

2016 U.S. IOOS Advisory Committee

NANOOS: Delivering Observations and Information in the Pacific Northwest

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Northwest Association of Networked Ocean Observing Systems

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













## CONSISTENT NATIONAL CAPABILITY









# Delivering Observations in the Northwest Region

- For what purpose ?
- By whom ?
- How best ?



## **NANOOS Stakeholder Priorities**

- The NANOOS Governing Council selected five areas from results of numerous regional workshops as the highest regional priorities because "these issues represent those having the greatest impact on PNW citizenry and ecosystems and, we believe, are amenable to being substantively improved with the development of a PNW Regional Coastal Ocean Observing System:"
  - Maritime Operations
  - Ecosystem Assessment
  - Fisheries and Biodiversity
  - Coastal Hazards
  - Climate



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### Northwest Association of Networked Ocean Observing Systems

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Surfrider Foundation

The Boeing Company

**Oregon Sea Grant** 

12. Quileute Indian Tribe

16. WA Dept of Ecology

**18. Port of Newport** 

10. WET Labs, Inc.

**Oregon State University** 

**Puget Sound Partnership** 

**University of Washington** 

11. Oregon Health and Sciences University

13. OR Dept of Geology and Mineral Industries

Washington Sea Grant

14. Humboldt State University

20. Sound Ocean Systems, Inc.

24. Sea-Bird Electronics, Inc.

27. OR Dept of Fish and Wildlife

29. Quinault Indian Nation

15. Marine Exchange of Puget Sound

17. Pacific Northwest National Laboratory

**19. Puget Sound Harbor Safety Committee** 

21. Council of American Master Mariners

23. Northwest Indian Fisheries Commission

22. Pacific Northwest Salmon Center (& HCSEG)

25. Western Association of Marine Laboratories

26. Science Applications International Corporation

28. King County Dept Natural Resources & Parks

**30. Western Resources and Applications** 

**OR Dept of Land Conservation & Development** 

#### 31. **OR Dept of State Lands**

- Columbia River Crab Fisherman's Association
- 33. **Port of Neah Bay**
- 34. Northwest Research Associates
- 35. **Pacific Ocean Shelf Tracking Project**

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- 36. WA Dept of Fish and Wildlife
- 37. **Northwest Aquatic and Marine Educators**
- 38. **Seattle Aquarium**
- 39. **NOAA Northwest Fisheries Science Center**
- Port Gamble S' Klallam Tribe 40.
- 41. **The Nature Conservancy**
- 42. **Portland State University**
- 43. **NOAA Olympic Coast National Marine Sanctuary**
- 44. University of Victoria
- 45. University of Oregon
- 46. Port Townsend Marine Science Center
- 47. Intellicheck-Mobilisa
- 48. **NortekUSA**

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- 49. **Grays Harbor Historical Seaport Authority**
- Pacific Coast Shellfish Growers Association 50.
- 51. **US Army Corps Engineers**
- 52. **Olympic National Park**
- 53. **Oak Harbor Middle School**
- 54. Vancouver Island University
- 55. Ocean Networks Canada
  - Lower Columbia Estuary Partnership
- 57. Western Washington University
- 58. Raincoast GeoResarch
- 59. WA Dept of Health
- Say Yes to Life Swims 60.

- 61. NOAA PMEL
- 62. Hakai Institute
- 63. Salish Sea Expeditions

**KEY:** 

Tribal Government Industry Academia/Research

Federal/State/Local Government

# NANOOS: users; useful





Kurapov, OSU; ROMS model NANOOS supported



#### **Coastal ocean:**



Northern extent of California Current Winds, topography, freshwater input, ENSO & other climate cycles

### Major inland basins:

Puget Sound-Georgia Basin, Columbia River Urban centers, nearshore development, climate variation

### Coastal estuaries:

Willapa Bay, Grays Harbor, Yaquina Bay, Coos Bay, +20 Resource extraction, development, climate

### Shorelines:

Rocky to sandy, dynamic: storms, erosion Winds, development, climate

### Major rivers:

Columbia River (~75% FW input to Pacific from US WC) many rivers (e.g., Fraser, Skagit) via Strait Juan de Fuca Dredging, water regulation, climate change

### NANOOS Region User Groups:

Maritime: shipping, oil transport/spill remediation Fisheries: salmon, shellfish, crab, groundfish, aquaculture Environmental management: HABs, hypoxia Shoreline: erosion, inundation Hazards: Search and rescue, national security Educators: formal, informal, research Marine recreation: boating, surfing, diving



## Strategy to develop a PNW Observing System

- I. Integrate what we have (observing assets, people, technologies)
  - = federal, tribal, state, local, academic, NGO, and industry
- 2. Be strategic regarding what we need, based on priorities



# 2009 Science Issues

- WA coast is under sampled, physical dynamics are poorly resolved
- WA coast has seasonal hypoxia, strong inter-annual variation, but dynamics are different than off OR
- WA coast has a harmful algal bloom (HAB) "hot-spot" at Juan de Fuca eddy
- WA coast is exhibiting effects from OA now
- Current model accuracy is limited by data input



"A multi-platform high-resolution coastal ocean observing sensor array for researching Washington coastal waters and ecosystem response to climate change." Funded by Murdock Charitable Trust & UW now sustained as part of NANOOS



# 2015 Science Reality

- WA coast is sampled in near real-time; physical dynamics revealed and published
- WA coast has seasonal hypoxia; dynamics can be observed by tribes and agencies in real-time
- WA coast has a HAB "hot-spot"; now status will be monitored for toxicity in real-time
- WA coast is exhibiting effects from OA now, observed by a NOAA OAP buoy (Cha'ba) year-round
- Current model accuracy is increased and skill can be verified by the on-line "comparator"



## Strategy to sustain a PNW Observing System

- I. Support and harden what we have (observing assets, people, technologies)
  - = federal, tribal, state, local, academic, NGO, and industry
- 2. Be strategic regarding what we need, based on priorities

## **NANOOS Objectives for FY2016**

1) Maintain NANOOS as the U.S. IOOS PNW 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) Provide sustained support to a **community of complementary regional numerical models**.

