

Northwest Association of Networked Ocean Observing Systems  
The Integrated Ocean Observing System (IOOS)  
Regional Association for the Pacific NW



[www.nanoos.org](http://www.nanoos.org)



**NANOOS**

NORTHWEST ASSOCIATION OF NETWORKED OCEAN OBSERVING SYSTEMS

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# 1. Call to Order

## Welcome, Introductions, Charge for the Day

*David Martin*  
*NANOOS GC Board Chair*



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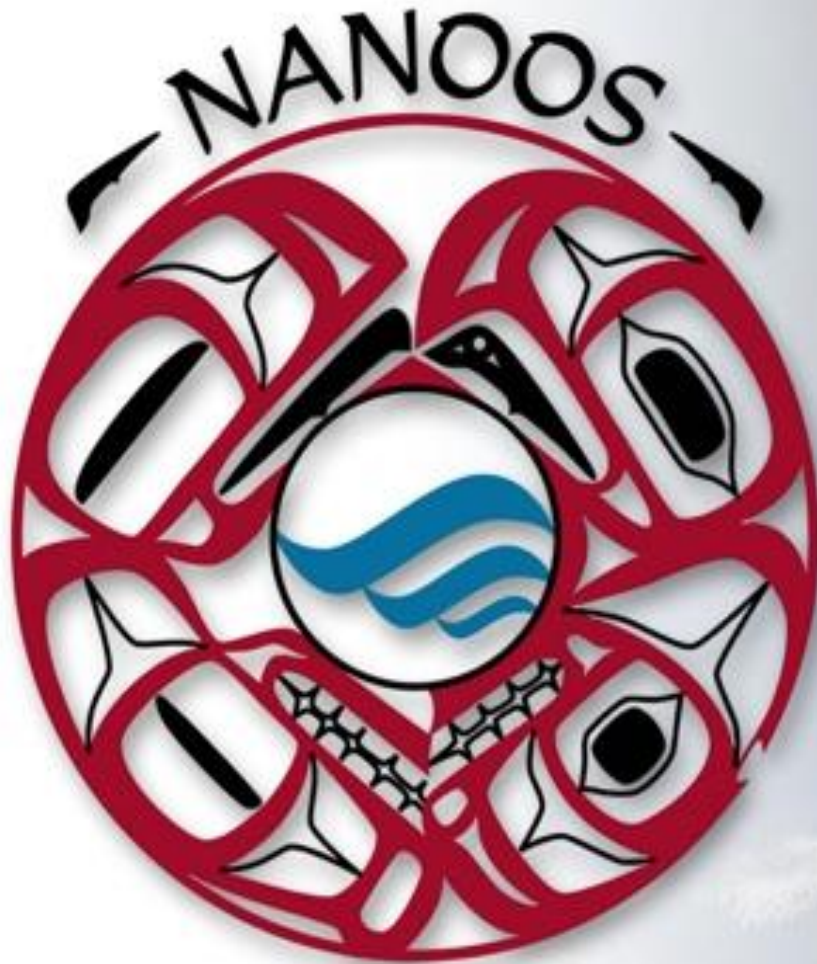
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## 2. NANOOS update

*Jan Newton*

*NANOOS Executive Director*



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# NANOOS Governing Council Members 8/2019



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- |  |  |                                  |
|--|--|----------------------------------|
| 1. Ocean Inquiry Project                       | 31. OR Dept of State Lands                       | 61. NOAA PMEL                    |
| 2. OR Dept of Land Conservation & Development  | 32. Columbia River Crab Fisherman's Association  | 62. Hakai Institute              |
| 3. Surfrider Foundation                        | 33. Port of Neah Bay                             | 63. Salish Sea Expeditions       |
| 4. The Boeing Company                          | 34. Northwest Research Associates                | 64. Aquatic Innovations Research |
| 5. Oregon State University                     | 35. Pacific Ocean Shelf Tracking Project         | 65. Long Live the Kings          |
| 6. Oregon Sea Grant                            | 36. WA Dept of Fish and Wildlife                 | 66. Rockland Scientific          |
| 7. Puget Sound Partnership                     | 37. Northwest Aquatic and Marine Educators       | 67. Northwest Indian College     |
| 8. University of Washington                    | 38. Seattle Aquarium                             | 68. Pacific Shellfish Institute  |
| 9. Washington Sea Grant                        | 39. NOAA Northwest Fisheries Science Center      | 69. Weatherflow                  |
| 10. WET Labs, Inc.                             | 40. Port Gamble S' Klallam Tribe                 |                                  |
| 11. Oregon Health and Science University       | 41. The Nature Conservancy                       |                                  |
| 12. Quileute Indian Tribe                      | 42. Portland State University                    |                                  |
| 13. OR Dept of Geology and Mineral Industries  | 43. NOAA Olympic Coast National Marine Sanctuary |                                  |
| 14. Humboldt State University                  | 44. University of Victoria                       |                                  |
| 15. Marine Exchange of Puget Sound             | 45. University of Oregon                         |                                  |
| 16. WA Dept of Ecology                         | 46. Port Townsend Marine Science Center          |                                  |
| 17. Pacific Northwest National Laboratory      | 47. Intellicheck-Mobilisa                        |                                  |
| 18. Port of Newport                            | 48. NortekUSA                                    |                                  |
| 19. Puget Sound Harbor Safety Committee        | 49. Grays Harbor Historical Seaport              |                                  |
| 20. Sound Ocean Systems, Inc.                  | 50. Pacific Coast Shellfish Growers Association  |                                  |
| 21. Council of American Master Mariners        | 51. US Army Corps Engineers                      |                                  |
| 22. Pacific Northwest Salmon Center            | 52. Olympic National Park                        |                                  |
| 23. Northwest Indian Fisheries Commission      | 53. Oak Harbor Middle School                     |                                  |
| 24. Sea-Bird Scientific                        | 54. Vancouver Island University                  |                                  |
| 25. Western Association of Marine Laboratories | 55. Ocean Networks Canada                        |                                  |
| 26. Leidos                                     | 56. Lower Columbia Estuary Partnership           |                                  |
| 27. OR Dept of Fish and Wildlife               | 57. Western Washington University                |                                  |
| 28. King County Dept Natural Resources & Parks | 58. Raincoast GeoResearch                        |                                  |
| 29. Quinault Indian Nation                     | 59. WA Dept of Health                            |                                  |
| 30. Western Resources and Applications         | 60. Say Yes to Life Swims                        |                                  |

KEY:  Tribal  Industry  NGO  Academia/Research  Federal/State/Local Government



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# New NANOOS members

- Northwest Indian College
- Pacific Shellfish Institute
- Weatherflow

*Welcome!*



### **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

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

APPLICATIONS: EFFORTS:	Coastal Ocean					Estuaries					Shorelines				
	mar ops	ecology	hazards	biodiversity	climate	mar ops	ecology	hazards	biodiversity	climate	mar ops	ecology	hazards	biodiversity	climate
<b>Multivariable assets:</b>															
WA shelf glider line	Currently directly supports					Not applicable					Not applicable				
Columbia shelf, glider tracks	Currently directly supports					Not applicable					Not applicable				
CA shelf glider line	Currently directly supports					Not applicable					Not applicable				
WA shelf buoy	Currently directly supports					Not applicable					Not applicable				
Columbia shelf buoy	Currently directly supports					Not applicable					Not applicable				
OR shelf buoy	Currently directly supports					Not applicable					Not applicable				
WA nearshore OAH	Proposed to directly support					Not applicable					Not applicable				
<i>PNW nearshore hypoxia</i>	no coastal nearshore					Not applicable					Not applicable				
<i>OR nearshore OAH</i>	Proposed to directly support					Not applicable					Not applicable				
Puget Sound estuary buoys	Not applicable					Currently directly supports					Not applicable				
Puget Sound estuary ferrybox	Not applicable					Currently directly supports					Not applicable				
Columbia estuary buoys	Not applicable					Currently directly supports					Not applicable				
South Slough estuary moorings	Not applicable					Currently directly supports					Not applicable				
<i>Salish Sea estuary buoy</i>	Not applicable					no central Salish Sea					Not applicable				
<b>Biological sampling:</b>															
<i>OR shelf plankton timeseries</i>	no plankton					no plankton					Not applicable				
<i>OR estuarine timeseries</i>	no plankton					no plankton					Not applicable				
<b>Shorelines:</b>															
Washington shorelines	Not applicable					Not applicable					Currently directly supports				
Oregon shorelines	Not applicable					Not applicable					Currently directly supports				
PNW bathymetry	Not applicable					Not applicable					Currently directly supports				
<b>Surface currents:</b>															
Oregon coastlines HF	Currently directly supports					Not applicable					Currently directly supports				
<i>Washington coastlines HF</i>	no WA					no WA					no WA				
Critical coastal ports X-band	Not applicable					Currently directly supports					Currently directly supports				
<b>Forecast models:</b>															
PNW circulation forecasts	Currently directly supports					Not applicable					Not applicable				
Puget Sound circulation forecasts	Not applicable					Currently directly supports					Not applicable				
Columbia circulation forecasts	Currently directly supports					Not applicable					Not applicable				
PNW bio geochem forecasts	Not applicable					Currently directly supports					Not applicable				
Puget Sound bio geochem forecasts	Not applicable					Currently directly supports					Not applicable				
Columbia estuary habitat forecasts	Not applicable					Currently directly supports					Not applicable				
<i>Coastal wave forecasts</i>	no forecast					no forecast					no forecast				
<i>Flood/erosion forecasts</i>	no forecast					no forecast					no forecast				

**KEY:**

*Italicized efforts indicate new investment*

Currently directly supports  
Currently indirectly supports

Proposed to directly support  
Proposed to indirectly support

Not applicable  
no ... Text explains the current gap the proposed activities fill



# NANOOS Objectives for FY2019

- 1) Maintain **NANOOS** as the U.S. IOOS PNW Regional Association
- 2) Maintain **and enhance** surface current and wave mapping capability.
- 3) **Sustain** existing buoys and gliders in the PNW coastal ocean, in coordination with other 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, in coordination with state 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** efforts.



## NANOOS budget:

FY07-09: \$1.4M + 0.4M = \$1,800,000

Year 1, 2, 3

FY10: \$1.7M + 0.4M = \$2,100,000

Year 4

FY11: \$2,087,500 (*w/ new start date*)

Year 5 or 1 of new 5-y award

FY12: \$2,428,291 (\$2,288,000 base; ~\$140K for DMAC, OA workshops)

Year 6 or 2

FY13: \$3,089,477 (\$2,392,136 base; ~\$700K for OTT on OA plus OAP)

Year 7 or 3

FY14: \$2,818,441 (\$2,442,136 base; \$109K HF; \$217K OAP; \$50K glider)

Year 8 or 4

FY15: \$2,771,890 (\$2,462,136 base; \$309K OAP)

Year 9 or 5

FY16: \$2,848,900 (\$2,452,552 base; \$317K OAP; \$79K adds)

Year 10 or 1 of new 5-y award

FY17: \$3,216,463 (\$2,457,136 base; \$360K HFR; \$282K OAP; \$117K adds)

Year 11 or 2

FY18: \$3,264,472 (\$2,462,136 base; \$180K HFR; \$330K OAP; \$291K adds)

Year 12 or 3

FY19: **\$3,485,217** (**\$2,462,136** base; **\$375K** obs; **\$379K** OA; **\$269K** adds)

Year 13 or 4



## NANOOS budget:

FY19: **\$3,485,217** (\$2,462,136 base; \$375K obs; \$379K OA; \$269K adds)  
Year 13 or 4

### *Fill the Gaps in Obs*

- \$150,000\* for O&M for a glider: Columbia
- \$150,000\* for procurement of a glider: La Push
- \$75,000\* for observations: gear replacement
- \$75,000 one time add: address observing data certification requirements

### **OA**

- \$189,790 for NANOOS ocean acidification observations in Oregon coastal waters (OSU)
- \$66,291 for NANOOS ocean acidification observations in Washington coastal waters (UW)
- \$70,000 to enhance the GOA-ON data portal as an OA dashboard to the world (UW)
- \$40,000^ to continue funds for OA experts to aid OA observations for growers (OSU/UW)
- \$13,000 to support NOAA-ON mooring test-beds (UW)

### **Other**

- \$50,000 for workshop on extension and lessons learned from OA Regional Vulnerability Assessment
- \$20,000 for deployment of LiveOcean in the IOOS cloud sandbox (MacCready)
- \$15,000 for biology pilot projects in honor of Matt Howard on biological data stewardship
- \$9,000 for OceanHackWeek 2019 (Mayorga)
- \$100,000 for OSU ROMS-ICE model in Alaska (Kurapov)



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# The year of the glider

- Restore O&M for Columbia glider
- Obtain La Push glider
- New glider products on NVS, including OOI
- Glider group established



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## *Why are glider data important to PNW?*

### **1. Hypoxia is an existing and increasing issue in the Pacific Northwest.**

NANOOS has used its gliders to monitor this information. This need will only grow with time. Work to date has included a successful partnership on the Columbia line with the Quinault Indian Nation who provided operational ship tending that allowed operation of this glider. **QIN wanted the data so that they could better visualize the hypoxic zone off their lands and inform fishing/crabbing practices.**

NANOOS glider information on hypoxia has been relayed to NOAA and others who are involved with stock management affecting fishers and crabbers.

### **2. Glider data are critical to monitoring change in seawater properties like temperature and salinity for climate variability and change including phenomena, like El Niño, with strong societal impacts.**

Glider data provided information about the shoreward intrusion of the warm water anomaly (“the Blob”) and its development over time. **Gliders provide subsurface temperature and salinity which added important information to the spatial view of surface T provided by satellites.** While some said the Blob was dead, subsurface data showed that it was NOT! And this was important because it is the deeper waters that upwell.

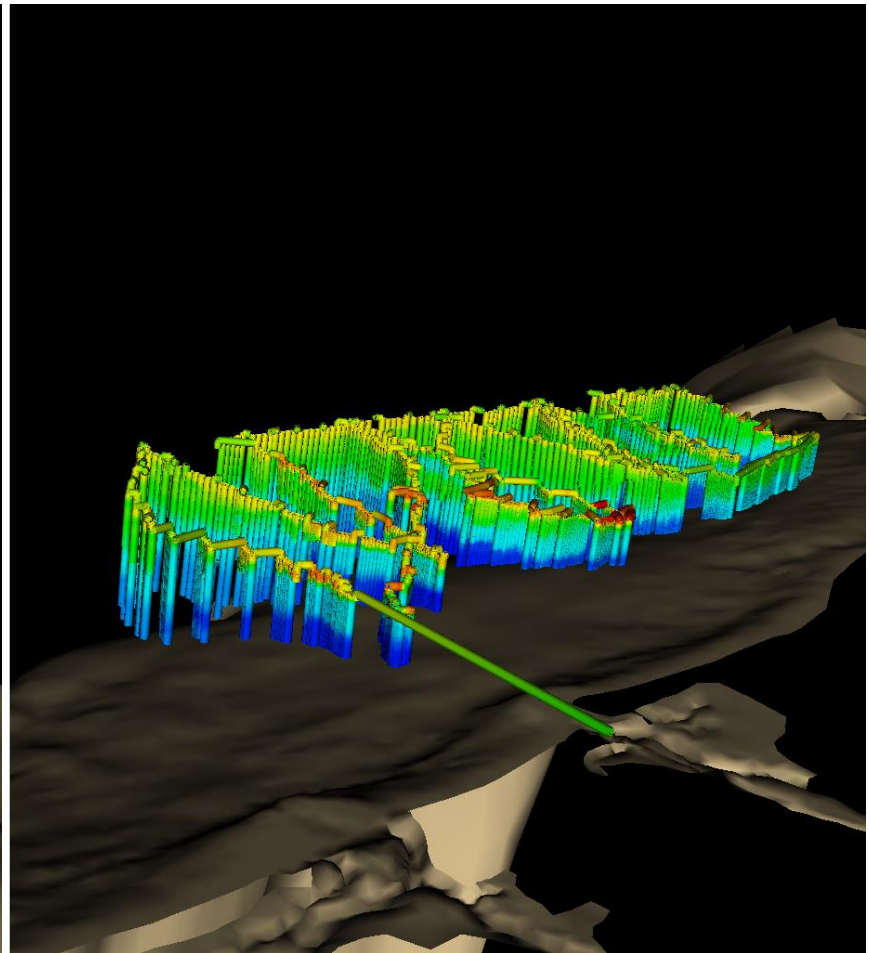
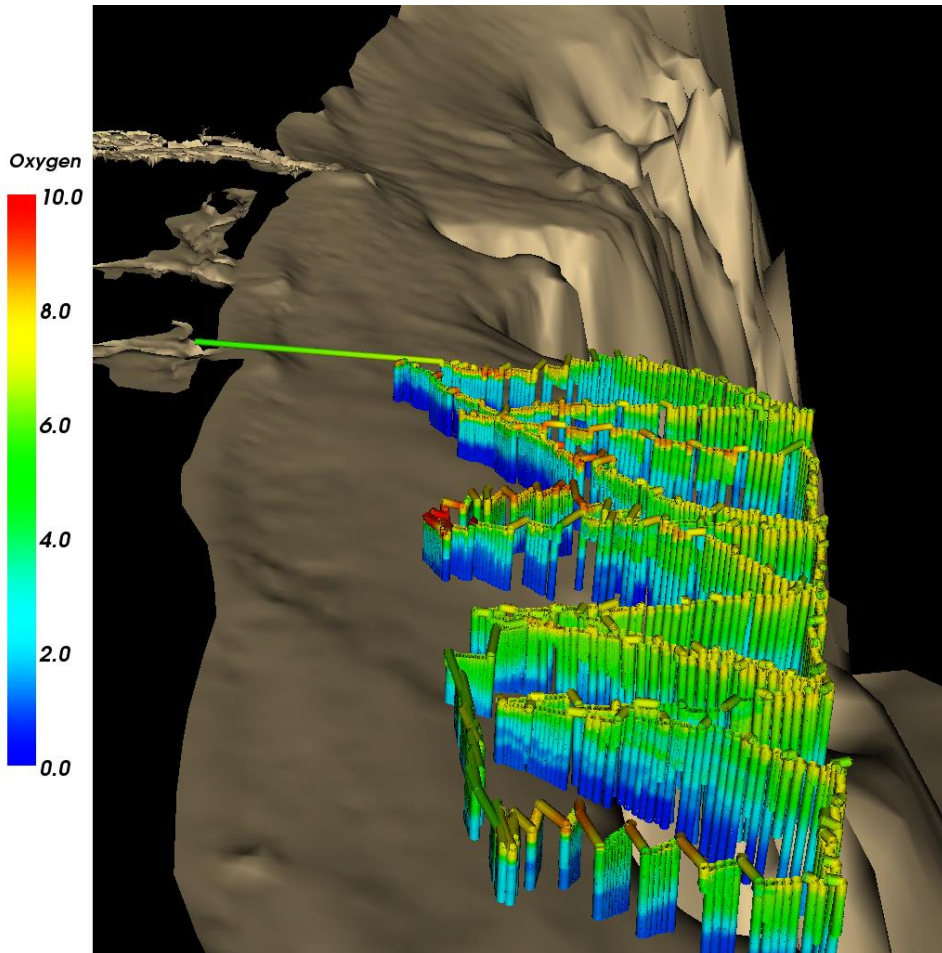


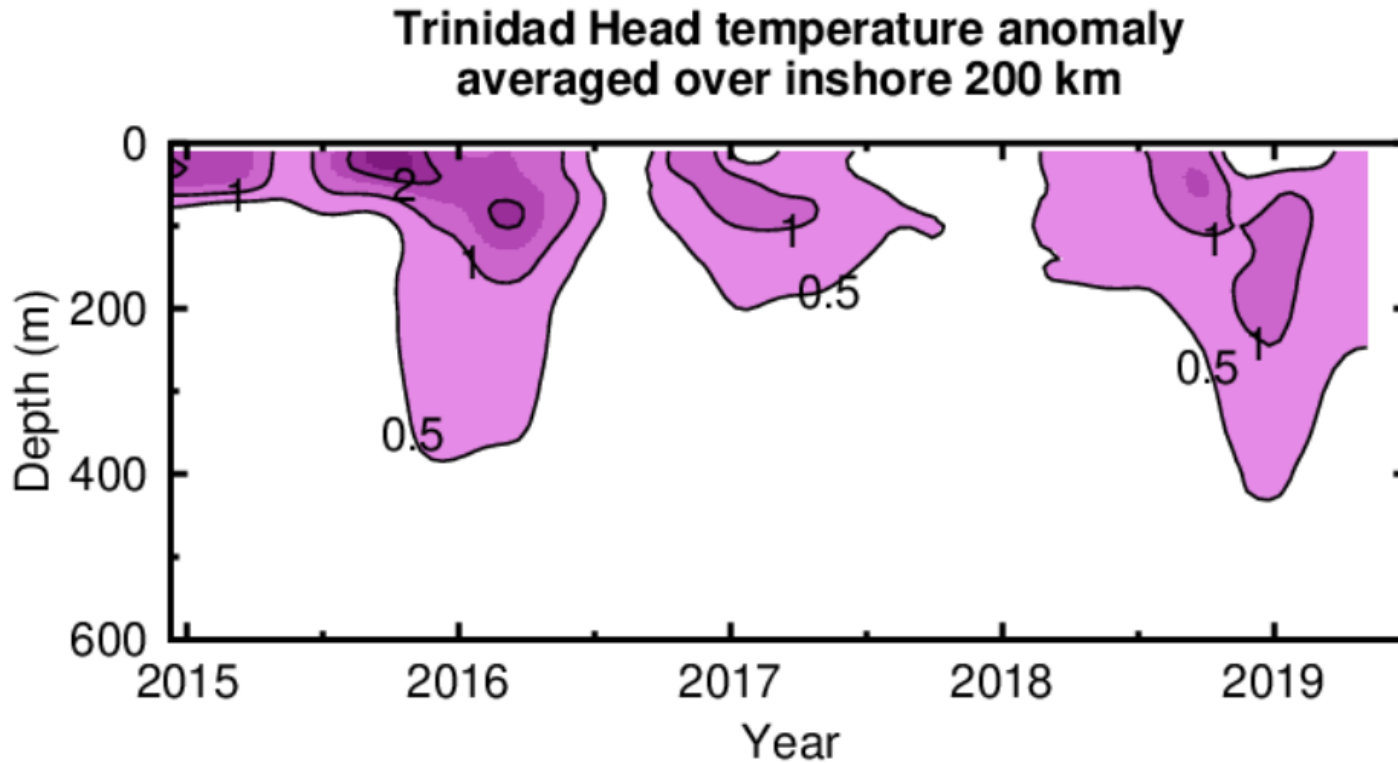
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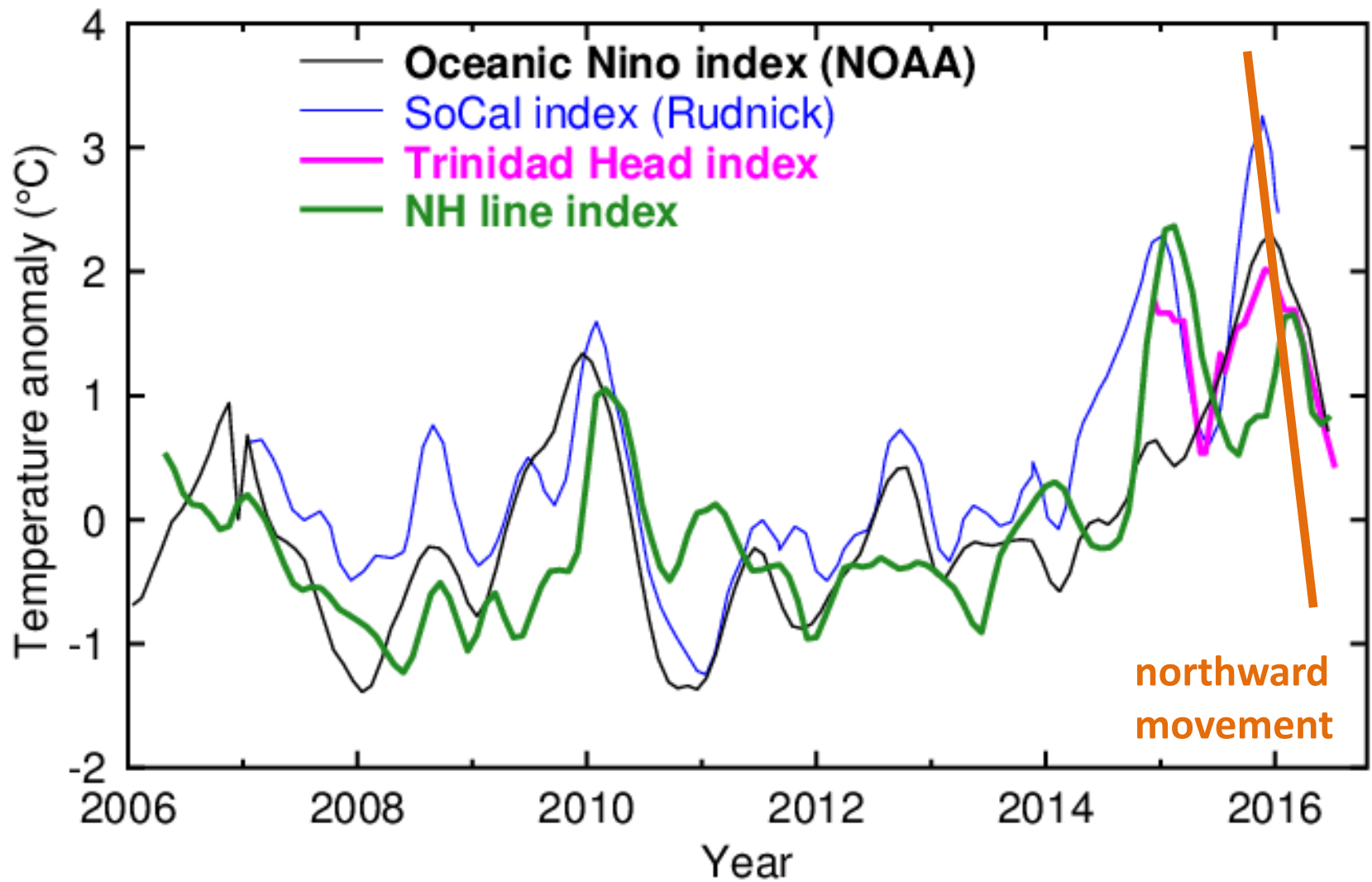
## CMOP Columbia glider from 2012





**Figure 1:** Temperature anomaly from the Trinidad Head, CA ( $41^{\circ} 3.5'N$ ) glider line.

# 50-m temperature anomaly averaged within 200 km of the coast (ala Rudnick)







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## IOOS planning strategies

*From 2016 planning document:*

- **Top Priority: ~ \$300,000**
- *1-2 sentence description of the top priority for funding gliders in your region for \$300K.*
- **MAKE COLUMBIA OPERATIONAL:** Provide operational shallow water O&M funds to Columbia glider with the existing two gliders. Continue work with QIN.
- **RESTORE LA PUSH:** Replace La Push glider. Continue coastal dynamics northwards
- **Next Priority: ~ \$300,000 (in addition to #1 priority)**
- *1-2 sentence description of the second priority for funding gliders in your region for \$300K.*
- **MAKE LA PUSH OPERATIONAL:** Provide operational shallow water O&M funds to La Push glider with the existing glider from first priority purchase.
- **INSURE FUTURE OF HUMBOLDT OPERATIONS:** Purchase second glider for Humboldt line for field swapping/replacing aging equipment.



