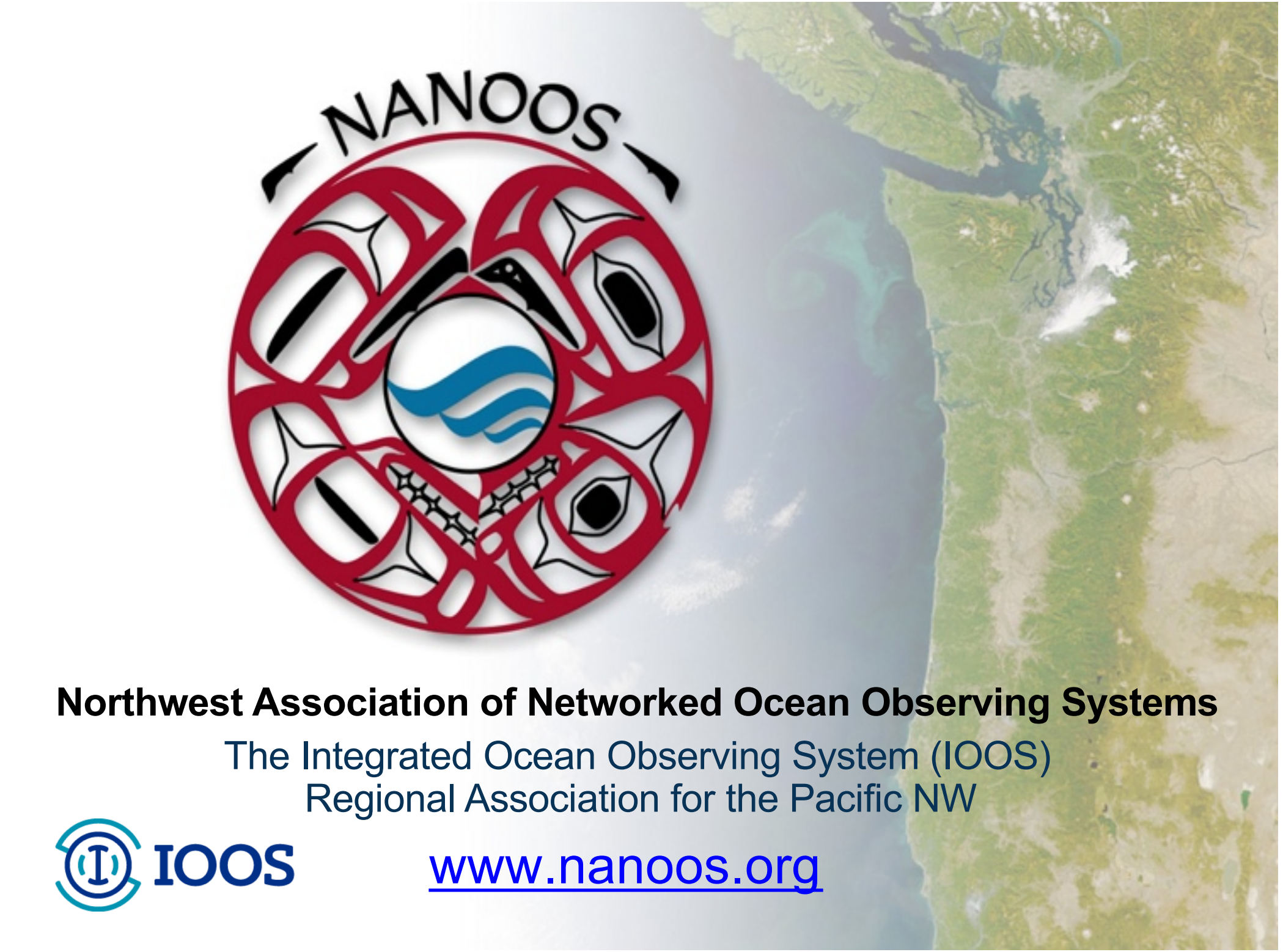


Northwest Association of Networked Ocean Observing Systems

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

IOOS

www.nanoos.org

U.S. Integrated Ocean Observing System (IOOS)

- ***IOOS Vision:***

A fully integrated ocean observing system to provide service to the Nation through:

- improved ecosystem and climate understanding;
- sustained living marine resources;
- improved public health and safety;
- reduced impacts of natural hazards and environmental changes; and
- enhanced support for marine commerce and transportation.

- ***IOOS Mission:***

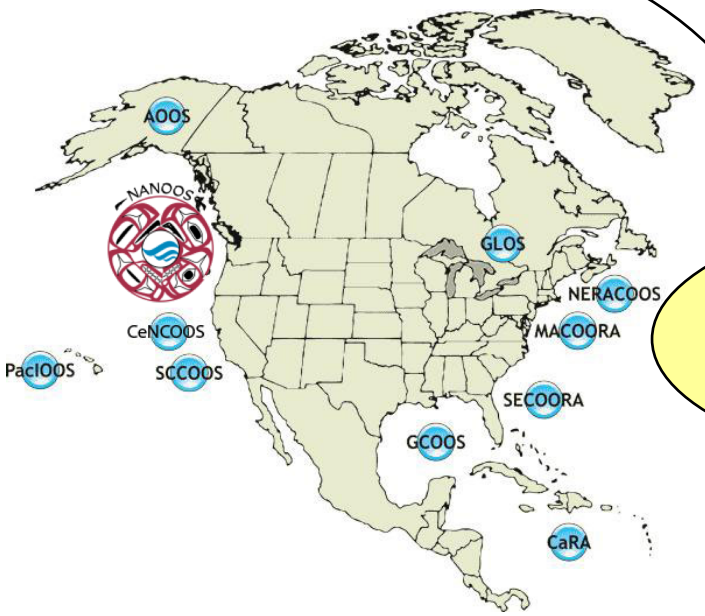
Lead the integration of ocean, coastal, and Great Lakes observing capabilities, in collaboration with Federal and non-Federal partners, to **maximize access to data** and **generation of information products**, ***inform decision making***, and ***promote economic, environmental, and social benefits to our Nation and the world***.

