

NANOOS Overview

2014



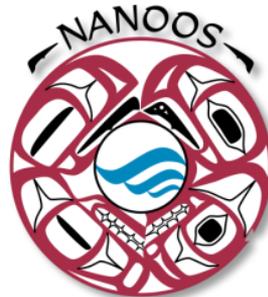
Sustaining NANOOS, the Pacific Northwest component of the U.S. IOOS®

- 1) Maintain NANOOS as the PNW IOOS **Regional Association**.
- 2) Maintain surface **current and wave** mapping capability.
- 3) Sustain existing buoys and gliders in the PNW **coastal ocean**, in coordination with national programs.
- 4) Maintain observation capabilities in PNW **estuaries**, in coordination with local and regional programs.
- 5) Maintain core elements of **beach and shoreline** observing programs.
- 6) Contribute to a community of complementary **numerical regional models**.
- 7) Maintain NANOOS' **Data Management and Communications (DMAC)** system for routine operational distribution of data and information.
- 8) Deliver existing **user-defined products and services** for PNW stakeholders.
- 9) Sustain NANOOS **education and outreach** efforts.

Sustaining NANOOS, the Pacific Northwest component of the U.S. IOOS®

1) **Maintain NANOOS as the PNW IOOS Regional Association.**
Sustain our proven role for regional coordination, administrative infrastructure, and stakeholder engagement.

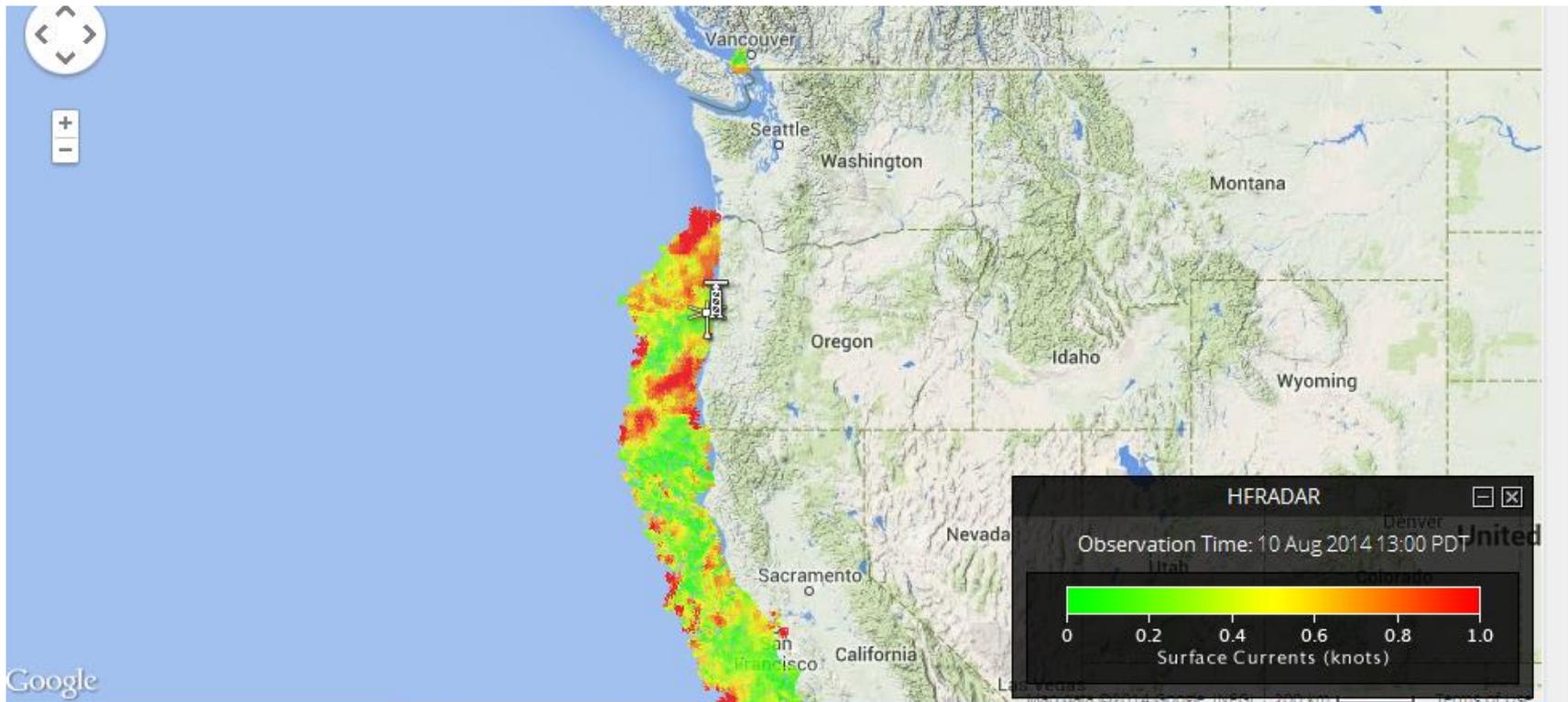
- NANOOS is engaged regionally and nationally
- Funds are dispersed to seven NANOOS partners
- NANOOS has 55 members, 30 anticipated tomorrow
- Academia, federal, tribal, and state governments, industry, and NGOs all involved
- We have an identity



Sustaining NANOOS, the Pacific Northwest component of the U.S. IOOS[®]

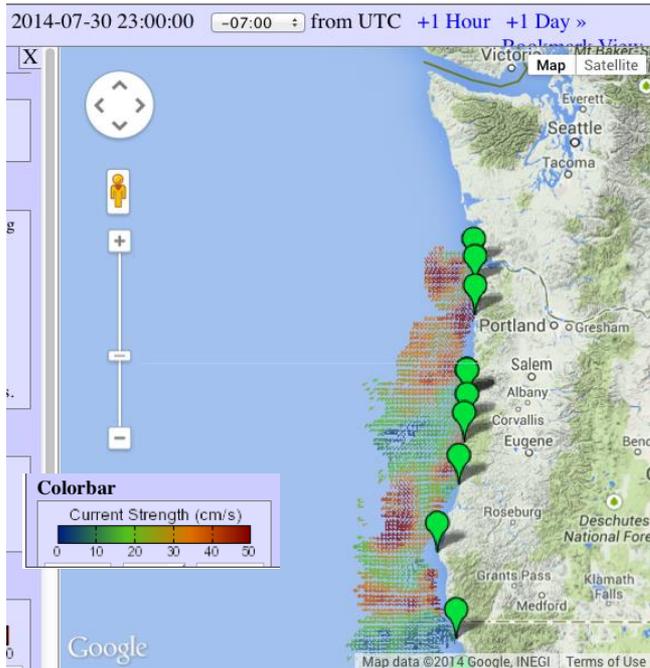
2) Maintain surface current and wave mapping capability.

Maintain existing HF-radar foundational capability providing a portion of critical national capacity, and continue investment in wave mapping at a critical port.



HF Radar

Mike Kosro, Anne Dorkins, Erik Arnesen, OSU



We use radiowave backscatter to measure **hourly maps of ocean surface currents** to 150km offshore along full coast of Oregon.

Data are distributed nationally in near-real-time via national data centers.

Provided to agencies, e.g. **US Coast Guard** for search & rescue, both data and Short Term Prediction System results from Uconn. USCG shows HF improves searches. **NOAA OR&R** for pollution. **NOAA COOPS** for tidal current predictions. **National Weather Service** via GTS this fall, and forecasters through **AWIPS**.

Collaborate with circulation **modelers**, particularly Kurapov's group at OSU. This past year used radial currents to identify hotspots in diurnal tides off Heceta Bank and Cape Blanco, part of a student's PhD dissertation (Osborne et al., JPO, 2014). Worked with Sung Yong Kim on inertial current time-space scales (important in mixing) (Kim & Kosro, JGR, 2013), and on poleward propagation in alongshore currents (Kim et al., JGR, 2013).

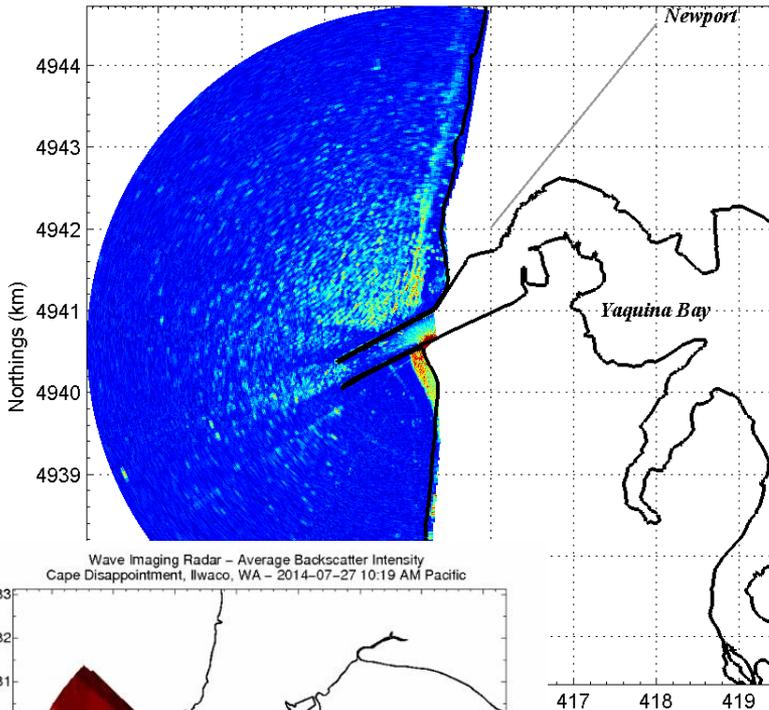
Operating an AIS (Automatic vessel Identification System) site from Cape Blanco, with data sent to **MarineTraffic.com**.

Challenge: *proposed wind turbines off Coos Bay have high potential to interfere* with HF operations in the area. We have been part of the public comment process at meetings in Florence and Charleston.