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Apps Settings

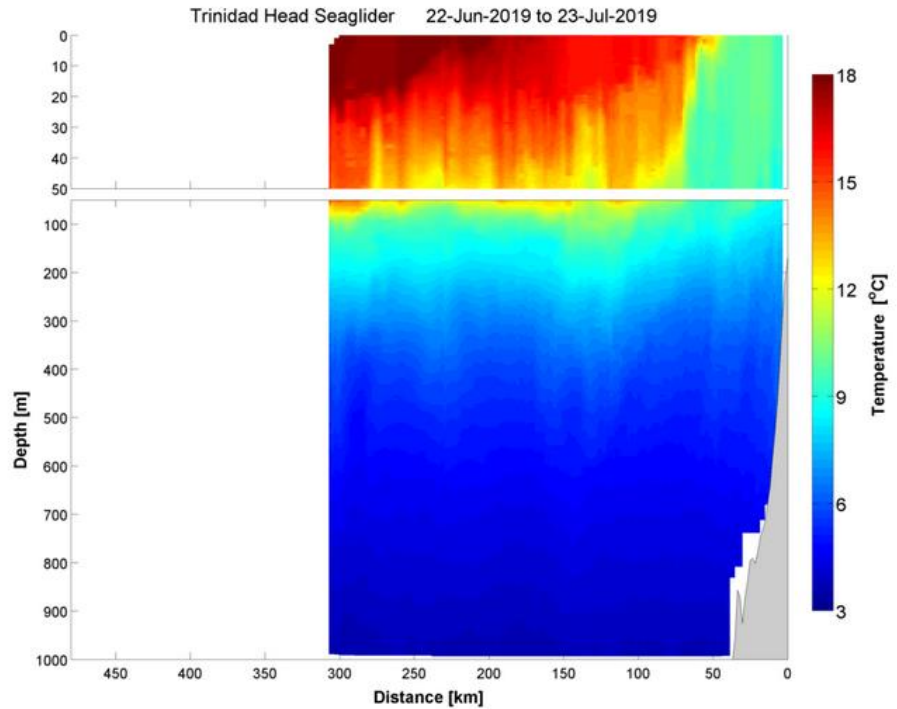
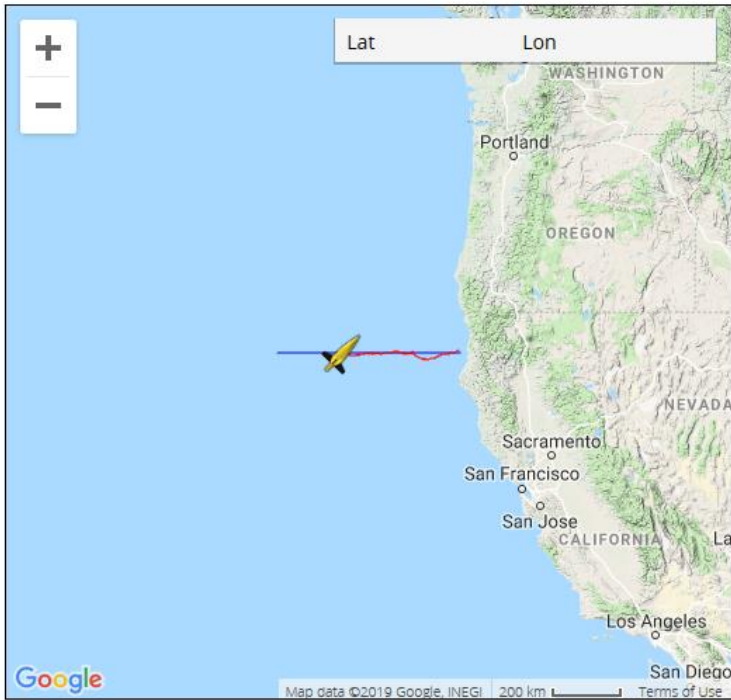
## NVS TRINIDAD HEAD GLIDER

Log In More

Plots Annual Plots

Missions  Type: Seaglider Provider: OSU CEOAS GRG Contact: Jack Barth

Temperature Salinity Density Dissolved Oxygen Fluorescence CDOM Backscatter



Prev

23 July 2019 5:48 pm

Next





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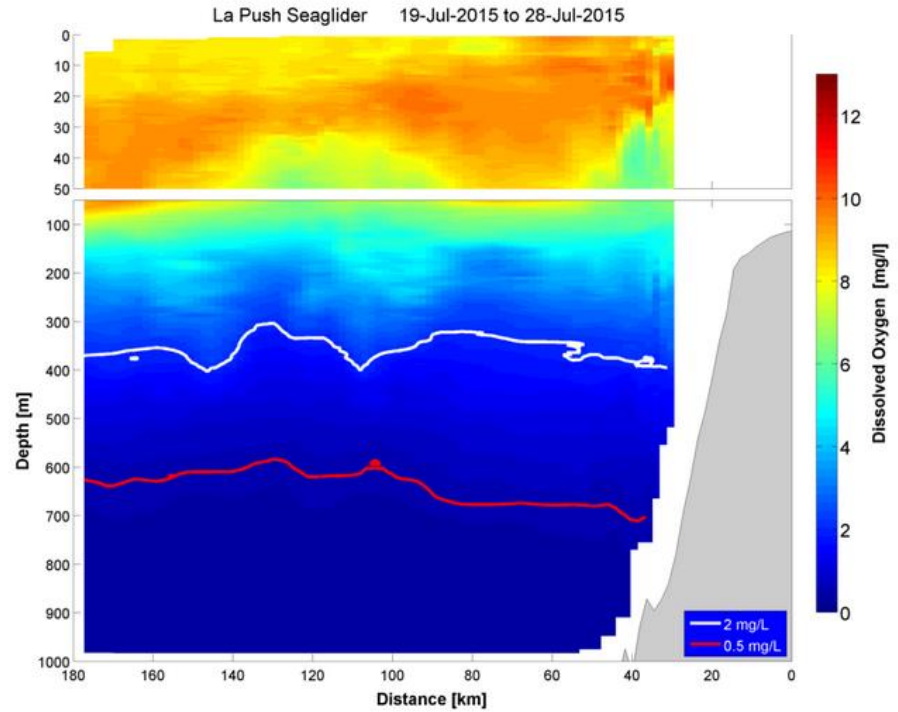
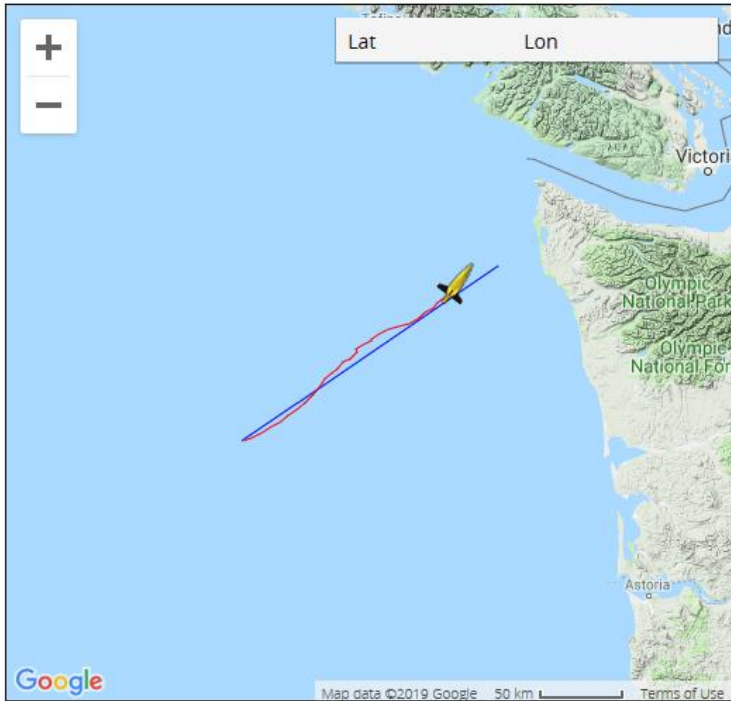
NVS LA PUSH GLIDER

Log In More

Plots Annual Plots

Missions  Type: Seaglider Provider: UW IOP Contact: Craig Lee

Temperature Salinity Density **Dissolved Oxygen** Fluorescence CDOM Backscatter



Prev

21 July 2015 10:00 pm

Next



# Goals for WA HF re national "Fill the Gaps:"

- Complete the US west coast map
- Meet and join with Canadian system in Strait Juan de Fuca
- Expose full path of coastal currents
- Illuminate processes in the JdF Eddy, a HAB incubator

*Ideal plan: add sites*  
*N. Wash: Cape Flattery*  
*C. Wash: La Push*  
*S. Wash: Copalis*



## **Success!**

- Have funds for 2 HFRs

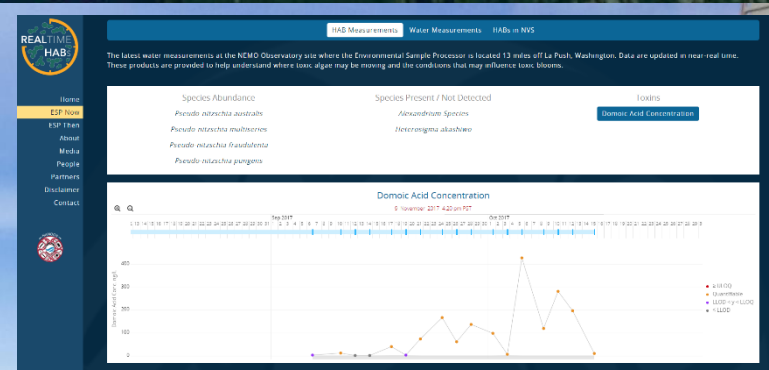
## **Difficulties:**

- Remote coast
- Lack of power
- Obstructing headlands
- Wide beaches
- Cars on beaches

## **Update:**

- Going forward on permit for site near Westport
- Evaluating site near Kalaloch
- Will seek funds for 3<sup>rd</sup> radar

# Operational ecological forecasting of PNW harmful algal blooms using an Environmental Sample Processor



**MERHAB award:**  
Operational funds  
for 4 years starting  
year after next



# OA Science-Grower Partnerships

Wiley Evans,  
Hakai Institute



Alutiiq Pride Shellfish Hatchery  
Seward, AK



Simone Alin,  
NOAA PMEL

Tessa Hill,  
UC Davis



Taylor Shellfish Hatchery  
Quilcene, WA

Whiskey Creek Shellfish Hatchery  
Tillamook, OR



Hog Island Oyster Company  
Tomales Bay, CA




Carlsbad Aquafarm  
Carlsbad, CA

Todd Martz,  
SIO



Burke Hales,  
OSU





**The Olympic Coast as a Sentinel:**  
*An Integrated Social-Ecological  
Regional Vulnerability Assessment to  
Ocean Acidification*

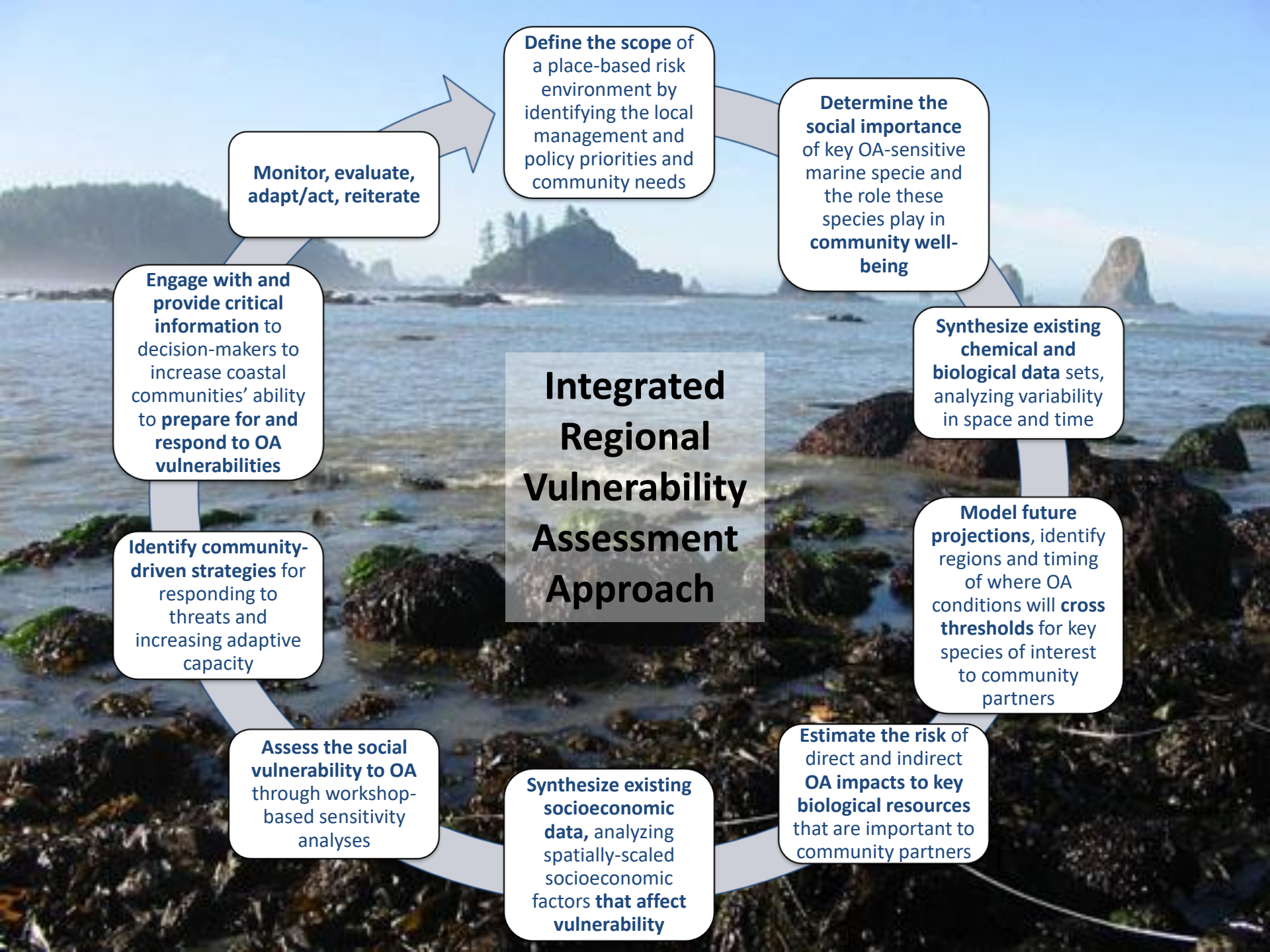


# ***Goal:***

Our overarching goal is to provide:

- an assessment of coupled social-ecological vulnerability to effects from OA that is
- based on *new* social science and a synthesis of existing data and model projections
- relevant to the Olympic Coast, its biological resources, and its inhabitants (including participating coastal tribes),
- developed in an actionable interdisciplinary approach that is
  - 1) transferrable to other locations and
  - 2) strengthens capacities for vulnerable place-based communities to adapt.





# Integrated Regional Vulnerability Assessment Approach

**Monitor, evaluate, adapt/act, reiterate**

**Define the scope of a place-based risk environment by identifying the local management and policy priorities and community needs**

**Determine the social importance of key OA-sensitive marine species and the role these species play in community well-being**

**Synthesize existing chemical and biological data sets, analyzing variability in space and time**

**Model future projections, identify regions and timing of where OA conditions will cross thresholds for key species of interest to community partners**

**Estimate the risk of direct and indirect OA impacts to key biological resources that are important to community partners**

**Synthesize existing socioeconomic data, analyzing spatially-scaled socioeconomic factors that affect vulnerability**

**Assess the social vulnerability to OA through workshop-based sensitivity analyses**

**Identify community-driven strategies for responding to threats and increasing adaptive capacity**

**Engage with and provide critical information to decision-makers to increase coastal communities' ability to prepare for and respond to OA vulnerabilities**

# ***Project Team***

- Lead PIs:

**Jan Newton** (Lead PI), UW Applied Physics Lab/Washington Ocean Acidification Center (WOAC)

**Melissa Poe** (Co-PI), UW Washington Sea Grant (WSG)/NOAA Northwest Fisheries Science Center (NWFSC)

- Co-PIs:

**Simone Alin**, NOAA Pacific Marine Environmental Lab (PMEL)

**Meg Chadsey**, WSG/PMEL

**Richard Feely**, NOAA PMEL

**Steven Fradkin**, Olympic National Park (ONP)

**Jennifer Hagen**, Quileute Tribe

**Khalid Marcus**, Hoh Tribe

**Joe Schumacker**, Quinault Indian Nation (QIN)

**Samantha Siedlecki**, U Connecticut

**Adrienne Sutton/Brendan Carter** (JISAO/ NOAA PMEL)

**Russell Svec**, Makah Tribe

**Jenny Waddell**, Olympic Coast National Marine Sanctuary (OCNMS)

**Melissa Watkinson**, WSG



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Observing Network

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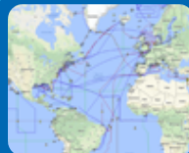
Data Portal

Add a Platform



Global Ocean Acidification  
Observing Network

*GOA-ON is a collaborative international approach to document the status and progress of ocean acidification in open-ocean, coastal, and estuarine environments, to understand the drivers and impacts of ocean acidification on marine ecosystems, and to provide spatially and temporally resolved biogeochemical data necessary to optimize modeling for ocean acidification.*



## GOA-ON Data Portal

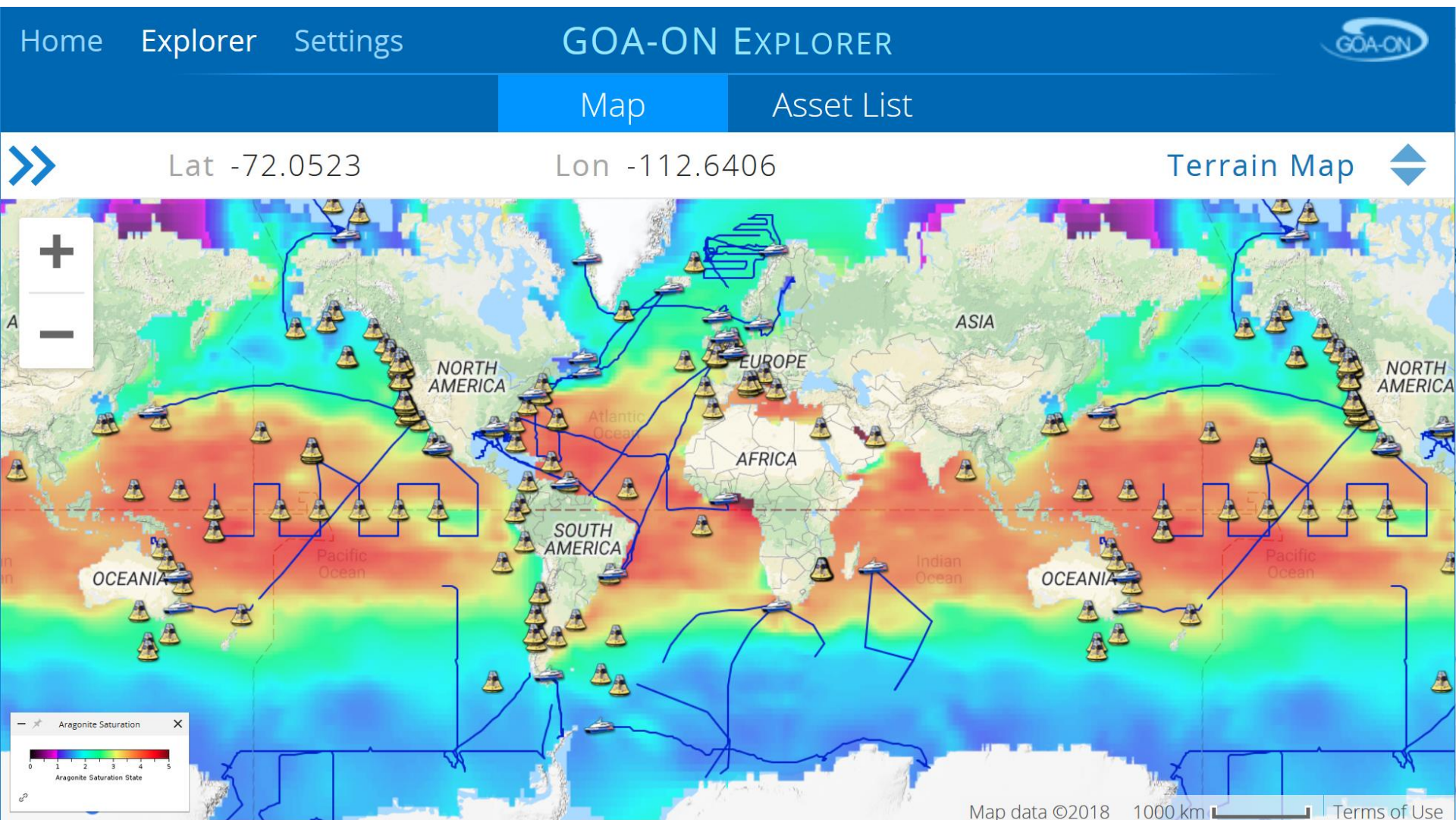
The GOA-ON data portal provides easy access to data and visualizations.

## IOC-UNESCO Executive Council Welcomes SDG Indicator 14.3.1 Methodology



During its 51st Executive Council Meeting from 3-6 July

# Supporting UN SDG 14.3



# North American Ocean Acidification Network



North American  
OA Network

Select Language ▼

About

Activities

Canada OA

United States

OA

Mexico OA



The North American Ocean Acidification Hub is being established to serve the countries of Canada, United States, and Mexico. The Global Ocean Acidification Observing Network ([GOA-ON](#)) has encouraged grass-roots formation of regional hubs to foster communities of practice for the efficient collection of comparable and geographically distributed data to



## NANOOS Presentation for NOAA West Watch

NOAA's most recent West Watch was held on 22 January 2019. The webinar summarized coastal environmental conditions and impacts in the Western Region. The webinar included contributed slides from the NANOOS, CeNCOOS, and SCCOOS regions, who regularly report on their local coastal ocean conditions. The next webinar date is TBD. Contact us at NANOOS if you want to participate and please let us know if you have any comments!

14 Feb 2019

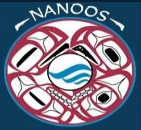
[View the Webinar Slide Set \(PDF\)](#)

[Link](#)

Please join us for the next NOAA West Watch on Tuesday, September 10 2019 from 1-2 pm Pacific Time. I will send out a reminder email the week before the webinar. You are encouraged to add this meeting to your calendar. If you wish to be removed from this distribution list, please contact me at [daniel.mcevoy@dri.edu](mailto:daniel.mcevoy@dri.edu).

Background: NOAA West Watch is a periodic webinar undertaken by the NOAA Western Regional Collaboration Team in partnership with the Western Regional Climate Center and with contributions from the three West Coast Integrated Ocean Observing System Regional Associations. These webinars are designed to bring together NOAA staff and partners from across the agency and region to share information about regional scale environmental observations and impacts on human systems. The webinars are not formal public releases of data but are a mechanism to facilitate interdisciplinary connections and the exchange of information among agency staff and partners on regional climatic and oceanic conditions, particularly departures from normal.