IOOS

IOOS
Integrated Ocean Observing System

CONSISTENT NATIONAL CAPABILITY

REGIONAL INFORMATION COORDINATION ENTITY
CERTIFIED
assure



Regional Associations

engage

Observations

Forecasts/Modeling

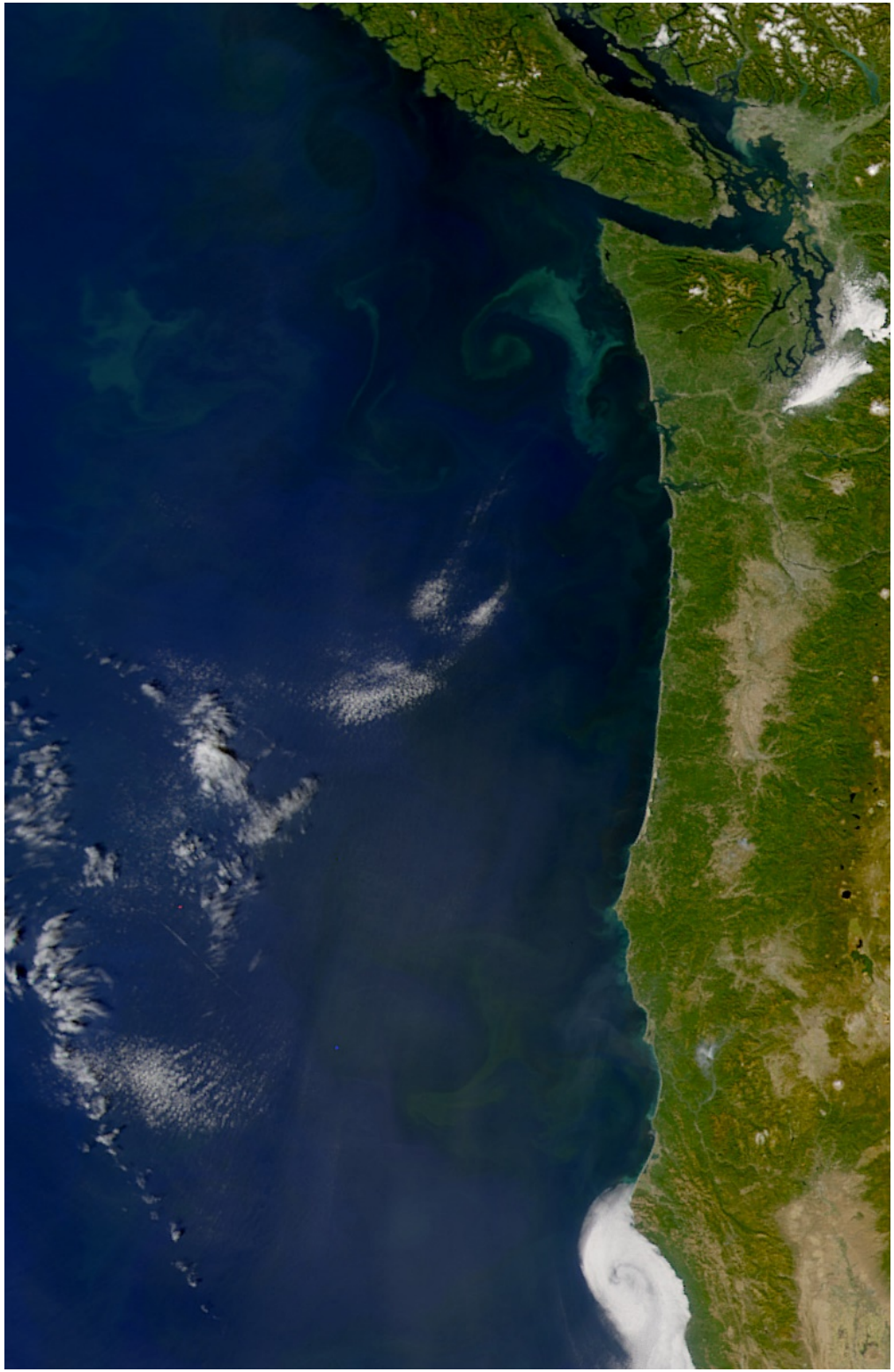
Data Management

User Products

Outreach

Leverage and Link

DIVERSE LOCAL STAKEHOLDERS



Started by defining the region, the users, their needs:

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 Stakeholder Priorities

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

- **Maritime Operations**
- **Ecosystem Assessment**
- **Fisheries and Biodiversity**
- **Coastal Hazards**
- **Climate**

Effort:

- Observations
- Modeling/forecasts
- Data management and communication
- Tailored user-driven products
- Outreach, Engagement, Education