X-band wave imaging radar

Merrick Haller

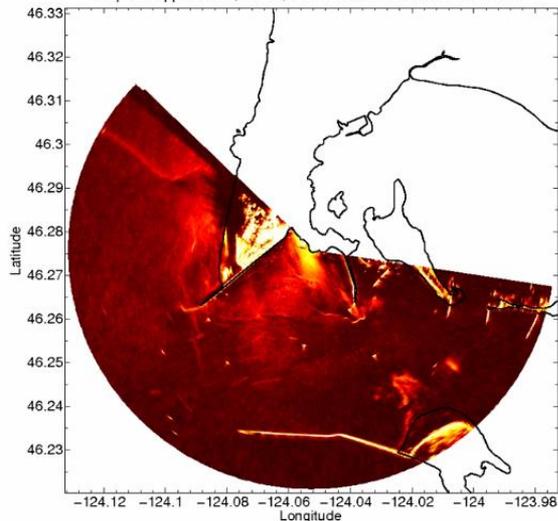
Wave Imaging Radar - Backscatter Intensity Snapshot
South Jetty at Newport, OR - 2014-08-10 3:05 PM Pacific



The wave imaging radar at Newport South Jetty has continued to operate and **provide imagery of the wave conditions and wave spectral information** to the NANOOS Visualization System **on an hourly basis.**

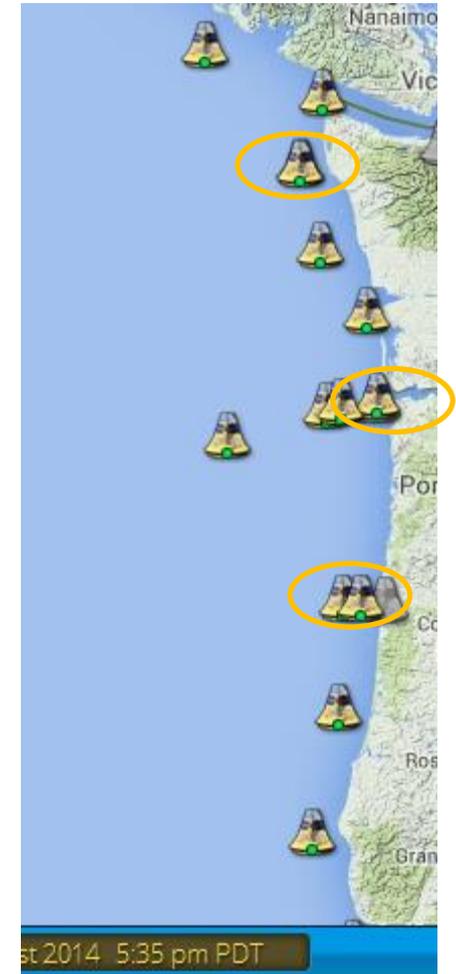
We remain excited about the new radar installation at the **Mouth of the Columbia River.** *We would like to consider adding that station as a regular NANOOS observational station,* there is significant stakeholder interest in the Columbia River site. We have been working with the **Columbia River Bar Pilots** (Dan Jordan) to develop a “front - imaging” data product. These fronts indicate where there are sharp surface current gradients that can affect navigation. We are also sharing our data with a group (Donald Lyons et al.) in the **Oregon Cooperative Fish and Wildlife Research Unit** (OSU) who are tracking cormorant behavior and their foraging around the fronts.

Wave Imaging Radar - Average Backscatter Intensity
Cape Disappointment, Ilwaco, WA - 2014-07-27 10:19 AM Pacific



Sustaining NANOOS, the Pacific Northwest component of the U.S. IOOS®

3) Sustain existing buoys and gliders in the PNW coastal ocean, in coordination with national programs. Maintain these essential assets providing regional observations, with focus on hypoxia, HABs, ocean acidification, climate change detection and modeling input.



Cha'ba Mooring

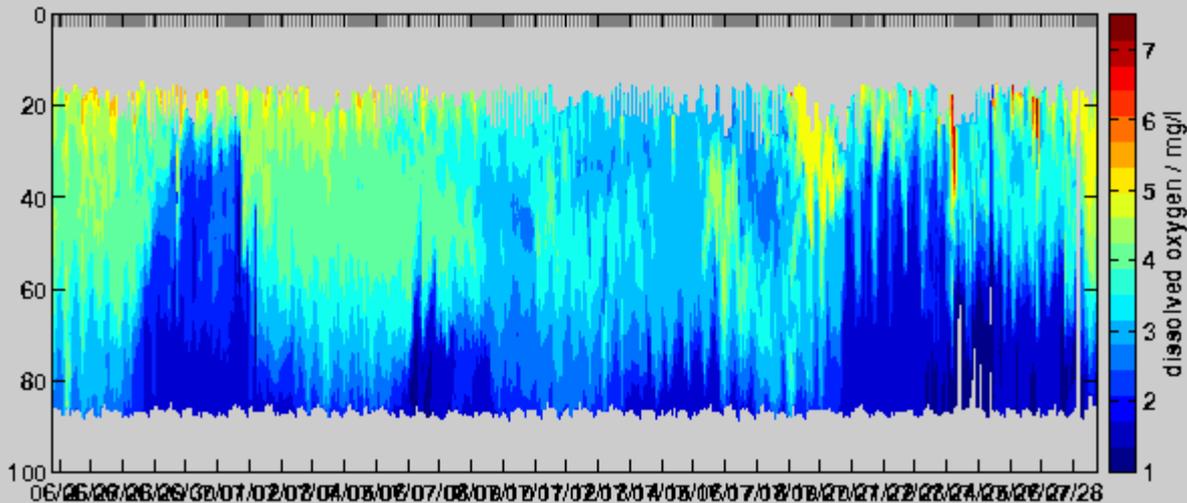
John Mickett, Matthew Alford, Jan Newton, UW



Cha'ba has physics, oxygen, $p\text{CO}_2$, pH, chlorophyll.

NEMO profiles:

Both Cha'ba surface and NEMO subsurface moorings were recovered in early May 2014 from a **vessel of opportunity**, the R/V Norseman II, which was en-route to Seattle from Long Beach. Having been deployed since October 2013, this was the first winter deployment of both moorings. Though this deployment prompted some minor modifications to the mooring design, in general the design showed that it could success **fully withstand the harsh winter conditions on the Washington Shelf**. Data coverage for both moorings was relatively good despite power issues with Cha'ba early in the deployment. Both moorings were serviced throughout May in preparation for a late June deployment from APL's R/V Robertson.



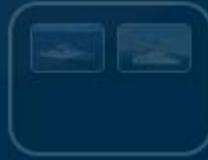
Observations highlighting **several low-dissolved oxygen events and anomalously warm near-surface water in late summer** will be published in the Puget Sound Ecosystem Monitoring Program (PSEMP) "2013 Overview of Puget Sound Marine Waters" publication.



Maritime Operations



High Frequency Radar



Cruises



Gliders



La Push Glider



OSU Glider 'Bob'



OSU Glider 'Hoop'

U.S. IOOS Program's Ocean Glider Network Gains Momentum



The National Underwater Glider Network Map is a collaborative effort and includes current and historical glider missions dating back to 2005 from [Gulf of Mexico Coastal Ocean Observing System \(GCOOS\)](#), [Southern California \(SCCOOS\)](#), [Pacific Northwest \(NANOOS\)](#), [Central and Northern California \(CeNCOOS\)](#) and [Mid-Atlantic \(MARACOOS\)](#).

The gliders displayed have been funded by U.S. IOOS, NOAA, ONR, NSF, EPA, various universities, state agencies and industries.

Gliders

N. WA Shelf: Craig Lee

WA-OR shelf: Antonio Baptista

Central OR shelf: Jack Barth, Kipp Shearman

OR shelf glider

Jack Barth, Kipp Shearman, OSU

- The Oregon State University glider group conducted sampling using underwater gliders off Newport, Oregon. The Newport Hydrographic (NH) Line was sampled during March and April, 2014, using a 1000-m Seaglider on the offshore part of the line. We collected a total of 33 glider-days of measurements along 673 km of track. This included 438 vertical profiles and 2 cross-margin vertical sections.
- The central Oregon glider data are being shared with NANOOS modeler Alexander Kurapov to 1) **investigate the influence of the Columbia River plume on upwelling off central Oregon** (Kurapov et al., 2013) and 2) **to incorporate glider data into the data-assimilative modeling forecast system for the NANOOS region.**
- The transition of glider operations on the Newport Line to being funded by NSF's **Ocean Observatories Initiative (OOI)** is anticipated to occur in summer 2014. Starting in March 2014, PI Barth began **collaboration with Dr. Eric Bjorkstedt (NOAA Southwest Fisheries Science Center, Humboldt State University)** to plan glider observations off **Trinidad Head, CA** (41° 3.5'N). We plan to deploy a 1000-m Seaglider off Trinidad Head, CA, starting in about July 2014 to complement Bjorkstedt's monthly hydrographic and zooplankton sampling, analogous to that being conducted by Bill Peterson's group along the NH line. This represents an excellent opportunity for **collaboration between NANOOS and CeNCOOS** and **fills a gap in glider coverage along the U.S. west coast** as identified in several California Current science plans. This transition is consistent with NANOOS' plan to expand the range once OOI assets were in.