Daniel McEvoy, PhD, Western Regional Climate Center

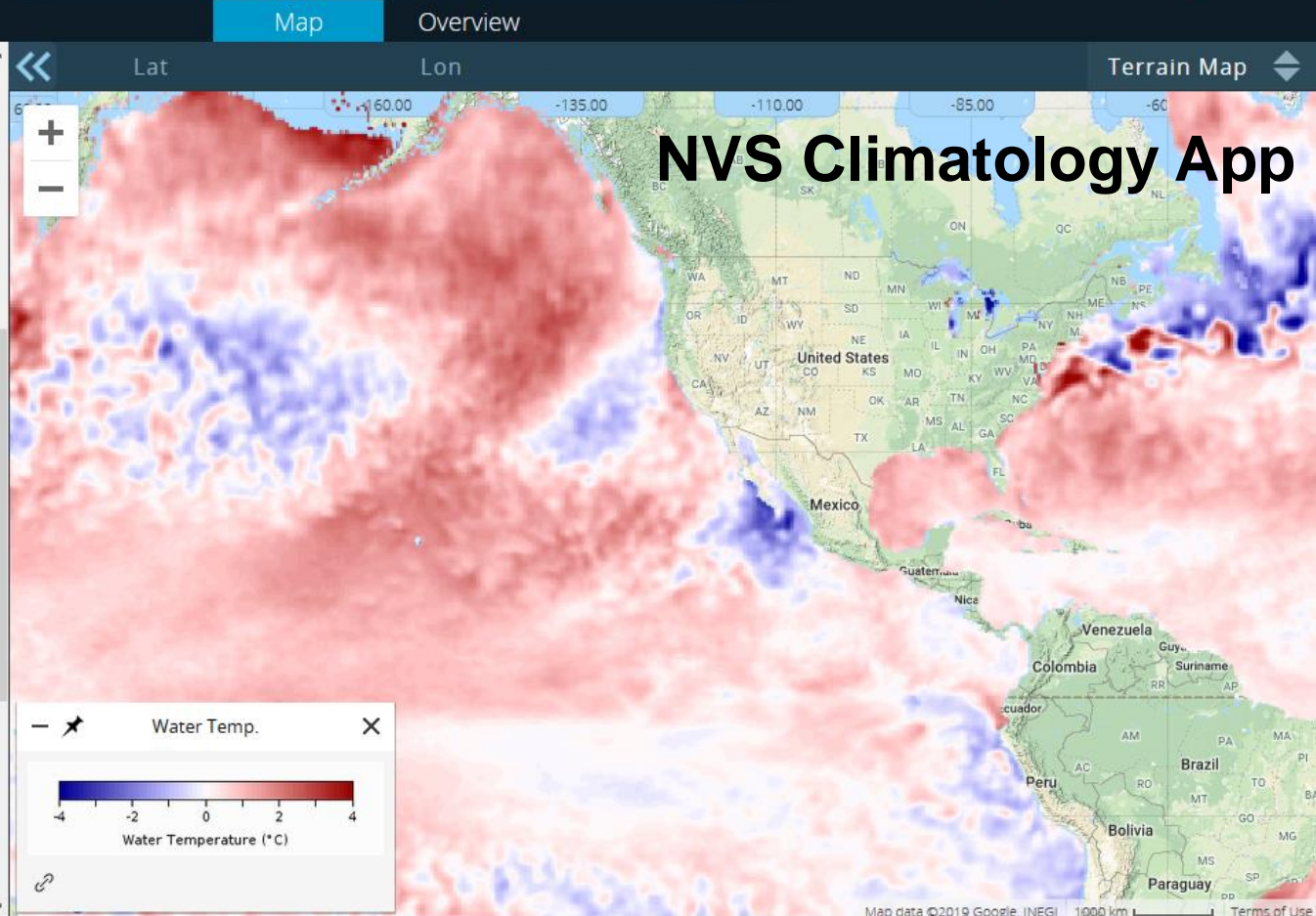


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- Layers
- Indices
- Sites
- Legend
- Remote Sensing
  - NCDC OI SST
    - Water Temp. (Climate)
    - Water Temp. (Anomaly)
    - Water Temp. (Mean)
  - NODC Ocean Atlas
    - Surface Salinity (Climate)
  - OSU AVISO Climate
    - Sea Level (Climate)



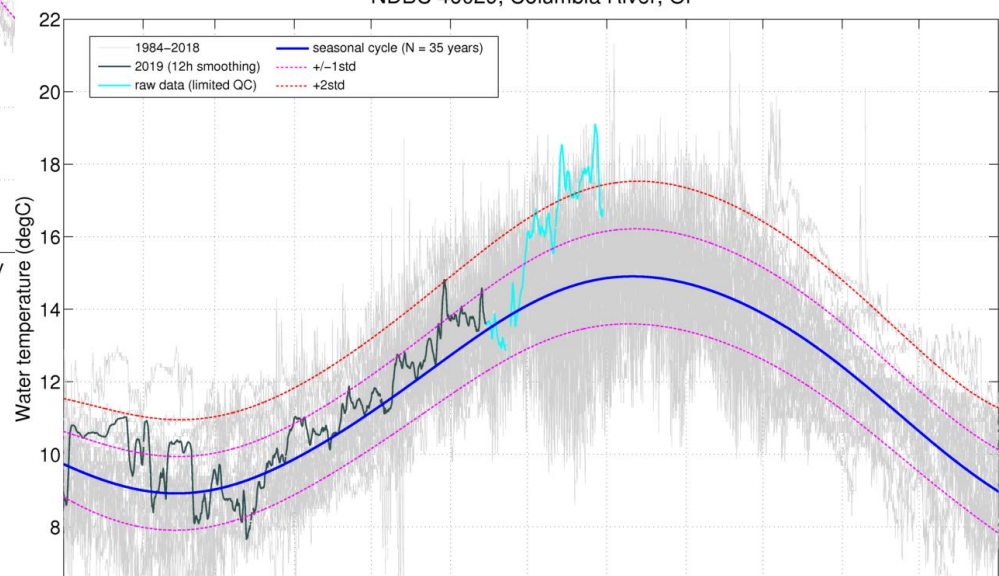
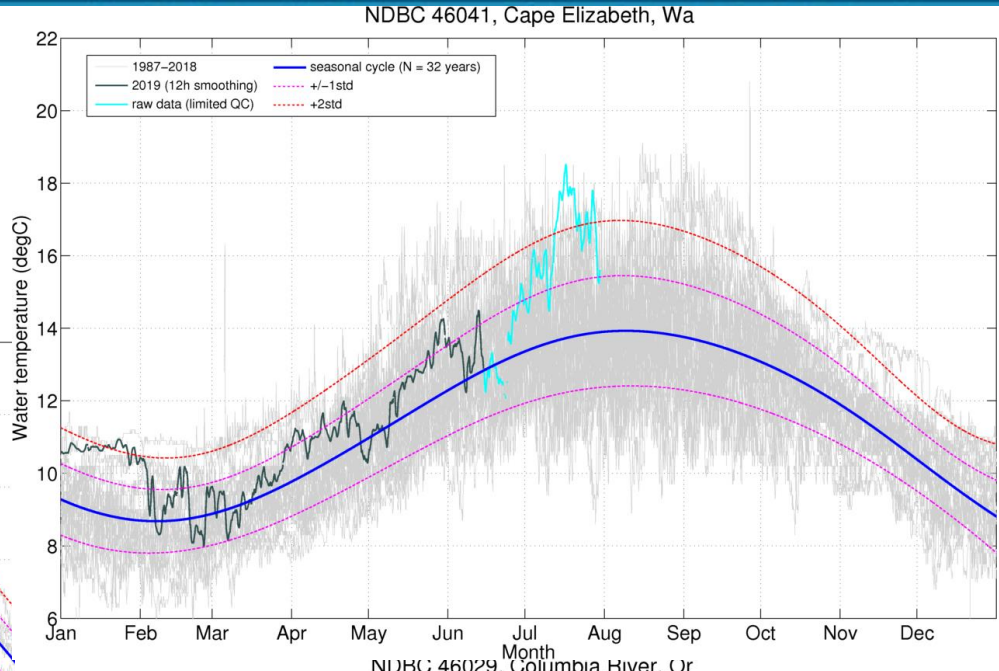
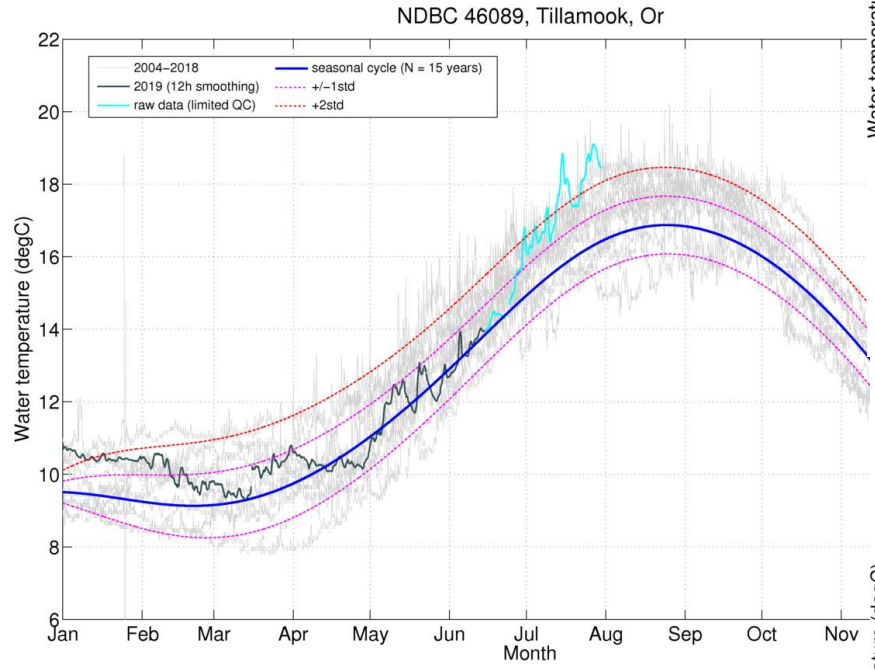
## NVS Climatology App

15 June 2019 4:59 pm PDT





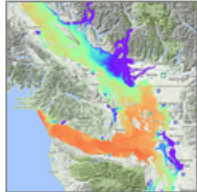
### NVS Climatology App







### 2018-9 *new developments:*



#### University of British Columbia Salish Sea Model Live on NVS

The high-resolution "SalishSeaCast" University of British Columbia (UBC) model, funded by the Marine Environmental Observation Prediction and Response Network (MEOPAR), can be accessed on the NVS Data Explorer App. This model includes temperature and salinity now-casts from the surface to 415m depth, covering the Strait of Georgia and Salish Sea.

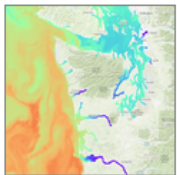
[View the SalishSeaCast Model in NVS](#)

[More Information About the Project](#)

### **NANOOS modeling PNW scale**

#### 4 regional models:

- *CMOP Columbia*
- *UW LiveOcean*
- *OSU ROMS*
- *UBC SalishSeaCast*
  
- *PNNL Salish Sea*



#### LiveOcean comes to the Salish Sea!

A new version of the UW Live Ocean model has been released! Alongside greater spatial resolution comes the coverage of the Salish Sea in the model's 3-day forecasts of variables like aragonite saturation state, oxygen, nutrients, and phytoplankton. Forecasts are available for many depths, including a bottom contour. See the LiveOcean homepage link below for more information and some great animations.

[NVS LiveOcean](#)

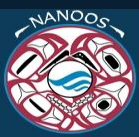
[LiveOcean Homepage](#)

[Read UW News Article](#)

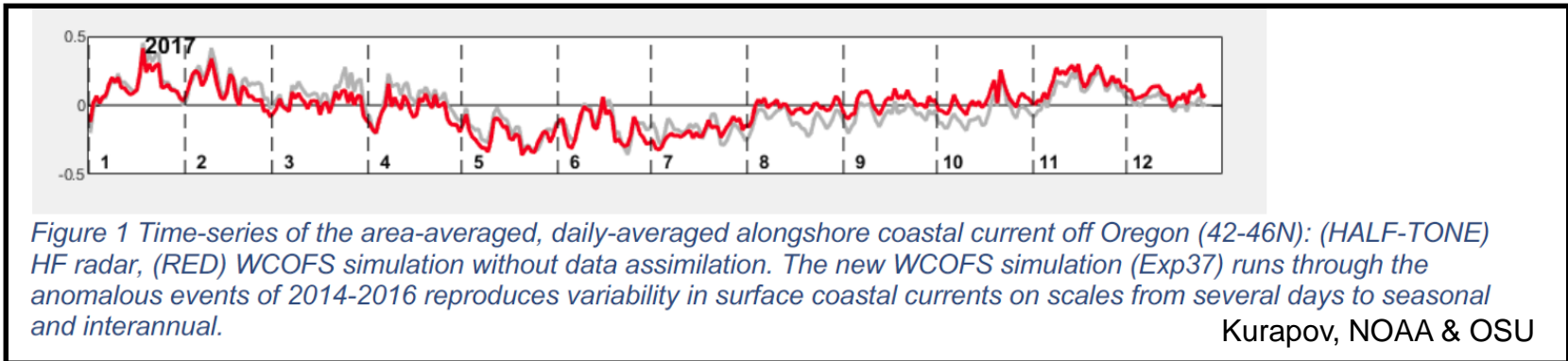
11:00-11:20

#### **Towards an *Operational Forecast System* for the Salish Sea to Support Maritime Emergency and Spill Response**

Tarang Khangaonkar, Principal Program Manager, Coastal Ocean Modeling,  
Pacific Northwest National Laboratory



# IOOS COMT WCOFS: West Coast scale



You are cordially invited to attend a stakeholder engagement workshop on the 5-6 September 2019 at Monterey Bay Aquarium Research Institute (MBARI) in beautiful Moss Landing, CA. The workshop is supported by a U.S. Integrated Ocean Observing System ([IOOS Coastal Ocean Modeling Testbed \(COMT\) project](#)) that is evaluating the utility of a pre-operational NOAA model, the [West Coast Ocean Forecast System \(WCOFS\)](#). The purpose of the workshop is to initiate a dialogue with important members of the natural resource management community who have a vested interest in guiding the development and implementation of ecological forecasting for marine species habitat, harmful algal blooms, and ocean acidification.

This 1 1/2 day workshop will focus on conversations between the technical team and the broader scientific and management communities from California, Oregon, and Washington states. Importantly, this workshop will lay the groundwork for years of ecological forecasting discussions on how best to meet management requirements given the broad scope of applications along the U.S. West Coast.



# NANOOS

NORTHWEST ASSOCIATION OF NETWORKED OCEAN OBSERVING SYSTEMS

WASHINGTON - OREGON - NORTHERN CALIFORNIA



IOOS

## Challenges

- Sustaining infrastructure on ~level funding
- Avoiding NANOOS being the best kept secret



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NANOOS pays annual \$1000 non-federal dues to IOOS Association, split by:

- Seabird Scientific
- Pacific Coast Shellfish Growers Association

**THANK YOU!!!**



# NORTHWEST ASSOCIATION OF NETWORKED OCEAN OBSERVING SYSTEMS (NANOOS)

The eye on the Pacific Northwest's ocean and coast

“ NANOOS provides critical life safety information to the public, aiding coastal communities to reduce risk. ”

-Jonathan Allan, Coastal Geomorphologist  
Oregon Department of Geology and Mineral Industries

NANOOS is the Regional Association of the national Integrated Ocean Observing System (IOOS) in the Pacific Northwest, primarily Washington and Oregon. Investments in NANOOS have resulted in high-technology jobs, better-informed decisions, and new innovation.

## We help improve:

### HEALTH

Decision-making to protect human health

### SAFETY

Enabling preparedness and security

### ECONOMY

Preserving economic benefits of the ocean

### NANOOS Increases Efficiency

The NANOOS Visualization System (NVS) integrates data from a wide variety of sources, and makes that data available in one online data portal, saving substantial time and money. Real-time observations and forecasts from a range of assets including buoys, shore and tidal stations, high-frequency radar, wave and current forecasts, and satellites are available in user-friendly data displays. NVS provides sophisticated yet accessible capabilities such as comparisons of forecasts with real-time observations, and customized presentations based on community feedback.



nanoos.org

IOOS in the Pacific Northwest



## Benefits for People and Businesses in the Pacific Northwest

### Innovative Technology for Safe & Profitable Resource Use



NANOOS detects toxins from harmful algal blooms (HABs) from an undersea robot at La Push. "Having the NANOOS automated HAB sampler, with toxin assessment capability, offshore between our harvest beaches and the HAB generation sites will give tribes the forewarning they need to adjust sampling protocols and better protect the health of coastal residents, tribal and non-tribal." - Joe Schumacker, Department of Fisheries, Quinalt Indian Nation

NANOOS partners with industry to develop a lower cost sensor for effective shellfish growing. "This current generation of shellfish farmer is reliant upon data and services from NANOOS. Checking the NANOOS app before seeding a beach or filling a settling tank has become standard practice." - Margaret Barrette, Pacific Coast Shellfish Growers Association Director

### Support for Maritime Operations, Safety & Fishing Commerce

NANOOS data products allow mariners to choose safe and efficient routing. High frequency radars in Oregon provide real-time data on surface currents, which decrease the size of search and rescue areas by two-thirds. We need to extend this radar system to the Washington Coast to fill the gap in coverage.

"Ships crossing the Columbia River Bar face one of the most dangerous harbor entrances in the world. The Columbia River Bar Pilots rely on weather forecasts, real time buoy data along with wave and current models when determining safe times for ships to cross the bar. NANOOS provides an excellent location for us to see and compare all the available data sources."

- Captain Dan Jordan, Columbia River Bar Pilots



### Information for Coastal Hazard Risk Reduction



NANOOS products help coastal communities minimize impacts from coastal hazards and keep the public safe. NANOOS data are used by the Oregon Department of Geology and Mineral Industries (DOGAMI) for coastal flood hazard maps; together NANOOS and DOGAMI provide tsunami hazard evacuation information to coastal populations. Both products aid risk reduction and increase coastal preparedness.

"NANOOS support has "... provided us with invaluable information concerning our ongoing erosion problems. Without such assistance, we are operating blind." - Mayor Crystal Dingler, City of Ocean Shores

"The Oregon Office of Emergency Management (OEM) appreciates the tools that NANOOS provides. The online tsunami evacuation route viewer is especially useful in helping coastal residents and visitors understand and respond to the tsunami hazards." - Althea Rizzo, Oregon OEM Geologic Hazards Program Coordinator



nanoos.org

### For More Information

Contact us if you have any questions, or to learn more about our program:

Jan Newton, NANOOS Executive Director

Tel: (206) 543-9152 | janewton@uw.edu



# NORTHWEST ASSOCIATION OF NETWORKED OCEAN OBSERVING SYSTEMS

NANOOS enhances health, safety and economic prosperity in the Pacific Northwest



## TSUNAMI RISK REDUCTION

*"As a coastal community deeply committed to emergency preparedness, we find the new tsunami application to be a critical tool. It is easy and flexible to use and allows access to and clear designation of evacuation zones, allowing you to understand your risk and how to get to safety quickly after an earthquake. Access to accurate information is so important to our citizens and, as a destination location, to our visitors as well. We are proud to market our region as the most prepared on the Oregon coast and the tsunami software has become an important and useful tool!"*

**– Linda Kozlowski, President, Emergency Volunteer Corp of Nehalem Bay**

*"This app is great for homeowners on the coast as well as visitors who are planning trips. Knowing where you are in the tsunami zone means you will be better prepared should a tsunami occur. You can bookmark places and save or print a unique evacuation map centered on your home, workplace, hotel or even campsites. Users can then determine their nearest point of high ground outside the evacuation zone and develop a plan for how to get there."*

**– Jon Allan, Coastal Geomorphologist, Oregon Department of Geology and Mineral Industries**

## FISHERIES SCIENCE & COMMERCE

*"I just wanted to let everyone know that the real time data from the various buoys are incredibly helpful for those of us in the Marine Fish Science Unit at WDFW. We use this information to assist us with planning our field sampling on a daily and weekly basis; wind speeds and directions, as well as temperatures, help us determine the feasibility of our sampling routine. We hope this network stays funded to provide long-term data that we can use to help understand the dynamics of forage fish and their trophic interactions in the southern Salish Sea and beyond!"*

**– Todd Sandell, Senior Forage Fish Specialist, Washington Department of Fish and Wildlife**

*"I wanted to let you know that we started using the tuna fishers application again after a year away from fishing due to back surgery. I am so impressed with the improvements you have made since I used it last. Your team has made this a very solid and valuable tool for our tuna fishing business. Some of my favorite features are trip planning and creating routes; identifying sea surface temperatures — current and forecasted; combining chlorophyll locations with warm water currents; understanding current flow so I can estimate the direction and distance we will drift at night; and wave and wind forecasting. This application is helping us enjoy safer trips, find the fish easier and save on fuel usage. Thank you for the great job you're doing, we appreciate it very much."*

**– Gary and Julie Palmer, Fishing Oregon Podcast**

## RECREATION SAFETY

*"For Pacific Northwest boaters crossing the Strait of Juan de Fuca or the Strait of Georgia, real time data on wave heights, wind speeds, and other meteorological information can be invaluable. To time such passages optimally and safely requires a knowledge of the sea conditions actually present at the time of the decision to set sail. A VHF weather broadcast, which is hours old can be inadequate when compared to the immediacy of the data available through the NANOOS NVS system."*

**– Captain Lincoln Rutter, S/V Sejal**

*"The NANOOS surfer application provides the most comprehensive assemblage of ocean and coastal data on water quality, swell direction/height, winds, tides, and beach cameras that is currently available for the Pacific Northwest. Having access to these current conditions and forecasting models is crucial for decision making on where and when to recreate, which aids in trip planning and safe ocean enjoyment."*

**– Gus Gates, Washington Policy Manager, Surfrider Foundation**



[nanoos.org](http://nanoos.org)

IOOS in the Pacific Northwest



**IOOS**  
Integrated Ocean  
Observing System



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*Next 5-y FFO will post before our next meeting*

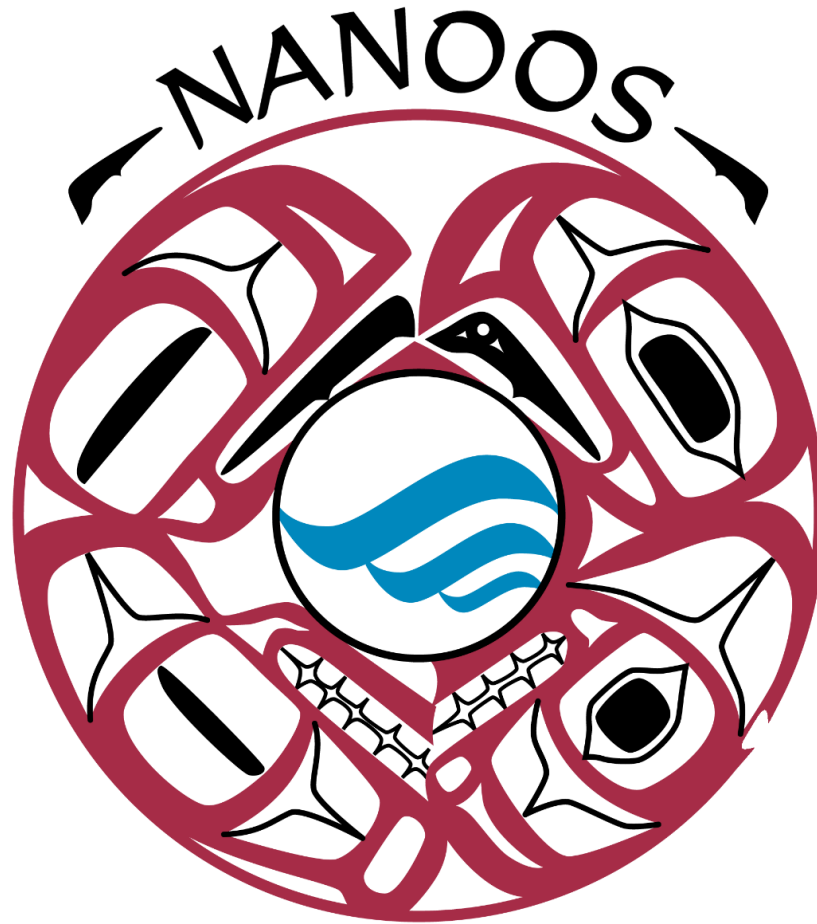
- What are your priority needs?
- What do you value: sustaining obs or new investments?
- What kind of products do you need?
  - For decision support, for prediction?
- Are there geographical priorities?



# NANOOS

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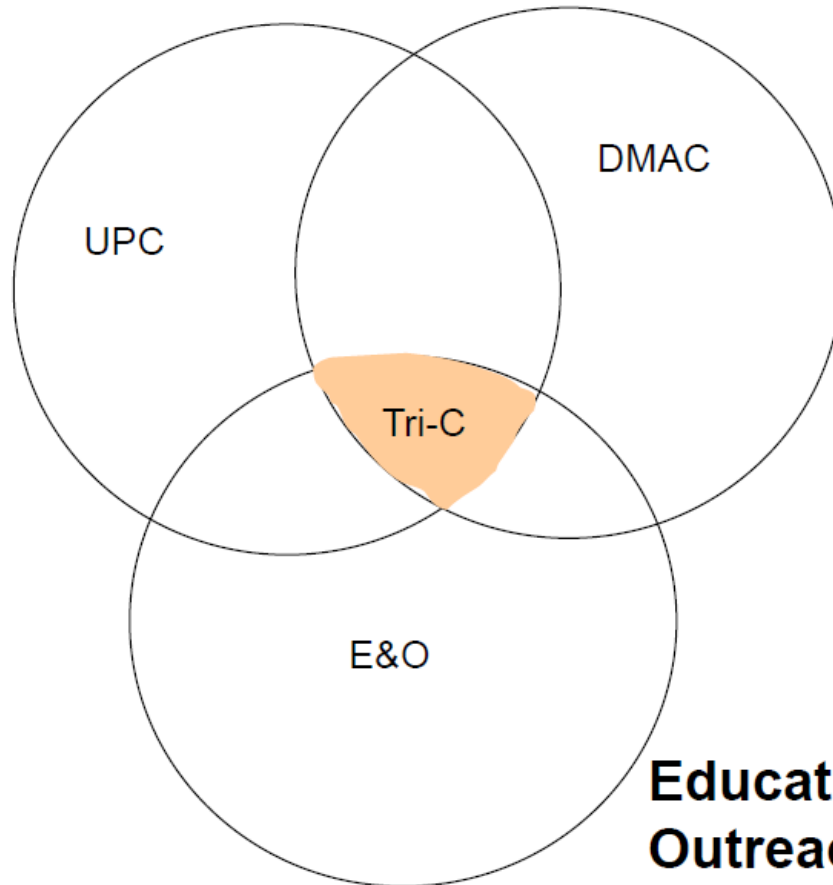
**THANK YOU !!!**





## 3. NANOOS Standing Committees reports

**User  
Products  
Committee**



**Data Management and  
Communication  
Committee**

**Education and  
Outreach Committee**



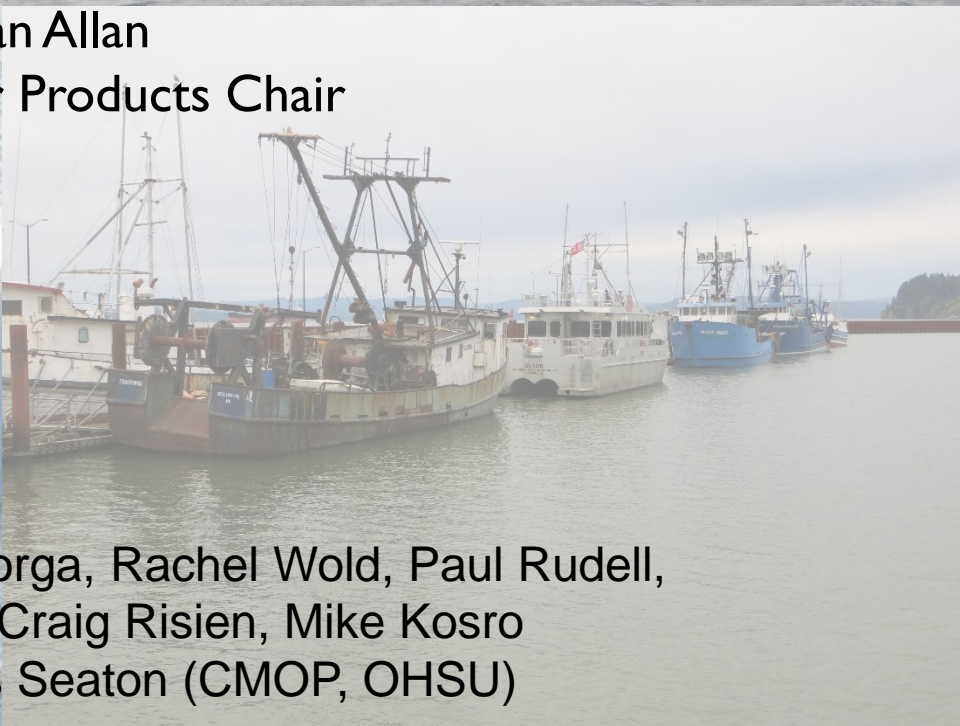
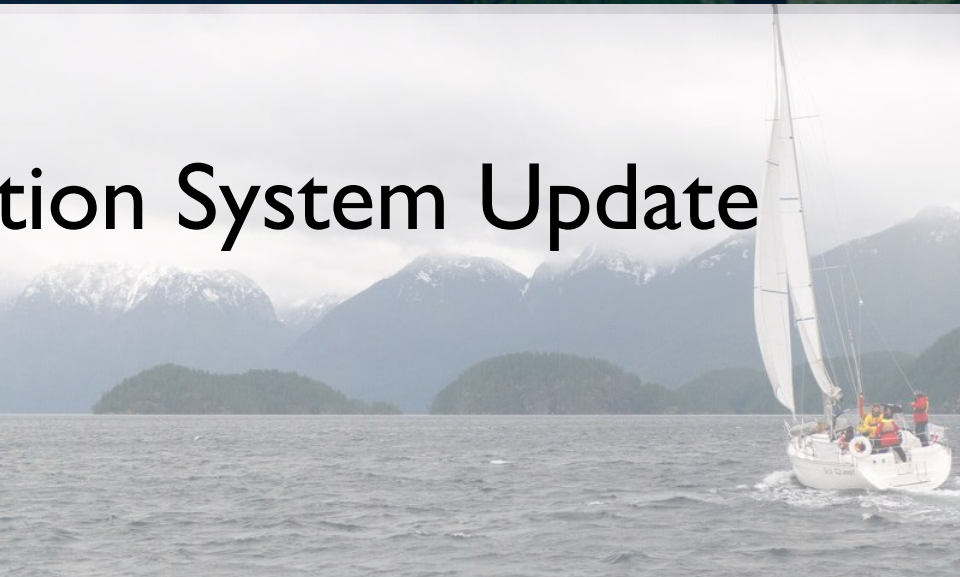
# NANOOS