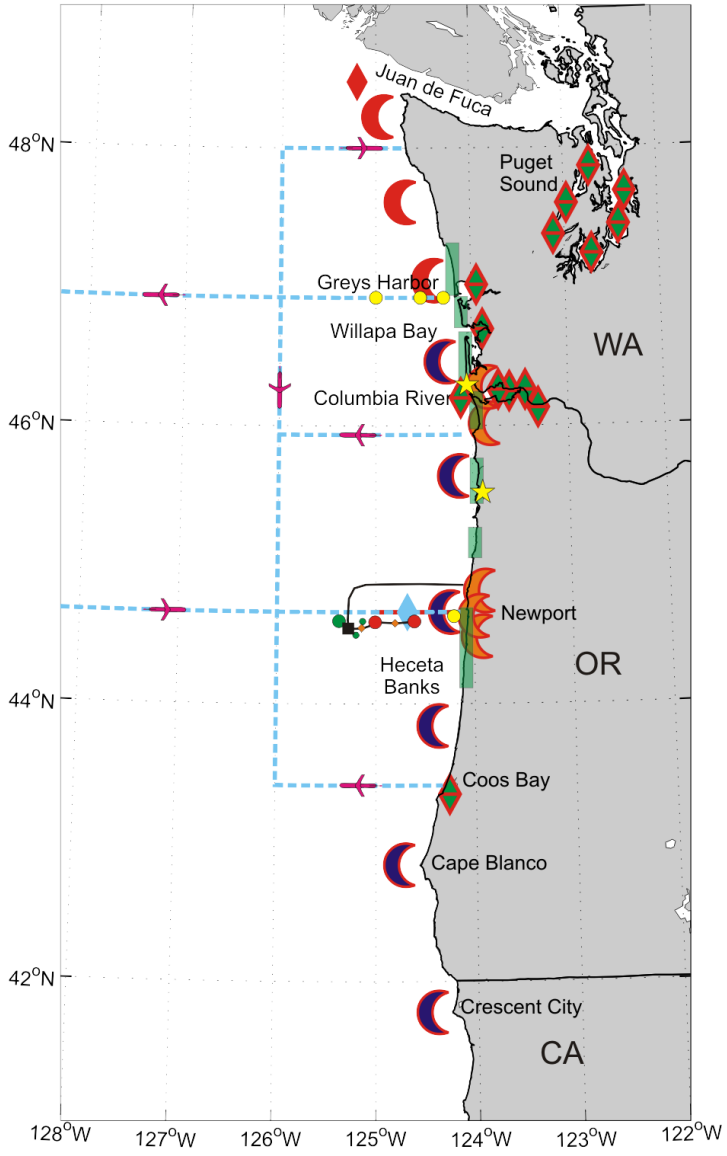
NANOOS

Northwest Association of Networked Ocean Observing Systems

Washington - Oregon - Northern California

IOOS

PNW Ocean Observing Systems Design



NANOOS RCOOS Enhancement Conceptual Design

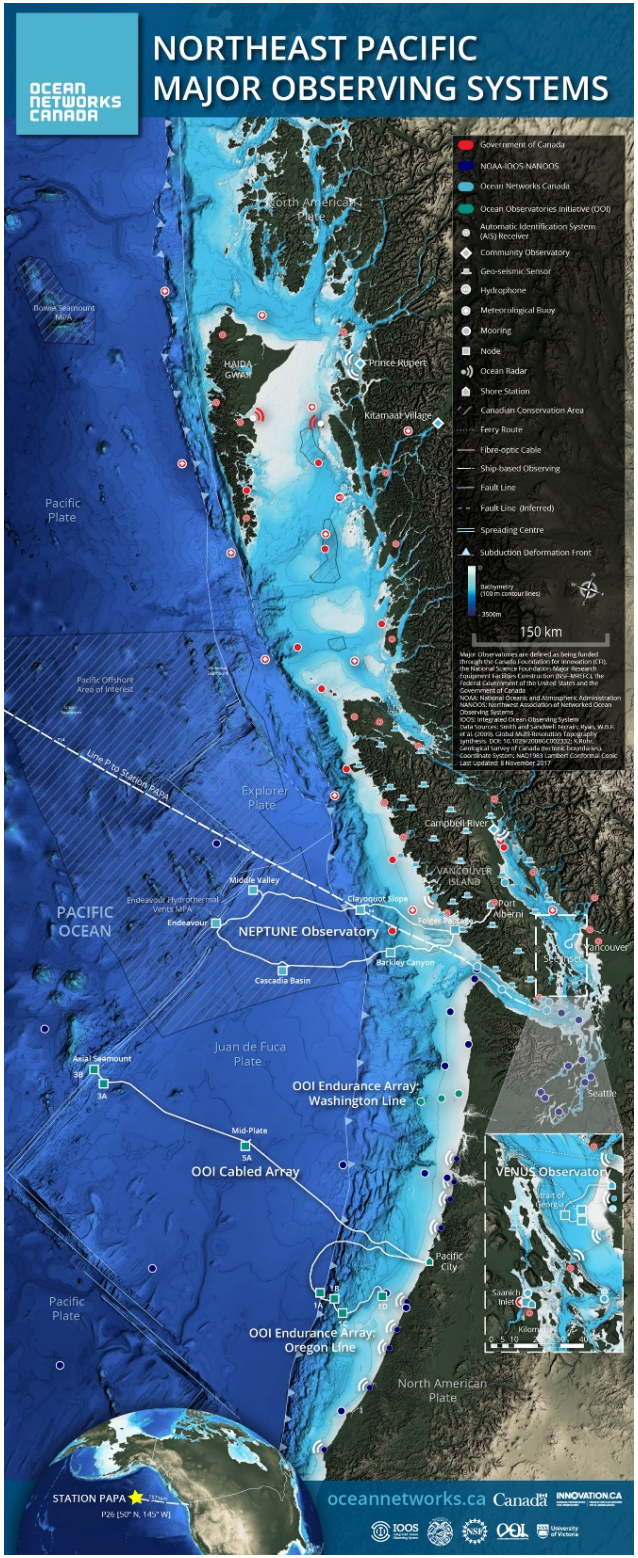
- Proposed new coastal buoy
- Existing coastal buoy to be sustained
- Existing estuarine buoys* to be sustained in partnership
- Existing glider track to be sustained
- Proposed new long-range HF site
- Existing long-range (180 km range) HF site to be sustained in partnership
- Existing standard-range (50 km range) HF site to be sustained in partnership
- Proposed new port wave radars
- Shoreline assessment to be sustained in partnership

*estuarine buoys are more numerous than symbols

OOI Conceptual Design

OCEAN OBSERVATORIES INITIATIVE

- Coastal mooring
- Cabled mooring
- Deepwater column mooring
- High voltage primary node
- Medium voltage primary node
- RSN cable
- Glider track
- Glider


OCEAN NETWORKS CANADA
NORTHEAST PACIFIC
MAJOR OBSERVING SYSTEMS
Government of Canada
NOAA-IOOS-NANOOS
Ocean Networks Canada
Ocean Observatories Initiative (OOI)
Automatic Identification System (AIS) Receiver
Community Observatory
Geo-seismic Sensor
Hydrophone
Meteorological Buoy
Mooring
Node
Ocean Radar
Shore Station
Canadian Conservation Area
Ferry Route
Fibre-optic Cable
Ship-based Observing
Fault Line
Fault Line (Inferred)
Spreading Centre
Subduction Deformation Front
Bathymetry (100 m contour lines)
3500m
150 km
Major Observatories are defined as being funded through the Canada Foundation for Innovation (CFI), the National Science Foundation Major Research Equipment Ice Blips Construction (NSF-MREFC), the Federal Government of the United States and the Government of Canada.
NOAA: National Oceanic and Atmospheric Administration
NANOOS: Northwest Association of Networked Ocean Observing Systems
IOOS: Integrated Ocean Observing System
Data sources: SRTM and Tanalwet: Ferrari, Ryan, W.B.F. et al. (2009). Global Multi-Resolution Topography synthesis. DOI: 10.1029/2008GC002332. U.Rolle Geological Survey of Canada (tectonic boundaries)
Coordinate System: NAD1983 Lambert Conformal Conic
Last updated: 8 November 2017
North American Plate
Bowie Seamount MPA
HAIDA GWAII
Prince Rupert
Kitamaat Village
Pacific Plate
Pacific Offshore Area of Interest
Line P to Station Papa
Explorer Plate
Campbell River
VANCOUVER ISLAND
Middle Valley
Endeavour Hydrothermal Vents MPA
Endeavour
Clayoquot Slope
Port Alberni
Folger Passage
PACIFIC OCEAN
NEPTUNE Observatory
Barkley Canyon
Cascadia Basin
Vancouver
Juan de Fuca Plate
Axial Seamount
3B
3A
OOI Endurance Array: Washington Line
Seattle
Mid-Plate
5A
OOI Cabled Array
VENUS Observatory
Strait of Georgia
Pacific City
Saanich Inlet
1B
1A
1D
OOI Endurance Array: Oregon Line
Pacific Plate
North American Plate
STATION PAPA
P26 [50° N, 145° W]
oceannetworks.ca
Canada
INNOVATION.CA
IOOS
NSF
OOI
University of Victoria

NANOOS Objectives for FY2017

1) Maintain **NANOOS as the U.S. IOOS PNW Regional Associ**ation

2) Maintain **surface current and wave mappin**g capability.

3) Sustain **existing buoys and gliders in the PNW coastal ocean**, in coordination with national programs.

4) Maintain **observation capabilities in PNW estuaries**, in coordination with local and regional programs.