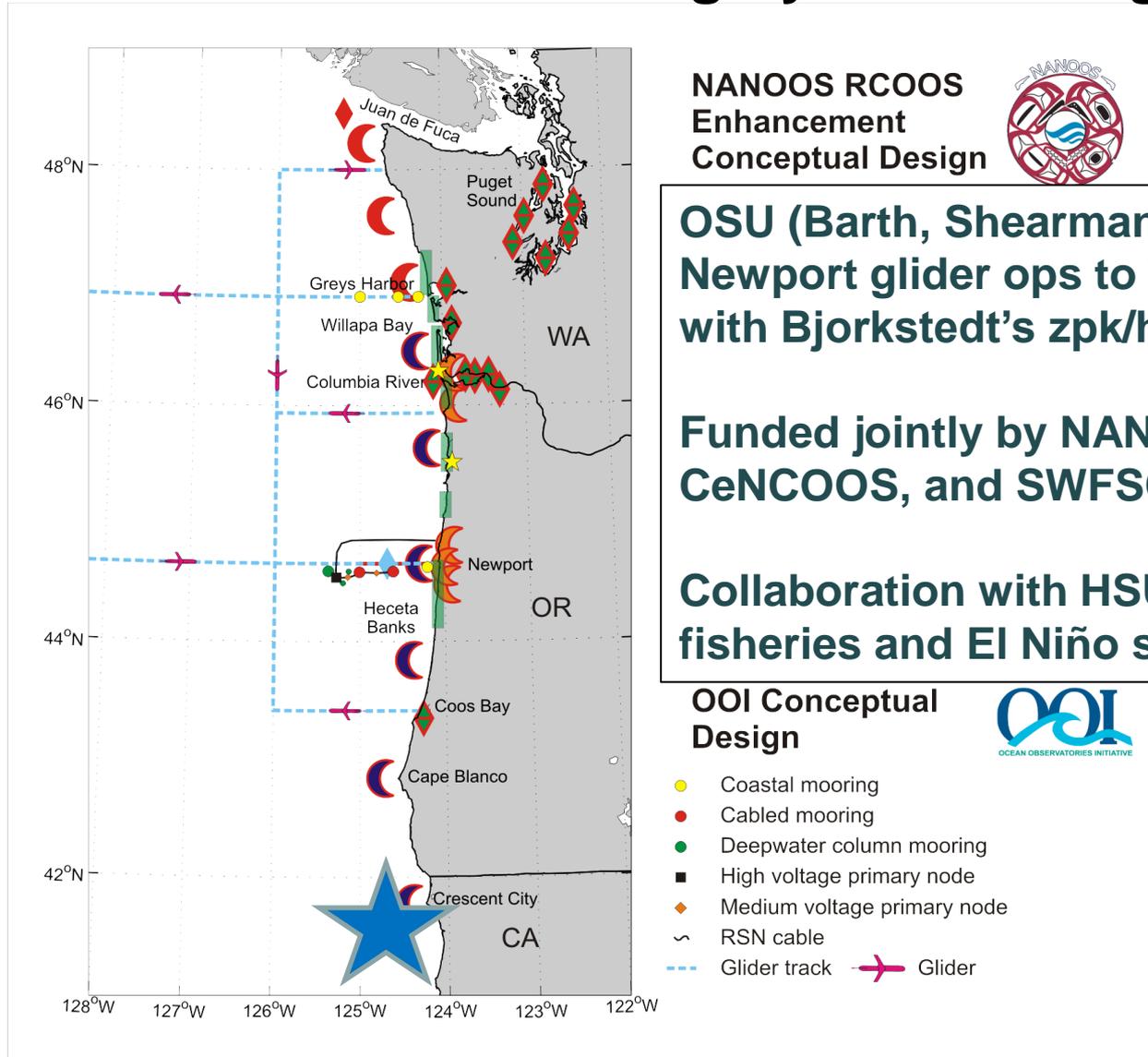
NANOOS

NORTHWEST ASSOCIATION OF NETWORKED OCEAN OBSERVING SYSTEMS

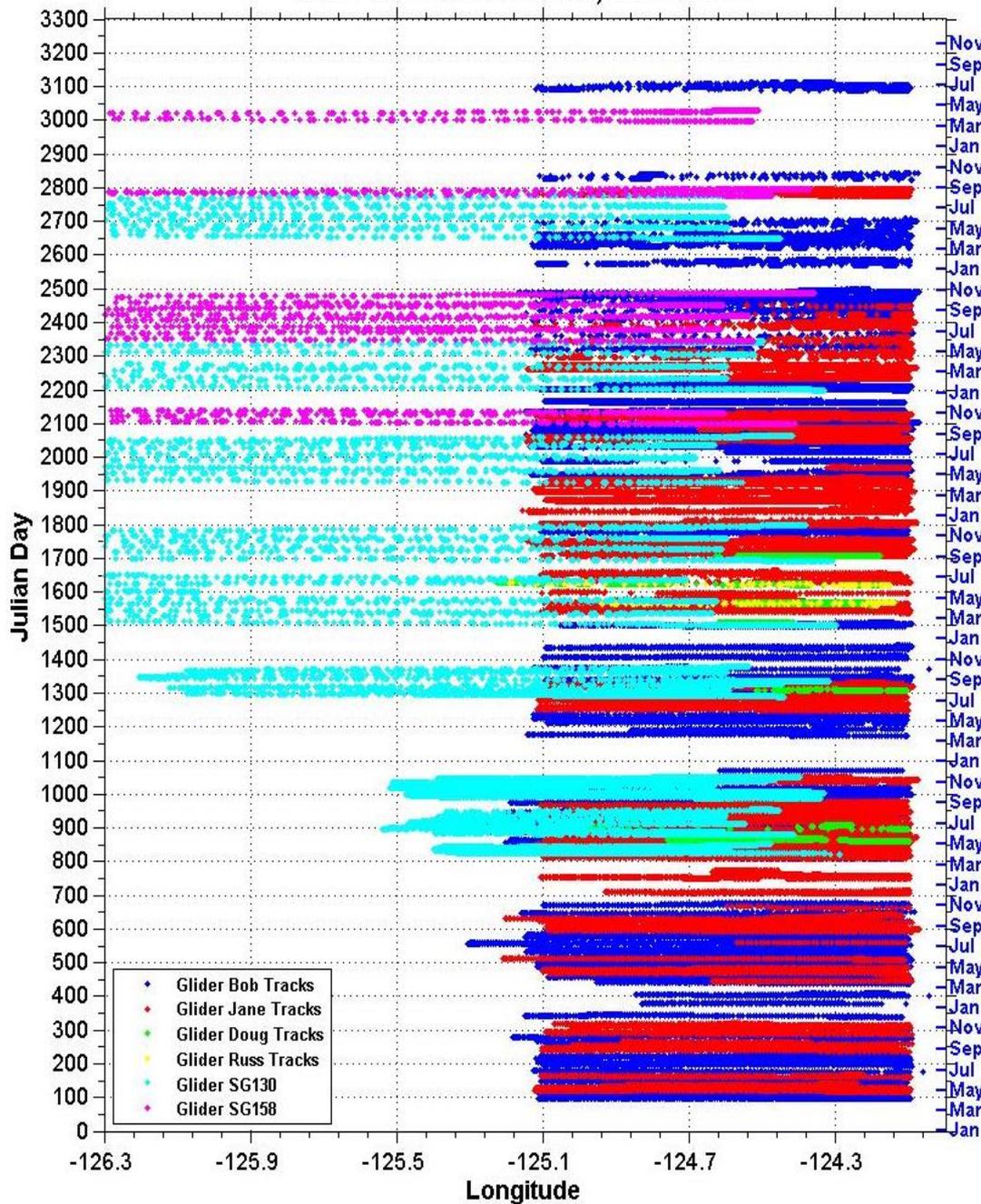


WASHINGTON - OREGON - NORTHERN CALIFORNIA

PNW Ocean Observing Systems Design



OSU Glider Positions, 2006-2014



2014

2013

2012

2011

2010

2009

2008

2007

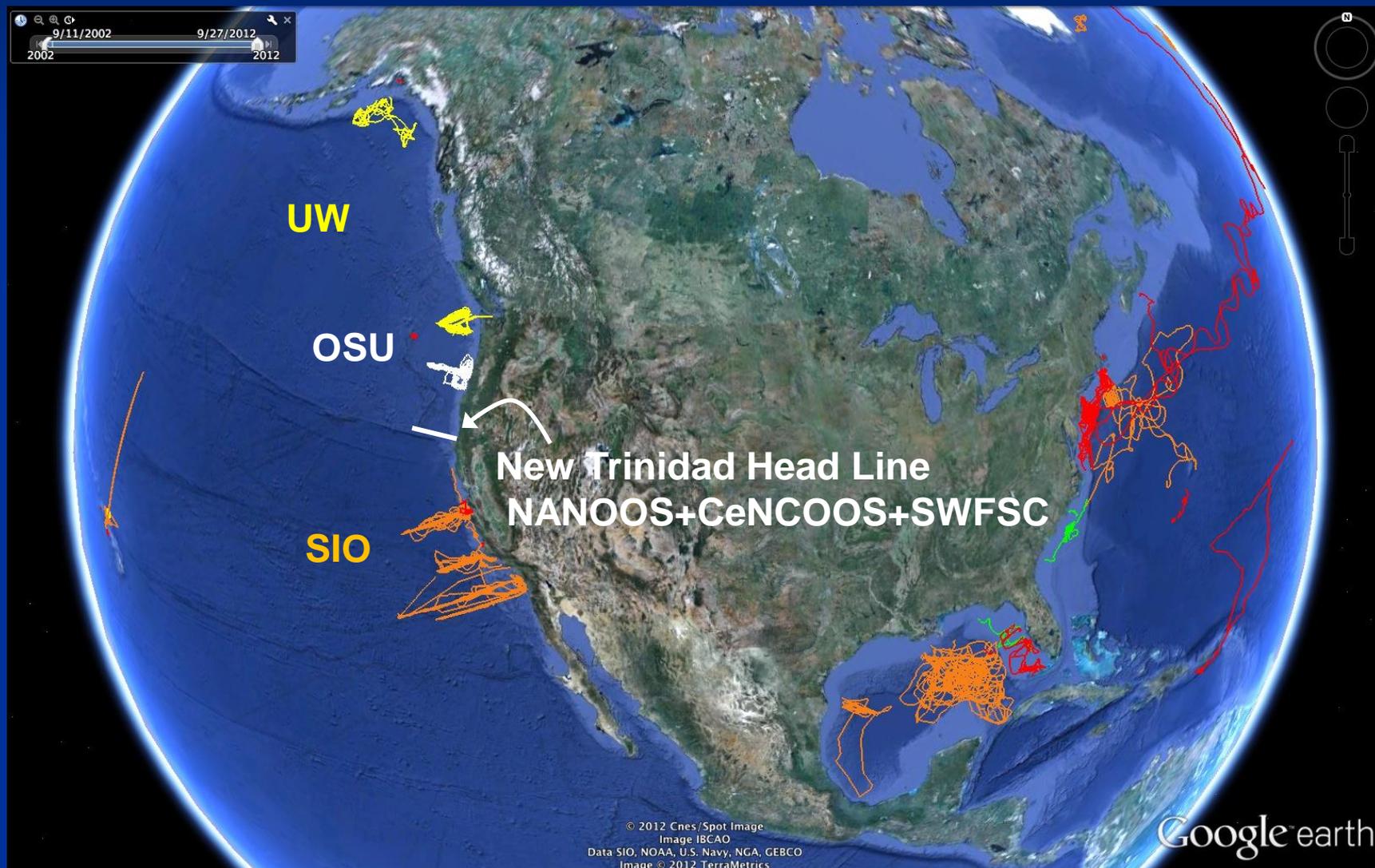
2006

} temporary
resumption of
Newport line
awaiting OOI

Combination of
NSF, GBMF and
NANOOS funding

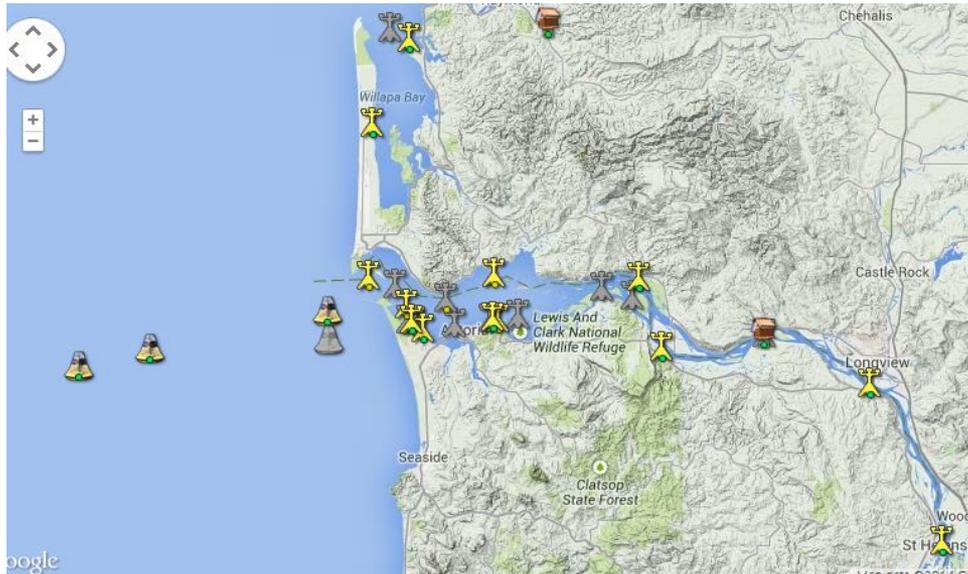
National glider activities

all lines are combinations of NOAA IOOS and other funding; not all are ongoing!



Sustaining NANOOS, the Pacific Northwest component of the U.S. IOOS®

4) **Maintain observation capabilities in PNW estuaries, in coordination with local and regional programs.** Maintain these to aid sustainable resource management, water quality assessment and sub-regional climate change evaluation, with high priority new feeds.



South Slough, Coos Bay estuary

Alicia Helms, ODSL, NERRS

- Through the Oregon Dept. of State Lands, South Slough NERR continues operating a network of moored observing stations and a real-time weather station as part of the NERRS System Wide Monitoring Program with additional support provided by NANOOS. The five water quality monitoring stations located along the estuarine salinity gradient provided continuous data over the period December 2013–May 31, 2014. In addition, we maintain one water quality station in **partnership with one of our local tribes, the Confederated Tribes of the Coos, Lower Umpqua and Siuslaw Indians (CTCLUSI)**. Working in partnership with the CTCLUSI tribes, we secured mounting infrastructure and the protective tube for the Boathouse station by diving at this site near the mouth of Coos Bay.
- The water quality stations provide real-time data access for **shellfish growers in South Slough and Coos Bay**, including **North Bend and Coos Bay Oyster Companies, Clausen Oysters, and Qualman Oyster Farms** to monitor environmental conditions, and environmental data for **eelgrass, fecal coliform monitoring and native oyster restoration projects**. The weather station provides real-time data to assess the short-term **effects of local weather on water quality** within the estuary.
