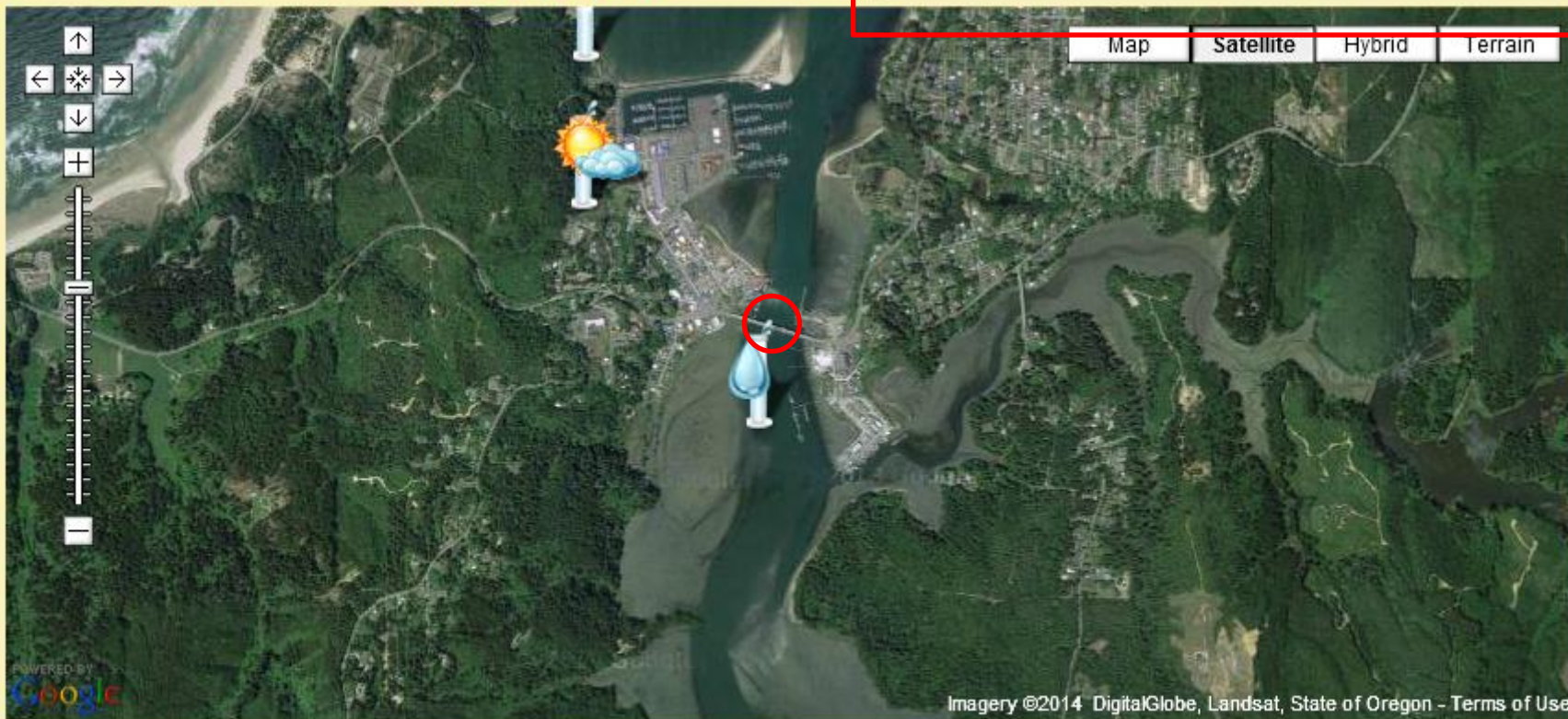
[Choose Reserve](#)[Choose Sampling Station](#)[View or Download Data](#)[Submit Info](#)[Complete!](#)

Please select a sampling station from South Slough, OR:

Filter sampling stations by data type:

All Stations

Station Name	SWMP	Real Time ▼	Status	Data Type	Station Code
Elliot Creek	P	Yes	Active	water quality	EC
Winchester Arm	P	Yes	Active	water quality	WI
Valino Island	P	Yes	Active	water quality	VA
Charleston Bridge	P	Yes	Active	water quality	CH
Charleston Mkt Station	P	Yes	Active	water quality	CM

Your Station Selection: Charleston Bridge**Proceed with this Station >>**

Data Export System

Powered By The Centralized Data Management Office

[Choose Reserve](#)[Choose Sampling Station](#)[View or Download Data](#)[Submit Info](#)[Complete!](#)

Select how to view or download data:

☐ **Export Data (1995-Present) --**

Select this option to export data from a custom date range to include [authenticated, provisional, and/or provisional plus data](#).

☐ **Yearly Files --**

Yearly files contain only data that have been verified and [authenticated](#) by the CDMO; may include non-standard parameters.

☐ **Graph Data --**

Choose this option to graph a parameter from any date range.

☒ **Current Conditions --**

Choose this option to view current conditions for your selected station and Reserve.

South Slough Current Conditions



Station: Charleston Bridge

Latest Timestamp: 02/22/2014 09:15 (LST)

Water Temperature: 9.5 °C (49°F)

Salinity: 17.2 PPT

Turbidity: 5 NTU

Specific Conductivity: 28.05 mS/cm

Dissolved Oxygen: 9.4 mg/L

Percent Saturation: 91.4 %

pH: 7.6 Units

Depth: 1.82 m (6.0 ft.)

[Click here to visit the CDMO's Real Time Data Application](#)

Data Export System

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[Choose Reserve](#)[Choose Sampling Station](#)[View or Download Data](#)[Submit Info](#)[Complete!](#)☐ Yearly Files☐ Export Data☒ Graph Data☐ Current Conditions

Please choose how you would like to select your dates:

☒ Custom Dates (Enter below)☐ Preselected Options (24 hours, etc.)

From: MM/DD/YYYY



To: MM/DD/YYYY



Parameter(s):

Choose 1st Parameter

Optional 2nd Parameter

[Graph!](#)

Now choose the dates and parameter you would like to see graphed above!

Chosen Reserve: **South Slough**

Chosen Sampling Station: **Charleston Bridge**

Data Type: **water quality**

Active Dates: **Apr 2002-Present**

Station Code: **SOSCHWQ**

Real Time Station: **Yes**

Data Export System Powered By The Centralized Data Management Office[Choose Reserve](#)[Choose Sampling Station](#)[View or Download Data](#)[Submit Info](#)[Complete!](#)

☐ **Yearly Files** ☐ **Export Data** ☐ **Graph Data** ☐ **Current Conditions**

Please choose how you would like to select your dates: ☐ Custom Dates (Enter below) ☒ Preselected Options (24 hours, etc.)

Preset Option: 24 Hours ▼

Parameter(s): Water Temperature ▼ Salinity ▼ **Graph!**

Now choose the dates and parameter you would like to see graphed above!