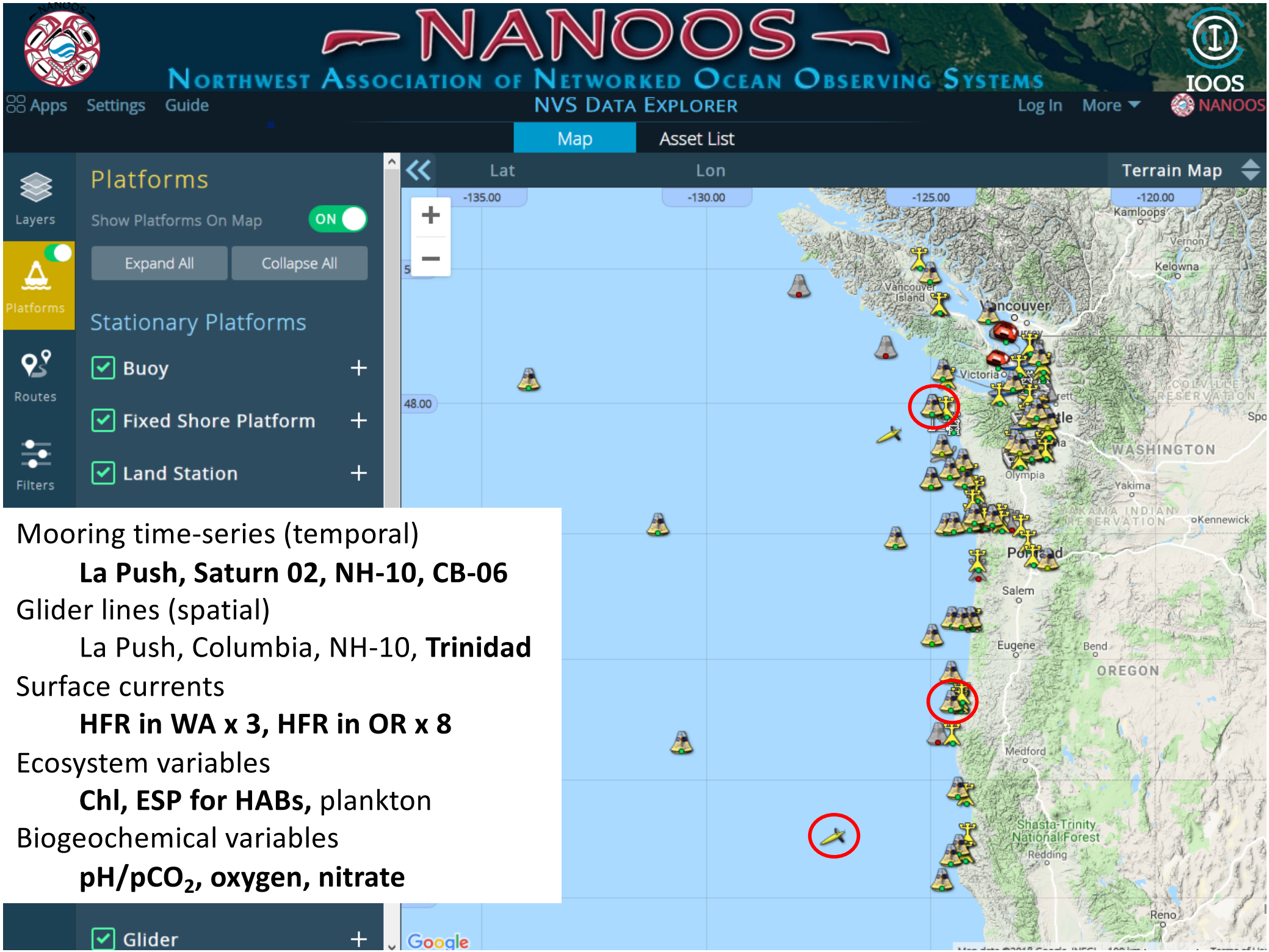
5) Maintain **core elements of beach and shoreline observing** programs.

6) Provide sustained support to a **community of complementary regional numerical models**.

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

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

9) Sustain **NANOOS outreach, engagement, and education**.



Mooring time-series (temporal)

La Push, Saturn 02, NH-10, CB-06

Glider lines (spatial)