- We have expanded the network of Coos Bay water quality stations to include four stations in Upper Coos Bay through the **NERRS Science Collaborative Partnership for Coastal Watersheds project**. With future funds, South Slough would prioritize adding real - time capability to the North Point station which is near **commercial oyster cultivation areas** in Mid Coos estuary and this station would also provide **real-time water level data for Coos Bay Bar Pilots, who currently rely on staff tide gauges**.

Columbia R. estuary

Antonio Baptista, OHSU, CMOP, SATURN

- SATURN observations are used extensively in support of regional management and decision making associated with **Endangered Species Act (ESA)** biological opinions, **salmon restoration, navigation improvements and hydropower operations**. The observations are integral to CMOP science initiatives addressing **estuarine hypoxia and acidification**, plankton blooms, biogeochemistry of lateral bays, and estuarine turbidity maxima.
- We routinely observe dissolved oxygen (DO) from river to plume, and have since 2010 captured multiple events of **severe estuarine hypoxia**, some of which partially mitigated by local production (*M. rubrum* blooms). The findings have informed regional recommendations to the **State Department regarding the Columbia River Treaty Review**.
- We are maintaining pH and CO₂ sensors at 2-3 stations along the navigation channel, informing our characterization of estuarine **hypoxia and acidification as coupled processes**.
- We maintain photosynthetically active radiation (PAR) sensors at SATURN-02 and at Desdemona Sands, and an ACS (in situ spectrophotometer) sensor at SATURN-03. The goal is to characterize local solar radiation and light attenuation, to provide context for observations of productivity in the lower estuary and to **support an emerging suite of ecological models**.
- We maintain bottom nodes with Acoustic Doppler profilers and T/S , to better characterize salt intrusion as a surrogate for the propagation of acidic/hypoxic ocean waters into the lower estuary, and mechanisms of enhanced estuarine retention that **might play a role mitigating hypoxia/acidification through local production**.
- We have conducted several adaptive sampling experiments of microbial communities. The experiments involved the deployment of an Environmental Sampling Processor.

Washington estuaries

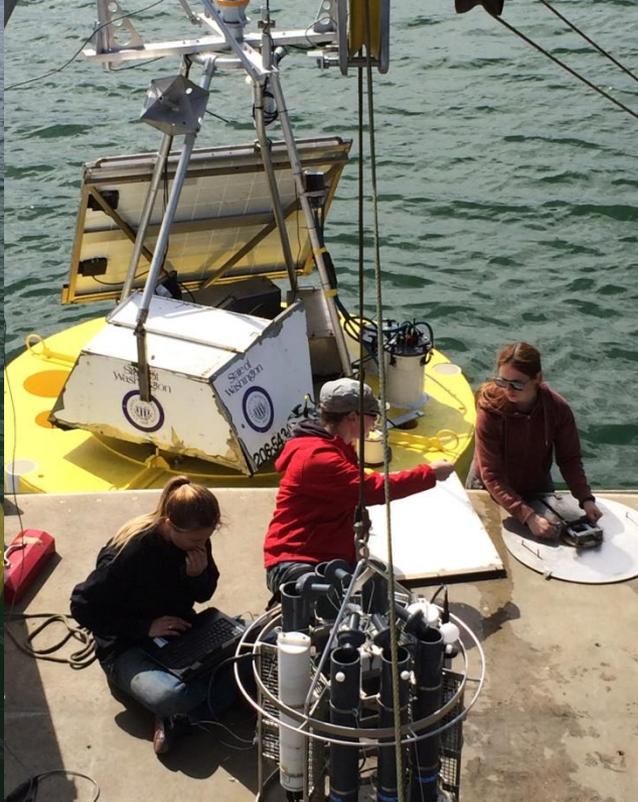
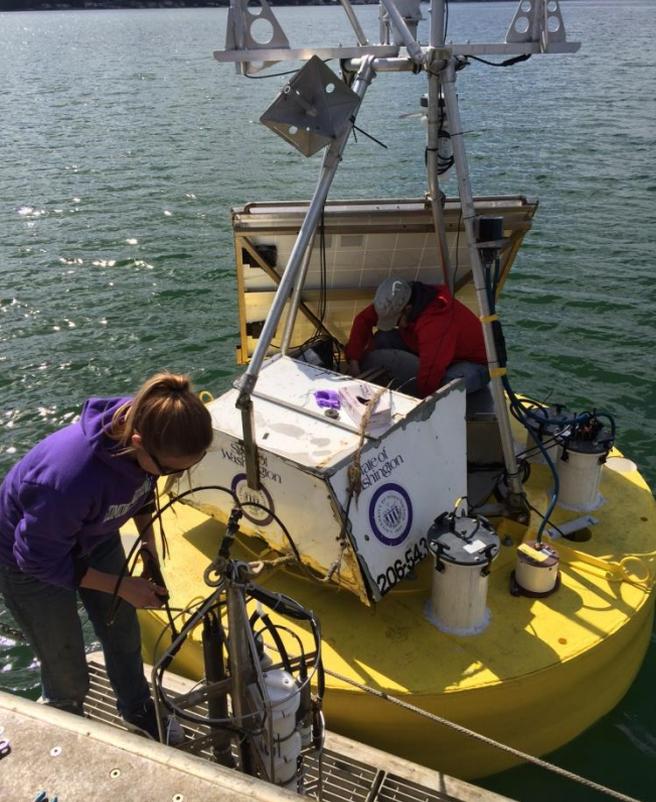
Christopher Krembs, Carol Maloy, Ecology, NEP