Chosen Reserve: **South Slough**

Chosen Sampling Station: **Charleston Bridge**

Data Type: **water quality**

Active Dates: **Apr 2002-Present**

Station Code: **SOSCHWQ**

Real Time Station: **Yes**

Data Export System

Powered By The Centralized Data Management Office

[Choose Reserve](#)[Choose Sampling Station](#)[View or Download Data](#)[Submit Info](#)[Complete!](#)

☐ Yearly Files ☐ Export Data ☐ Graph Data ☐ Current Conditions

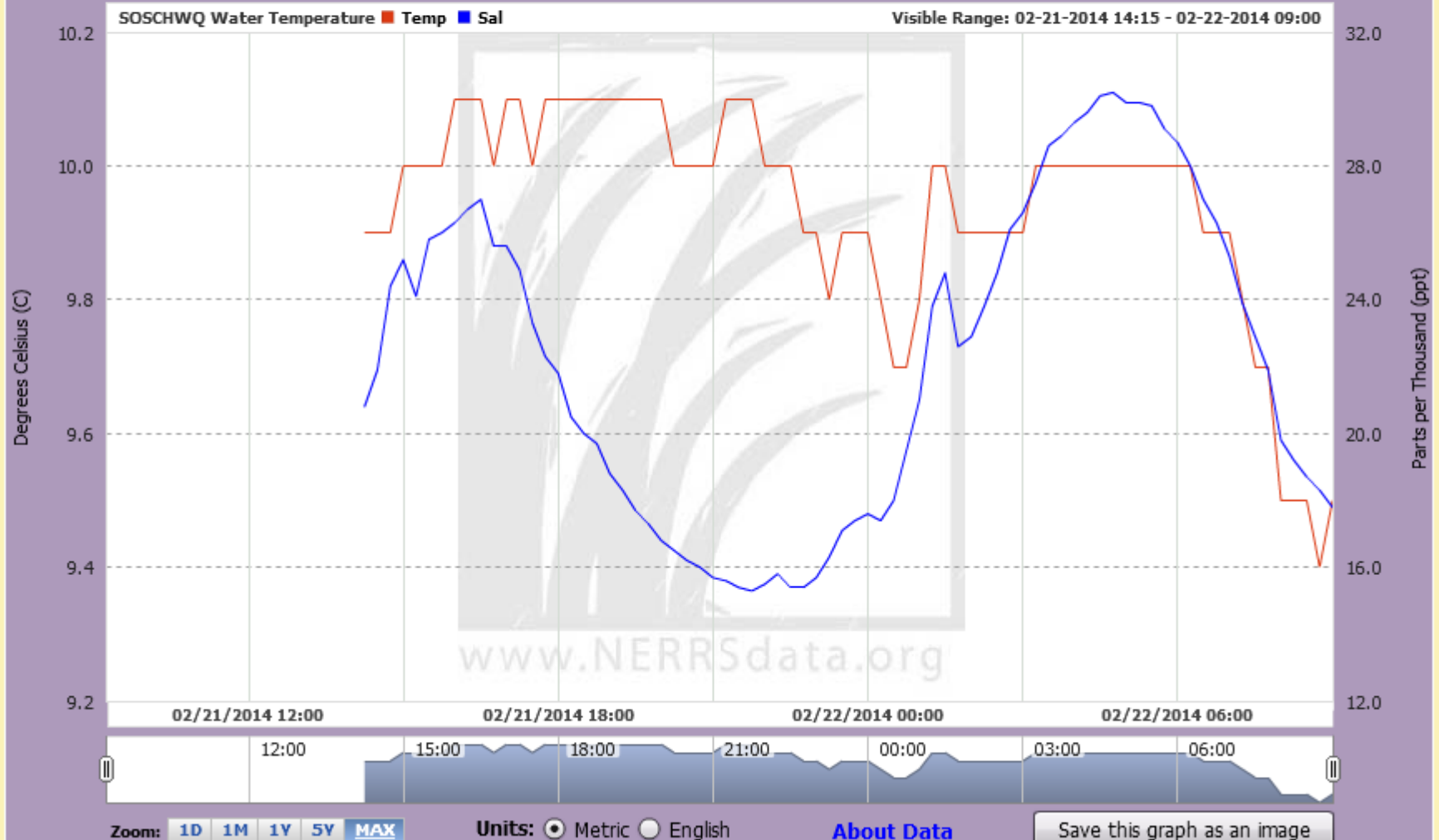
Please choose how you would like to select your dates: ☐ Custom Dates (Enter below) ☒ Preselected Options (24 hours, etc.)

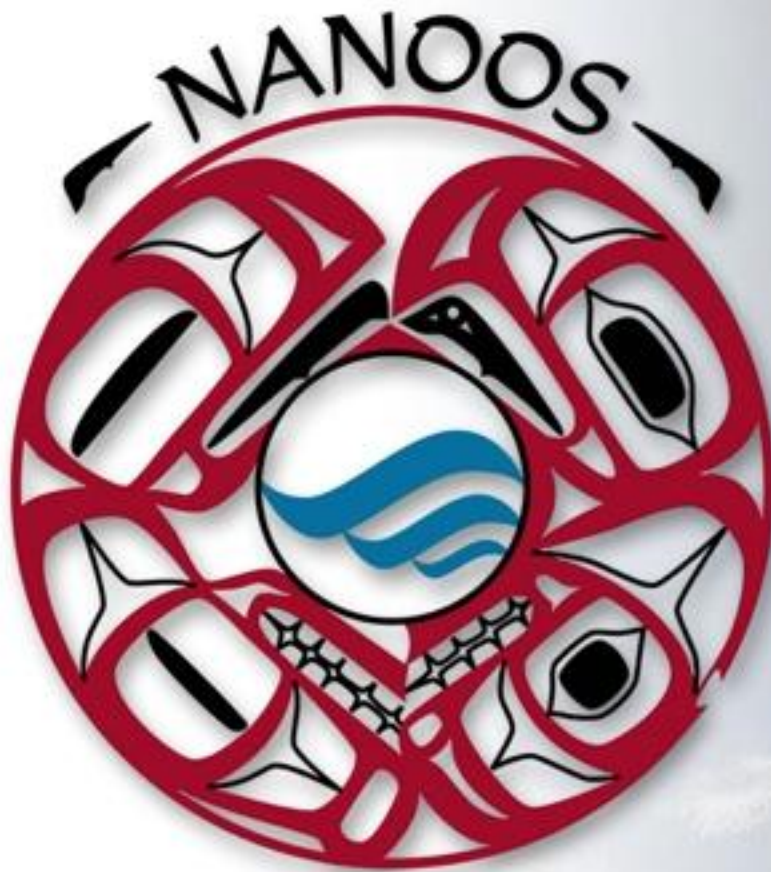
Preset Option: 24 Hours

Parameter(s): Water Temperature

Salinity

Graph!





Northwest Association of Networked Ocean Observing Systems

The Integrated Ocean Observing System (IOOS)
Regional Association for the Pacific NW



www.nanoos.org

NVS

NANOOS VISUALIZATION SYSTEM

**Data Explorer****Tsunami
Evacuation Zones****Tuna
Fishers****Shellfish
Growers****Beach and
Shoreline Changes****Maritime
Operations****High Frequency
Radar****Cruises****Gliders**

ADDITIONS & UPDATES

[View Last 3 Months](#)**ORCA Dabob Bay**

Offline. Profiling is temporarily offline, but will be restored soon. Near-real-time access to CO2 sensor data are unavailable since Nov. 1, 2013, but will be restored by April. Weather sensors remain offline.

Updated on 30 Jan 2014**APL-UW NPB-2**

Buoy back online since Jan. 14. Currently only temperature, salinity and pressure profiling sensors are deployed; weather sensors are not deployed.

Updated on 22 Jan 2014**ORCA Hoodsport**

Buoy back online since Dec. 28. Currently only temperature, salinity and pressure profiling sensors are deployed; weather sensors are not deployed.

Updated on 22 Jan 2014**CDIP Astoria Canyon**

Buoy back online since Jan. 17. Some wave variables are not available.