La Push, Columbia, NH-10, **Trinidad**

Surface currents

HFR in WA x 3, HFR in OR x 8

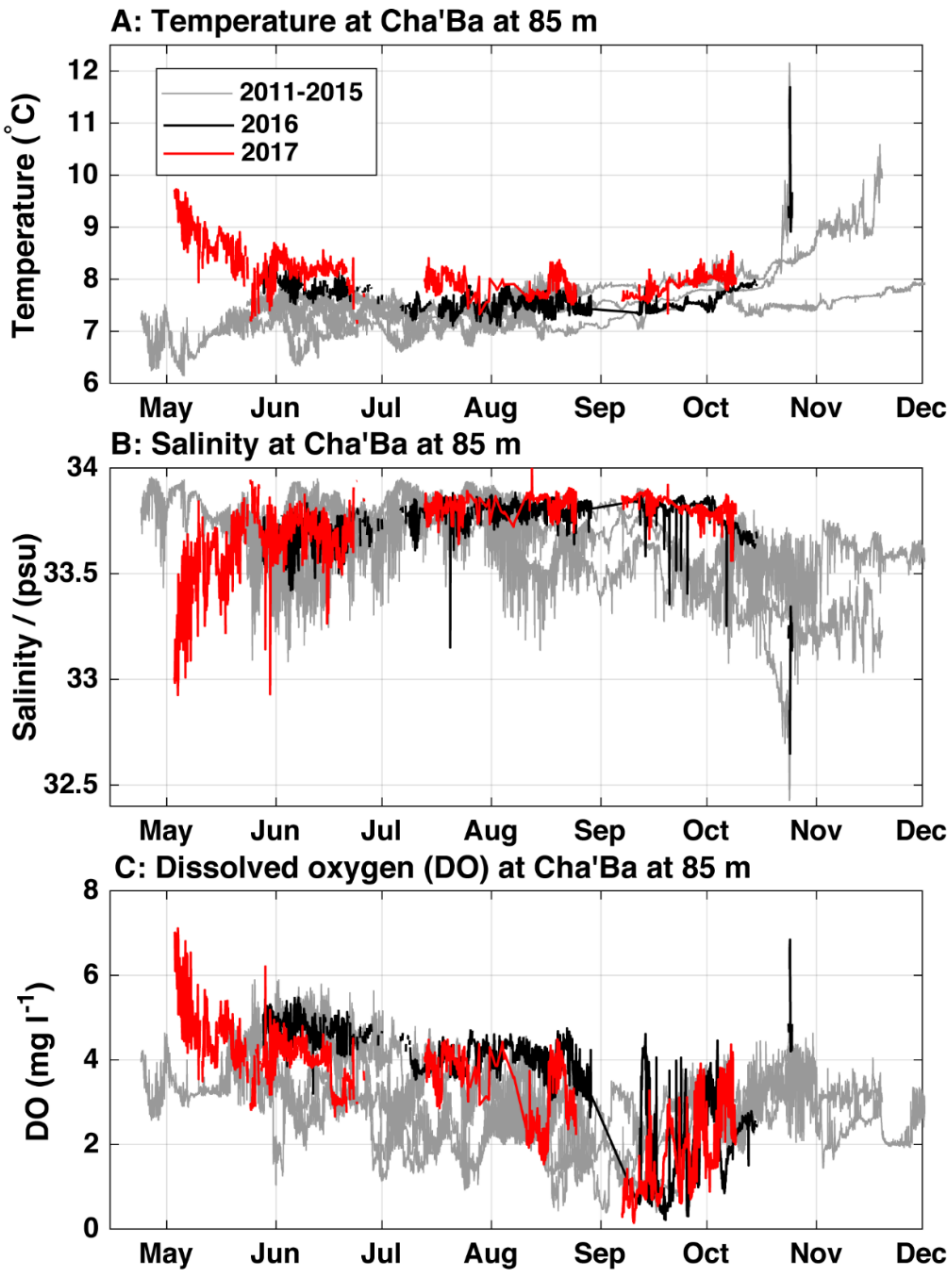
Ecosystem variables

Chl, ESP for HABs, plankton

Biogeochemical variables

pH/pCO_2, oxygen, nitrate

La Push Deep Water Properties

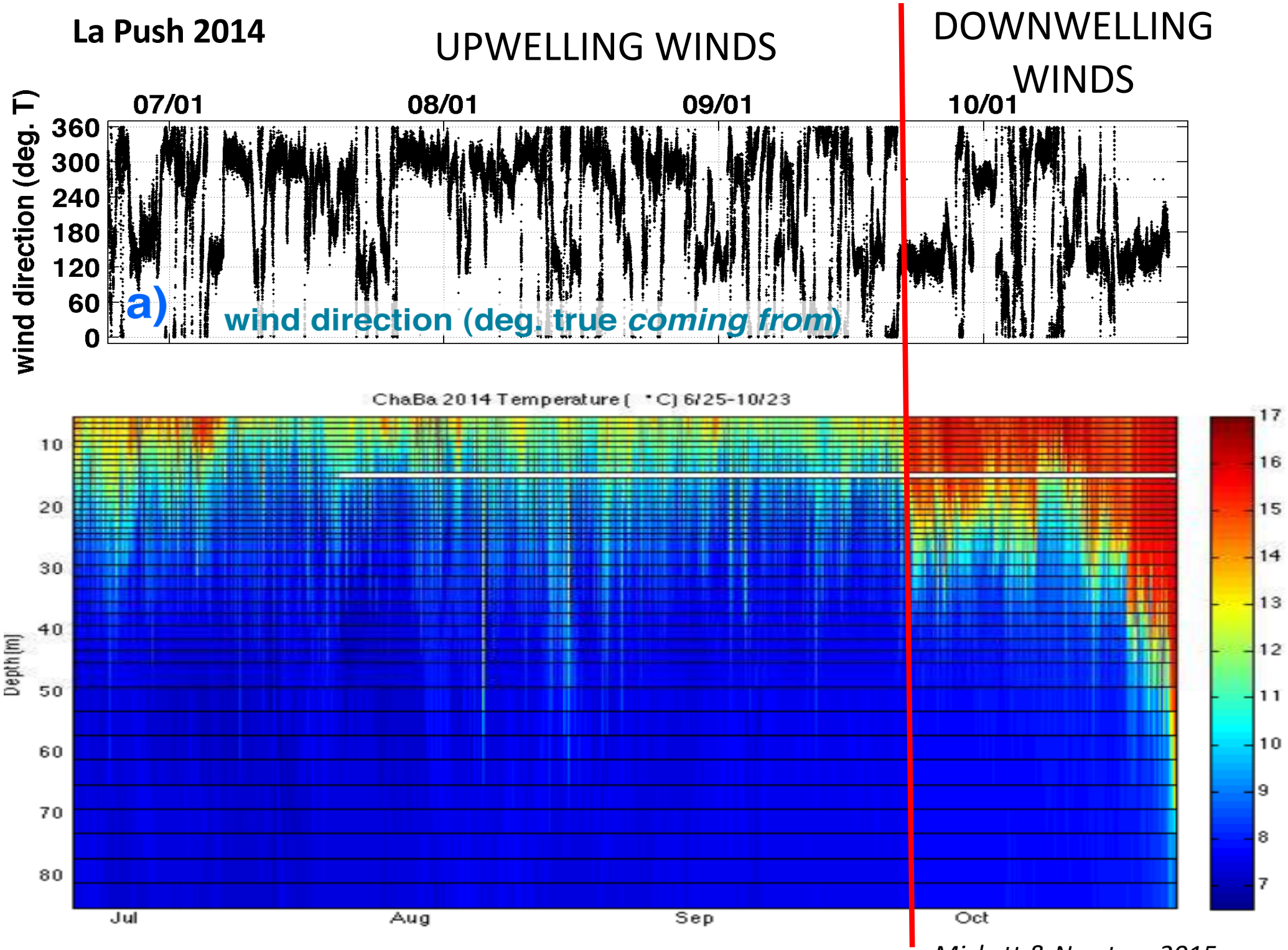


Local winds measured by Cha'ba suggest that steady upwelling conditions did not set in until late June 2017, compared to April-May in previous years; however, a relatively steady decrease in deep (85 m) temperature and increase in deep salinity and nitrate was observed in early May from the start of the deployment. This trend continued until about mid-September when downwelling conditions began to take over.

Early season deep salinity was lower than previous spring observations, potentially in response to record rainfall over the winter and spring of 2017, but rapidly increased in May with the onset of intermittent upwelling conditions.

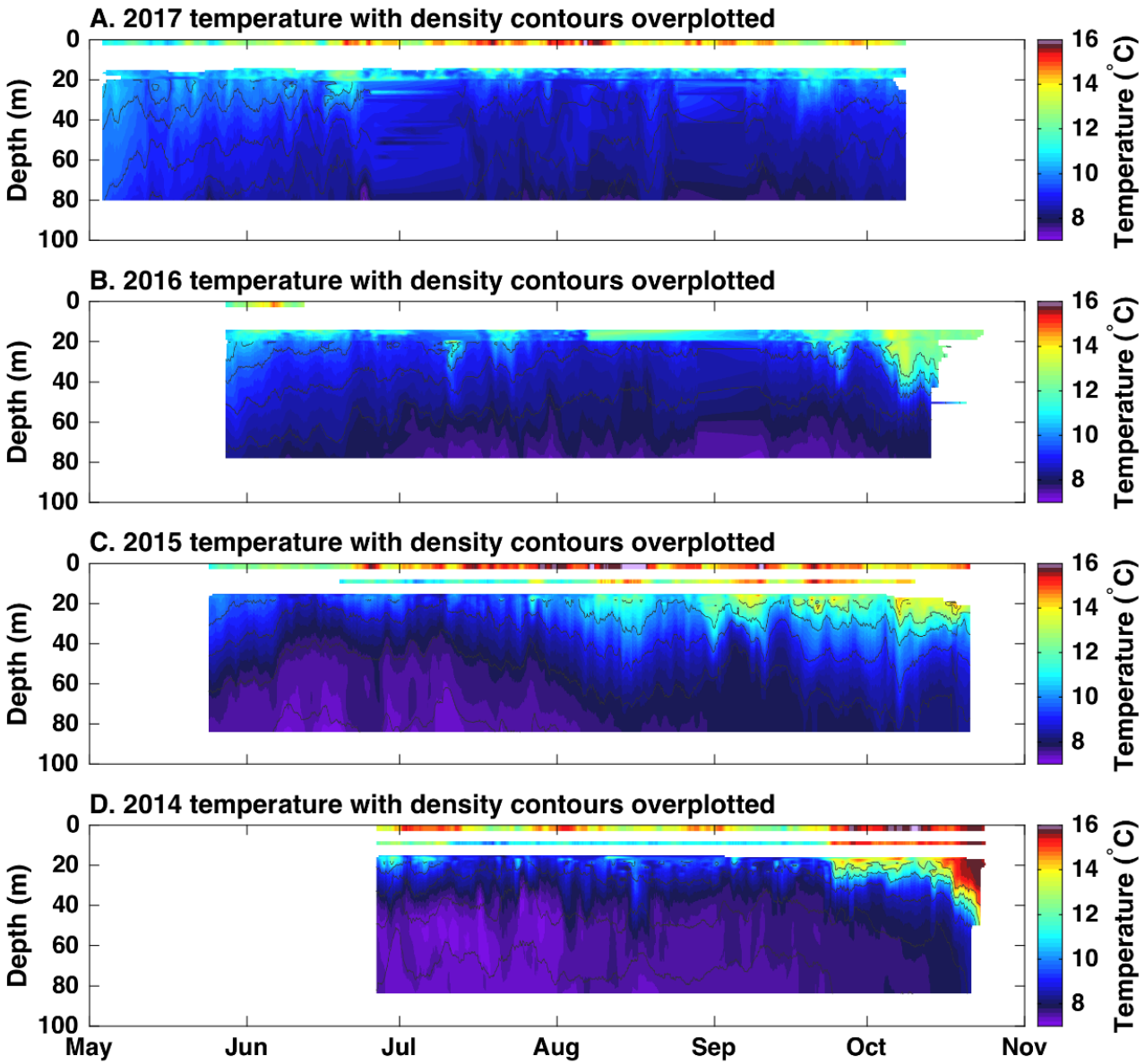
Deep dissolved oxygen showed a relatively steady, slow decrease until late August when it dropped rapidly to hypoxic levels with the onset of downwelling conditions. This rapid drop is likely a consequence of wind-shifts bringing low-DO water from the south to this location as reported in previous PSEMP reports. The seasonal trend of the relatively steady decrease in DO was similar to 2016 observations, but is not a consistent seasonal pattern. In 2014 and 2015 for example, upwelling season peaks in deep salinity and nitrate and minima in deep temperature occurred in June and July and were linked to periods of the strongest upwelling winds.