- Ecology maintained its sole nearshore mooring station in Mukilteo (daily telemetry of real-time data to Ecology's website and NANOOS NVS) in collaboration with **Everett Community College and Port of Everett**. In Puget Sound, we previously maintained moorings at Admiralty Reach, Mukilteo, Manchester, and Shannon Point with a focus on dissolved oxygen. The Admiralty Reach station remains suspended with plans to resume later in 2014. Budget cuts have required us to continue suspension of several stations with no immediate plans to resume: Manchester, Shannon Point, and Willapa Bay (however the USCG license to use the channel marker for the mooring was renewed for five years).
- The Mukilteo mooring observations from Dec 13 to May 14 began with a downward trend in temperature and salinity. **In early spring, temperature and dissolved oxygen (DO) increased into April, after which DO declined. Skagit and Snohomish river flows in early March coincided with changes in salinity and DO.**
- Ecology has begun a transition to **using ferry vessels as an additional and cost-effective means of data collection**. The advantage of ferry en route monitoring is **large surface spatial coverage, leveraging and calibrating daily satellite products**. Currently, Ecology has two sensors and a GPS on the Victoria Clipper IV ferry vessel that runs twice daily between Seattle and Victoria, BC. Variables include temperature, salinity, fluorescence, CDOM, and turbidity. The previous data collection system had been exposed to heat and fine oily dust since 2010, so frequently failed last year. During attempts to resurrect and upgrade the system, we were minimally successful in recording data from all sensors for only 12 days in this reporting period. We are now leveraging **EPA NEP** funds to resolve ongoing technical problems and restore data acquisition, data flow, and **telemetry with help from APL UW**.

Puget Sound estuary

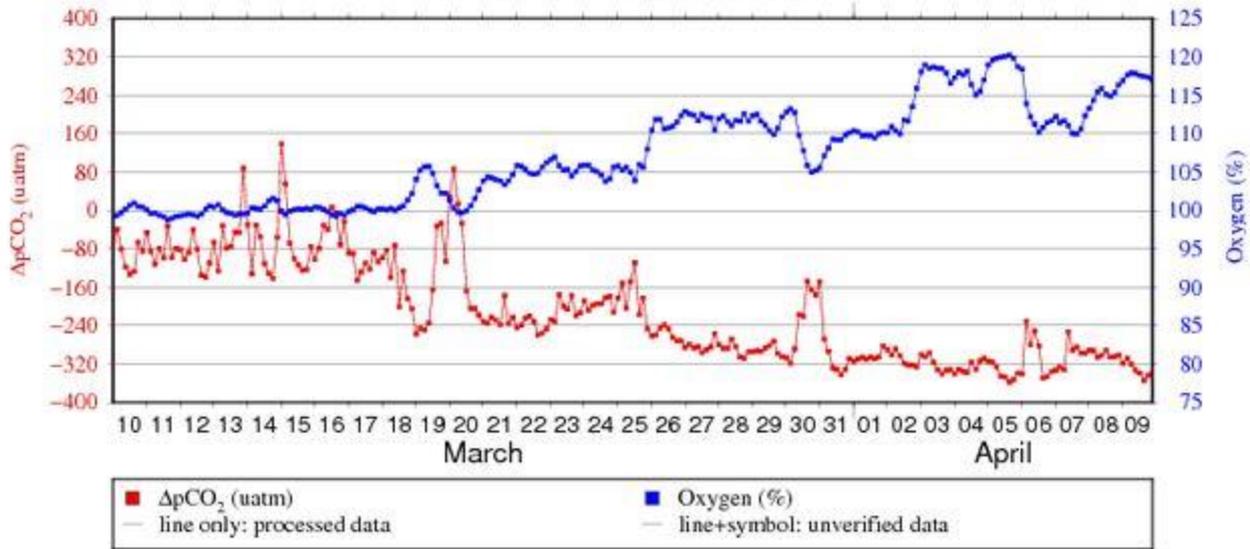
Allan Devol, John Mickett, Wendi Ruef, Jan Newton, UW

- The ORCA (Oceanic Remote Chemical Analyzer) group had buoys in operation in Hood Canal (Twanoh, Hoodsport, and Dabob Bay), near Admiralty Inlet (Hansville), in Puget Sound (Pt Wells), and south Puget Sound (Carr Inlet). There were periods of downtime at all the buoys, mostly due to **failure of aging components**, worn winch parts, corroded cables and connectors, and sensor failure. Both the Pt. Wells and Hansville moorings were down for refurbishment during the report period. Despite the downtime, a total of 1541 profiles were collected from the buoy system during the report period. We continued to make all buoy data available in real-time through NVS. Buoy maintenance is partially leveraged with **National Estuary Program/WA Ecology and NSF funding**.
- We continued to **collaborate with NOAA PMEL** to support the deployment of the pCO₂ systems operated on the Twanoh and Dabob Bay moorings through system maintenance and collection of water samples to aid system calibration. As part of **the IOOS MSI in FY13**, two moorings were **upgraded with new hulls** in order to facilitate mounting the pCO₂ system so as to protect and insulate sensors, **increasing robustness and accuracy**. In Dabob Bay a former grant from the **State of Washington Puget Sound Partnership** was leveraged to monitor surface water acidity and water column conditions as they might **relate to shellfish hatchery failure**.
- Dissolved oxygen concentrations in S. Hood Canal were above normal for the first half of 2014; while temperature and salinity were lower than average. In contrast, dissolved oxygen concentrations, temperature and salinity were average at Carr Inlet in S. Puget Sound. We will again be closely monitoring dissolved oxygen conditions in southern Hood Canal through the growing season and into the fall bloom, a time when the potential for fish kills increases. These observations are important for **State efforts to assess water quality and habitat**.



Location: Twanoh (123W,47.37N) (Last 30 days)

$\Delta p\text{CO}_2$ & Oxygen @ Twanoh (123W,47.37N)
[Date: 2014-03-10 to 2014-04-09]



Hello Spring Bloom !!

Sustaining NANOOS, the Pacific Northwest component of the U.S. IOOS®

5) Maintain core elements of beach and shoreline observing programs. Contribute to hazard mitigation by providing essential observations and decision support tools for coastal managers, planners and engineers, as resources allow.

Apps Disclaimer Settings Log In

NVS
BEACH AND SHORELINE CHANGES

Map Overview Help

Map Regions Beaches Legend

Lat: 45.997 Lon: -118.6963

Horizontal distance (ft) 1800 1600 1400 1200 1000 800 600 400 200 0

Maximum/Minimum Profile
+/- Standard Deviation
Fall 2010
Winter 2011
Spring 2011

Elevation, NAVD83 (m) 5 4 3 2 1 0 -1

MHW

MLLW

Horizontal distance (m) 500 400 300 200 100 0

Horizontal distance (ft) 1800 1600 1400 1200 1000 800 600 400 200 0

Maximum sand level
+/- 1 St.Deviation (N=10yrs)
s97
Dec13
Feb14

Elevation, NAVD83 (m) 10 9 8 7 6 5 4 3 2 1 0 -1

MHW

MLLW

Horizontal distance (m) 600 500 400 300 200 100 0

Victoria Mt. Baker-Snoqualmie National Forest Everett Seattle Tacoma Washington Yakima Kennewick Walla Walla Portland Gresham Salem Albany Corvallis Eugene Bend

Washington shorelines

George Kaminsky, WA Dept Ecology

- NANOOS funds contribute to the Washington State Department of Ecology Coastal Monitoring & Analysis Program (CMAP) led by G. Kaminsky. CMAP conducted fall seasonal beach monitoring surveys in the **Columbia River Littoral Cell (CRLC)**. At the end of March through April 2014, CMAP completed winter CR LC seasonal monitoring surveys. During this survey, 46 seasonal profiles along with 11 additional profiles on the south side of the Columbia River East Jetty for the **U.S. Army Corps of Engineers** to augment the monitoring being done for the newly placed revetment. The **wave bumpers and geotubes that protect condominiums along the primary dune at Ocean Shores are still a concern** as they have continued to become increasingly exposed and several photos were taken to document the change. Photos were also taken of profiles Worm and Spice in Grayland Plains where **erosion is also of particular concern due to nearby development**.
- Also in April, CMAP worked with the USGS to collect 135 beach and nearshore profiles at the **Elwha River mouth**, with some additional nearshore profiles extending the routine survey area east toward Ediz Hook. Data compared to previous surveys show **significant accumulation of sediment in the nearshore totaling 2.8 million m³ of net deposition since the dam removals began** in September 2011, including the development of multiple sand bars that have attached to the shore on the east side of the delta.

Oregon Shorelines

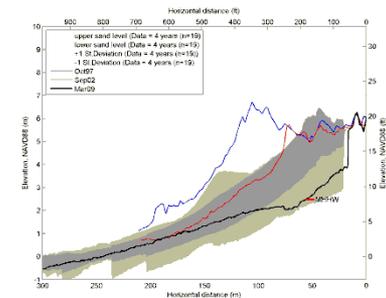
Jonathan Allan, Vicki McConnell, DOGAMI

- As part of DOGAMI's commitment to NANOOS, the Oregon Beach and Shoreline mapping Analysis Program (OBSMAP) network continues to be sustained, with surveys of beach observation sites having been undertaken in December 2013-March 2014, with data available through the NANOOS Visualization System. **Due to the current phase of mild weather and a lack of significant storms in the past three years, many beach study sites exhibit a general trend toward accretion. Erosion issues that had plagued several sites in the past, are for now somewhat stable.** PI Allan updated the Neskowin beach profile database so that it is **fully standardized across all surveys** (e.g. 2006 vs 2014 formats) **and survey platforms** (GPS vs lidar), allowing easier extraction and exporting of the data to end users. During this period, problems with **aging infrastructure** continued to occur. We continue to be plagued with ATV breakdowns (now 10 years old), often occurring in precarious locations out on the beach.
- Data continues to be used by agencies such as the **Oregon Parks and Recreation Department** to help guide permitting for engineering structures, **by local community groups** in Neskowin and Rockaway to help guide their understanding of changes taking place along their beach. Beach morphology and shoreline change data from Tillamook County is being used to **guide the development of new coastal erosion hazard maps**. PI Allan helped run a **Coastal Processes and Hazards Working Group meeting** at the Newport Community College, to bring a **variety of folks together**, such as from state agencies (e.g., **ODOT, OPRD, ODFW, DLCD, and DSL**), **local Government (coastal planners), academia (OSU, Oregon Sea Grant), geotechnical consultants, and NGOs** to discuss issues relating to coastal hazards along the Oregon coast. PI Allan presented to the **Central Oregon Coast Board of Realtors** as part of a **Coastal Hazard Training Session for Realtors** operating on the central Oregon coast.