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IOOS

## NANOOS Visualization System Update

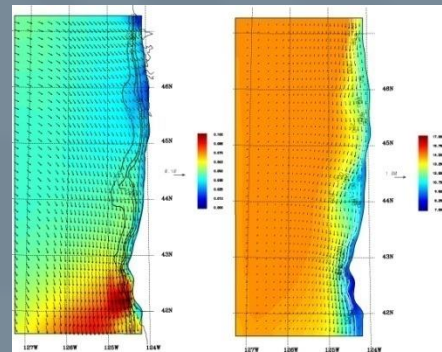
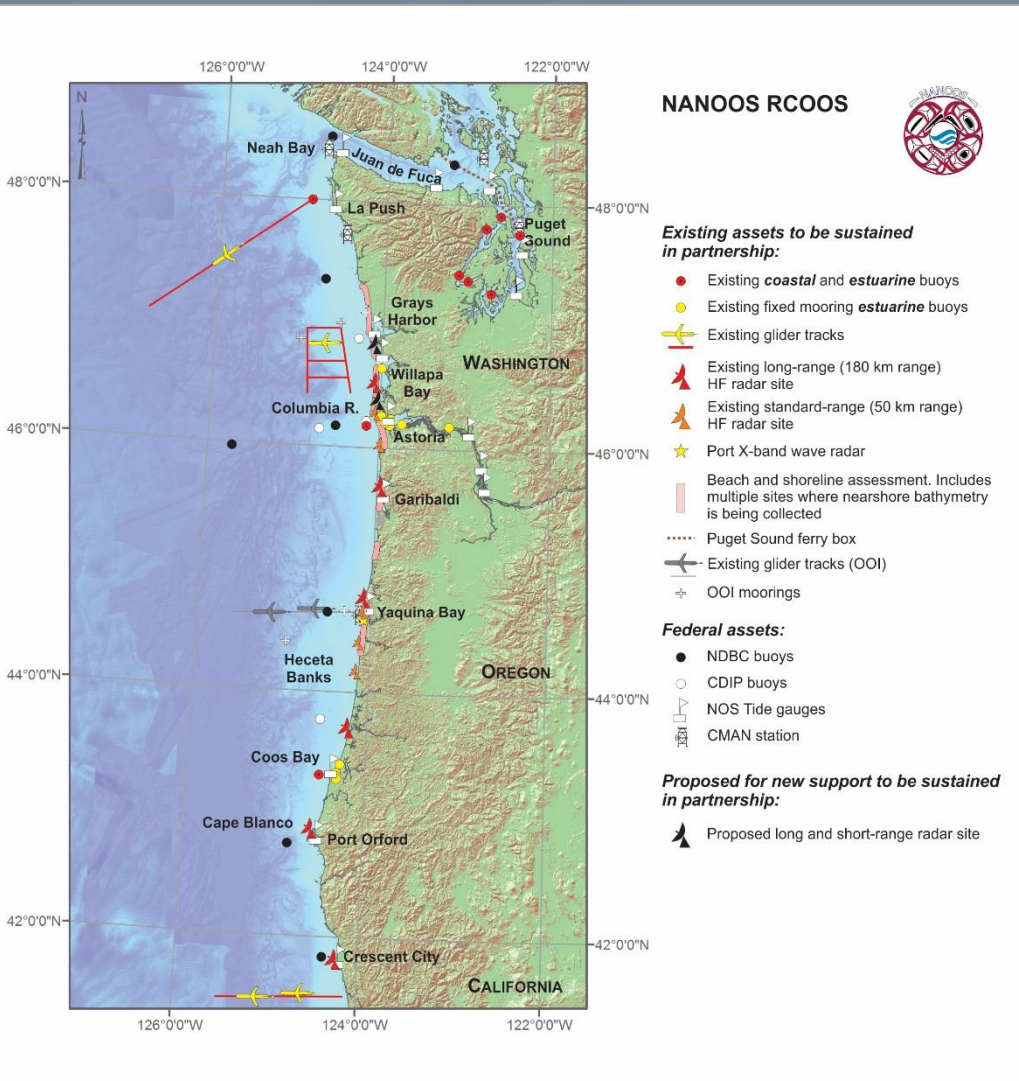


Jonathan Allan  
NANOOS User Products Chair

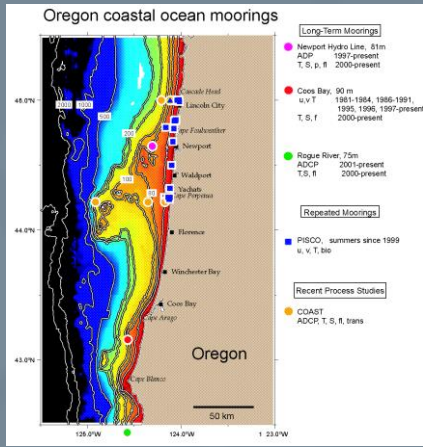
Team: Troy Tanner, Emilio Mayorga, Rachel Wold, Paul Rudell, Jan Newton (APL, UW); Craig Risien, Mike Kosro (CEOAS, OSU), Charles Seaton (CMOP, OHSU)



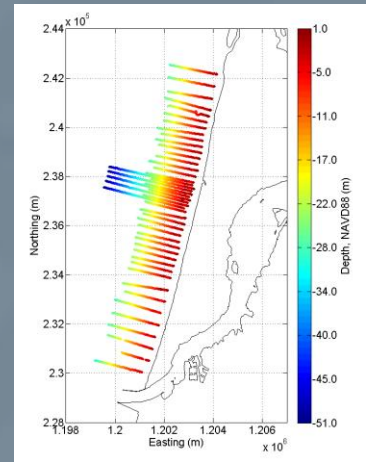
**Lots of data:** NANOOS provides access to 47 different types of variables, and in total ~234 'assets' & 12 model/forecast overlays.



Overlays (Satellite, Models, & other geospatial data)



Glidors



Shorelines & Bathymetry



# NANOOS

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Apps Settings Guide

NVS DATA EXPLORER

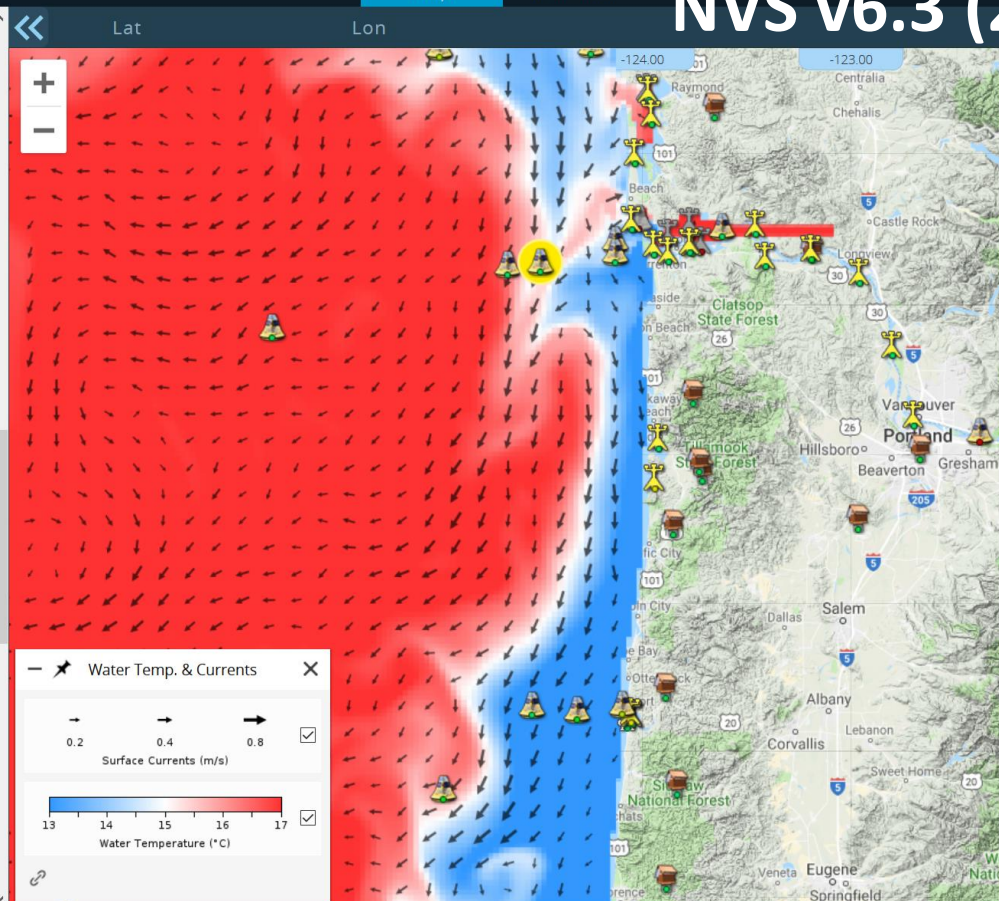
jcallean More

Map Asset List

## NVS v6.3 (2019)

Terrain Map

- Layers
  - Winds (Climate)
  - Winds (Anomaly)
  - Winds (Mean)
- OSU ROMS
  - Bottom Salinity
  - Bottom Temperature
  - Pycnocline
  - Salinity & Currents
  - Sea Surface Height (Anomaly)
  - Thermocline
  - Water Temp. & Currents
  - Water Temp. & Currents
- UBC SalishSeaCast
  - Nitrate Concentration
  - Salinity
  - Water Temperature
- WAVEWATCH III
  - Dom. Wave Period (Global)
  - Waves (Global)
  - Winds (Global)
  - Dom. Wave Period (USWC)



**NDBC 46029 - Columbia R Bar - 20NM W of Columbia R Mouth**

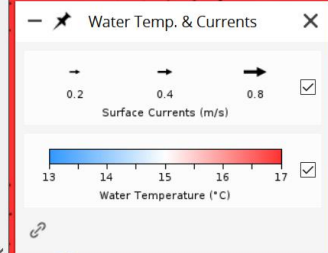
Observations Forecasts Comparator Details History

Data Updated: 29 Jul 2019 10:50 PDT Provider: NDBC

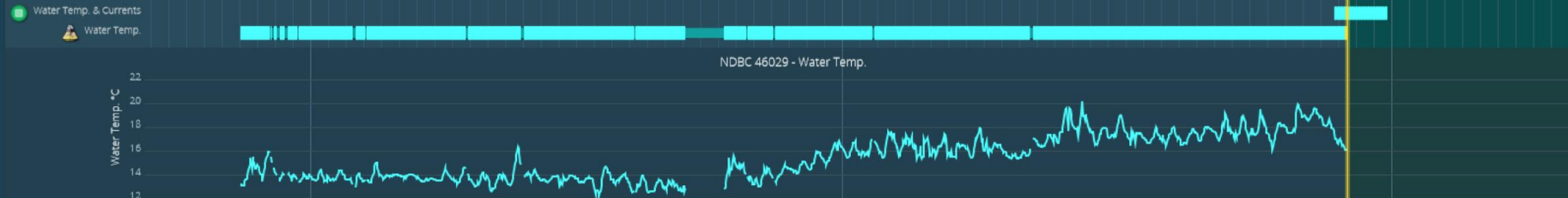
ATMOSPHERIC		
Air Temperature (4 m)	17 °C	
Baro. Pressure (0 m)	1,019.2 mbar	
Wind Direction (5 m)	330 deg (from)	
Wind Gust (5 m)	7.0 m/s	
Wind Speed (5 m)	6.0 m/s	

HYDROGRAPHIC		
Avg. Wave Period (0 m)	5.9 sec	
Dom. Wave Period (0 m)	8.0 sec	
Water Temperature (-0.6 m)	16.0 °C	
Wave Height (0 m)	1.4 m	
Wave Mean Dir. (0 m)	321 deg (from)	

[Link](#)



29 July 2019 11:00 am PDT





## NVS History and Status:

Oct 2014 – v3.8 – Climatology web app released

....

Jun 2017 - v. 4.0 iPhone/Android NVS rebuild released

....

Dec 2017 – v5.5 – Added map graticules (selectable);

May 2018 – v6.0 – Developed new web app for fishing community (**SEACAST**, *unplanned*). New UI released (simplified format).

Expanded Xtide to include Canadian tide stations (**Boaters**);

Jun 2017 – v6.1 – Added two new web apps: **BEACHVIEW & SURFERS**

July 2018 – Released Tsunami print-your-own brochure.

....

**smartphone**

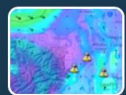
**January 2019 – v. 2.0 iPhone/Android TsunamiEvac released**

### **V6.2**

- Updated tsunami evacuation zones (Washington)
- Added ability to query overlay (model) data in Surfers App

### **V6.3**

- Improvements to timeline (able to plot timeseries for model outputs for any location in map)
- Added ability to query overlay (model) data in Boaters App (new overlays)



Data Explorer



Tsunami Evacuation Zones



Boaters



Tuna Fishers



Seacast



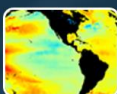
Surfers



Beach View



Shellfish Growers



Climatology



Beach and Shoreline Changes



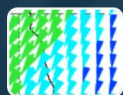
Maritime Operations



Cruises



Gliders



High Frequency Radar



Comment



Help

### ADDITIONS & UPDATES

View Last 3 Months



#### APL-UW Óhá?ba

Telemetry malfunctions will be investigated when a mooring visit can be arranged. Telemetry from PMEL sensors is operating normally.

Updated on 16 Jul 2019



#### UBC SalishSeaCast

Model upgraded to new version, v18-12, with improvements in the biology model including improved nitrate concentrations.

Updated on 3 Jul 2019



#### WADOH Oakland Bay

Sensors at new site were deployed for the season.

Updated on 3 Jul 2019



#### WADOH Kilisut Harbor

Sensors at new site were deployed for the season.

Added on 25 Jun 2019



#### WADOH Burley Lagoon

Sensors were redeployed or reactivated for the season.

Updated on 24 Jun 2019



#### WADOH Totten Inlet N

Sensors were redeployed or reactivated for the season.

Updated on 24 Jun 2019





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NORTHWEST ASSOCIATION OF NETWORKED OCEAN OBSERVING SYSTEMS



IOOS

Apps Settings Guide

NVS BOATERS

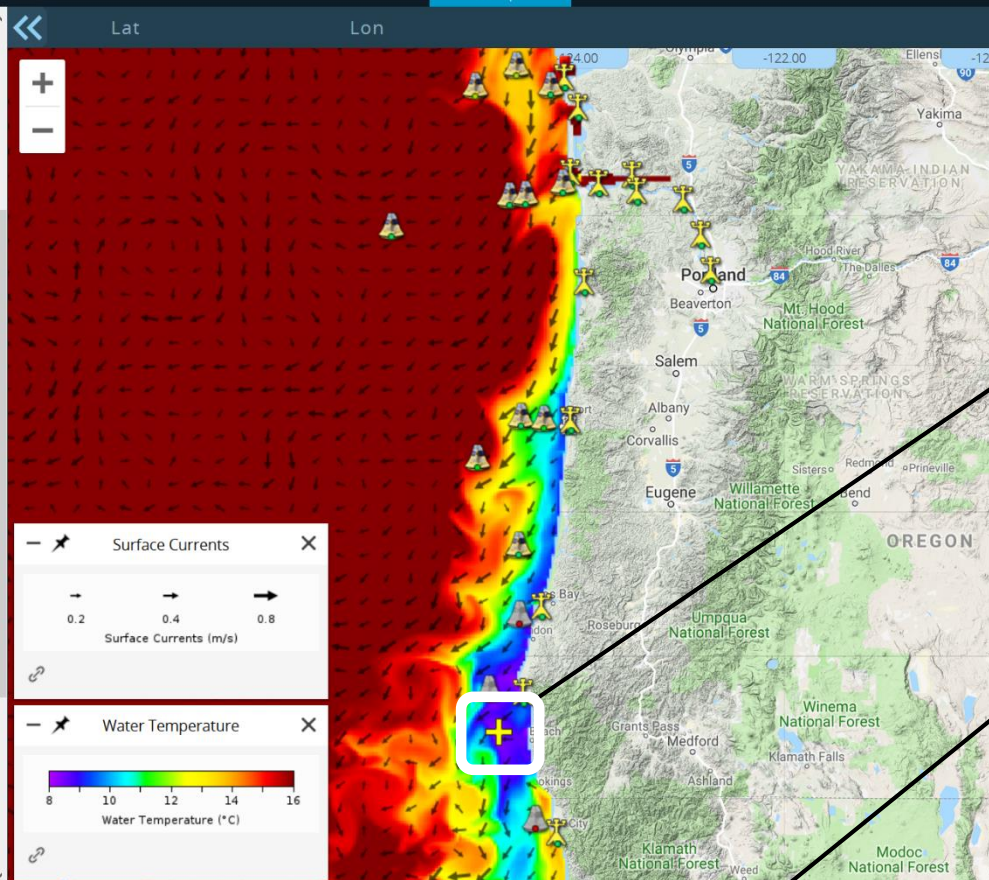
jcallan

More

NANOOS

Map

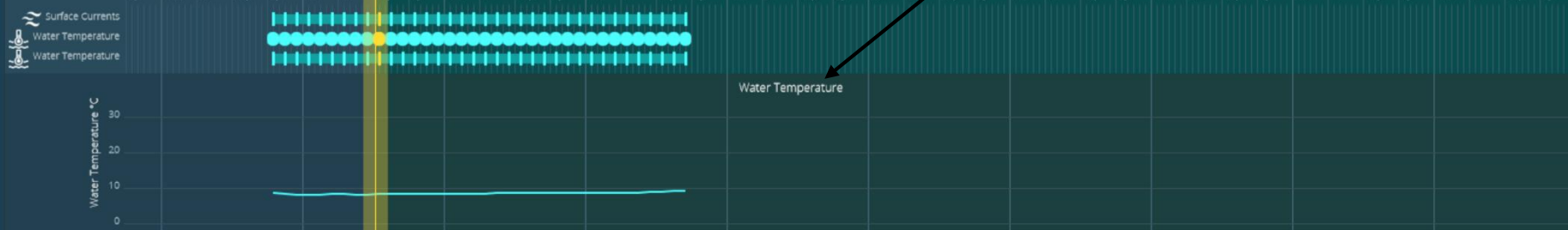
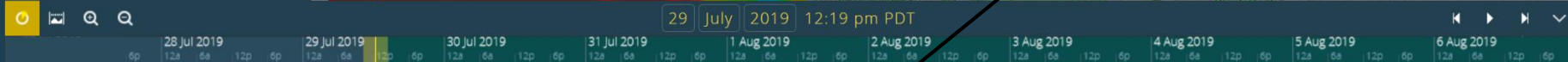
- Tides
- Current Conditions
  - Air Temperature
  - Barometric Pressure
  - Water Temperature (Surface)
  - Waves
  - Winds
- Forecast Arrows
  - Winds
  - Surface Currents
  - Combined Wave Direction
- Forecast Overlays
  - Air Temperature
  - Air Visibility
  - Barometric Pressure
  - Water Temperature
  - Wind Speed
  - Wind Gust
  - Combined Wave Height



Lat 42.4600 Lon -124.7424

29 July 2019 12:19 pm

Winds	from N at 9.8 m/s
Surface Currents	from ENE at 0.3 m/s
Combined Wave Direction	NW 325 deg (from)
Air Temperature	16 °C
Air Visibility	24 km
Barometric Pressure	1,017.2 mbar
Water Temperature	8.2 °C
Wind Speed	9.8 m/s
Wind Gust	15 m/s
Combined Wave Height	1.5 m





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NANOOS

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NVS BOATERS

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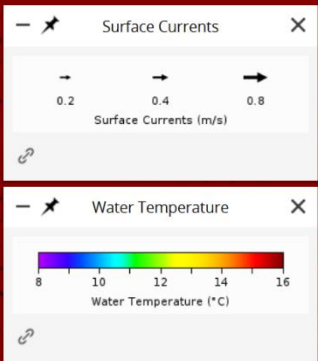
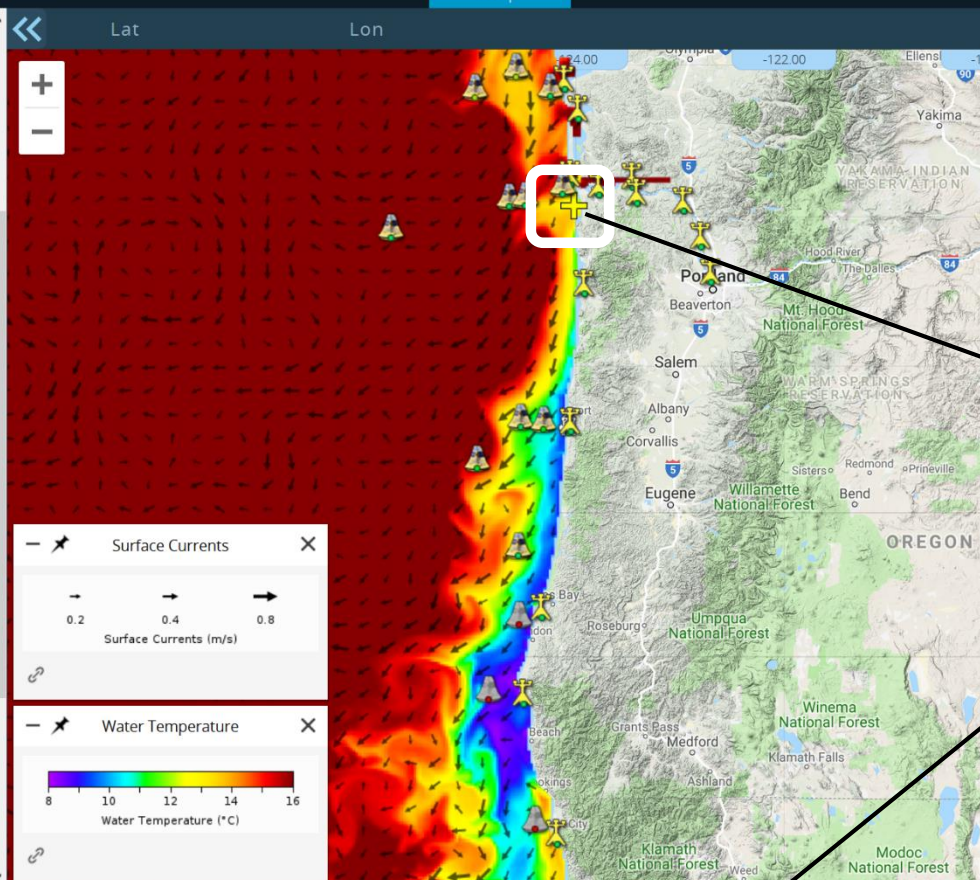
More

Map

Terrain Map

- Layers
- Platforms
- Routes
- Markers
- Legend

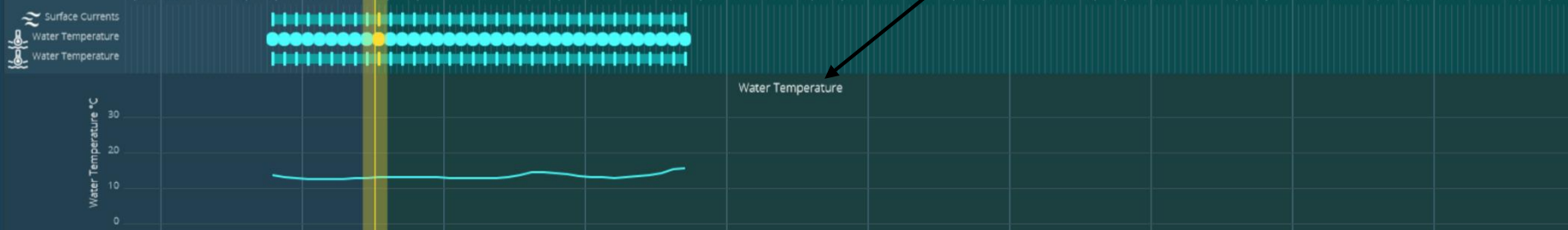
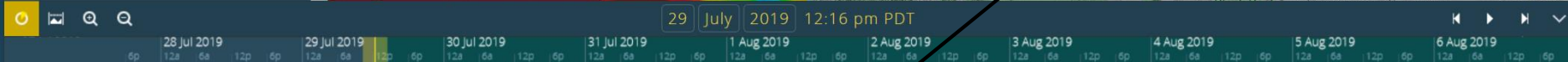
- Tides
- Current Conditions
  - Air Temperature
  - Barometric Pressure
  - Water Temperature (Surface)
  - Waves
  - Winds
- Forecast Arrows
  - Winds
  - Surface Currents
  - Combined Wave Direction
- Forecast Overlays
  - Air Temperature
  - Air Visibility
  - Barometric Pressure
  - Water Temperature
  - Wind Speed
  - Wind Gust
  - Combined Wave Height



Lat 46.0695 Lon -124.0173

Prev 29 July 2019 12:16 pm Next

Winds	from NNW at 4.9 m/s
Surface Currents	from SE at 0.0 m/s
Combined Wave Direction	WNW 298 deg (from)
Air Temperature	17 °C
Air Visibility	24 km
Barometric Pressure	1,018.1 mbar
Water Temperature	13.0 °C
Wind Speed	4.9 m/s
Wind Gust	6.2 m/s
Combined Wave Height	1.2 m