Mickett & Newton, 2018



Mickett & Newton, 2015

La Push Cha'ba Temperature Profiles



For most of the 2017 record, deep waters (i.e., water below about 40-50 m depth in 100 m total water depth) were on-average warmer (~0.8 ^{o}C) than previous years at this site.

This could be the delayed signature of the 2014-2016 North Pacific marine heat wave (aka "the Blob"), characterized by a warmer mixed layer (Bond et al. 2015), slowly subducting or mixing downward to reach upwelling source water depths.

Mickett & Newton, 2018

NANOOS: UW-NOAA OAP

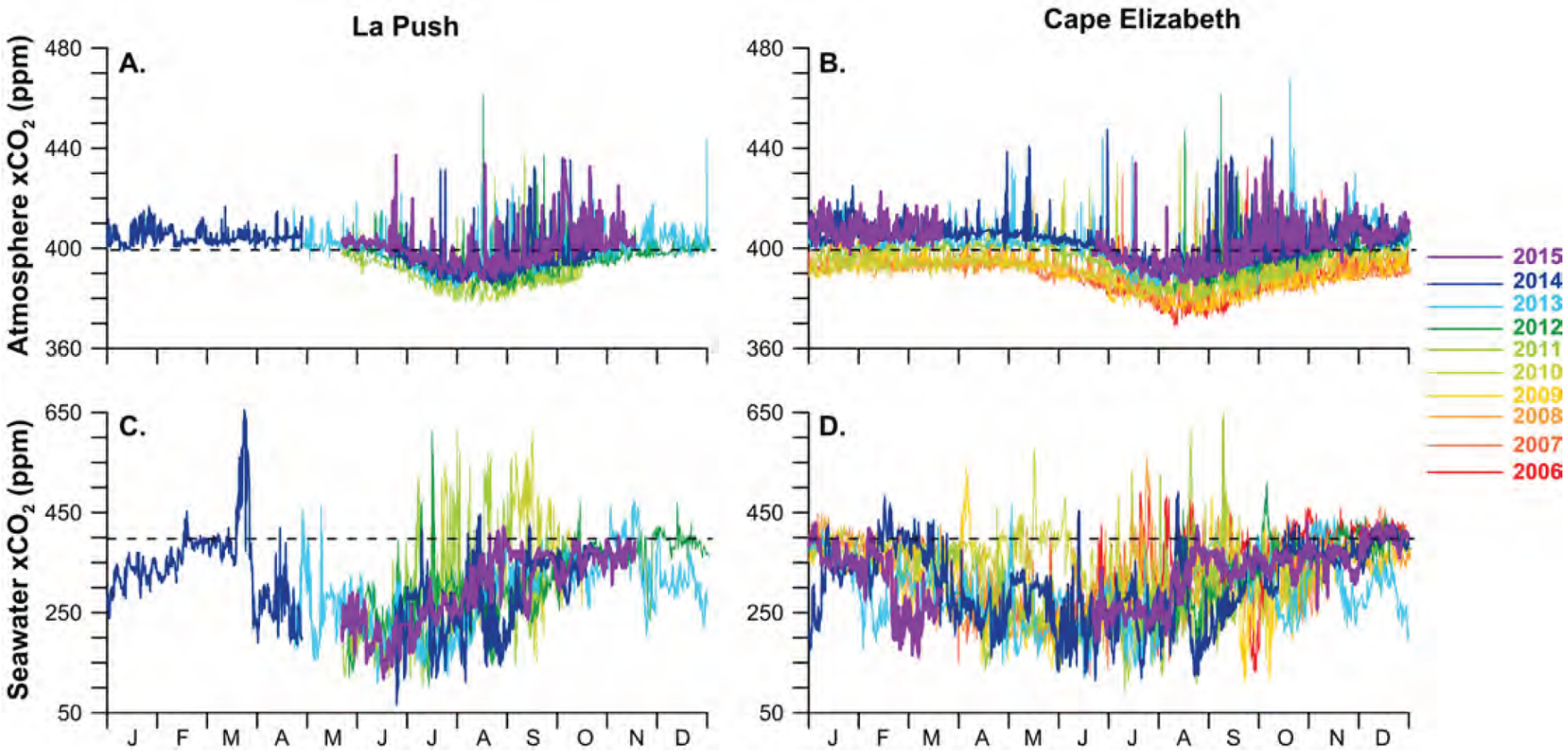
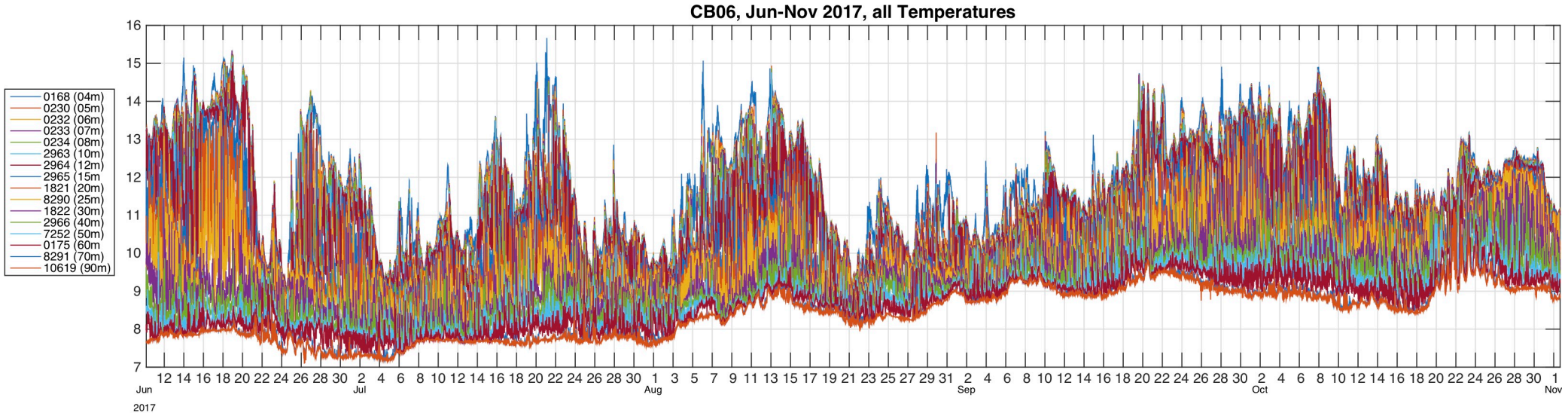


Figure 9. The mole fraction of carbon dioxide (xCO_2) in air at 1.5 m above seawater and in surface seawater at 0.5 m depth on the surface Chá Bă mooring off La Push, WA, and on the NDBC mooring 46041 off Cape Elizabeth, WA. Globally averaged marine surface air 2015 annual mean xCO_2 value of 399 ppm is indicated with a dashed line in each panel. Typical uncertainty associated with quality-controlled measurements from these systems is < 2 ppm for the range 100–600 ppm.