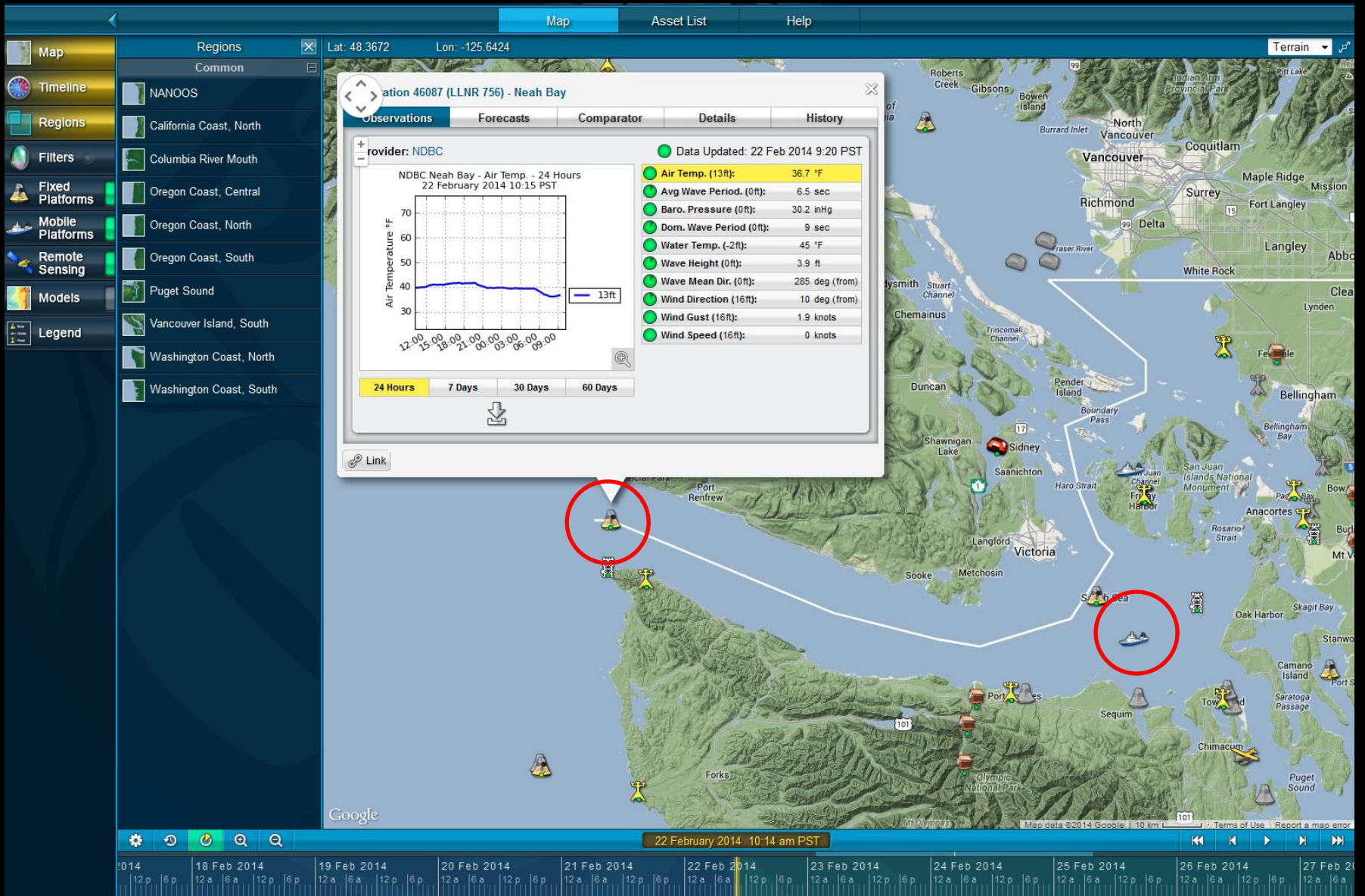
Updated on 22 Jan 2014**VIU Deep Bay MFS**

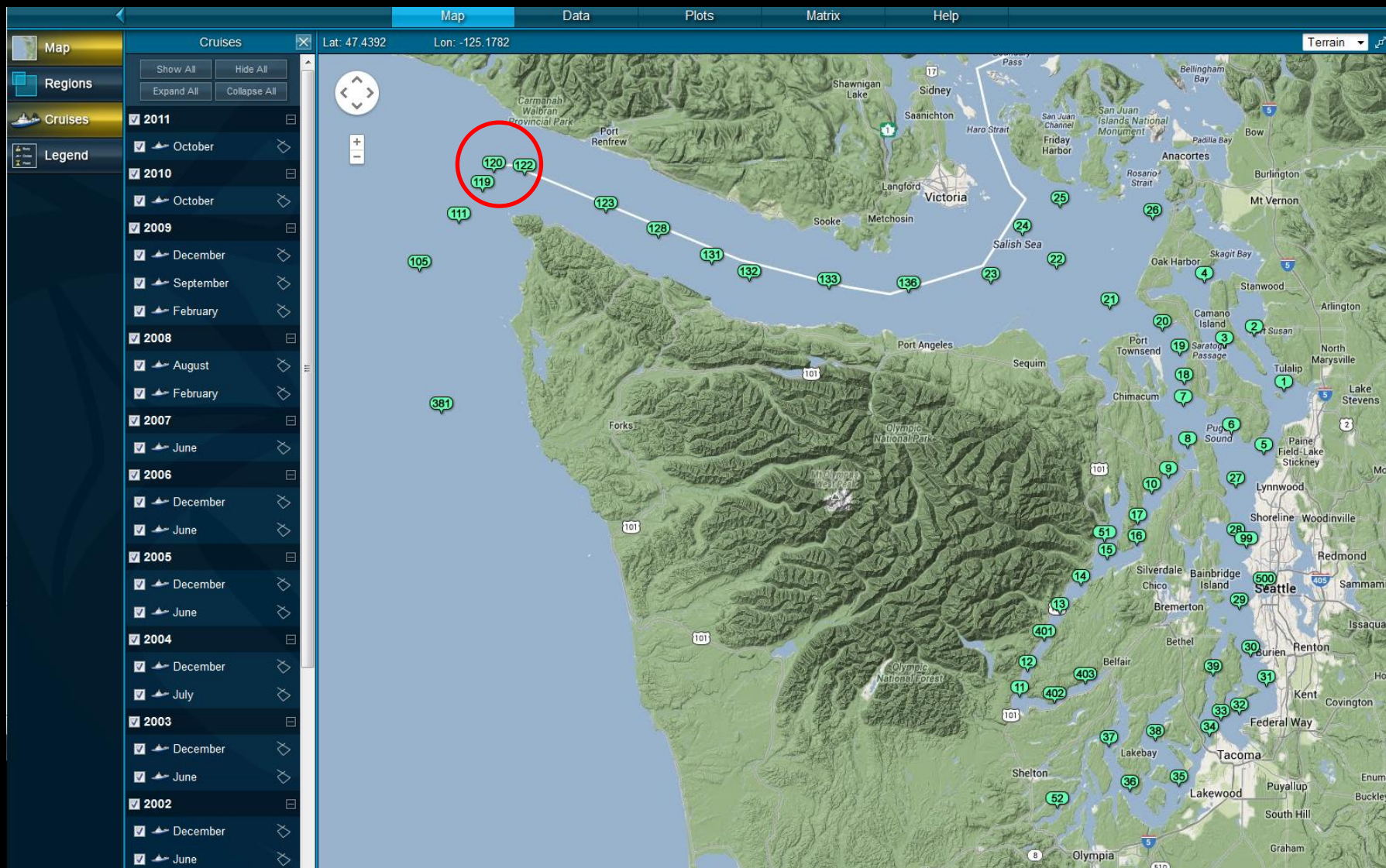
Monitoring site is back online after data transmission issues that started on 12/27/2013. The data gap since the first problem has been back filled.