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Apps Settings Guide

NVS SURFERS

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NANOOS

### Layers

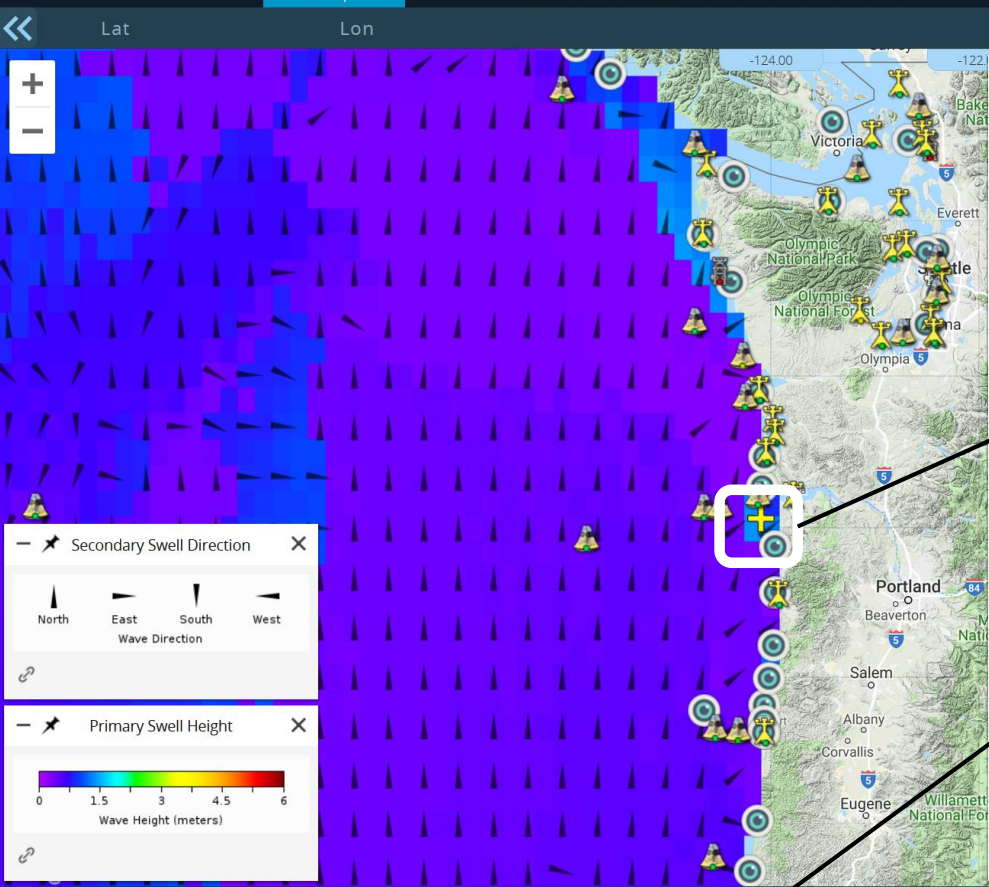
- Lat / Lon Lines
- NOAA Nautical Charts
- Platforms
- Live Webcams
- Surfrider Water Quality
- NOAA Tide Tables

### Current Conditions

- Air Temperature
- Water Temperature (Surface)
- Waves
- Winds

### Forecast Arrows

- Combined Wave Direction
- Primary Swell Direction
- Secondary Swell Direction
- Wind Wave Direction
- Winds
- Surface Currents



Secondary Swell Direction

North East South West  
Wave Direction

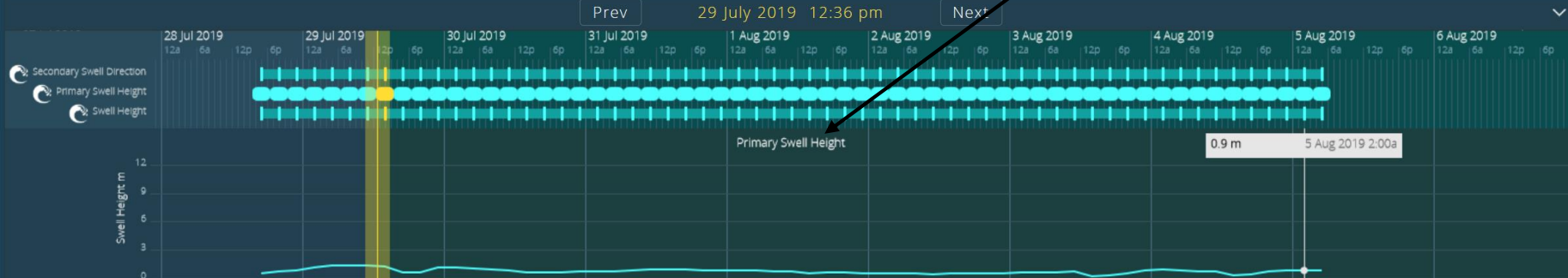
Primary Swell Height

0 1.5 3 4.5 6  
Wave Height (meters)

Lat 46.0616 Lon -124.0917

29 July 2019 12:36 pm

Combined Wave Direction	NW 305 deg (from)
Primary Swell Direction	NW 306 deg (from)
Secondary Swell Direction	WSW 256 deg (from)
Wind Wave Direction	--- deg (from)
Winds	from NNW at 5.4 m/s
Surface Currents	from N at 0.1 m/s
Combined Wave Height	1.4 m
Wave Period	7.4 sec
Primary Swell Height	1.3 m
Primary Swell Period	7.3 sec
Secondary Swell Height	0.3 m
Secondary Swell Period	11 sec
Wind Wave Height	--- m
Wind Wave Period	--- sec
Water Temperature	13.2 °C
Wind Speed	5.4 m/s





# NANOOS

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Apps Settings Guide

NVS SURFERS

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NANOOS

**Layers**

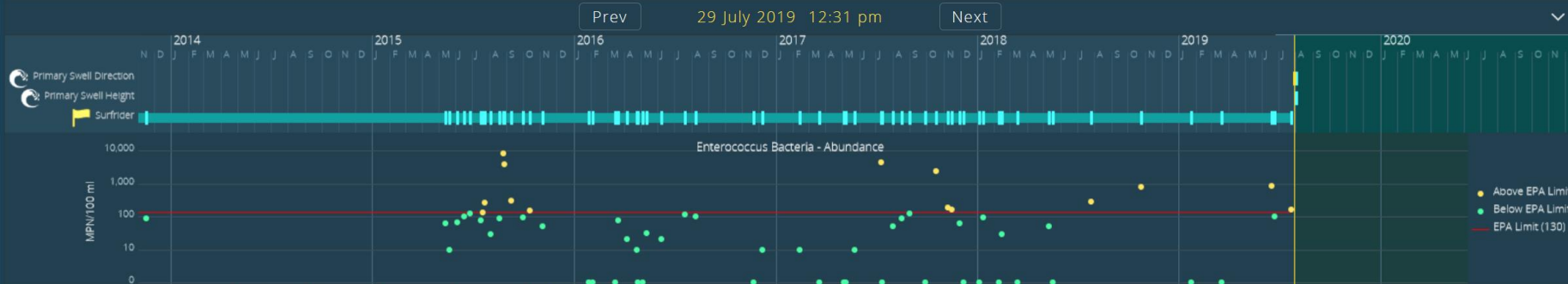
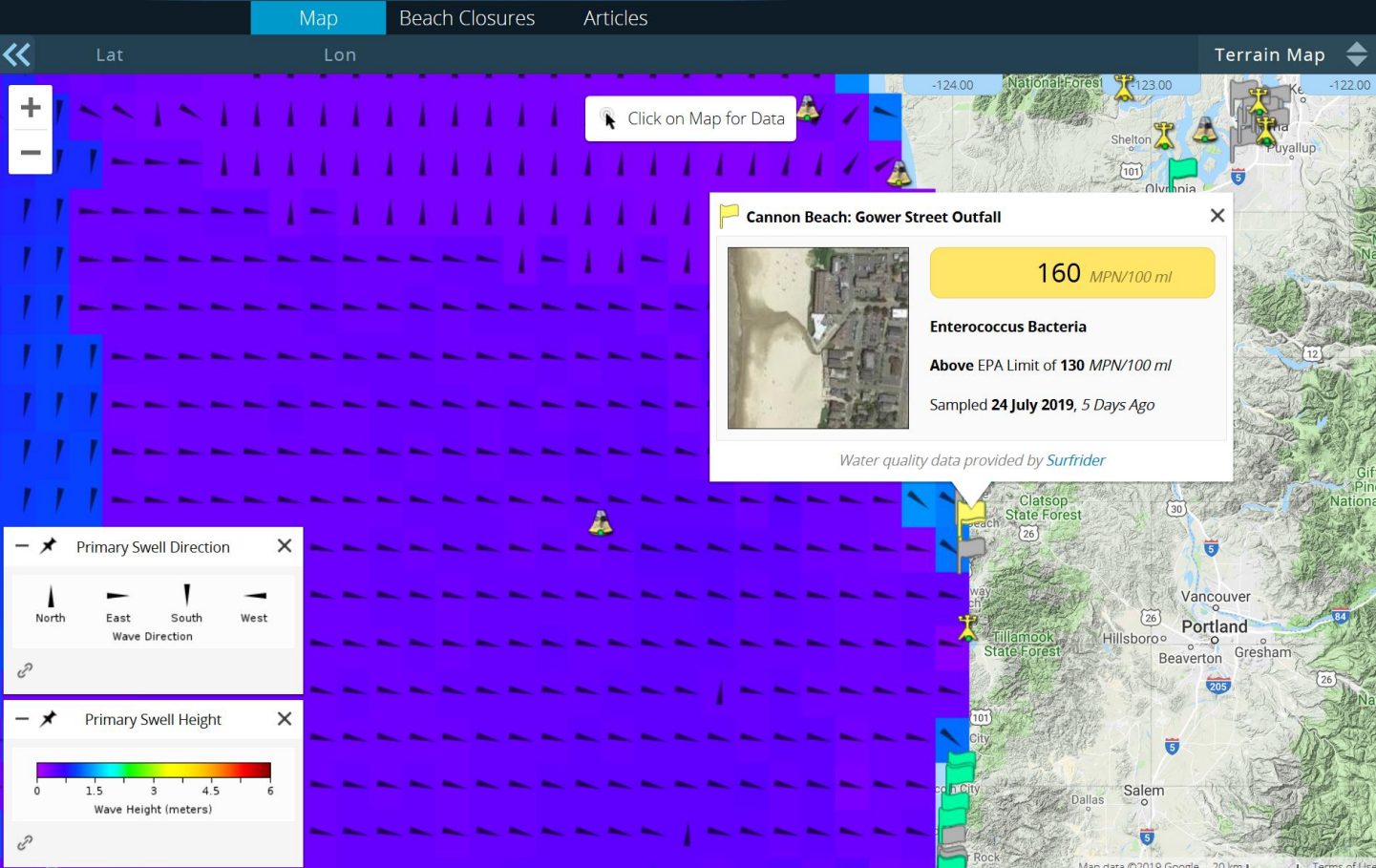
- Lat / Lon Lines
- NOAA Nautical Charts
- Live Webcams
- Surfrider Water Quality**
- NOAA Tide Tables

**Current Conditions**

- Air Temperature
- Water Temperature (Surface)
- Waves
- Winds

**Forecast Arrows**

- Combined Wave Direction
- Primary Swell Direction
- Secondary Swell Direction
- Wind Wave Direction
- Winds
- Surface Currents



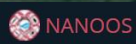


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Apps Settings Guide

NVS TSUNAMI EVACUATION ZONES

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More

Map Brochures About Warnings Planning

**Places**  
Show Places On Map

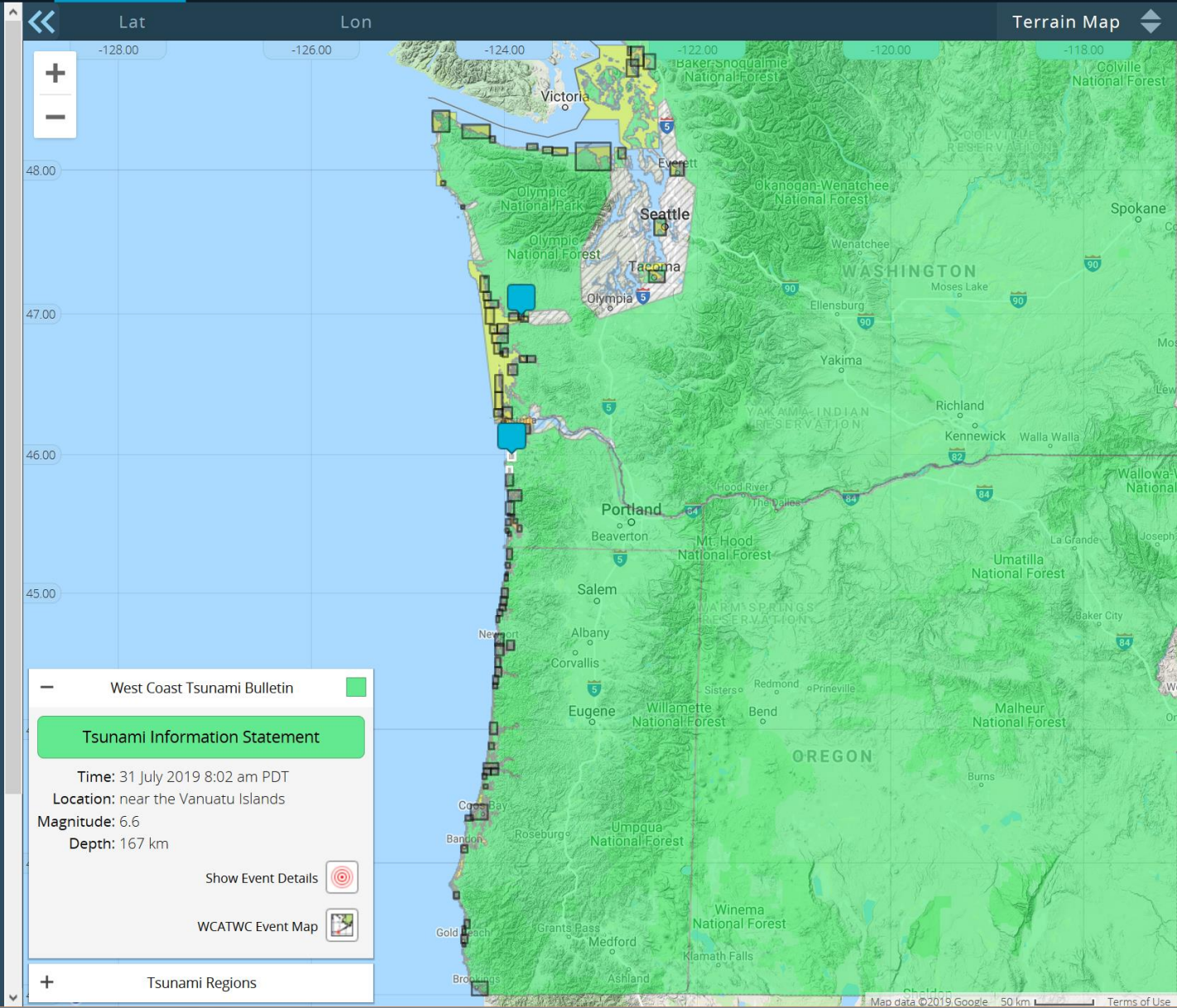
Enter Address  Click on Map

**Your Places**

- Edit Places
- Aberdeen
- Seaside

**Markers**  
Show Markers On Map

- Airport 7
- Assembly Area 367
- Beach Access 643
- Bridge 457
- City Hall 9
- Coast Guard 8
- Evacuation Shelter 4
- Fire Station 144
- Generic 4
- Hospital 30
- Law Enforcement 59
- Lighthouse 3





Layers

Markers

Regions

Legend

### Places

Show Places On Map

Enter Address

Click on Map

Get Location

### Your Places

Edit Places

Aberdeen

Seaside

### Markers

Show Markers On Map

Airport 7

Assembly Area 367

Beach Access 643

Bridge 457

City Hall 9

Coast Guard 8

Evacuation Shelter 4

Fire Station 144

Generic 4

Hospital 30

Law Enforcement 59

Lighthouse 3

Lat Lon

Zoom controls (+, -)

#### Tsunami Information Statement

Event Overview WCATWC

**An earthquake has occurred, but does not pose a tsunami threat.**

**Time:** 31 July 2019 8:02 am PDT

**Magnitude:** 6.6 **Depth:** 167 km

**Location:** near the Vanuatu Islands

**Latitude:** -16.2000 **Longitude:** 167.9000

\* There is no tsunami danger for the U.S. West Coast, British Columbia, or Alaska. \* Based on the depth of the earthquake, a tsunami is not expected.  
 \* This will be the only U.S. National Tsunami Warning Center message for this event unless additional information becomes available. Refer to the internet site tsunami.gov for more information.

#### West Coast Tsunami Bulletin

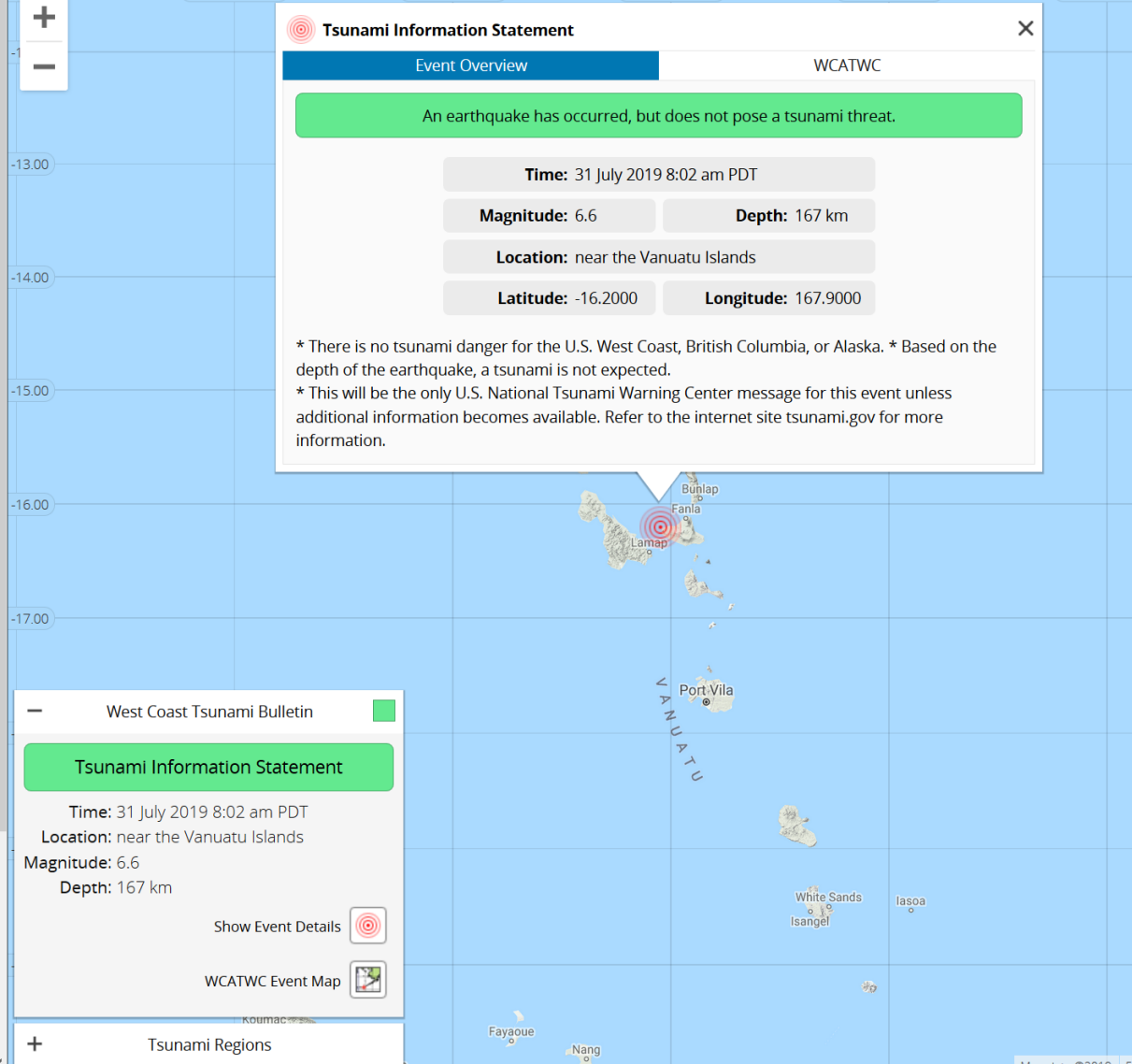
**Tsunami Information Statement**

**Time:** 31 July 2019 8:02 am PDT  
**Location:** near the Vanuatu Islands  
**Magnitude:** 6.6  
**Depth:** 167 km

Show Event Details

WCATWC Event Map

Tsunami Regions



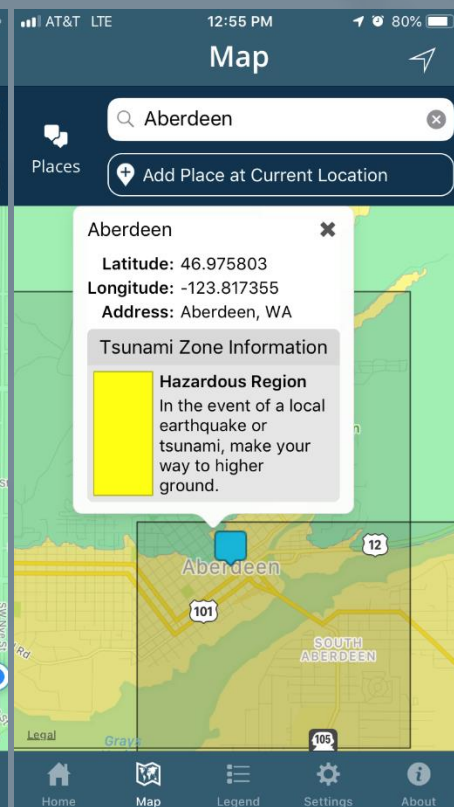
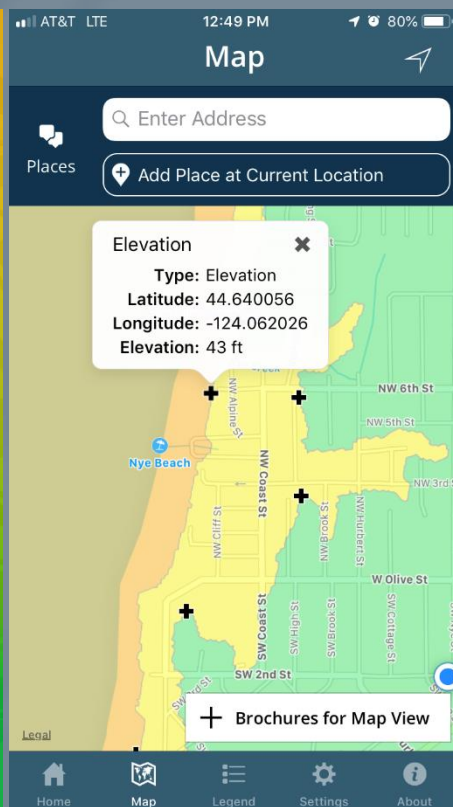
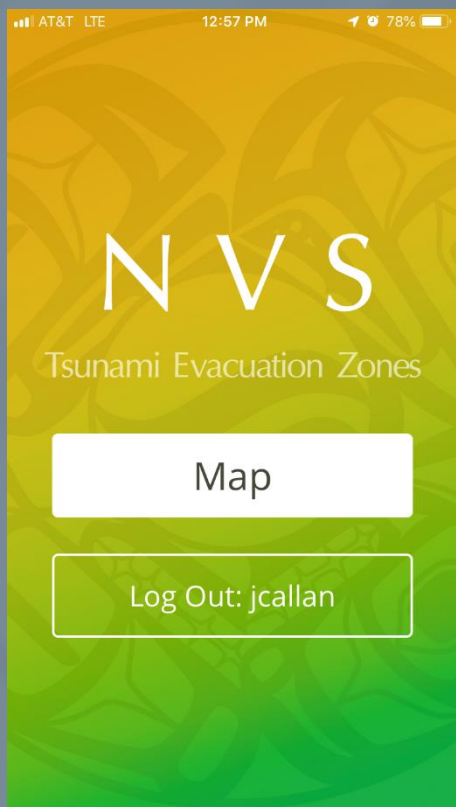


# NANOOS

NORTHWEST ASSOCIATION OF NETWORKED OCEAN OBSERVING SYSTEMS



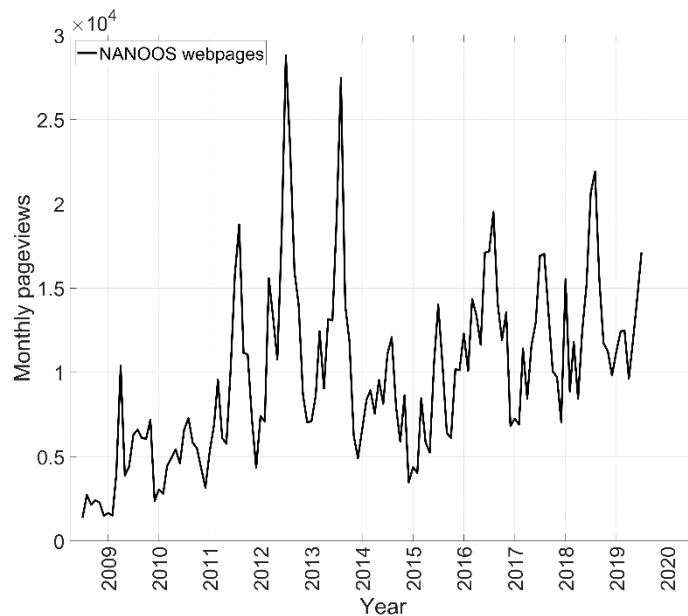
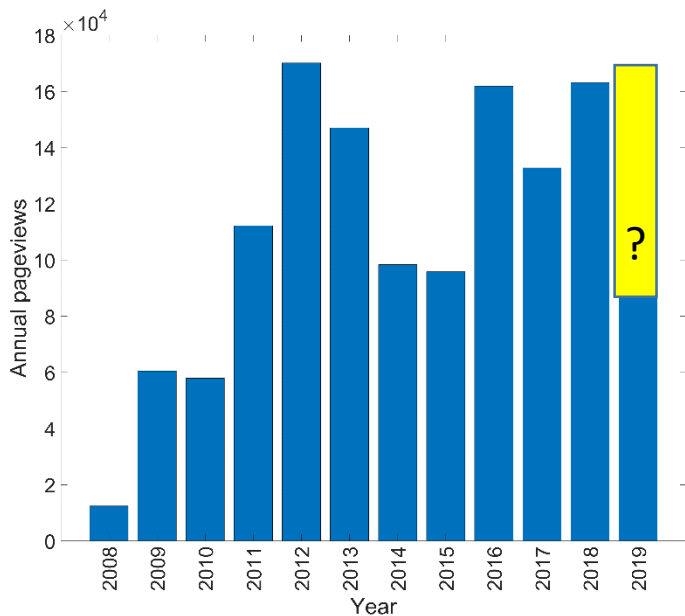
## Mobile Phone App NVS-TsunamiEvac (Released Jan 2019)



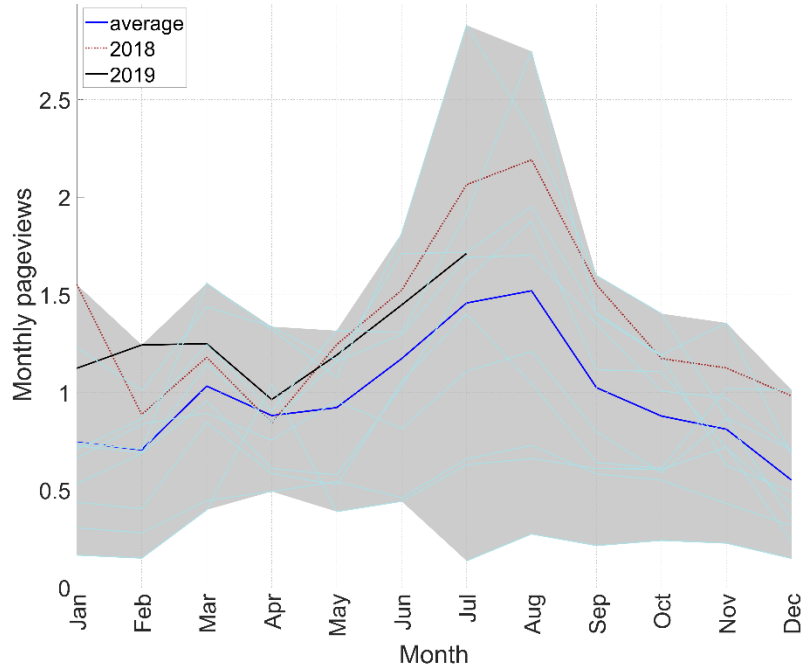


# NANOOS

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How are we doing?