Simone Alin, 2016

Coos Bay CB-06 Temperature



Kosro, OSU

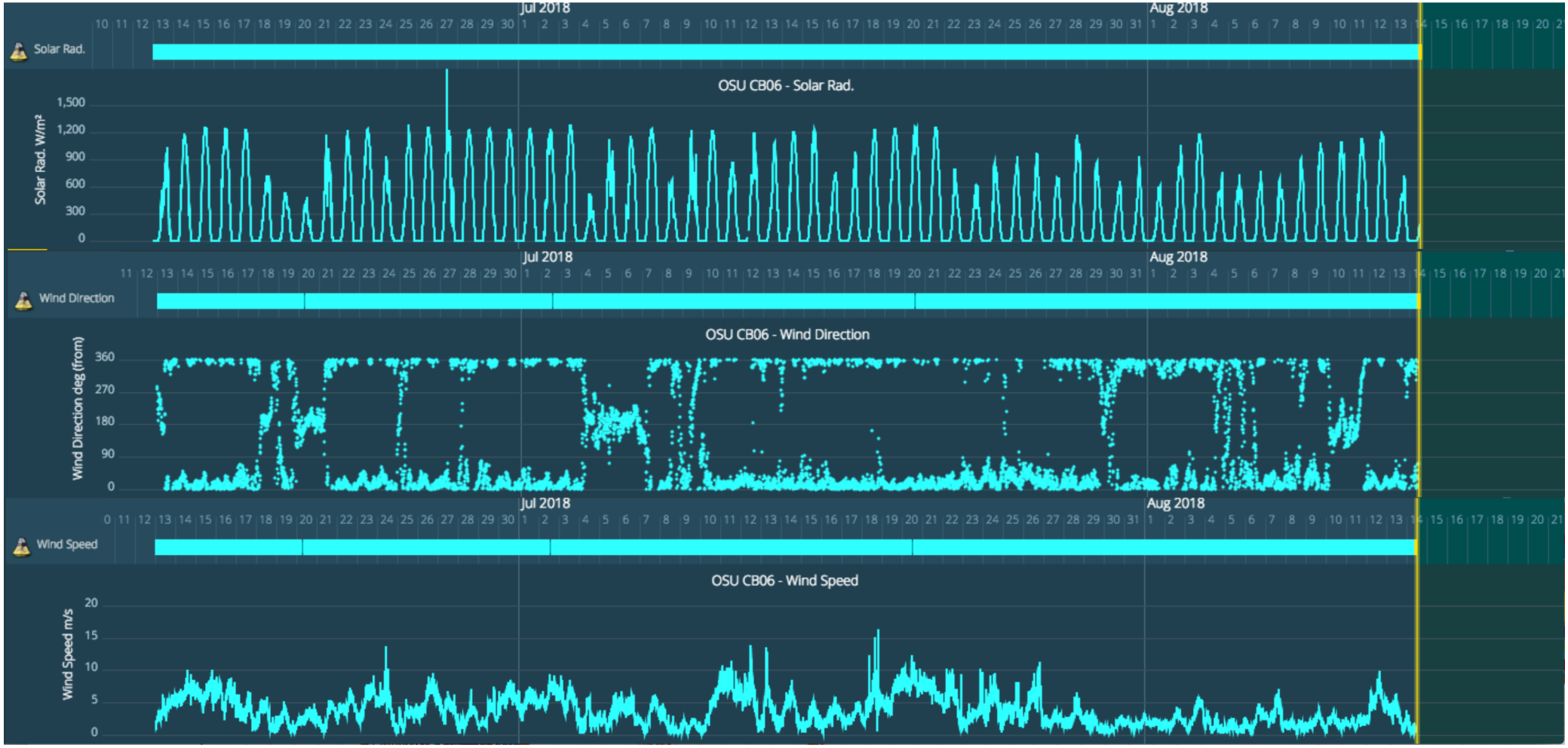
Coos Bay CB-06

Surface T, Surface S, northward Current

Kosro, OSU

Coos Bay CB-06

Meteorological Data: Solar Insolation, Wind Direction & Speed



Kosro, OSU

Coos Bay CB-06

Biogeochemical: Air CO_2, Water CO_2, pH

Kosro, OSU

Apps Settings