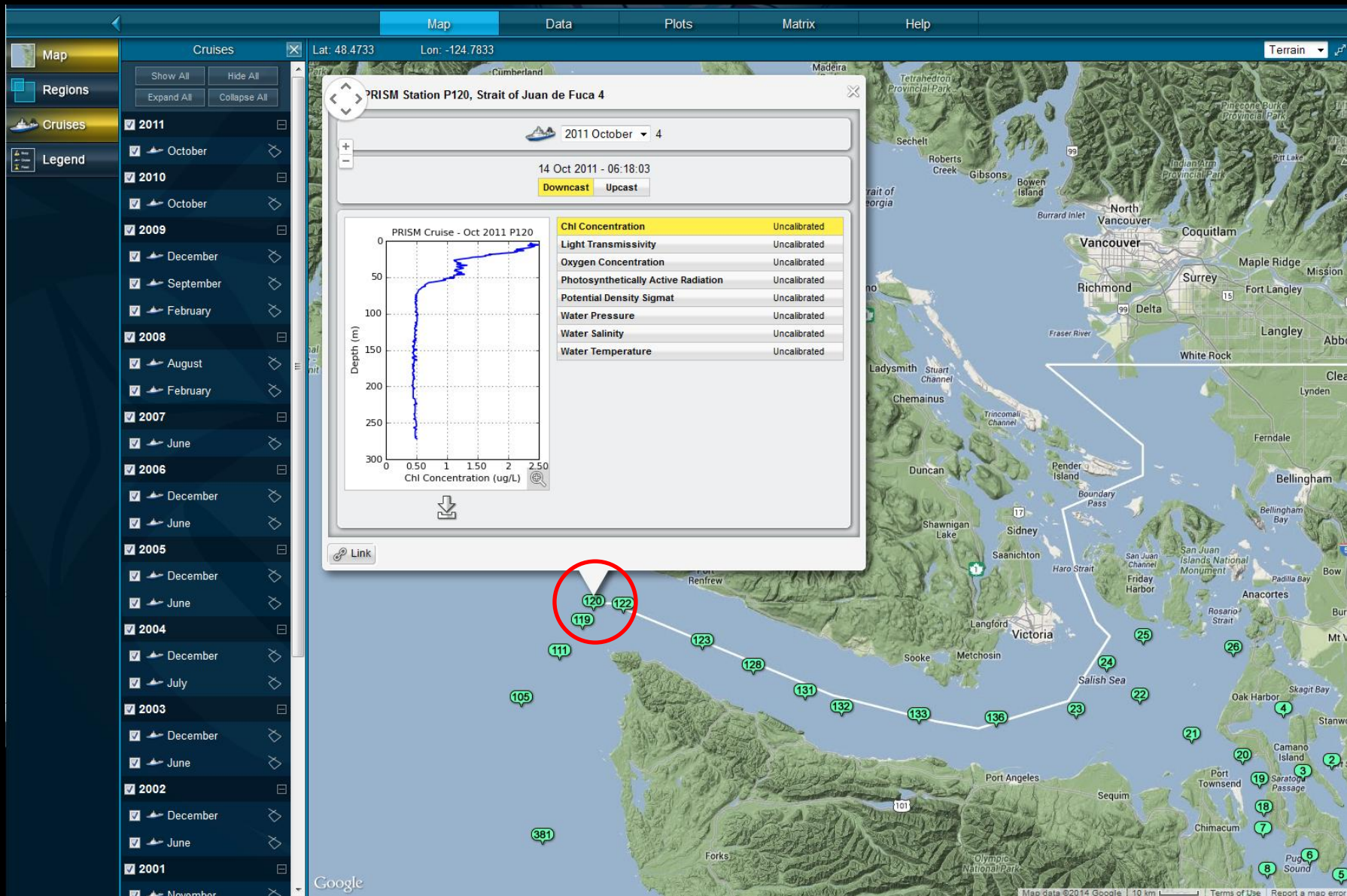
Updated on 14 Jan 2014**NDBC Eel River**

Buoy was restored to service around Dec 24, 2013.

Updated on 7 Jan 2014







Explore your regional resources

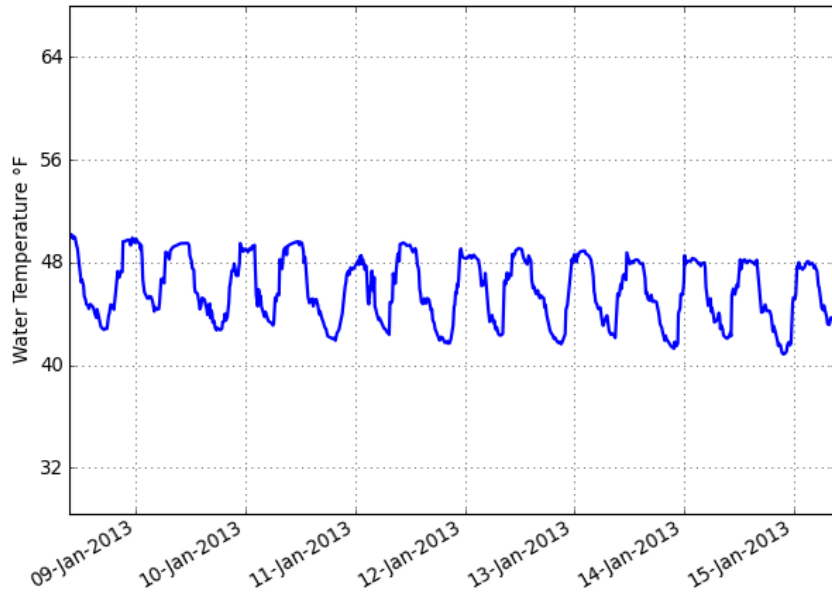
- Find regional OOS networks and NERR reserves.
- Explore assets, available data, data visualizations.
- Think about questions students can explore and concepts you can support with these data.
- Try using the *lesson lab builder* as a template for building an inquiry-based exploration of data.

Results from Data Investigations

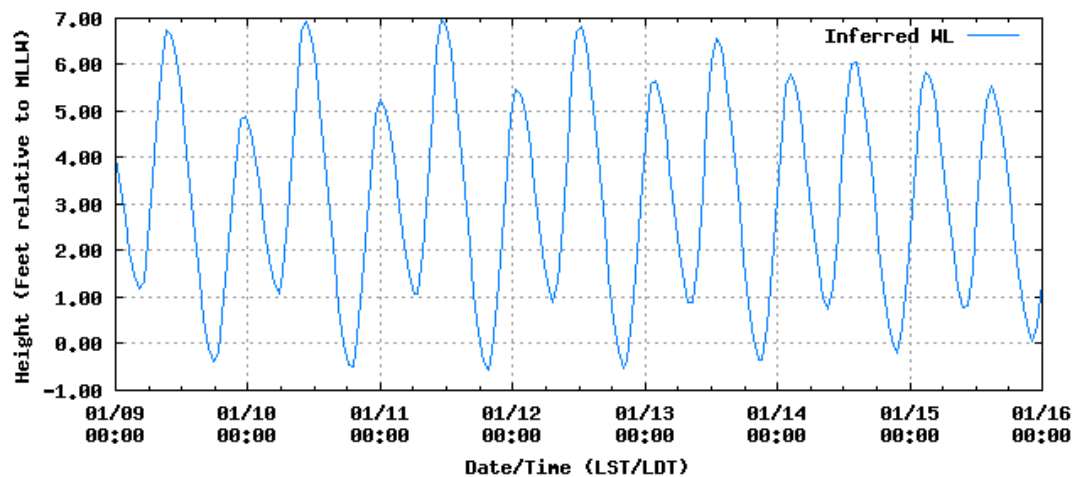
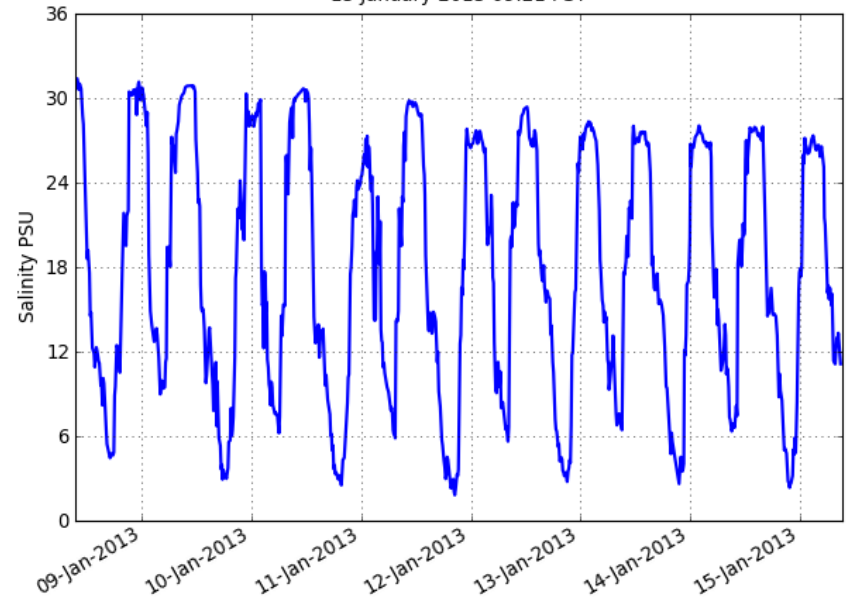
I. Examining the influence of tides and river flow on coastal water salinity.