Beach Monitoring Stations

Cross-sections



Shorelines



Log In | Register

NVS NANOOS VISUALIZATION SYSTEM v2.5

NVS > Products > Beaches > Mapping

Map Beches Regions Legend

Regions Specific

- Alesea Spit
- Bandon
- Bayocean Spit
- Beverly Beach
- Clatsop Plains
- Coos
- Elk River Spit
- Gold Beach
- Nehalem Spit
- Nesika Beach
- Neskowin
- Netarts Bay
- Newport
- Port Orford
- Reedsport
- Rockaway
- Rogue Shores
- South Beach
- Waldport

Chart Overview Help

Lat: 46.7446, Lon: -125.7166 Terrain

674 sites total

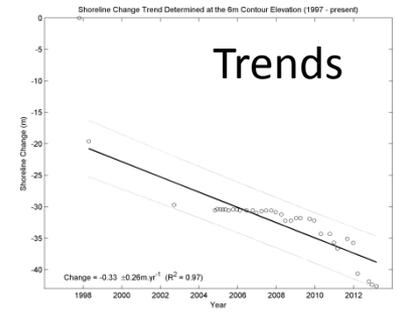
- 178
- 410
- 86

POWERED BY Google

50 mi 100 km

Logos: FEMA, Oregon Department of Geology and Mineral Industries, Oregon Department of Transportation, Oregon Department of Forestry, Oregon Department of Parks and Recreation, Oregon Department of Fish and Wildlife, Oregon Department of Education, Oregon Department of Health Services, Oregon Department of Transportation, Oregon Department of Forestry, Oregon Department of Parks and Recreation, Oregon Department of Fish and Wildlife, Oregon Department of Education, Oregon Department of Health Services

Trends

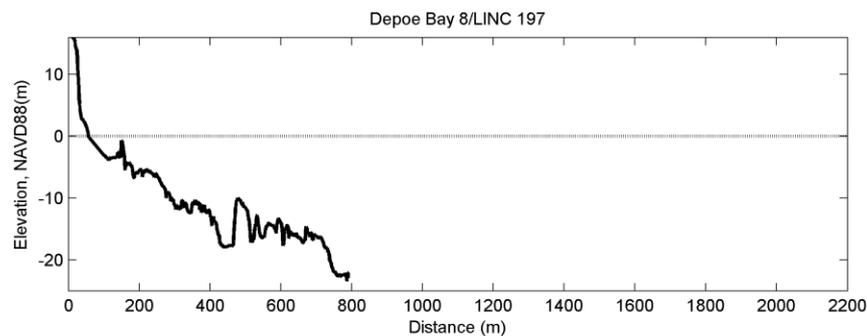
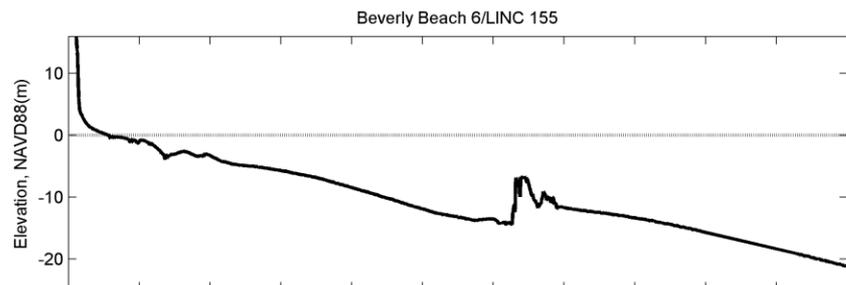
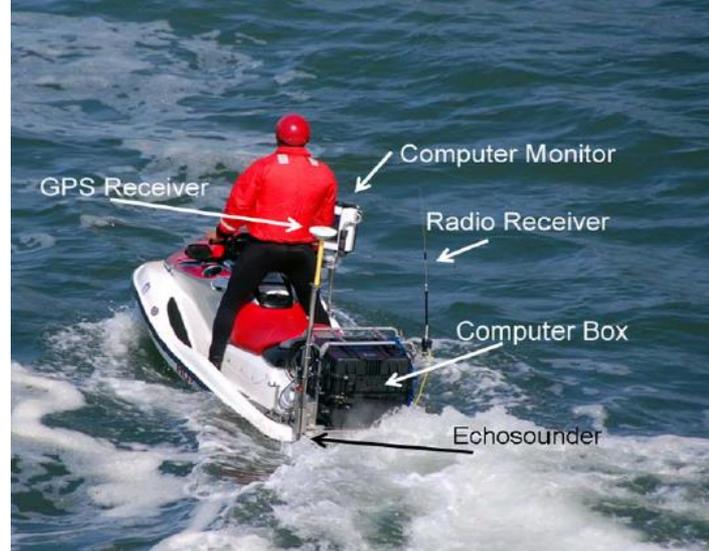
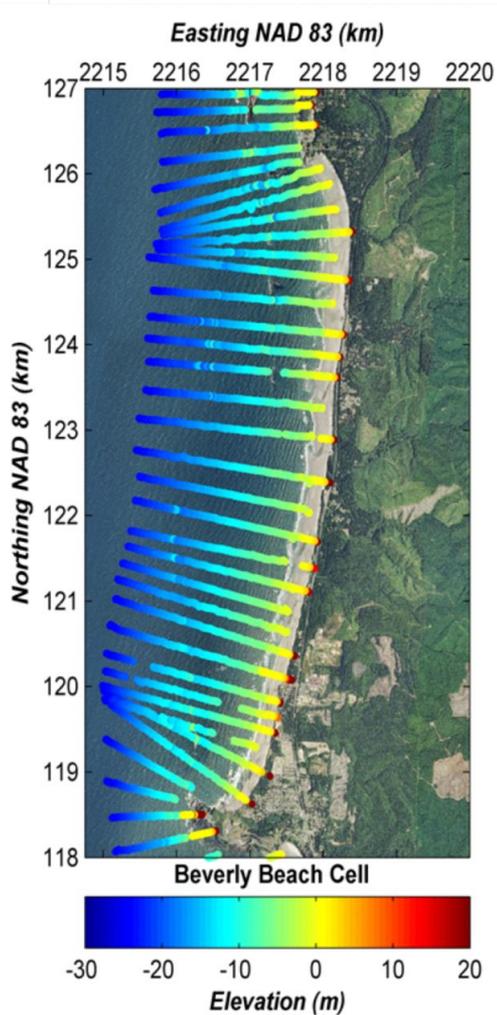
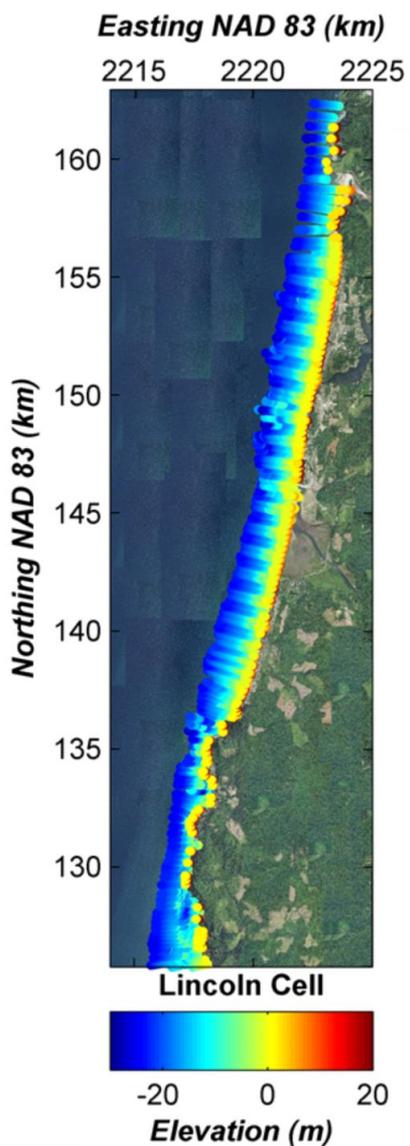