7) Maintain NANOOS' Data Management and Communications (DMAC) system for **routine operational distribution of data and information**.

8) Continue to **deliver existing and, to the extent possible, create innovative and transformative user-defined products and services** for PNW stakeholders.

9) Sustain NANOOS outreach, engagement and education.

### NANOOS "Effort versus Application" Map for Observing and Modeling

APPLICATIONS:	Coastal Ocean					Estuaries			Shorelines						
EFFORTS:	mar ops	ecology	hazards	biodivesity	climate	mar ops	ecology	hazards	biodivesity	climate	mar ops	ecology	hazards	biodivesity	climate
Multivariable assets:				_											
WA shelf glider line															
Columbia shelf, glider tracks															
CA shelf glider line															
WA shelf buoy															
Columbia shelf buoy															
OR shelf buoy															
WA nearshore OAH															
PNW nearshore hypoxia	по со	oastal nearsh	nore												
OR nearshore OAH															
Puget Sound estuary buoys															
Puget Sound estuary ferrybox															
Columbia estuary buoys															
South Slough estuary moorings															
Salish Sea estuary buoy						no ce	entral Salish .	Sea							
Biological sampling:															
OR shelf plankton timeseries		no plankton		no plankton											
OR estuarine timeseries							no plankton		no plankton	1					
Shorelines:															
Washington shorelines															
Oregon shorelines															
PNW bathymetry															
Surface currents:											-				
Oregon coastlines HF															
Washington coastlines HF	no WA		no WA		no WA						no WA		no WA		no WA
Critical coastal ports X-band															
Forecast models:															
PNW circulation forecasts															
Puget Sound circulation forecasts															
Columbia circulation forecasts															
PNW biogeochem forecasts															
Puget Sound biogeochem forecasts															
Columbia estuary habitat forecasts															
Coastal wave forecasts	no forecast		no forecast		no forecast	no forecast		no forecast		no forecast					
Flood/erosion forecasts	no forecast		no forecast		no forecast					-	no forecast		no forecast		no forecast
KEY:															
Italicized efforts indicate new invest	ment		Currently d	/ directly supports			Proposed to directly support			Not applicabl	e				
	Currently i		ndirectly supp	orts		Proposed to in		support no		Text explains the current gap the proposed activites fill		es fill			

## **NANOOS new efforts proposed**

- Need WA HFR
- Need forecasting of:
  - Waves
  - Flood & erosion
- Need coastal nearshore OA and Hypoxia observations
  - PNW hypoxia via crab pots
  - Central Oregon OAH
  - Washington Olympic Coast NMS OAH
- Need **biological observations** on plankton
  - Estuarine phytoplankton monitoring
  - Shelf plankton monitoring
- Need to strengthen more human connections
  - Indigenous Water Network
  - West Coast Governors' Alliance collaboration



University of Washington: Admin, Obs, Modeling, Data, Edu/Out Oregon State University: Obs, Modeling, Data, Products Oregon Health and Sciences University: Obs, Modeling, Data, Products OR Dept of Geology and Mineral Industries: Obs, Products WA Dept of Ecology: Obs OR Dept of State Lands: Obs



### **NANOOS Standing Committees and Integration**



The three committees meet for Tri-Committee (Tri-com) meetings to jointly establish priorities and activities; in addition, some members span more than one committee

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## NANOOS Website

#### IOOS INTEGRATED OCEAN OBSERVING SYSTEM



Home About NANOOS Join NANOOS Contact Us Disclaimer Site Map

> NVS Products Mobile Apps

> > Education



**Welcome to NANOOS**, the Pacific Northwest regional ocean observing system of IOOS. NANOOS is creating customized information and tools with these areas of emphasis:

Maritime Operations	Ecosystem Assessment	Fisheries & Biodiversity
Coastal Haz	ards	Climate

#### Data Exploration

NVS (NANOOS Visualization System) is a web app that provides easy access to observations, forecasts, data, and visualizations.



#### Track the "Blob" on NVS

The large expanse of unusually warm water in the Pacific Ocean, the "Blob", persists off the coast of OR and WA and has invaded inland waters. The NVS Climatology App provides comparisons of current and past water temperature from buoys and satellites, allowing you to track the warmer





### http://www.nanoos.org

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## **NANOOS Visualization System (NVS)**



NVS Send Us Your Comments About NVS Version History NANOOS Home



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





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## **Tailored User Products**

NVS for specific user groups with targeted subsets of the data 88 Apps Disclaimer Settings Log In NVS Contact (All NANOOS assets and data streams) Data Explorer Tsunami Boaters **Tuna Fishers Evacuation Zones** Shellfish Growers Climatology Beach and Maritime Shoreline Changes Operations 1-2-**High Frequency** Cruises Gliders Radar





# NANOOS observations and data



### NANOOS support for ocean forecast modeling



MacCready et al., UW



## **NANOOS remains vital !**

## "Why is NANOOS so good?"

- The people: creativity
- The spirit: cooperation
- The concept: collaboration