Tides and Salinity (Columbia River and Seaside tides)

CMOP Sandi - Water Temperature - 7 Days
15 January 2013 09:21 PST

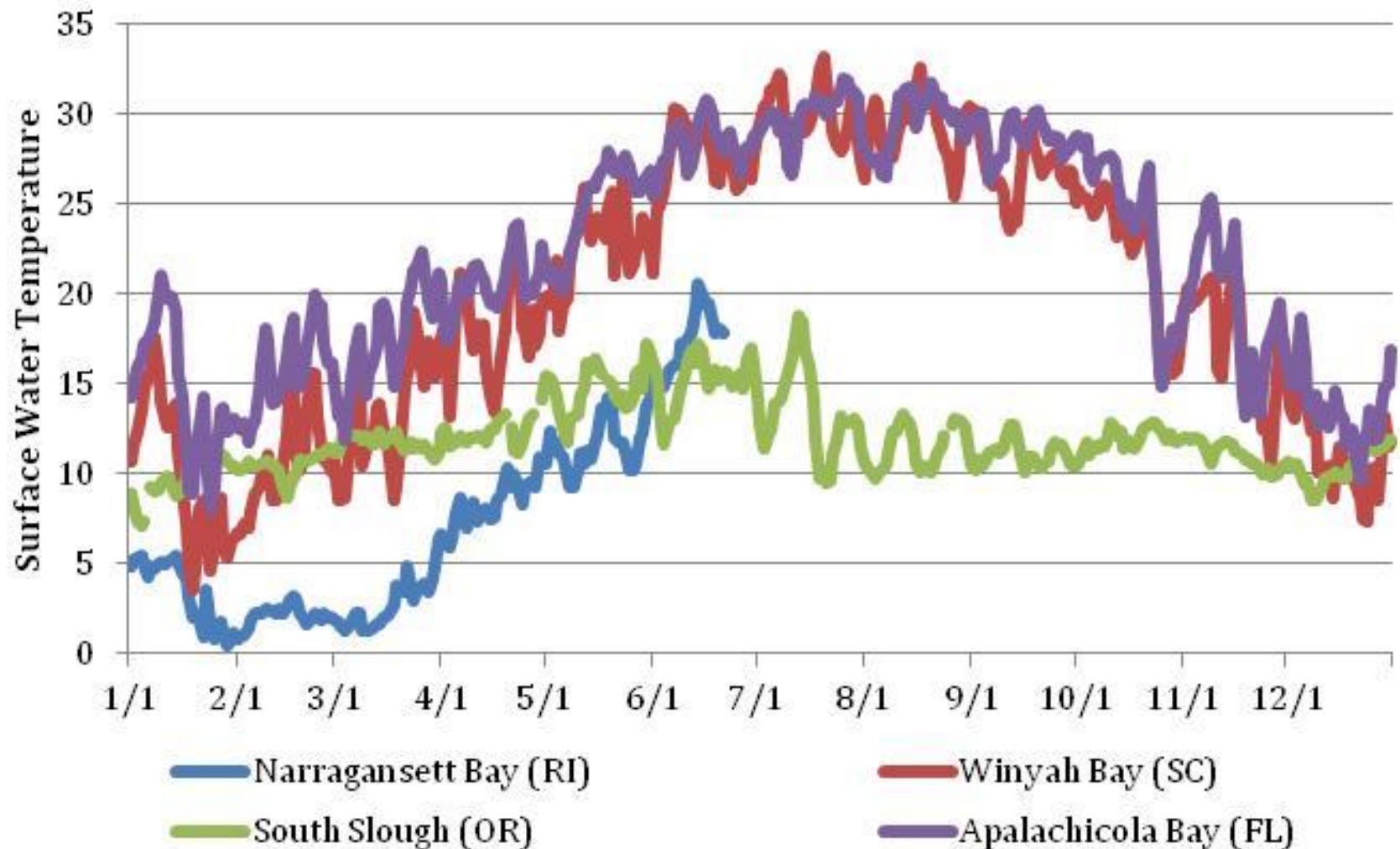


CMOP Sandi - Salinity - 7 Days