Nearshore Bathymetry

Peter Ruggrio, OSU

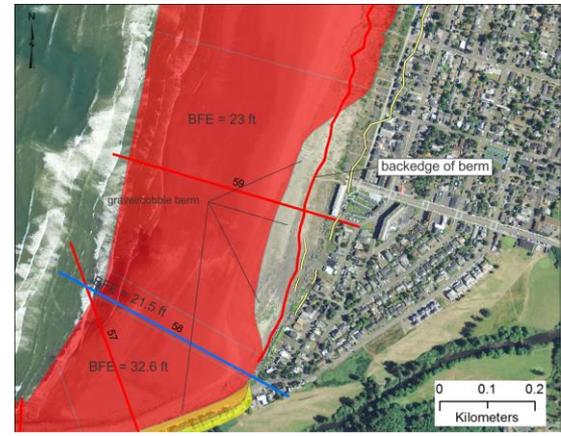
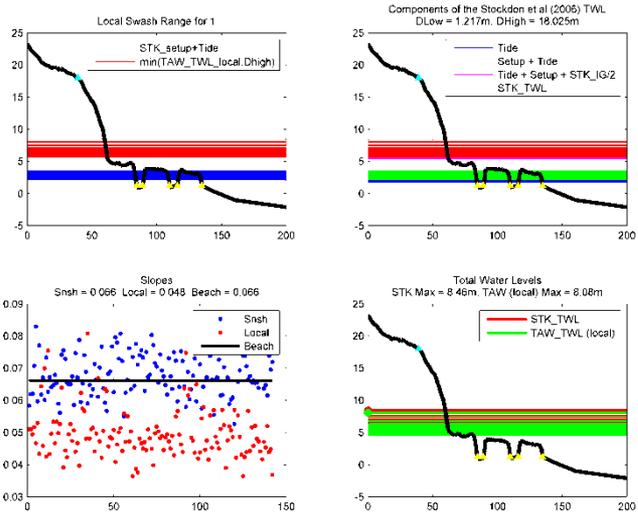
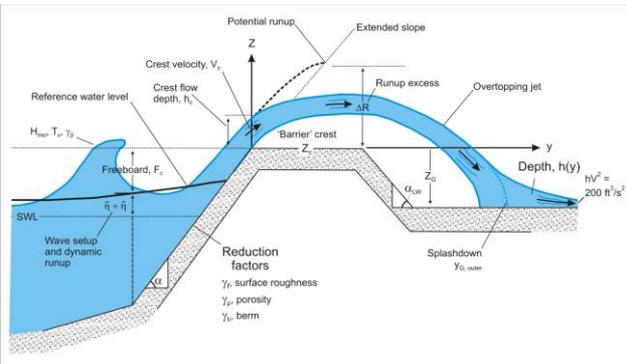
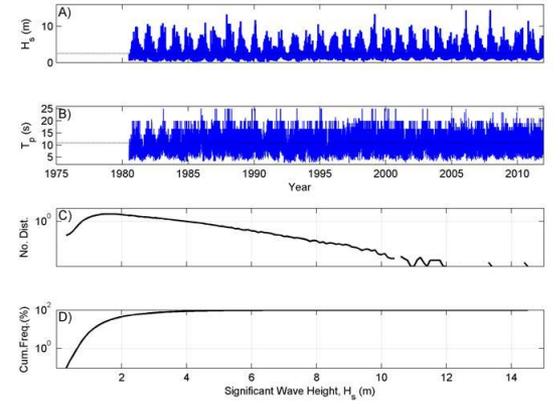
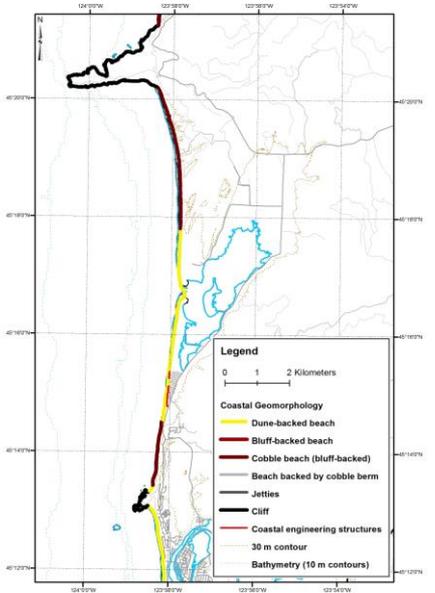
- P. Ruggiero's group at Oregon State University completed processing nearshore bathymetry data along four sub-cells of the **Columbia River littoral cell (CRLC)**. These nearshore bathymetry measurements have been combined with topographic measurement collected by **Ecology** developing complete maps of the nearshore planform. These nearshore bathymetric data continue to provide a **critical source of information for improving coastal hazard mitigation along the coastlines of the CRLC**. Ruggiero's group also completed the processing of nearshore bathymetric data within the Rockaway littoral cell in Oregon and processing of nearshore bathymetric data in Curry County in southern Oregon. These data have been combined with topographic data collected synoptically by **DOGAMI**. The combined beach/nearshore observation dataset now available for Curry County is being used to **assess 1% (100 - year) coastal flood and erosion risk along the county shorelines for the purposes of developing updated FEMA flood insurance rate maps**. These nearshore bathymetric data continue to provide a critical source of information for **improving coastal hazard mitigation** along the coastlines of the Pacific Northwest.
- During this reporting period, NANOOS funded nearshore bathymetric data has supported the **US Army Corps' Regional Sediment Management** at the Mouth of the Columbia River, **FEMA flood mapping activities in Tillamook, Lincoln, and Curry Counties**, Oregon, as well as basic research on coastal hazards, morphodynamics, and the impacts of climate change. In particular, NANOOS funded nearshore bathymetric data is being incorporated in a **coastal hazards decision support tool supported by NOAA's Climate Program Office Coastal and Ocean Climate Applications (COCA) program**.

Bathy Monitoring Stations





FEMA Coastal Flood Mapping – NANOOS Data





NANOOS

NORTHWEST ASSOCIATION OF NETWORKED OCEAN OBSERVING SYSTEMS

WASHINGTON - OREGON - NORTHERN CALIFORNIA

NANOOS observing partners

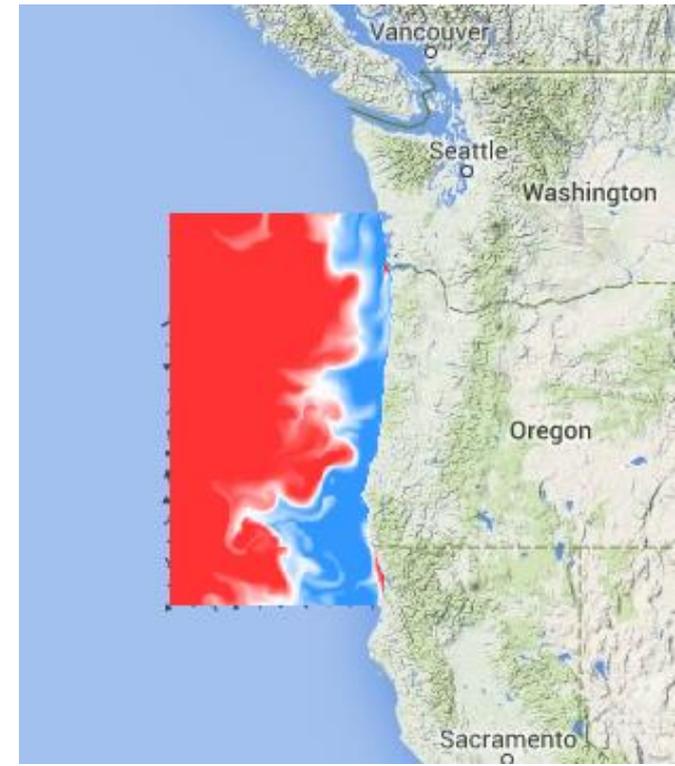
- Vancouver Island University
- VENUS
- Environment Canada
- NDBC
- NOS
- OCNMS
- Padilla NERRS
- USGS
- CDIP
- Stillaguamish Tribe
- King County Dept. Natural Resources and Parks
- Hatfield Marine Science Center
- Friday Harbor Labs
- Seattle Aquarium
- Penn Cove Shellfish
- Pacific Shellfish Institute
- Whiskey Creek Shellfish
- Taylor Shellfish

Sustaining NANOOS, the Pacific Northwest component of the U.S. IOOS[®]

6) **Contribute to a community of complementary numerical regional models.** Contribute to the operation of regional models, and the tools and products they support, covering the head of tide of estuaries to the outer edges of the EEZ in both OR and WA.

- Kurapov, OSU, OR shelf
- Baptista, OHSU, Columbia River estuary
- MacCready, UW, WA shelf and Salish Sea

- Kurapov et al., WC COMT
- Siedlecki, UW, J-SCOPE forecasting



OR shelf modeling

Alexandre Kurapov, Lana Erafееva, OSU

- Computer circulation modeling of PNW coastal ocean shelf conditions utilizes the Regional Ocean Modeling System (ROMS) as the forecast model. Along-track altimetry observations from Jason-2, CryoSat, and AltiKa, hourly GOES SST, and surface currents from land-based high-frequency (HF) radars have been assimilated to improve initial conditions for the forecasts. The system produces daily updates of 3-day forecasts of ocean conditions, including currents, temperature and salinity through the water column.
- Results are provided **to fishermen and public** via the NANOOS Visualization System. Via the OpenDAP server, forecast currents are also provided to the **NOAA Office of Response and Restoration Lab in Seattle**, where they can be used with the **tools for oil spill mitigation**. Routines for pre- and post-assimilation **quality control** have been established, along with new online tools.
- We also developed and tested (without assimilation) a 2-km resolution model in an extended domain that includes **both the WA and OR coasts**. Forcing of this model includes tides and the **Columbia River fresh water discharge**. Comparisons with and without the Columbia River reveal that the river plume, turning toward the Oregon coast in summer, influences the sea surface temperature. Plume waters, where atmospheric heat flux is attenuated in a shallower surface layer, are generally warmer. In response to upwelling-favorable southward winds, waters inshore of the river plume may be relatively colder than without the Columbia River. **Including the river discharge in the forecast model is planned, to potentially improve accuracy of forecasts.**