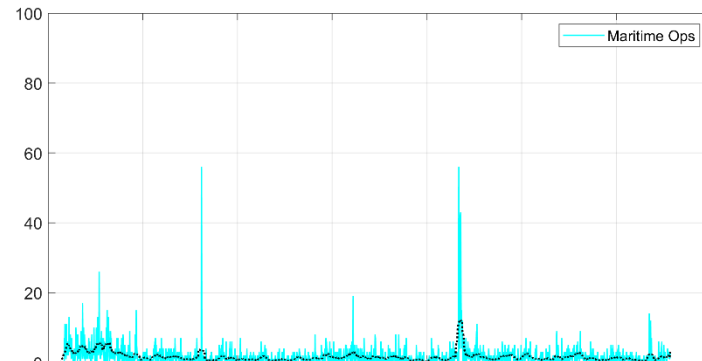
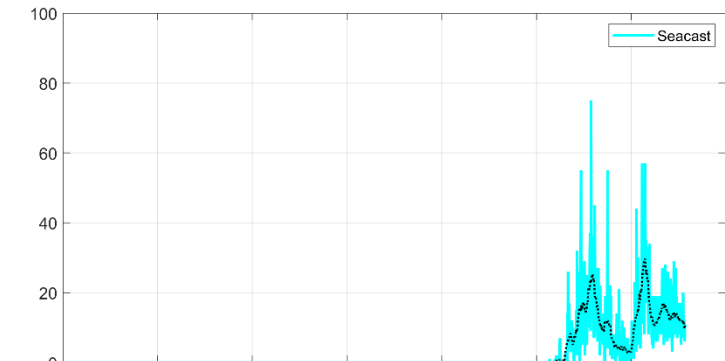
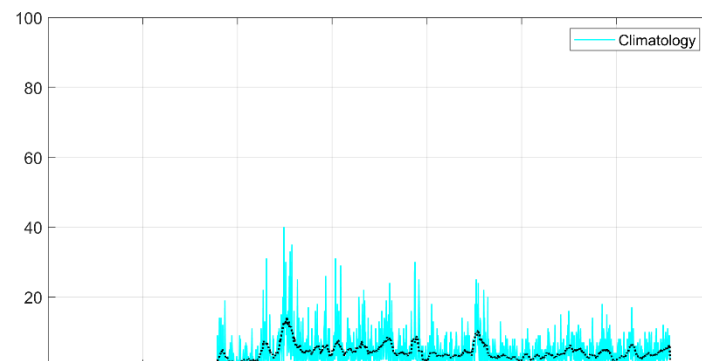
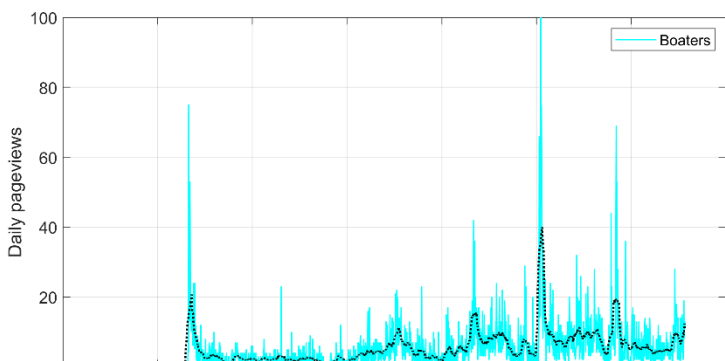
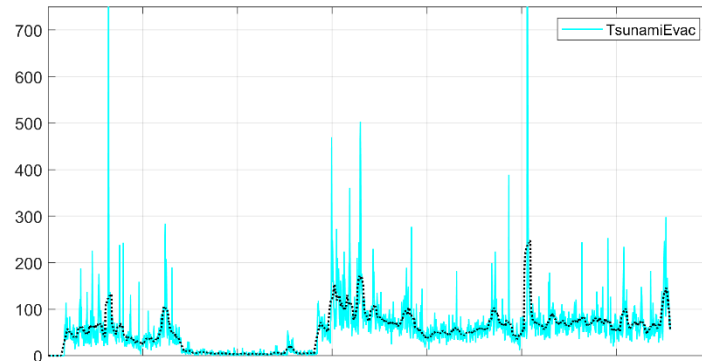
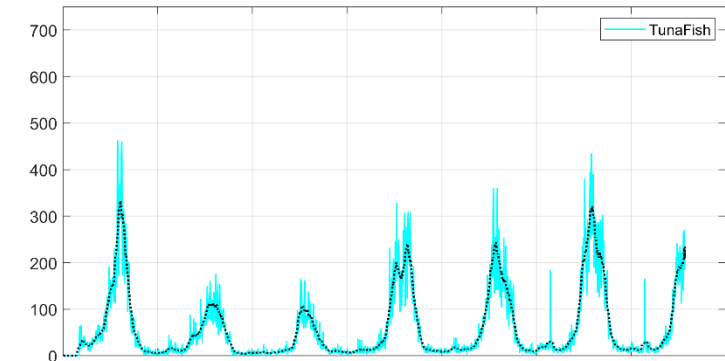


Web App/Asset	Pageviews	%	Page time
/TsunamiEvac	132,990	25.7	0:04:54
/TunaFish	140,332	27.1	0:05:47
/Explorer	65,843	12.7	0:04:38
/Boaters	11,031	2.1	0:03:53
/Explorer NWIC Bellingham Bay	10,464	2.0	0:05:43
/Climatology	7,480	1.4	0:03:50
/ShellfishGrowers	6,870	1.3	0:03:56
/Seacast	5,757	1.1	0:03:41
/BeachMapping	4,352	0.8	0:03:06
/MaritimeOps	3,995	0.8	0:02:42
/Explorer HMSC Newport	2,818	0.5	0:04:19
/CruisePrism	2,455	0.5	0:04:31
/HFRadar	2,351	0.5	0:01:32
/GliderLaPush	1,861	0.4	0:02:21
/Surfers	1,522	0.3	0:03:07
/CruiseSalish	1,291	0.2	0:04:58
/BeachView	1,225	0.2	0:03:02
NVS app landing page	108,069	20.9	0:00:28
LogIn, Settings, Disclaimer, ContactUs	6,986	1.3	0:00:37
	517,692		0:02:37



# NANOOS

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Year

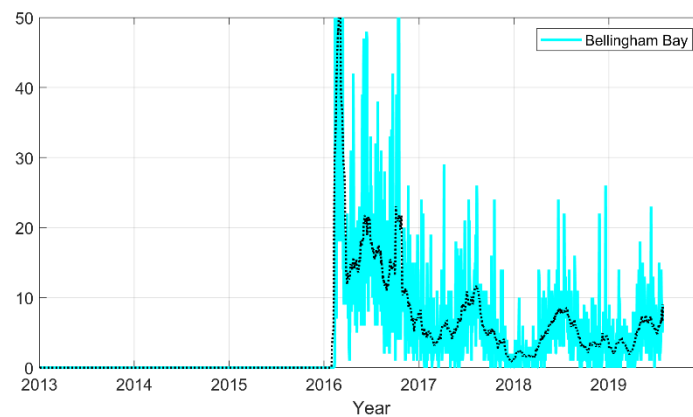
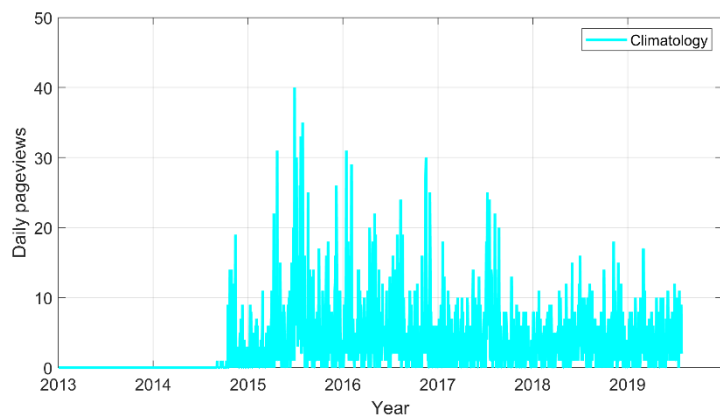
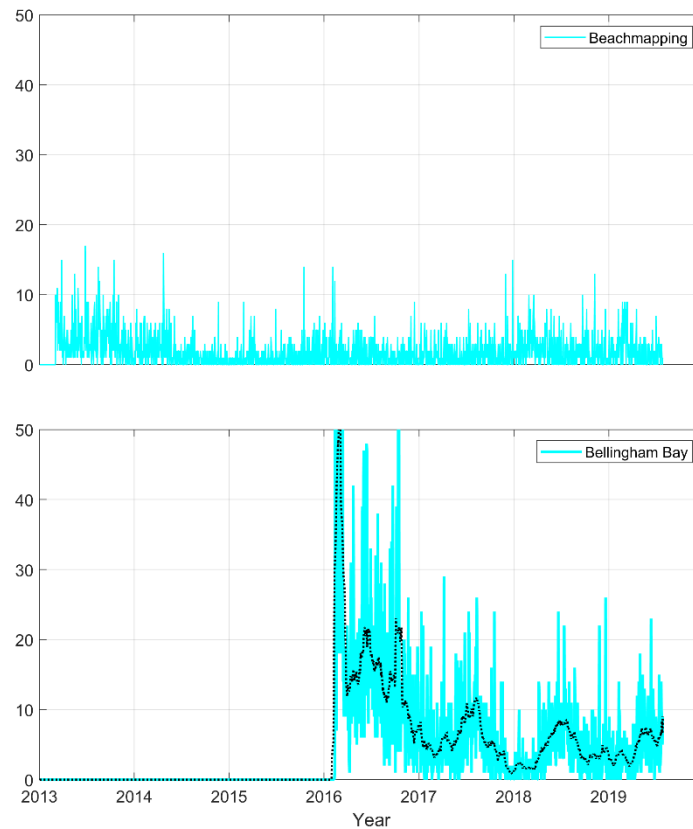
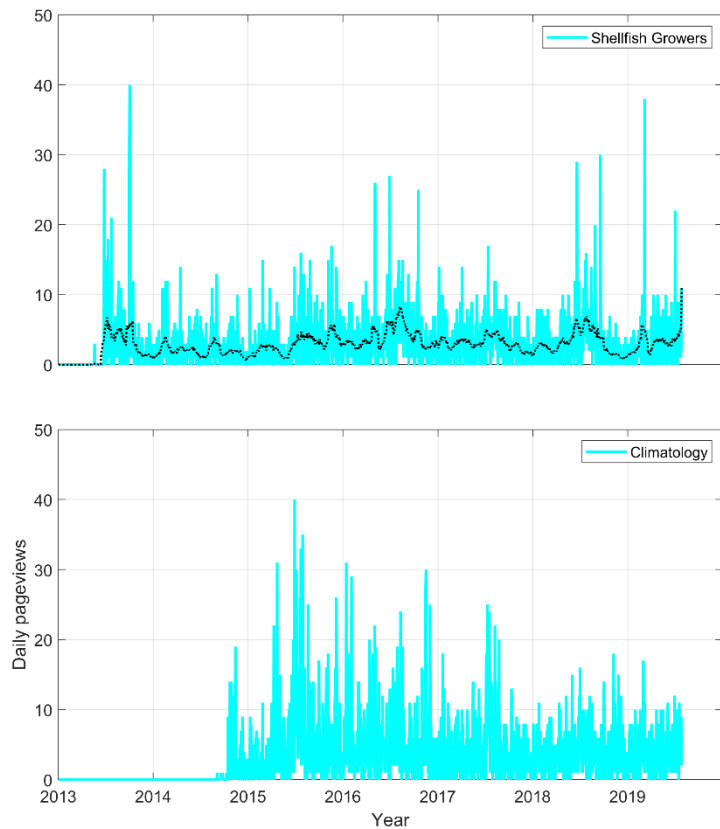
Year





# NANOOS

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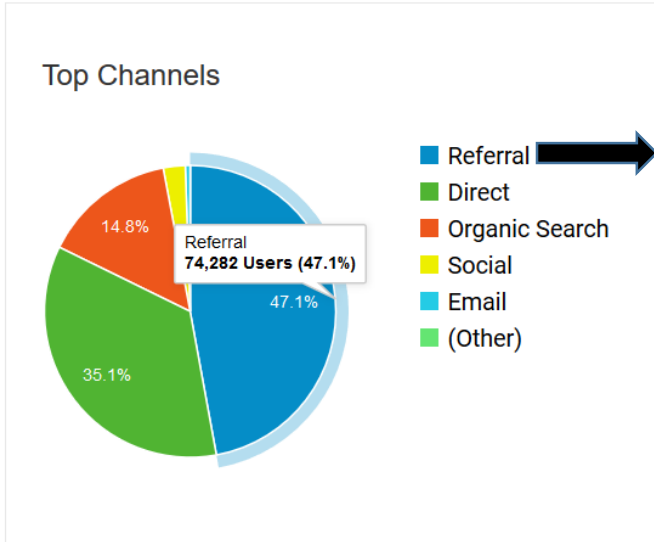




- Home
- Customization
- REPORTS
  - Realtime
  - Audience
  - Acquisition
    - Overview
    - All Traffic
    - Google Ads
    - Search Console
    - Social
    - Campaigns
  - Behavior

All Users  
100.00% Users

Primary Dimension: **Top Channels** Conversion: **All Goals**



1. oregongeology.org	24,737 (32.65%)
2. nanoos.org	22,179 (29.27%)
3. newyorker.com	7,410 (9.78%)
4. coosbay.org	1,863 (2.46%)
5. oregon.gov	1,276 (1.68%)
6. goldbeachoregon.gov	936 (1.24%)
7. hmsc.oregonstate.edu	914 (1.21%)
8. dnr.wa.gov	823 (1.09%)
9. thesweethome.com	766 (1.01%)
10. ifish.net	607 (0.80%)
11. amigocharters.com	588 (0.78%)
12. boatingcenter.org	572 (0.75%)
13. thecityofnewport.net	524 (0.69%)
14. newportoregon.gov	495 (0.65%)
15. cityofseaside.us	437 (0.58%)
16. threesheetsnw.com	437 (0.58%)
17. bdoutdoors.com	402 (0.53%)
18. oregongeology.com	399 (0.53%)
19. katu.com	377 (0.50%)
20. agate.coas.oregonstate.edu	303 (0.40%)
21. co.curry.or.us	287 (0.38%)
22. tsunamizone.org	282 (0.37%)
23. bis_portal.apl.washington.edu	257 (0.34%)
24. faculty.washington.edu	246 (0.32%)
25. social-buttons.com	242 (0.32%)

# How are people getting to NVS?

Direct = bookmarks/direct URLs; Referrals = from other sites

# How do we capture public interest?



Focus for next 12 months:

- 1) Particle Tracking (testing with CMOP data)
- 2) Dynamic Plotting (Climatology app)
- 3) Cross-section tool
  
- 4) Alerting capability (TsunamiEvac smartphone app,... coming very soon)



# NANOOS

NORTHWEST ASSOCIATION OF NETWORKED OCEAN OBSERVING SYSTEMS



Apps Settings Guide NVS More NANOOS

Map Asset List Terrain Map

### Particle Tracking

Cancel New Track

Particle Track 1

Color █

Model CMAP f33 Forecast

Number of Particles 10

Shape Circle

Size

Location

Direction Forward

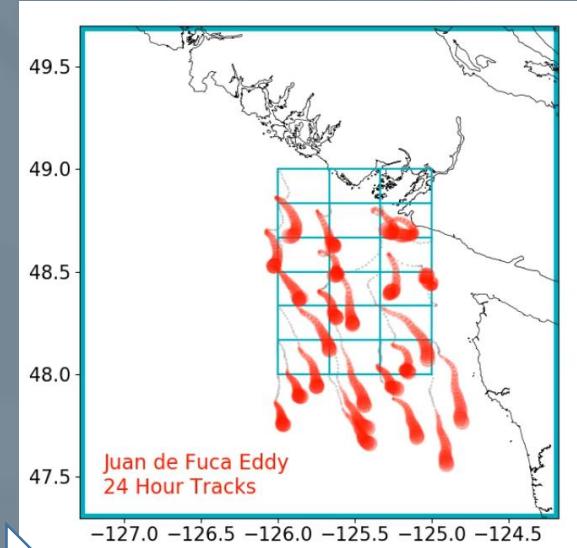
Start Time 29 July 2019 2:00 pm

Duration 12 Hours

End Time 30 July 2019 2:00 am

Create Particle Track

New Particle Track  
Click within the green region on the map to create an initial particle area.



Apps Settings Guide NVS More NANOOS

Map Asset List Terrain Map

### Particle Tracking

Cancel New Track

Particle Track 1

Color █

Model CMAP f33 Forecast

Number of Particles 10

Shape Circle

Size 1,848 ft

Location Lat 46.2696 Lon -123.6807

Direction Forward

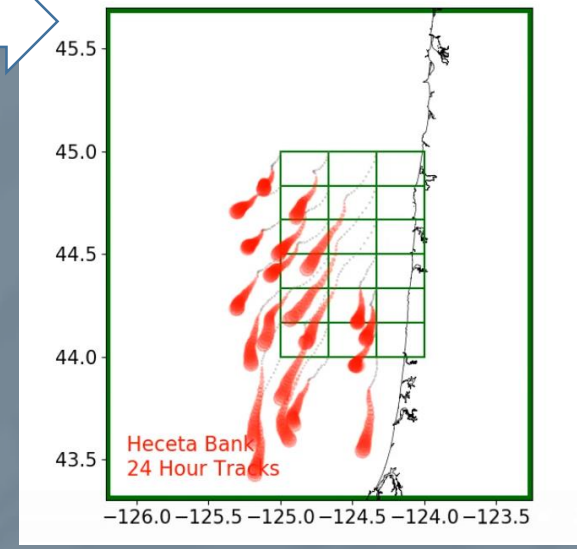
Start Time 29 July 2019 2:00 pm

Duration 12 Hours

End Time 30 July 2019 2:00 am

Building Time Remaining: 2 Seconds

New Particle Track  
Click and drag on the shape to move.  
Click and drag on the shape edge points to resize.



LiveOcean Particle Tracking



# NANOOS

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## Questions?





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# NANOOS

## Data Management and Communications (DMAC)

presentation to NANOOS Principal Investigators & Governing Council  
August 1, 2019

NANOOS DMAC chair:  
Emilio Mayorga –  
UW-APL



## NANOOS DMAC Focus Team:

Emilio Mayorga – UW/APL, Chair

Craig Risien – OSU

Charles Seaton – OHSU/CMOP

*Part of broader DMAC-UPC-Web-Outreach team. But with focused interactions to give sustained attention to “low-level” DMAC issues and IOOS DMAC compliance.*

Also: Alex Dioso, Troy Tanner (UW/APL); Jon Allan (DOGAMI)



## NVS: New or Enhanced Assets

<http://nvs.nanoos.org/AssetHistory>

### 1. In-situ fixed

- a. New OSU Yaquina Bay sensors, serving crab
- b. New Hakai Institute Kwakshua OA mooring, Queen Charlotte Sound, BC
- c. WADOH seasonal monitoring network: renewed engagement, new Kilisut Harbor site
- d. CB-06 ADCP integration and visualization
- e. Overhauling OOI mooring data ingest, enabling data from more sensors

### 2. Models

- a. UBC SalishSeaCast nowcast model: nitrate, new model versions
- b. UW LiveOcean: New model versions; handling substantial upgrades (challenges from larger data); higher resolution, extended domain

### 3. Gliders

- a. NVS Glider Apps. La Push: Updated plots and added optical sensors. Trinidad Head: updates now being released monthly
- b. Working on OOI gliders, to create NVS Glider Apps





## NANOOS Data Management Plan (NANOOS DMP)

### Table of Contents

A. Background.....	1
B. Roles and Responsibilities.....	3
C. Implementation of Data Management Protocols.....	4
D. Computing Infrastructure.....	4
E. Data Streams.....	5
E.1 NANOOS (Internal) Data Streams.....	7
* Surface Currents and Waves.....	9
* Fixed-location Sensor Platforms.....	9
* Gliders and Ferries.....	11
* Beach and Shoreline Observations.....	13
E.2 External Data Streams.....	13
F. Web Portal and User Applications.....	16
G. References.....	19

[http://www.nanoos.org/about\\_nanoos/certification.php](http://www.nanoos.org/about_nanoos/certification.php)

One year ago.

Certification does NOT cover models.

### Scope:

- NANOOS supported observation assets
- Local/regional “external” observation assets integrated by NANOOS (mainly in situ, fixed-location)



### NANOOS Data Management Plan (NANOOS DMP)

#### Table of Contents

A. Background...	<b>Data Management Plan</b>	DMP Template v2.0.1 (2015-01-01)
B. Role		
C. Impl		
D. Con		
E. Data		
E.1		
*		
*		
*		
*		
E.2		
F. Web Portal and	<a href="http://www.nanoos.org/about_nanoos/certification.php">http://www.nanoos.org/about_nanoos/certification.php</a>	
G. References....	<a href="http://www.nanoos.org/documents/certification/NANOOS_DMP.pdf">http://www.nanoos.org/documents/certification/NANOOS_DMP.pdf</a> (Hereon referred to as the <i>Certification NANOOS DMP</i> )	
	<a href="http://www.nanoos.org/documents/certification/DMP/NANOOSAssetInventory.pdf">http://www.nanoos.org/documents/certification/DMP/NANOOSAssetInventory.pdf</a>	

**Another NANOOS DMP Submitted July 1, in fulfillment of NOAA Data Management Planning Procedural Directive, NOAA's Environmental Data Management Committee (EDMC)**

- <https://nosc.noaa.gov/EDMC/PD.DMP.php>
- Drawn from Certification NANOOS DMP, but required substantial changes and new information, as questions asked were different

#### 1. General Description of Data to be Managed

- 1.1. Name of the Data, data collection Project, or data-producing Program:  
Northwest Association of Networked Ocean Observing Systems (NANOOS)
- 1.2. Summary description of the data:

The NANOOS Data Assembly Center (DAC) integrates and manages data from a variety of sources and types of assets including in-situ observations, remote sensing observations and products, processed data products (such as climatologies), and numerical model nowcasts and forecasts. These activities are carried out as a distributed collaboration involving primarily the University of Washington (UW), Oregon State University (OSU) and the Oregon Health and Science University (OHSU), led by UW. Integrated data includes "internal" data

#### Scope:

- NANOOS
- Local/regional (mainly in



## Certification DMAC Commitments

### 1.5-year period

- a. Phased implementation of requirements, where some are already fully met, others are in transition towards full implementation (demonstrated initial work and plans).

### 2.QARTOD Quality Control testing, flagging

- a. See next slide.

### 3.Archiving with NCEI

- a. See next slide.

### 4.Data Sharing

- a. Mostly met, except for some unconventional data sets (X-Band radar, Victoria Clipper, beach profiles, bathymetry)

### 5.“External” Datasets (partners not funded by NANOOS)

- a. Some requirements may not realistically apply, specially archiving. Next phase.



## QARTOD Testing and Flagging

1. Implement published QC tests and flagging for selected variables, at fixed stations
  - a. QC tests: **Gross range** (initially), local range, spike, flat line, etc
  - b. Emilio participated in Workshop on Quality Control processes of key Biogeochemical Parameters at NOAA PMEL, Sept. 2018
2. Tasks ahead, collaboratively with Charles Seaton (CMOP)
  - a. Tools and process to select thresholds for each test, variable. With input from PI's
  - b. Flags applied centrally while accommodating QARTOD flags from providers (CMOP, King County, Hakai, PMEL)
  - c. Initial operationalization in datasets on ERDDAP, Summer 2019 and later on NVS

## Archiving with NCEI

- 1. In place:** Complete CMOP fixed time series and largely automated monthly updates; some glider data.
- 2. Ongoing:** DOGAMI beach profiles (coordinating with NCEI since Nov. 2018); UW NW Environmental Moorings pH sensor data (initial discussions with Zoli & team), to be followed by ORCA depth profiles.
- 3. To do:** Initiate discussions with each NANOOS PI, to assess archiving procedures and develop plan and time frame for each dataset.