15 January 2013 09:21 PST



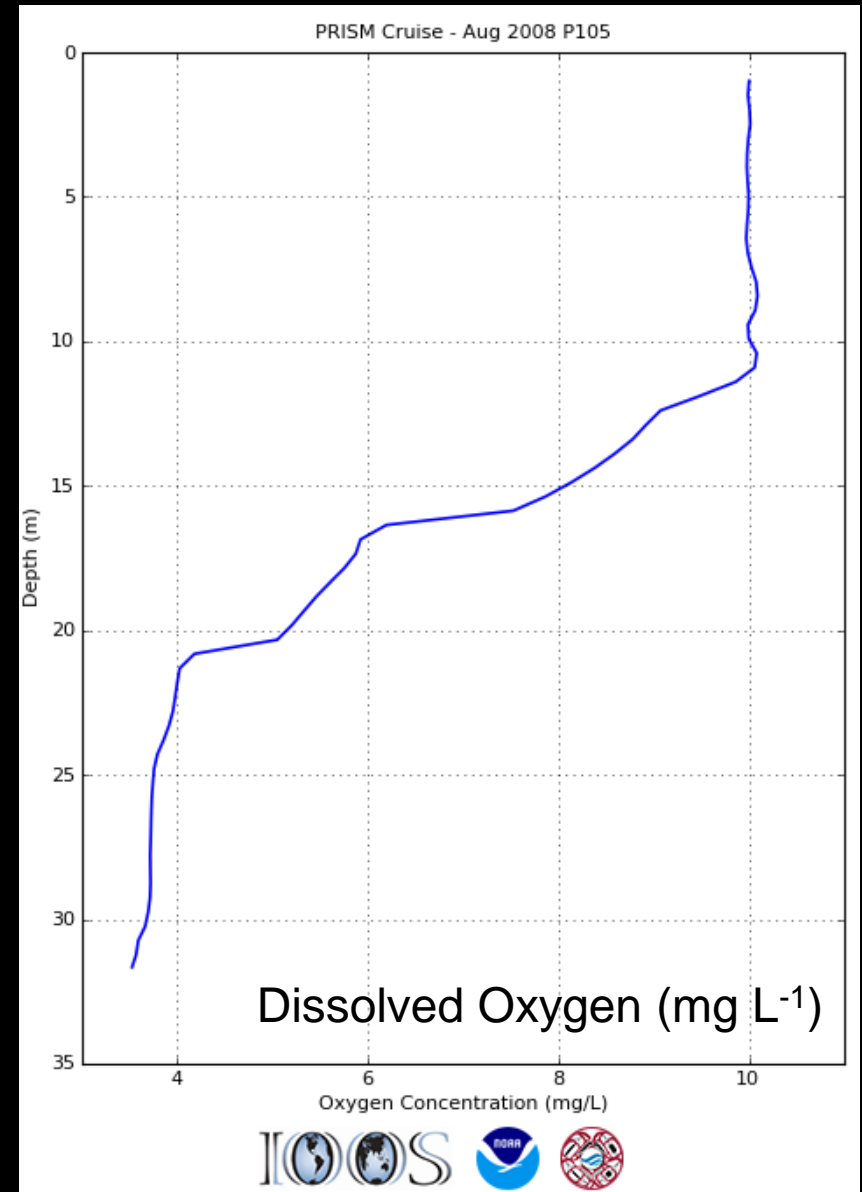
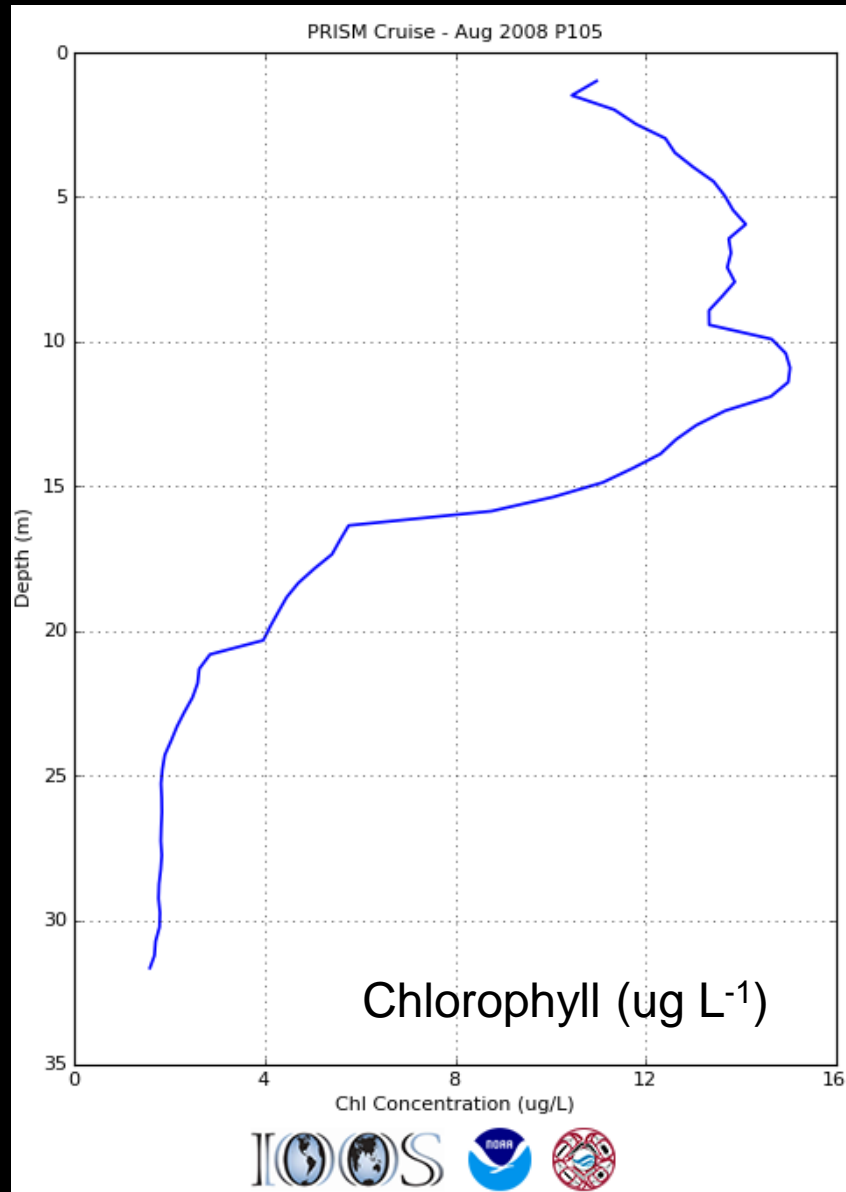
II. Regional differences in annual temperatures among coastal systems