Columbia River modeling

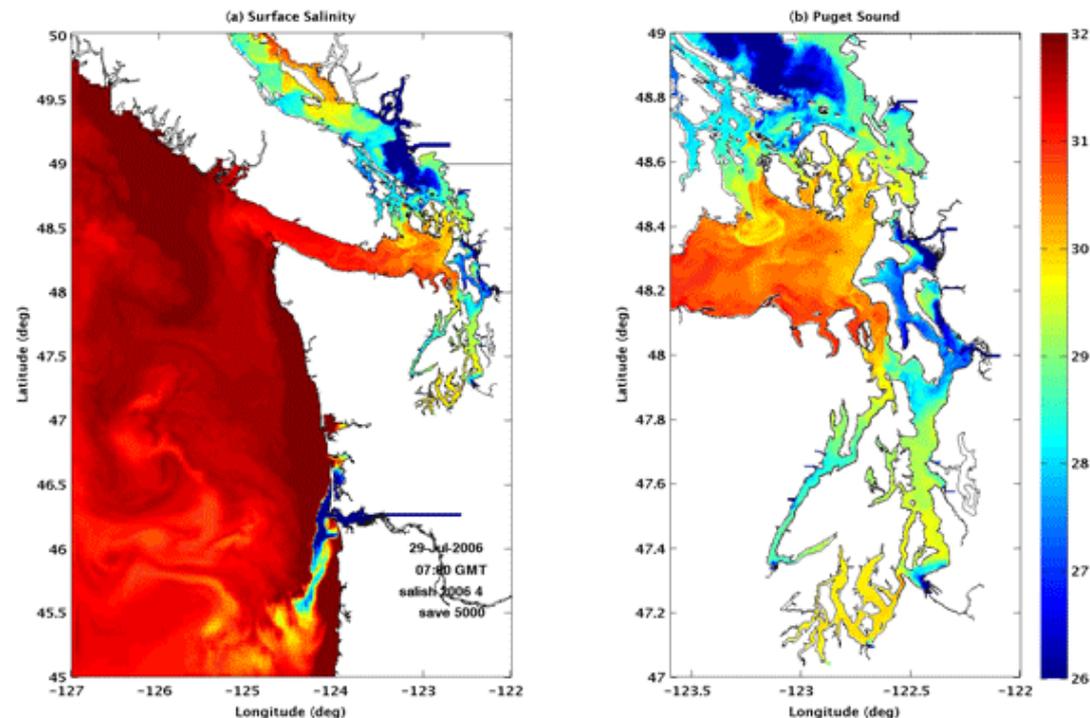
Antonio Baptista, OHSU, CMOP

- With a mix of NSF funding, regional stakeholder funding, and modest NANOOS funding, CMOP maintains an extensive modeling system for the Columbia River coastal margin, denoted Virtual Columbia River (VCR). We use VCR circulation modeling to assist the region in the study of salmon life cycle, habitat and status under the Endangered Species Act and in relation to hydropower management and climate change. Of particular note were studies supporting the region on (a) the **Columbia River Treaty Review, a collaboration with the USGS, Army Corps of Engineers, Bonneville Power Administration, Columbia River Inter-Tribal Fish Commission** and others; and (b) the post-construction assessment of the **ecological impact of the Columbia River Channel Improvement Project, a collaboration with the Army Corps of Engineers, NOAA, and a large number of state and federal agencies.**
- Daily forecasts of the VCR form the foundation of the **NOAA PORTS** forecasting system for the Columbia River. We continue to collaborate with NOAA in **improving the skill of the forecasts.**
- We continue to assess and improve the skill of the circulation simulations. Peer-reviewed papers are in preparation to document the process, with the first submitted in June 2014.
- We are continuing to **expand** the disciplinary scope of the VCR, to be able to address CMOP science questions and **emerging ecological issues** in the estuary. Progress has been made developing models of estuarine hypoxia, sediment dynamics and nitrogen and carbon cycles. Peer-reviewed papers are in preparation to document the process.
- Several presentations at regional and national forums were made on the VCR and its societal applications, including at **Native American forums on issues of interest to tribes.**

Puget Sound & WA shelf modeling

Parker MacCready, Neil Banas, David Jones, David Darr, UW

- This effort is creating a **pre-operational forecast** model of ocean circulation in Puget Sound and adjacent WA shelf waters. In the past six months MacCready and Banas used NANOOS support to develop parts of the forecast model system and a system for **validation against observations**.
- NANOOS funds also supported a system administrator, who oversees computer operations and assists with the gathering and archiving of **model atmospheric fields** from Dr. Cliff Mass, UW.
- The forecast work is also being supported by a grant of state funds made through the **Washington Ocean Acidification Center**, greatly accelerating the work and leveraging impact of the NANOOS funds.



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7) **Maintain NANOOS' Data Management and Communications (DMAC) system for routine operational distribution of data and information.** Sustain the DMAC system NANOOS has built, including the NANOOS Visualization System (NVS), for dynamic and distributed data access and visualization for IOOS.



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v3.7 Contact

NVS

Data Explorer

Tsunami Evacuation Zones

Boaters

Tuna Fishers

Shellfish Growers

Beach and Shoreline Changes

Maritime Operations

High Frequency Radar

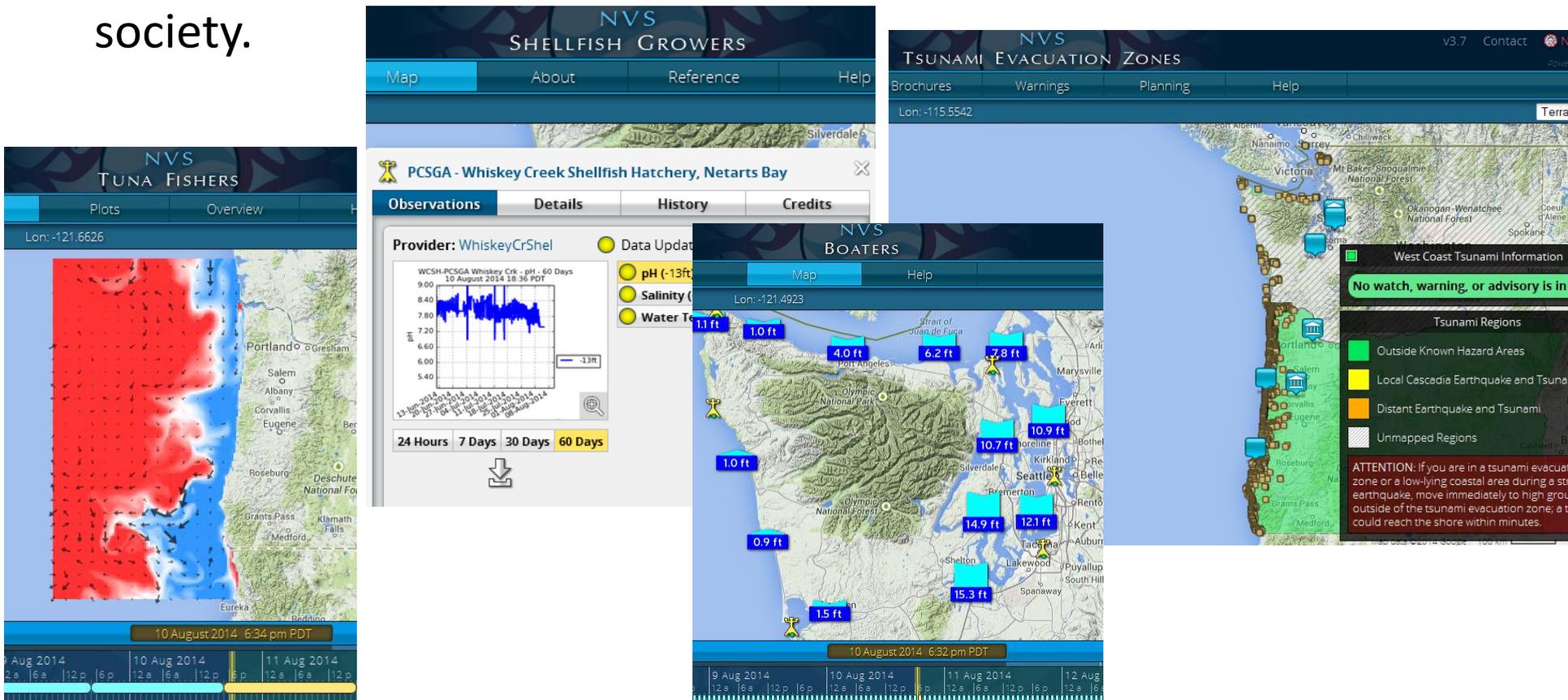
Cruises

Gliders

Help

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8) Deliver existing user-defined products and services for PNW stakeholders. Continue to provide meaningful and informative data products that will connect with user applications and serve society.



The NANOOS Maritime Operations web application showing dominant wave period as forecast by the OSU Wavewatch III model from 5am July 24 to 5pm July 27 and 30-day observations for the same variable as observed by the NDBC 46029 (Columbia River Bar) buoy.

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NVS
MARITIME OPERATIONS

Station 46029 (LLNR 688) - Col River Bar - 20NM W of Columbia River Mouth ✕

Observations | **Forecasts** | **Comparator** | **Details** | **History**

Provider: NDBC ● Data Updated: 25 Jul 2014 5:50 PDT

NDBC Col River Bar - Dom. Wave Period - 30 Days
25 July 2014 07:28 PDT

— 0ft

- **Air Temp. (13ft):** 59.7 °F
- **Avg Wave Period. (0ft):** 6.1 sec
- **Baro. Pressure (0ft):** 30.2 inHg
- **Dom. Wave Period (0ft):** 8 sec
- **Salinity (-2ft):** --
- **Water Temp. (-2ft):** 59.7 °F
- **Wave Height (0ft):** 3.6 ft
- **Wave Mean Dir. (0ft):** 307 deg (from)
- **Wind Direction (16ft):** 50 deg (from)
- **Wind Gust (16ft):** 7.8 knots
- **Wind Speed (16ft):** 5.8 knots

24 Hours | 7 Days | 30 Days | 60 Days

↓

[Link](#)

Google

25 July 2014 7:37 am PDT

OSU WWII ✕

22 Jul 2014 | 23 Jul 2014 | 24 Jul 2014 | 25 Jul 2014 | 26 Jul 2014 | 27 Jul 2014 | 28 Jul 2014

12a | 6a | 12p | 6p | 12a | 6a | 12p | 6p

Sustaining NANOOS, the Pacific Northwest component of the U.S. IOOS®

9) **Sustain NANOOS education and outreach efforts.** Foster ocean literacy and facilitate use of NANOOS products for IOOS objectives, the core task for which the entire NANOOS RCOOS is constructed, via existing approaches for engaging users.