All 3 NANOOS models are integrated

Theme : None Selected

Data Layers Legends Backgrounds

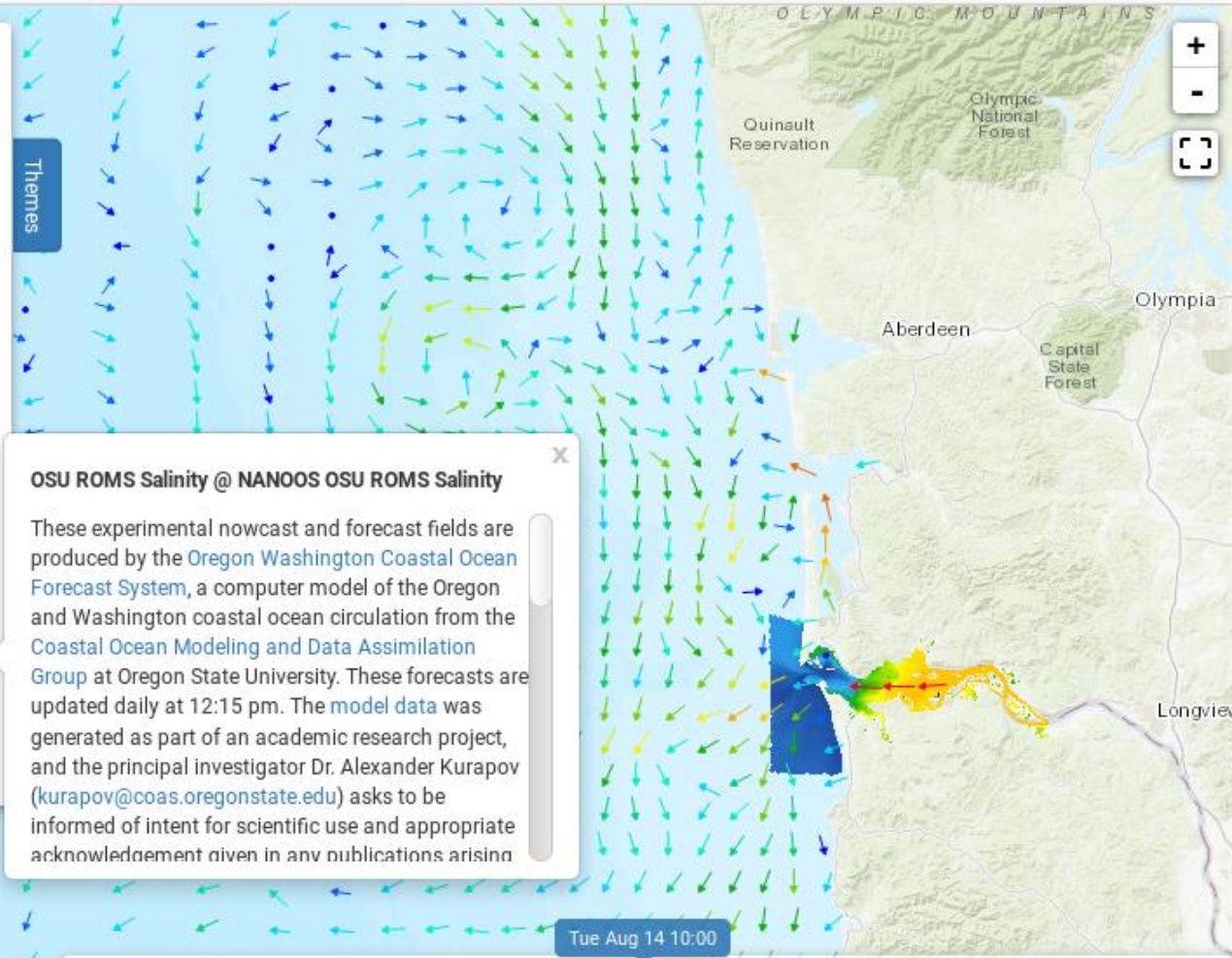
Q NANOOS

**Pacific**

- NANOOS CMOP SELFE Bottom Salinity
- NANOOS CMOP SELFE Bottom Temperature
- NANOOS CMOP SELFE Surface Salinity
- NANOOS CMOP SELFE Surface Temperature**  
Valid Time: Aug 14, 2018 02:00 (GMT -07:00)
- NANOOS LiveOcean ROMS Currents**  
Valid Time: Aug 14, 2018 10:00 (GMT -07:00) at surface
- NANOOS LiveOcean ROMS Salinity
- NANOOS LiveOcean ROMS Water Temperature
- NANOOS LiveOcean ROMS Winds
- NANOOS OSU ROMS Currents
- NANOOS OSU ROMS Salinity
- NANOOS OSU ROMS Water Temperature

**Global**

- NOAA RTOFS (Strided)



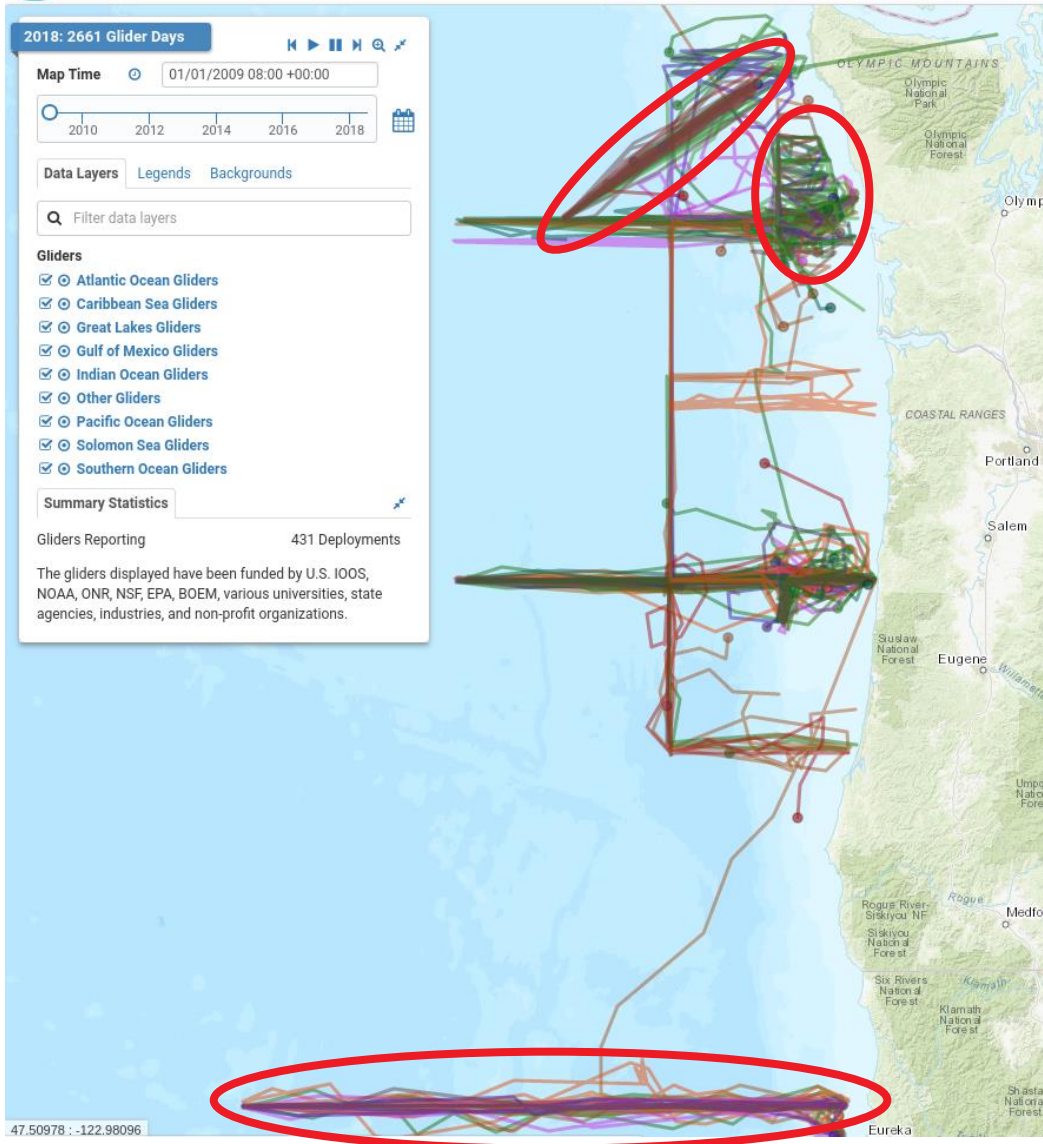
**OSU ROMS Salinity @ NANOOS OSU ROMS Salinity**

These experimental nowcast and forecast fields are produced by the Oregon Washington Coastal Ocean Forecast System, a computer model of the Oregon and Washington coastal ocean circulation from the Coastal Ocean Modeling and Data Assimilation Group at Oregon State University. These forecasts are updated daily at 12:15 pm. The model data was generated as part of an academic research project, and the principal investigator Dr. Alexander Kurapov (kurapov@coas.oregonstate.edu) asks to be informed of intent for scientific use and appropriate acknowledgement given in any publications arising



# Glider DAC: NANOOS & OOI

IOOS Underwater Glider DAC Map



## NANOOS on Glider DAC:

- UW La Push, CMOP SW WA, OSU Trinidad Head.
- Well positioned to enable near-real-time submissions to Glider DAC once La Push and CMOP SW WA gliders are deployed.
- New NVS Glider App for CMOP glider is needed.

## NVS Glider Apps for OOI gliders

- Beth Curry (UW APL) and others actively working on this!
- Targeting 2-3 glider transects.





## NANOOS ERDDAP

- ERDDAP provides data browsing, visualization and download that's highly flexible and reasonably user friendly, for technical users
- Enables automated data access
- IOOS has adopted ERDDAP as the new, recommended approach for distributing data interoperably, specially in-situ data. Previous recommended service (SOS) will be deprecated over next 12 months.
- NANOOS test ERDDAP in place. Expected public release this Summer.
- Another NANOOS ERDDAP is deployed at OSU (Craig Risien), used for development and internal data distribution.
- Planned datasets to be included:
  - Long time series from stations, from NANOOS and others: NDBC and CDIP time series and climatologies, from Jon and Craig; CMOP complete time series; other NANOOS station time series, as they become available.
  - Glider data, from NANOOS and OOI (via Glider DAC)
  - Biological datasets, as available
  - NANOOS model output
  - Remote sensing and other gridded data products
  - Beach profiles
  - Near-real-time data store from local and regional stations on NVS
  - Cruise data





## Other Activities

### Biological Data

1. IOOS support for enabling interoperable regional biological datasets
  - a. Goal to distribute the datasets via ERDDAP and submit to MBON Portal (<https://mbon.ioos.us>) and OBIS (<https://obis.org>), using IOOS data standards and procedures for data sharing.
  - b. UW Pelagic Ecosystem Functions (PEF) dataset, Salish Sea. Should be ready by early Fall.
  - c. Other potential target: OR Newport line, NOAA NWFSC, Jennifer Fisher.
2. Support continued into FY19

### Ocean Acidification Data

**New NANOOS portal Data/DMAC page by early Fall**

## New or Enhanced Assets, next 12 months

New OOI mooring configuration on staging NVS

### 1. OOI

- a. Substantially enhanced representation of all moorings (more sensors), and easier to maintain in the future.
- b. Depth profilers
- c. Gliders (as mentioned)

### 2. NEMO profiler

- a. Profiles expected on NVS by September.

### 3. Gliders

- a. Redeployed CMOP and UW La Push gliders. New NVS Glider App for CMOP glider

### 4. Reconnect with Stillaguamish Tribe, to find telemetry and data access solution for their Port Susan mooring?

### 5. Others, as they arise.





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# NANOOS Outreach, Engagement, & Education

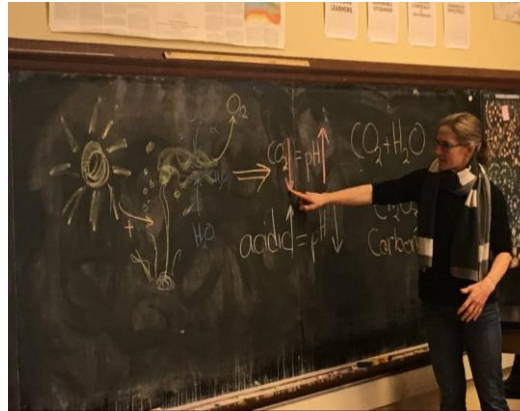
NANOOS Joint PI and Governing Council Meeting  
August 1, 2019

Paul Rudell, Operations Coordinator  
Rachel Wold, Outreach Chair



## Education:

*NANOOS goal is to increase ocean literacy*



- NW Aquatic & Marine Educators Conferences
- Whidbey Watershed Stewards
- NOAA Science Camp





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## Outreach: engaging with the public

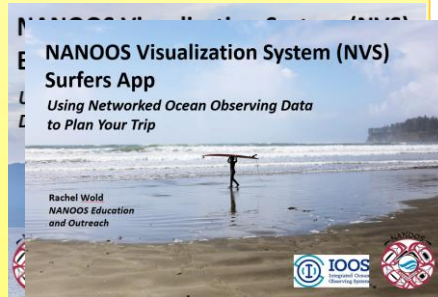
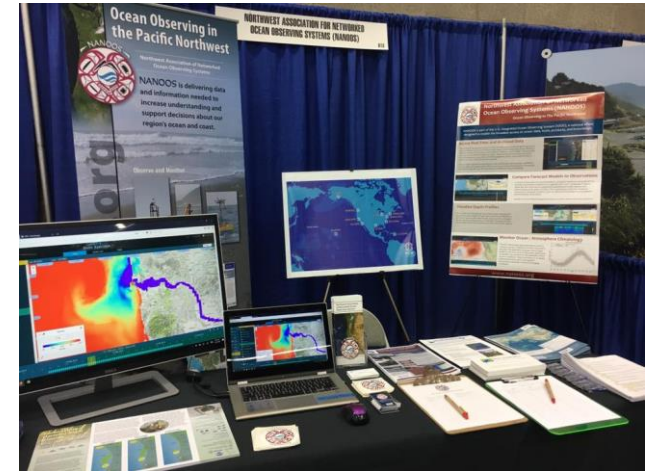
- Soundwaters – a ‘one-day university for all’
- Discover Science Weekend
- Curiosity Days: Climate Change





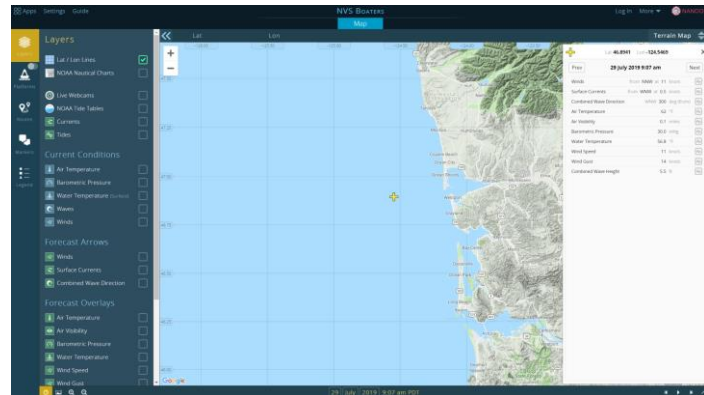
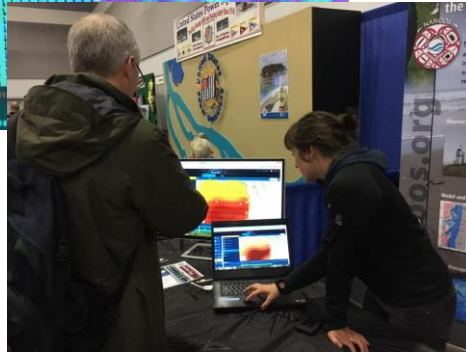
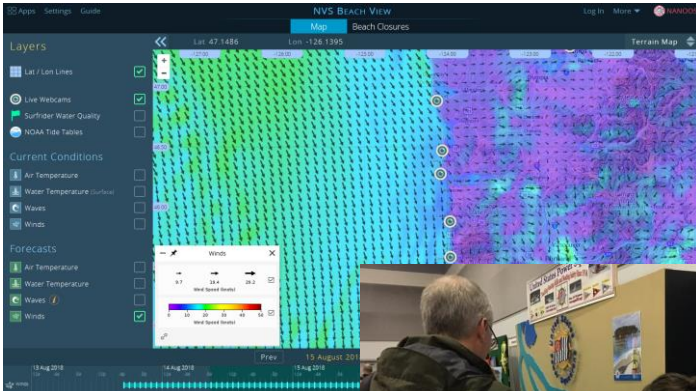
## Outreach: targeted user groups

- Shellfish Growers
  - Pacific Coast Shellfish Growers Association Meeting
- Maritime Industry
  - Blue Forum – Washington Maritime Blue
- Recreational users
  - OR and WA boat shows
  - Salem Saltwater Sportsmen
  - Illwaco Tuna Club
  - Club meetings and conferences





## Engagement: recreational users



- Tuna Fishers
  - Further developed Tuna Fishers App and Seacast
- Boaters
  - Visibility forecast
  - Click-anywhere capability
- Surfers
  - Worked directly with Surfrider and other users to refine app
  - Added CoastView content



# NANOOS

## NORTHWEST ASSOCIATION OF NETWORKED OCEAN OBSERVING SYSTEMS



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# Online presence

Welcome to NANOOS, the Northwest Association of Networked Ocean Observing Systems.

**NANOOS Visualization System**  
NVS provides easy access to observations, forecasts, data, and visualizations.

**Seacast comes to NVS!**  
The new NVS "Seacast" app was designed for the coastal fishing community, allowing users to see forecasts for a variety of ocean conditions up to three days out for any location in the region. Building on the web app that Oregon State University PIs have been designing and testing since 2012 via Oregon Sea Grant funding, the app has now been transitioned to NVS, with new features we added based on requests by users at our NANOOS community workshop last summer. See the article below for the fascinating story of Seacast's development, and be sure to check out Seacast on NVS!

[NVS Seacast App](#) [View the OSU Article](#)

Save the Date for Biology! | Seacast comes to NVS! | NANOOS Data Portal Survey | New Surfers App on NVS! | New Beach View App on NVS | NANOOS Presentation for NOAA West Watch | NVS Version 6.0 Released

Latest news and updates from NANOOS! [View this email in your browser](#)

**NANOOS Observer** Winter 2019

**New Tsunami Preparedness Mobile App**

NANOOS and the Oregon Department of Geology and Mineral Industries have released a new mobile app! The brand new [Tsunami Evacuation App](#) provides easy access to tsunami hazard areas on the Oregon and Washington coasts. Whether you are a coastal resident

Total Page Followers as of Today: 694







## Plan for Upcoming Year

### Stay the course!!

- Continue to assist with development of web and mobile apps assuring ease of use and relevance to users
- Continue outreach to public and user groups in OR and WA
  - Develop stronger bonds with commercial maritime (e.g., USCG, pilots)
- Continue to enhance visibility of NANOOS information to a wider audience



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## 4. Program Coordination

- *Krisa Arzayas, U.S. IOOS Program Office*
- *Josie Quintrell, IOOS Association*
- *Denis D'Armours, Canadian IOOS Pacific*
- *Dwight Owens, Ocean Networks Canada*



# NANOOS Governing Council

Krisa M. Arzayus, IOOS Program Update  
August 1, 2019



# U.S. IOOS: Program Overview

Partnership effort that leverages dispersed national investments to deliver ocean, coastal and Great Lakes data relevant to decision-makers.

## Global Component

- US contribution to Global Ocean Observing System (GOOS)
- 1 of 15 Regional Alliances of GOOS



The Global Ocean Observing System



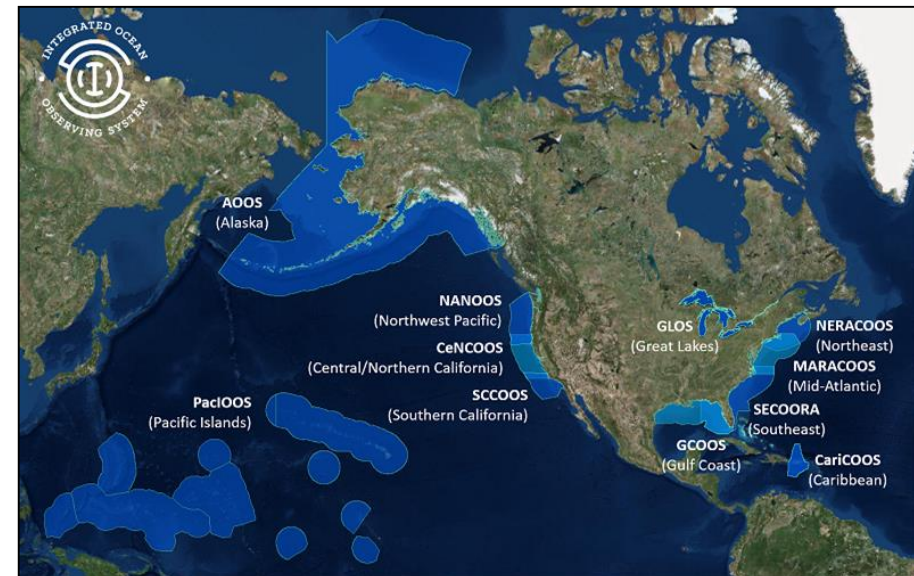
## National Component

- 17 Federal agencies



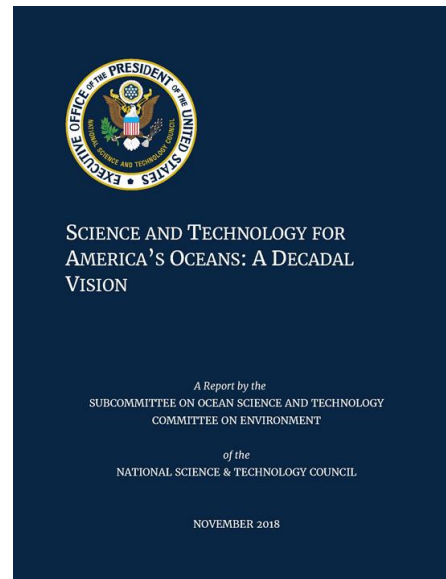
## Regional Component

- 11 Regional Associations
  - Stakeholder driven
  - Academia, state/local/tribal government, private industry



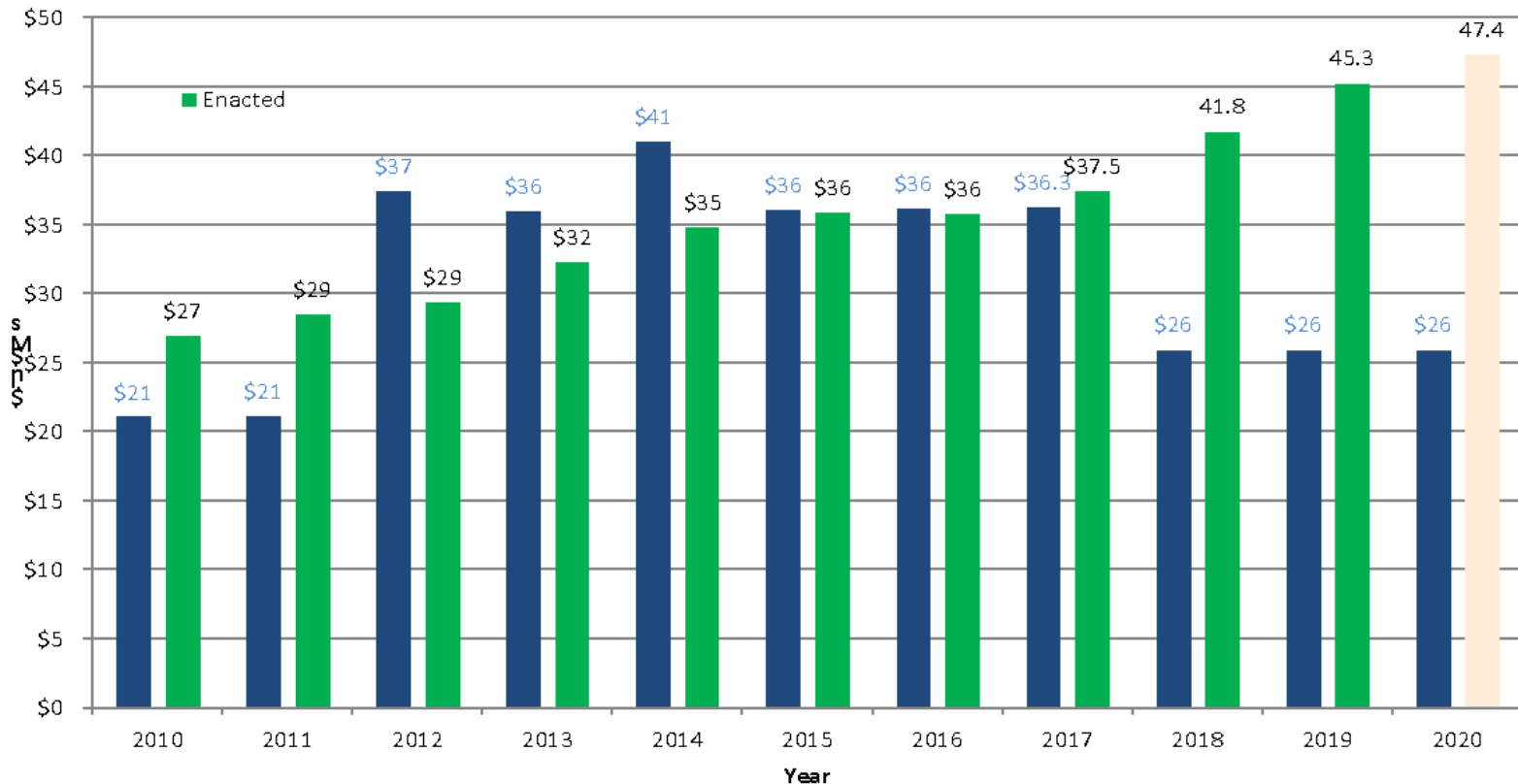
# Looking forward - importance of the ocean

- OceanObs'19 - Regional - Coastal - Global
- Essential Ocean Variables and Communities of Practice
- White House (OSTP) Science and Tech for America's Oceans: A Decadal Vision
- UN Decade of Ocean Science for Sustainable Development
- US IOOS 20th Anniversary Kick Off at Ocean Obs '19



# U.S. IOOS Enacted and President's Budgets FY10-20

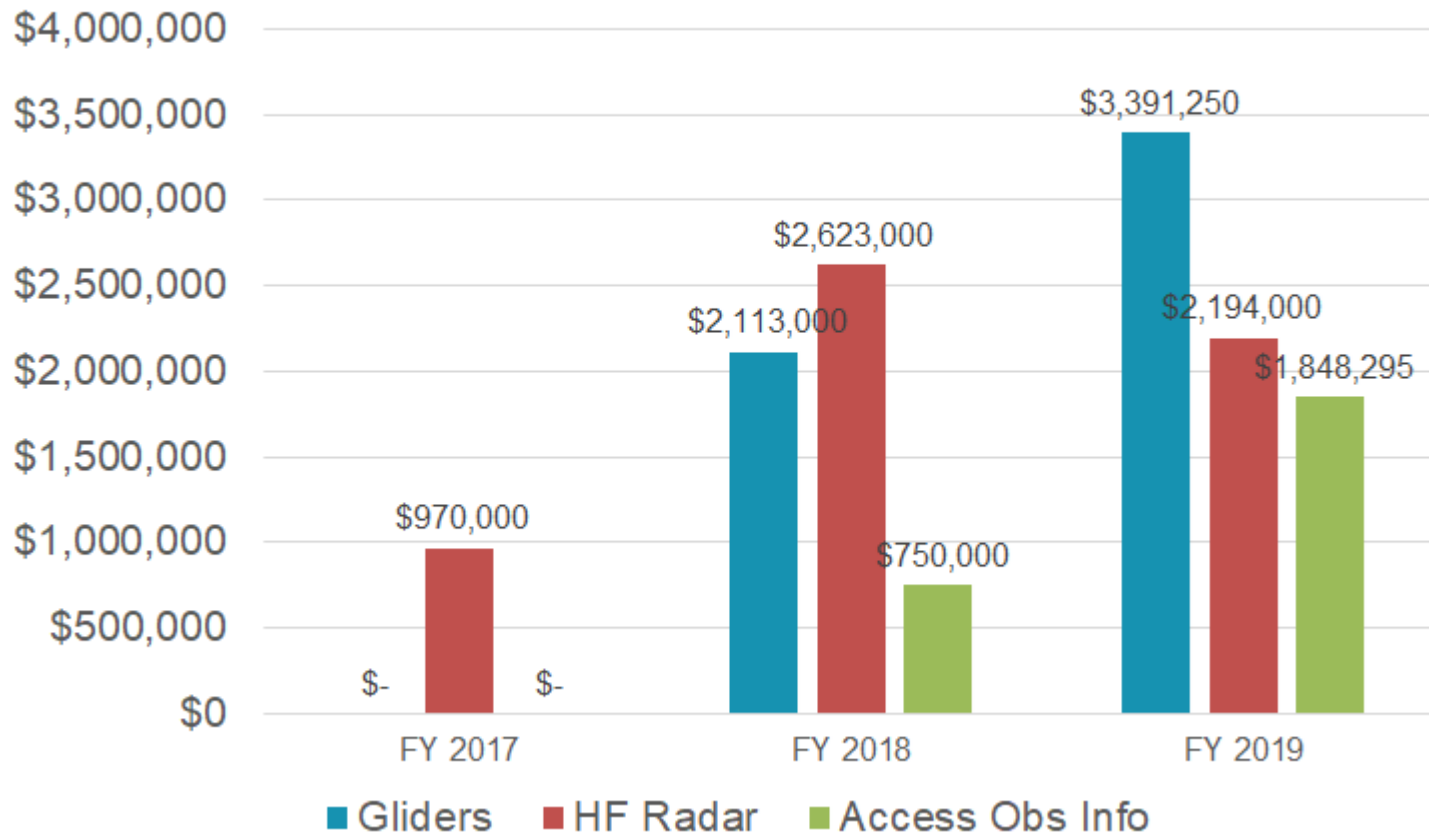
**NOS IOOS Request & Appropriation History**  
 Part of the Story – not including 'backbone and global'



NOAA National Ocean Service  
 Navigation, Observations, and Positioning: 'National IOOS' component FY19 Omnibus  
 \$6.8M & 'Regional IOOS Observations' \$38.5M [\$1.5M Reg. Ocean Partnerships]  
 Estimated Enacted levels are 'post rescission' totals for each year  
 'Request' = the President's Budget Request  
 FY20 House Mark is first, next is Senate Mark, then Conference...