Variability in Surface Temperature

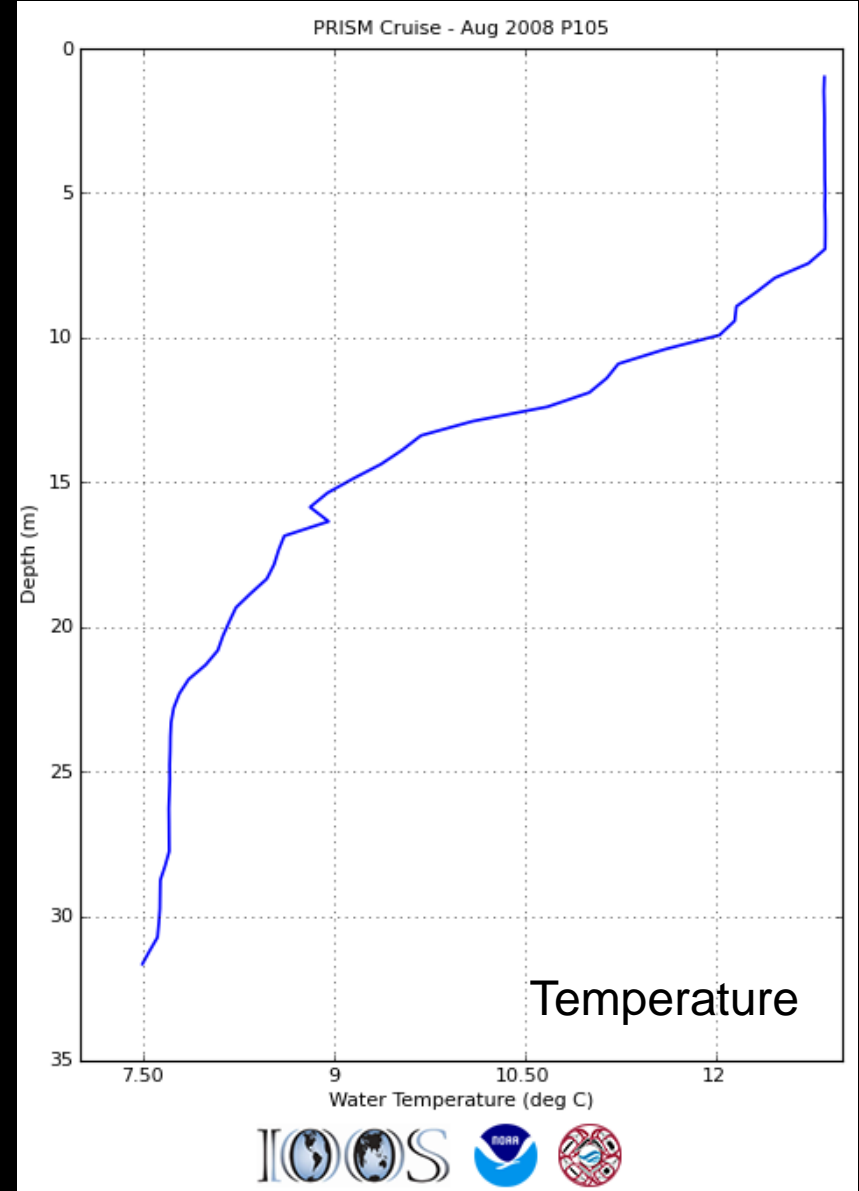
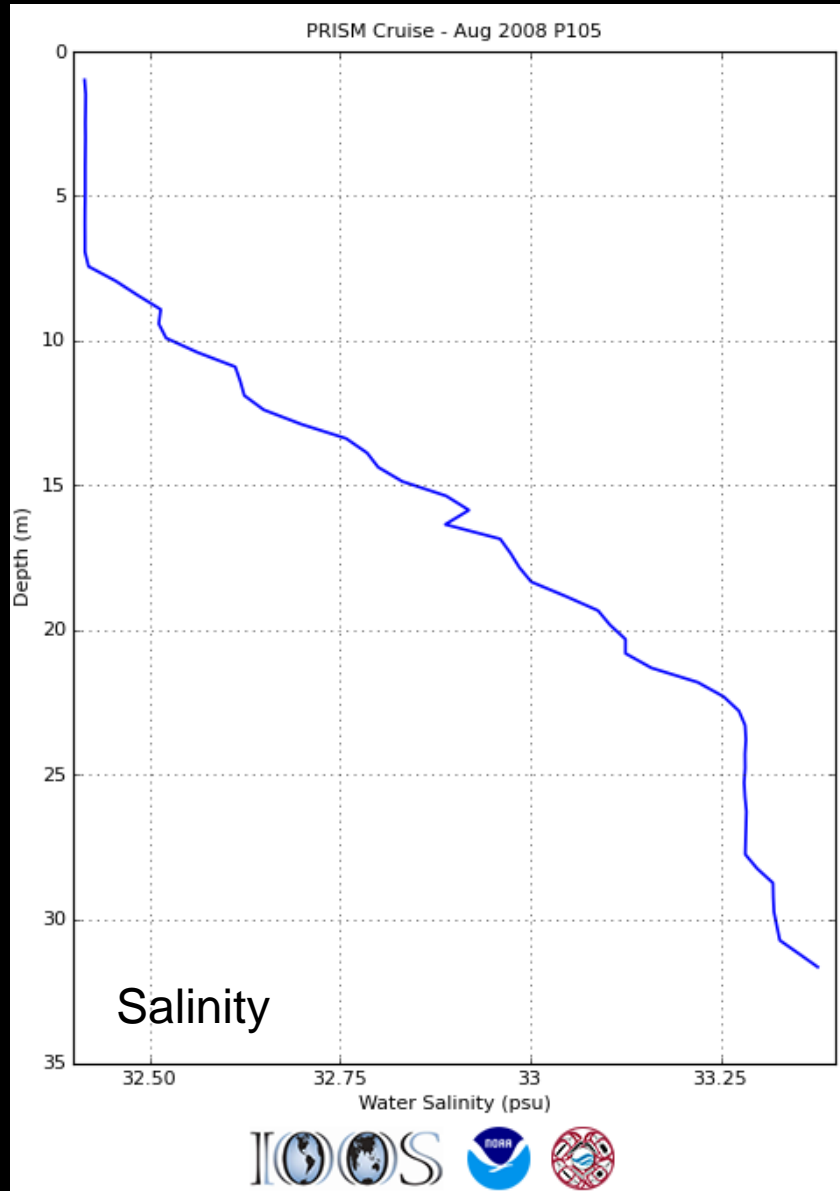


III. Water column profiles and upwelling

Water Column Profile at mouth of Strait of JDF



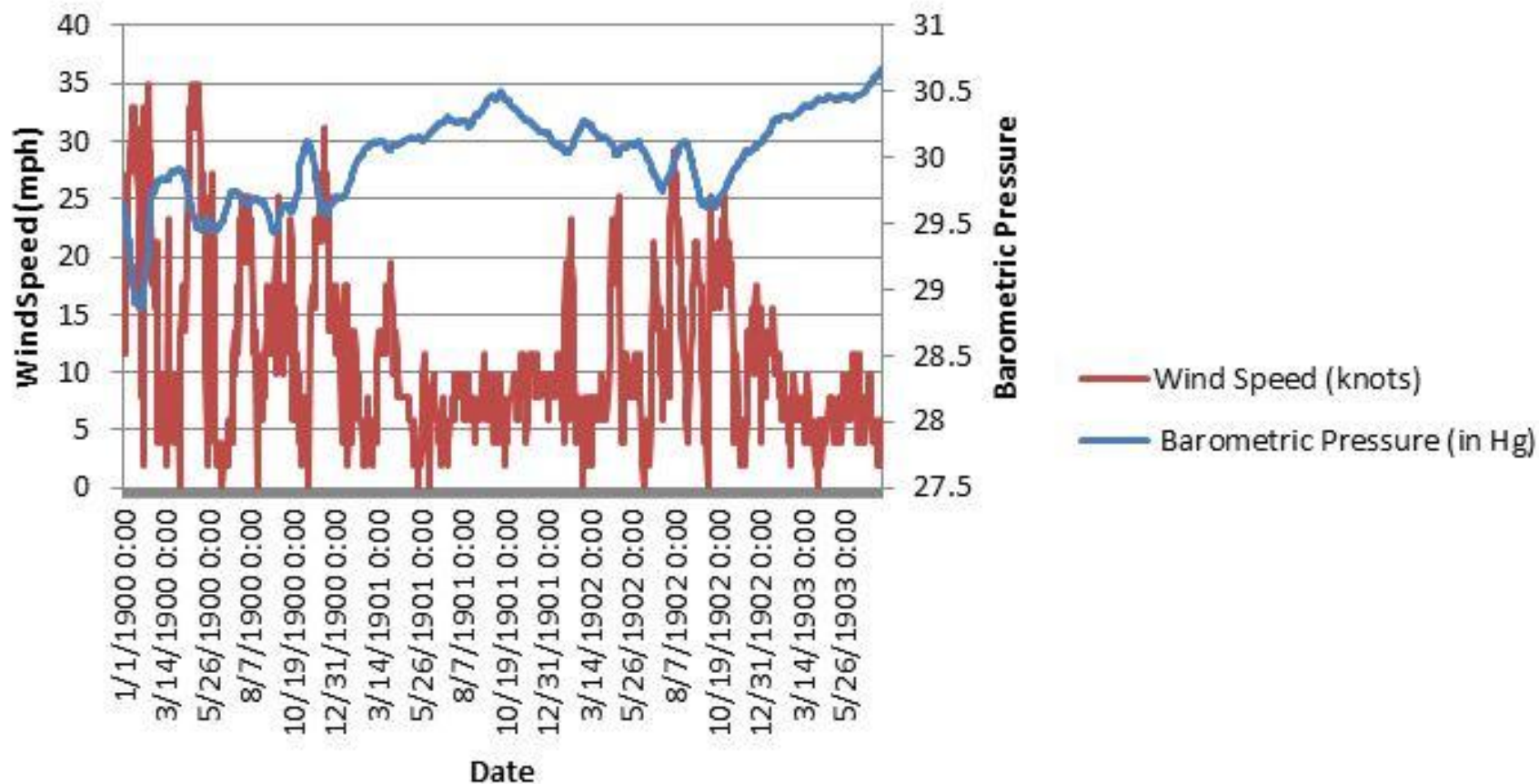
Water Column Profile at mouth of Strait of JDF