# IOOS Fill the Gaps Funding FY17-19

## Fill the Gaps Funding By Function



# FY2019 IOOS Highlights

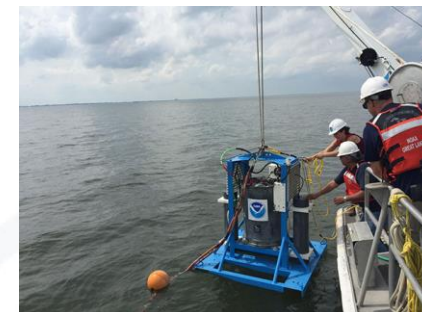
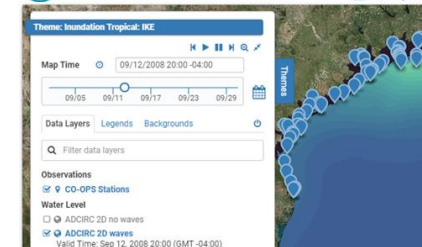
- FY20 NOAA Strategies: Artificial Intelligence, Unmanned Systems, and 'Omics
- OSTP Ocean Summit- November 2019
- ICOOS Act reauthorization
- NOAA Weather Act & NOAA Water Initiative
- CENOTE Act 2018 (Commercial Engagement Through Ocean Technology Act of 2018)
- [Ocean Enterprise Study](#) Reprise
- IOOS Advisory Committee
  - IOOS FAC public call Wednesday, August 21, 2019, 11:00 a.m. - 3:00 p.m. EST, see [website](#) for details.
- **Filling gaps +\$7.5M:** Surface Currents, Gliders, Streamlined Access to observation information

## Research and Development

- **Ocean Technology Transition** – new FFO ~late Aug 2019 for award in FY2020
- **Coastal and Ocean Modeling Testbed COMT** - Coastal / Ocean /Water Modeling, Forecasting, and Prediction
- **ACT** workshops for IOOS RAs and OAR Labs and 88 Cooperative Institutes



IOOS | Coastal and Ocean Modeling Testbed Viewer In Development



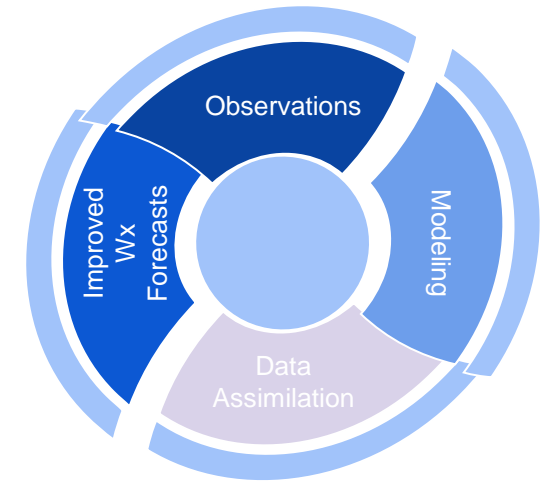


# Weather Research and Forecasting Innovation

PUBLIC LAW 115–25—APR. 18, 2017  
Title III / Sec. 301(a)(2)

## INTEGRATION OF OCEAN AND COASTAL DATA FROM THE INTEGRATED OCEAN OBSERVING SYSTEM.—

In National Weather Service Regions where the Director of the National Weather Service determines that ocean and coastal data would improve forecasts, the Director,...., shall—



(A) integrate additional coastal and ocean observations, and other data and research, from the Integrated Ocean Observing System (IOOS) into regional weather forecasts **to improve weather forecasts and forecasting decision support systems**; and

(B) support the development of real-time data sharing products and forecast products in collaboration with the regional associations of such system, including contributions from the private sector, academia, and research institutions to **ensure timely and accurate use of ocean and coastal data in regional forecasts**.

(C) support increasing use of autonomous, mobile surface, sub-surface, and submarine vehicle ocean and fresh water sensor systems and the infrastructure necessary to **share and analyze these data in real-time and feed them into predictive early warning systems**. (C was added with NIDIS reauth. Act S2200 in 115th Cong.)

# FY20 Annual Guidance Memorandum

Purpose: The AGM provides planning guidance for the execution of the IOOS Office's resources. It conveys IOOS Office strategic direction.

FY20 Highlights:

- **Obs**- fill gaps in the Surface Current Observing network and deploying gliders (includes hurricane forecasting, HABS, etc.)
- **Obs and data**- integrate biological observations into IOOS
- **Transition** and **integrate new technology** into operations (OTT, ACT)
- **Data** - Improve real time data flow into National Centers for Environmental Prediction “data tanks”



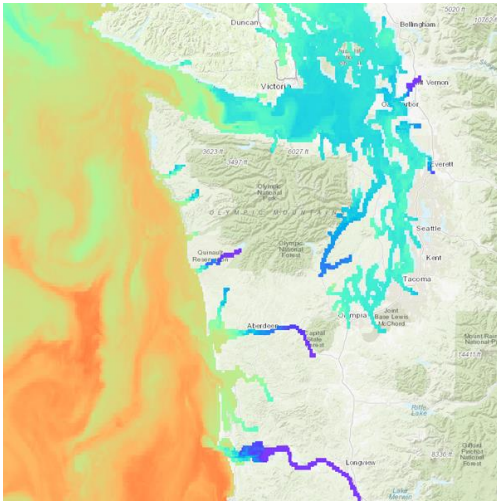
# FY20 Annual Guidance Memorandum

- **Modeling** - Develop a new NOS coastal modeling strategy with NOS offices and IOOS RAs
- **Modeling** - Develop a **cloud computing framework** to enable effective operational ocean model development and improvements.
- **Products and tools** - assess user satisfaction and economic benefit with IOOS data and information products and services.
- **Governance** - Support the U.S. IOOS Federal Advisory Committee as they formulate their work plan to guide the implementation of U.S. IOOS.




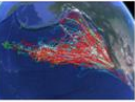


# Great work NANOOS!

- Live Ocean Expands to Salish Sea
- Promoting Safe Boating Conditions with NVS Boaters App
- Submaran Deployment for HABs Forecasting
- Participation on NOAA Westwatch Webinars
- US West Coast Biological Observations Workshop







Animal Telemetry NetworkOcean Tracking Network

Marine Biodiversity Observation Network

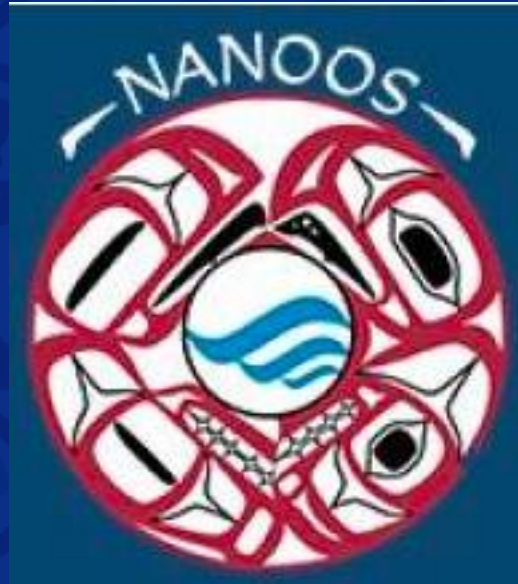


**WORKSHOP OBJECTIVES**

- Identify and prioritize keystone monitoring and observational needs
- Identify the existing assets and capabilities in the region
- Document stakeholder uses of telemetry data
- Identify infrastructure and data management challenges and opportunities







## NANOOS Governance Council



**Josie Quintrell, Director  
IOOS Association  
August 2019**



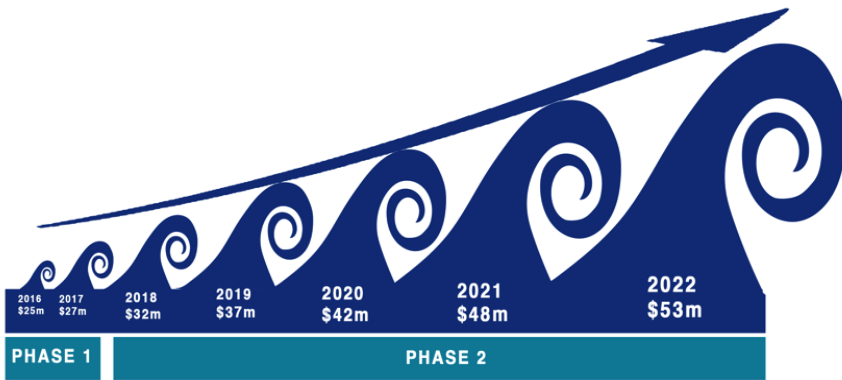


- Advocacy
- Common Issues
- IOOS federal/non-federal partnership
  - Administration
  - Congress
  - National Partners
- Emerging Issues
- Special Projects

Observing our oceans, coasts and Great Lakes  
*Providing information to those who need it,  
when they need it*



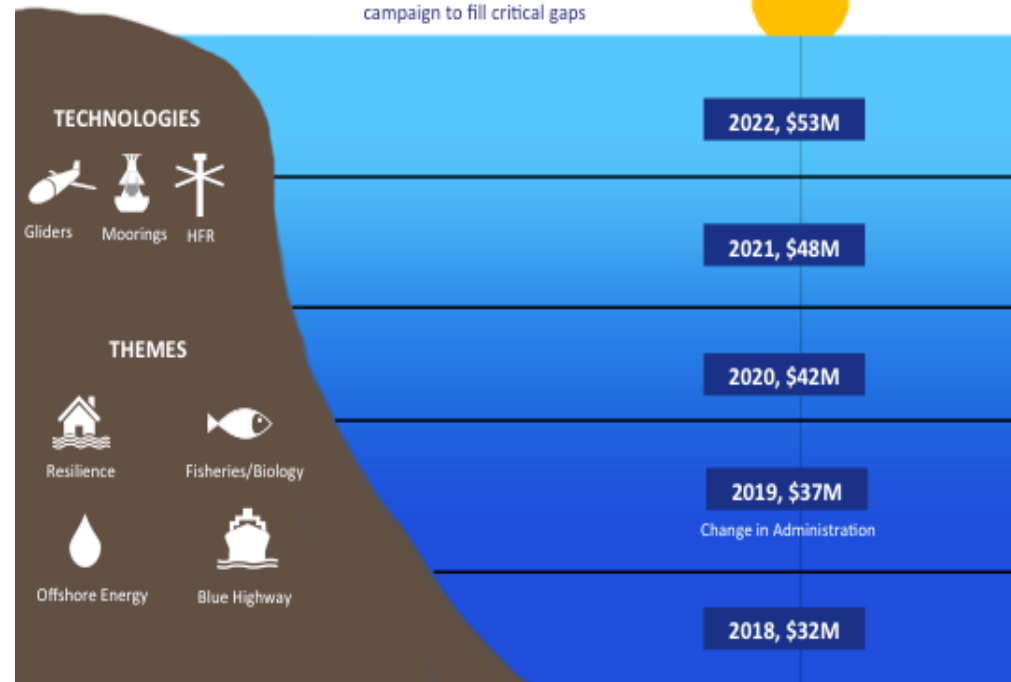
# Closing the Gaps: 5 yr Campaign



- Scalable campaign
- Tangible outcomes
- Align with Administration Priorities
- Filling targeted gaps in:
  - HR Radars
  - Gliders
  - And Moorings?

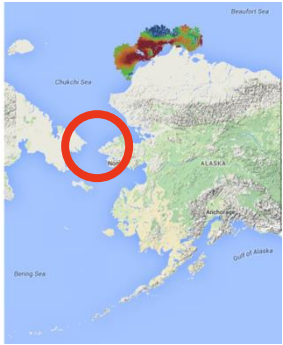
## CLOSING THE GAP CAMPAIGN Phase 2: FY18-FY23 Multiyear Strategy

Desired outcome of discussion: Input from the regions and the Program Office on how to organize a successful campaign to fill critical gaps



# US IOOS FY 17 High Frequency Radar Request

\$3.1 million to install 12 high frequency radar systems



Safeguarding the Arctic Marine Highway

2 remote radars needed



Protecting Lives and Public Health in the Pacific Northwest

3 radars needed



Cleaning up the Great Lakes

3 radars needed



Saving Lives off Florida's Coast

2 radars needed



Saving Millions in the Gulf of Mexico

3 radars needed



# FY 20 Appropriations



## Appropriations Chart for NOAA's National Ocean Service Regional IOOS

	FY14 Enacted	FY 15 Enacted	FY 16 Enacted	FY 17 Enacted	FY 18 Enacted	FY 19 Enacted	FY 20 Pres. Budget	FY 20 IA Request
<b>Regional IOOS Total</b>	\$28.5m	\$29.5m	\$29.5m	\$30.7m	\$35m	\$38.5m	\$19.4m	\$43.7m
<i>National network of regional infrastructure systems, gaps in radars and gliders</i>	\$24.3m	\$25.2m	\$25.2m	\$26.4m	\$30.7m	\$34.2m**	TBD	\$32.7m for systems, \$3.2m for radars, \$3.5m for gliders
<i>Marine Sensor Innovation Grants, Modeling Test Bed, Sensor Verification</i>	\$4.2m	\$4.3m	\$4.3m	\$4.3m	\$4.3m	\$4.3m	TBD	\$4.3m
<b>U.S. IOOS Program Office*</b>	\$6.6m	\$6.6m	\$6.6m	\$6.6m	\$6.8m	\$6.8m	TBD	\$6.8m
<b>Total U.S. IOOS</b>	\$35.1m	\$36.1m	\$36.1m	\$37.3m	\$41.8m	\$45.3m	TBD	\$50.5m

\* Funding included in the Navigation, Observations and Positioning funding line

\*\* Includes \$1.5m for Regional Ocean Partnerships

# Reauthorization of the ICOOS Act of 2019



**Senate - S 914 Marked up in Senate**  
**House - HR 1314 Hearing held in House**

## **S 933 – BLUE GLOBE Act**

Sen Whitehouse (D-RI) and Murkowski (R-AK), S 933 would enhance ocean monitoring by enhancing interagency coordination, expanding ocean exploration, creating innovation prizes and ARPA O for Oceans

## **Ocean Acidification – House Passes 4 bills**

HR 1237 - Coastal and Ocean Acidification Stressors and Threats (COAST) Research Act (Bonamici).

HR 1716 - Coastal Communities Ocean Acidification Act (Pingree) S 778 Senate Version (Murkowski)

HR 1921 - Ocean Acidification Act of 2019 (Kilmer)

HR 988 - National Estuaries and Acidification Research (NEAR) Act of 2019 (Kilmer)

## **National Ocean Partnership Program (NOPP)**

Rep Panette (D-CA) introduced H.R. 3161 introduced in House to reauthorized the NOPP,

Senator Wicker (R-MS) S 1439 MARAD to strengthen public and private partnership for oceanographic research and education

## **Regional Ocean Partnership S 2166 Wicker, Cantwell**

Establishes voluntary ROPs (including the West Coast Alliance) to coordinate science and data collection for large marine ecosystems.

# Building Support in DC

## GULF OF MEXICO CONGRESSIONAL BRIEFING

Are we better informed today than before Hurricane Katrina and the Deepwater Horizon Disaster? A discussion on the state of coastal observing in the Gulf of Mexico.



## SENATE OCEANS CAUCUS BRIEFING

*Coastal Innovations: Enhancing security, economy and the environment*



## SENATE OCEANS CAUCUS BRIEFING

*Buoying our Nation's Economy: The Role of Ocean Data in Supporting the Blue Economy*



# Major Milestone: Certified National Network

## Integrated Ocean Observing System (IOOS) Supports a National Network of Certified Regional Observing Systems

IOOS is essentially the weather service for the coastal ocean and Great Lakes, providing the ability to “see” what is happening above and below the water surface and making these insights readily available.

IOOS consists of 17 federal agencies with 11 regional observing systems.

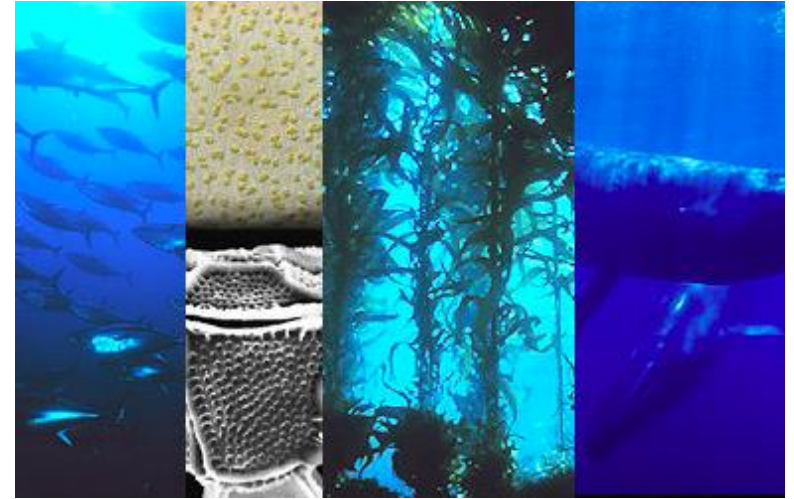
All 11 regional observing systems meet rigorous federal standards for governance and data management.

### Why Certification Matters

- IOOS provides national consistency while addressing unique and diverse regional needs.
- IOOS provides ready access and preserves data with transparency and documentation.
- Certification enhances efficient interagency coordination at the regional and national level.



# IOOS Coordination Meetings – March & Sept



## Special Focus - Biology

HABs – HAB operational observing network

Fisheries – integration of NMFS data

Marine biodiversity - adoption of data standards (Darwin core)

Sound – acoustics

Ecosystem monitoring - ecosystem moorings, etc

New technologies - eDNA, IFCB, ESPs, etc

Stakeholder needs

# Looking Forward

- Policy Meetings
  - IOOS Ex Comm and Program Office Leadership Discussion
    - Gaps Campaign and beyond
    - Funding decisions, building the network
- Economic Valuation
- Outreach Committee
- Ocean Obs 19 -- Hawaii 2019 – IOOS turns 20!
- HAB operational network
- 2020 All Hands Community of Practice



Thank you







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IOOS

## 5. Round Table for contributions from GC members

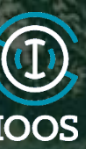
- announcements
- priorities



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## 6. Discussion



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## 7. PI reports

- Payoff to date
- Needs going forward



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## 8. GC Business

- Election
- FFO process
- Priorities

# 2017-8 NANOOS GC Board

## **Academic:**

- Parker MacCready, UW, Governing Council Board Member for UW
- Mike Kosro, OSU, Governing Council Board Member for OSU (**VICE CHAIR**)
- Antonio Baptista, OHSU, Governing Council Board Member for OHSU

## **State:**

- Carol Maloy, Ecology, Governing Council Board Member for Washington State Agencies
- Jon Allan, DOGAMI, Governing Council Board Member for Oregon State Agencies

## **Tribes:**

- Paul McCollum, Port Gamble S'Klallam Tribe, Governing Council Board Member for Tribes
- Joe Schumacker, Quinault Indian Nation, Governing Council Board Member for Tribes

## **Federal:**

- Kevin Werner, NOAA NWFSC, Governing Council Board Member for Washington Federal Offices
- Andy Lanier, Governing Council Board Member for Oregon Federal Offices

## **Industry:**

- Margaret Barrette, PCSGA, Governing Council Board Member for Industry
- Andrew Barnard, WetLabs, Governing Council Board Member for Industry

## **NGO:**

- Fritz Stahr, OIP, Governing Council Board Member for Non-Governmental Organizations
- Gus Gates, Surfrider, Governing Council Board Member for Non-Governmental Organizations

## **At Large:**

- Paul Dye, WA Sea Grant, Governing Council Board Member At-Large
- David Martin, Retired, Governing Council Board Member At-Large (**CHAIR**)

# 2019 NANOOS GC Board Election

## Academic:

- Parker MacCready, UW, Governing Council Board Member for UW
- Mike Kosro, OSU, Governing Council Board Member for OSU **(VICE CHAIR)**
- Antonio Baptista, OHSU, Governing Council Board Member for OHSU

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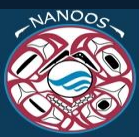
## At Large:

- Paul Dye, WA Sea Grant, Governing Council Board Member At-Large
- David Martin, Retired, Governing Council Board Member At-Large **(CHAIR)**



## FFO process

- Discuss NANOOS GC priorities
- Solicit input from current PIs for sustaining current observations, modeling, DMAC, products, EEO, and operations
- Solicit input from all PIs for new ideas
- Use Executive Committee (Board plus functional Chairs, and ED) to rank and decide on final budget priorities

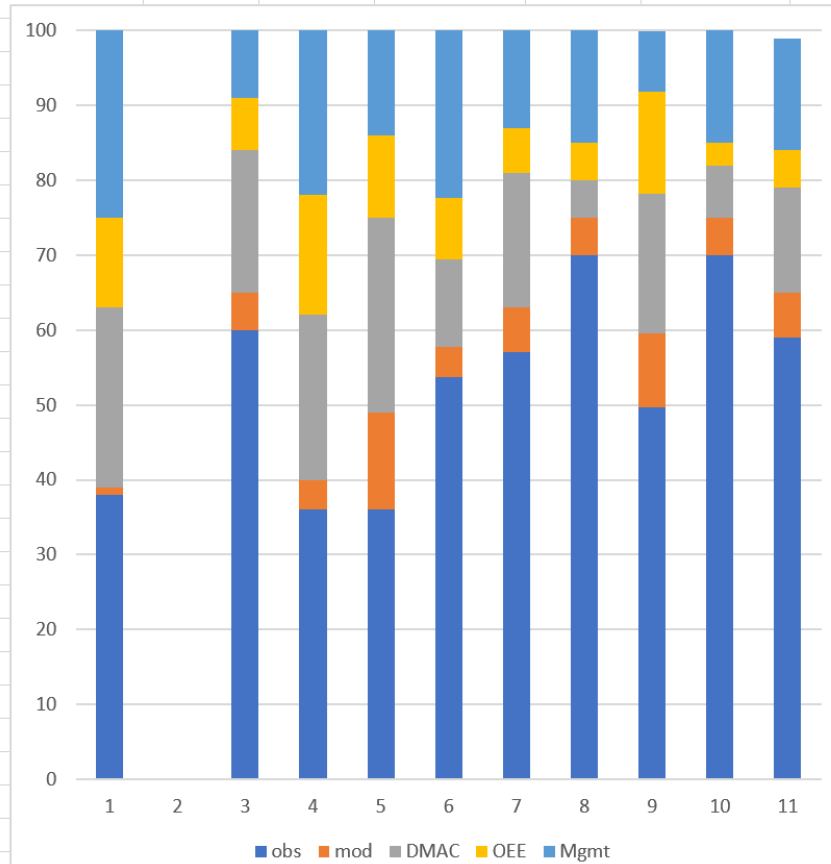


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	AOOS	CARICOOS	CeNCOOS	GCOOS	GLOS	MARACOOS	NANOOS	NERACOOS	PacIOOS	SCCOOS	SECOORA	average
Obs	38		60	36	36	53.7	57	70	49.7	70	59	55
Mod	1		5	4	13	4.1	6	5	9.9	5	6	6
Data	24		19	22	26	11.7	18	5	18.6	7	14	16
OEE	12		7	16	11	8.2	6	5	13.7	3	5	8
Manage	25		9	22	14	22.3	13	15	8	15	15	15







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## 9. Wrap-up, Action Item review, and Adjourn