IV. Wind, weather, waves and barometric pressure

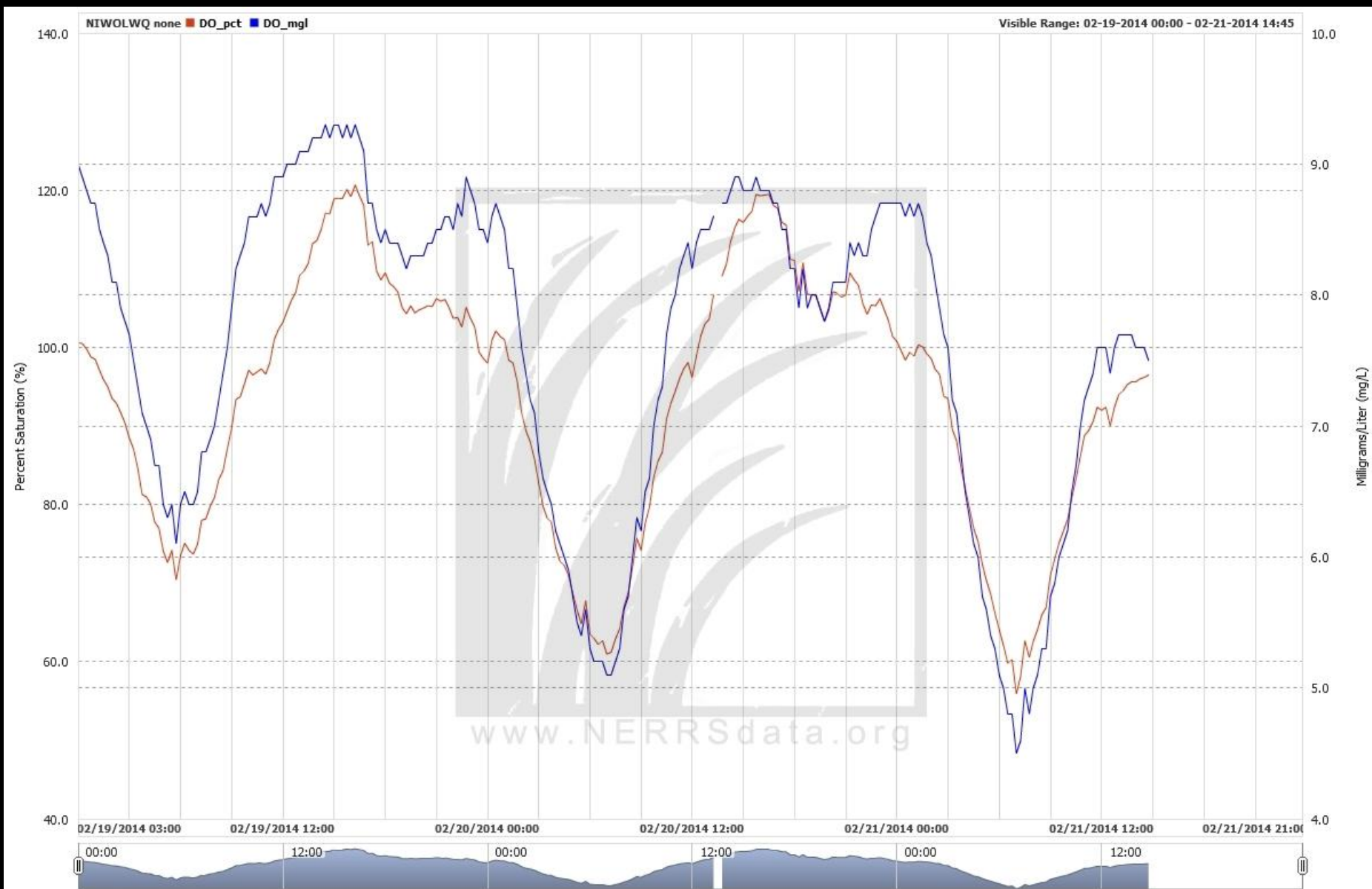
Pressure and Wind

30 Day Comparison

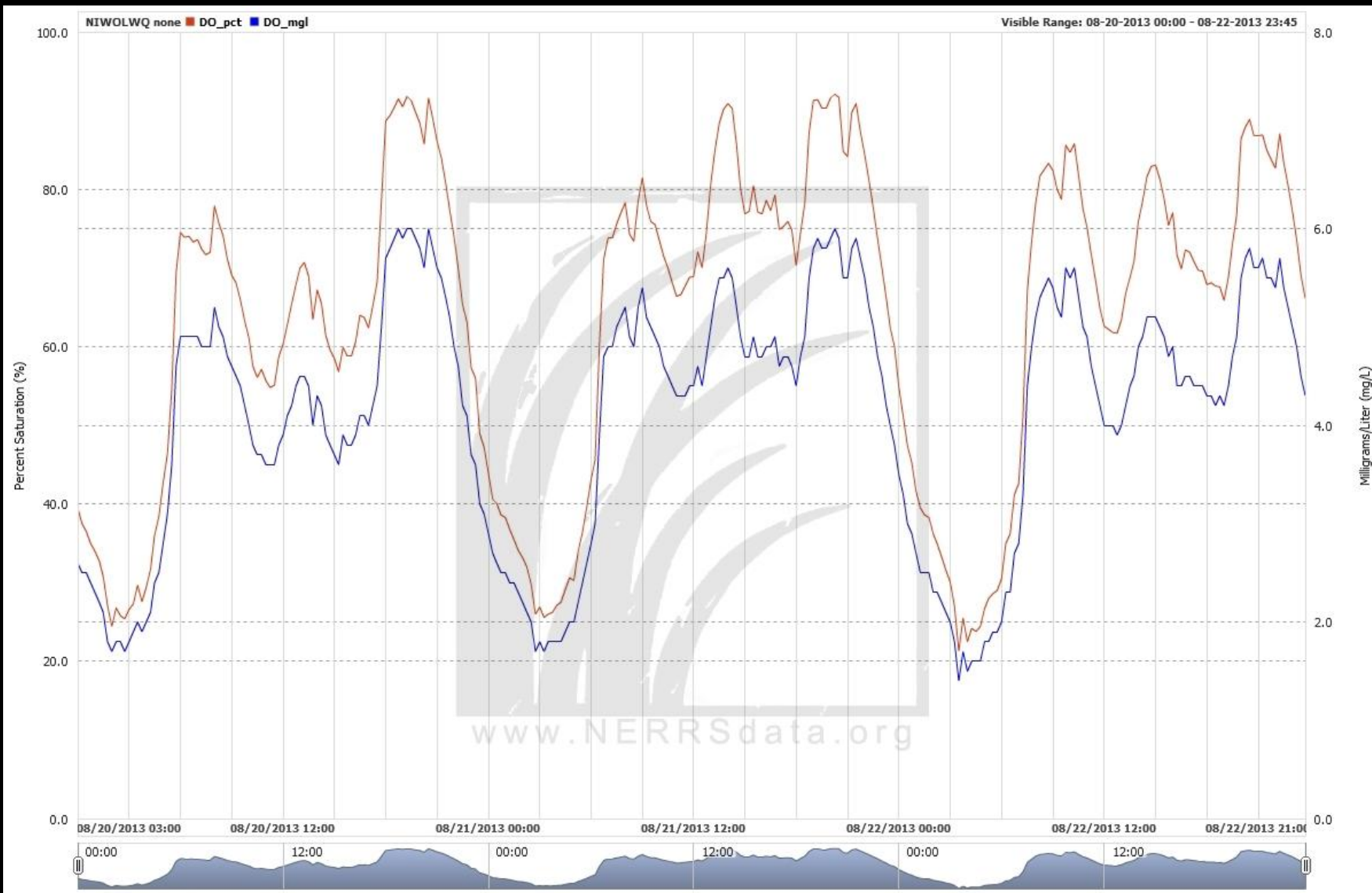


V. Seasonal and diel variability in dissolved oxygen concentrations

Dissolved oxygen at North Inlet (SC) February 2014



Dissolved oxygen at North Inlet (SC) August 2014



Oyster Landing DO during two 24 hour time periods