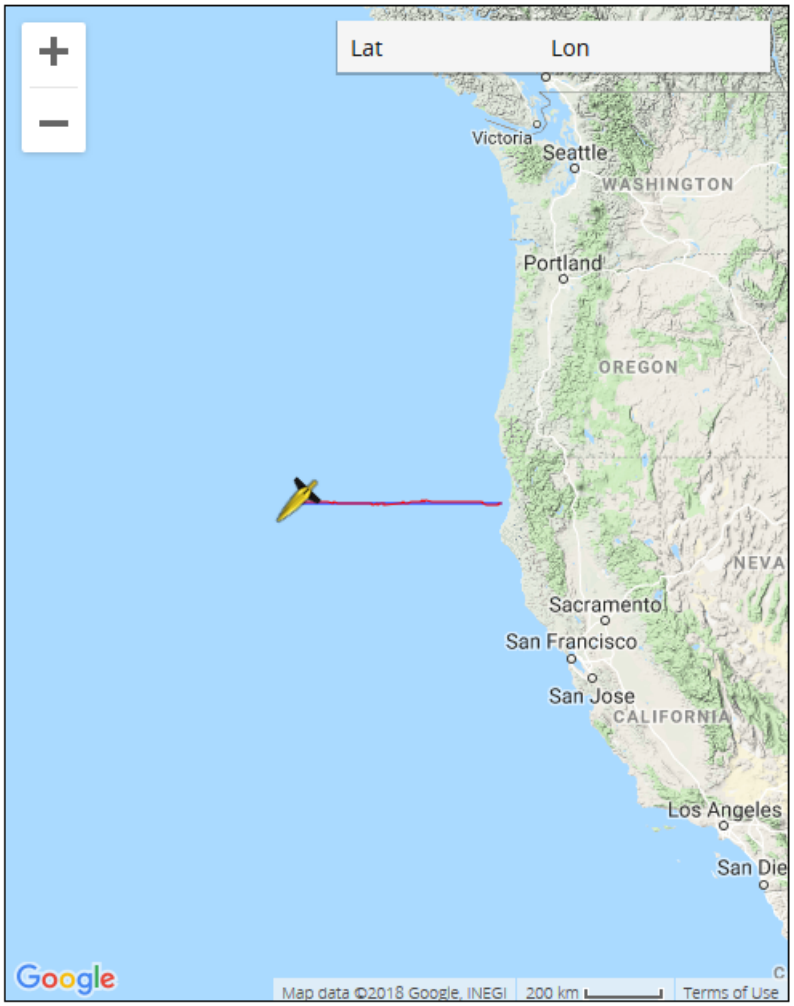
NVS Trinidad Head Glider

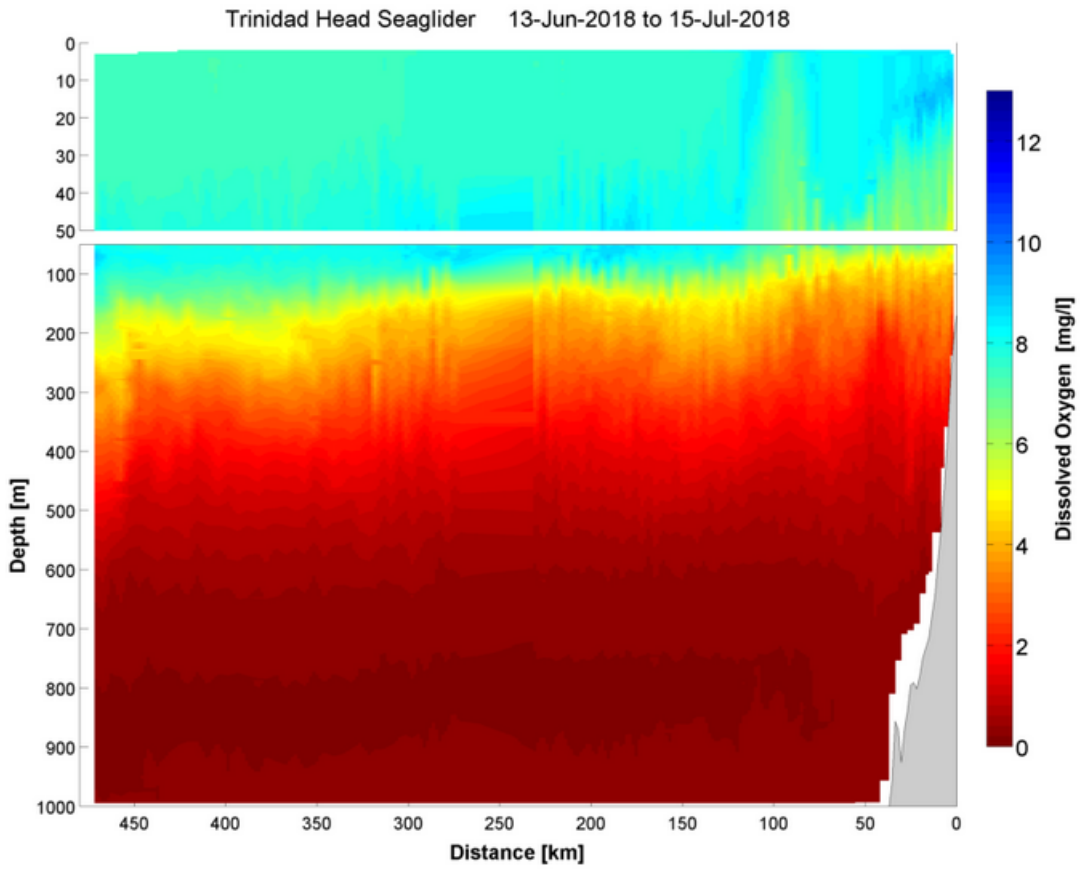
Log In More NANOOS

Plots | Annual Plots

Missions 2014-Present Type: Seaglider Provider: OSU CEOAS GRG Contact: Jack Barth

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



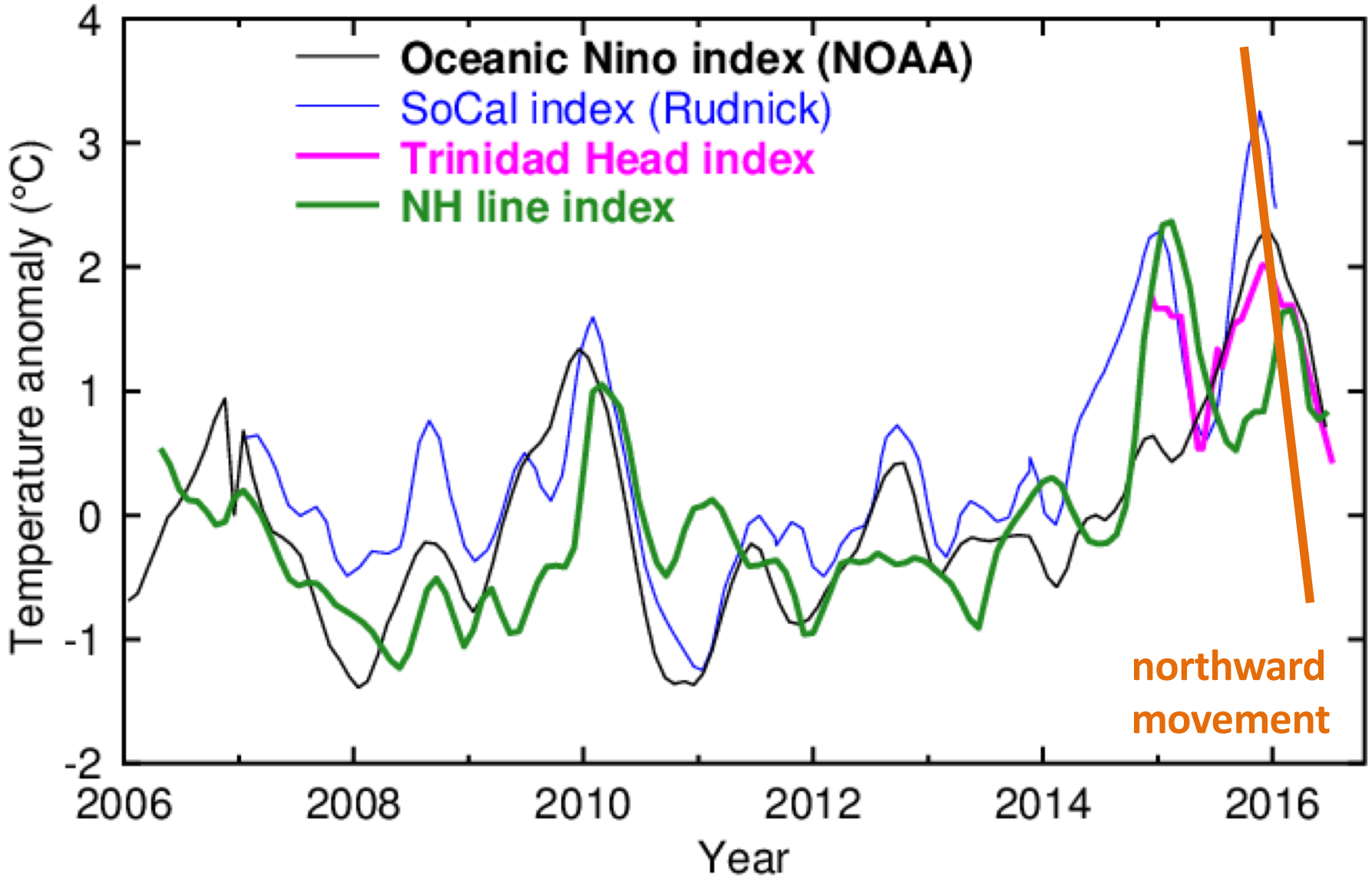


Prev 14 July 2018 11:36 pm Next

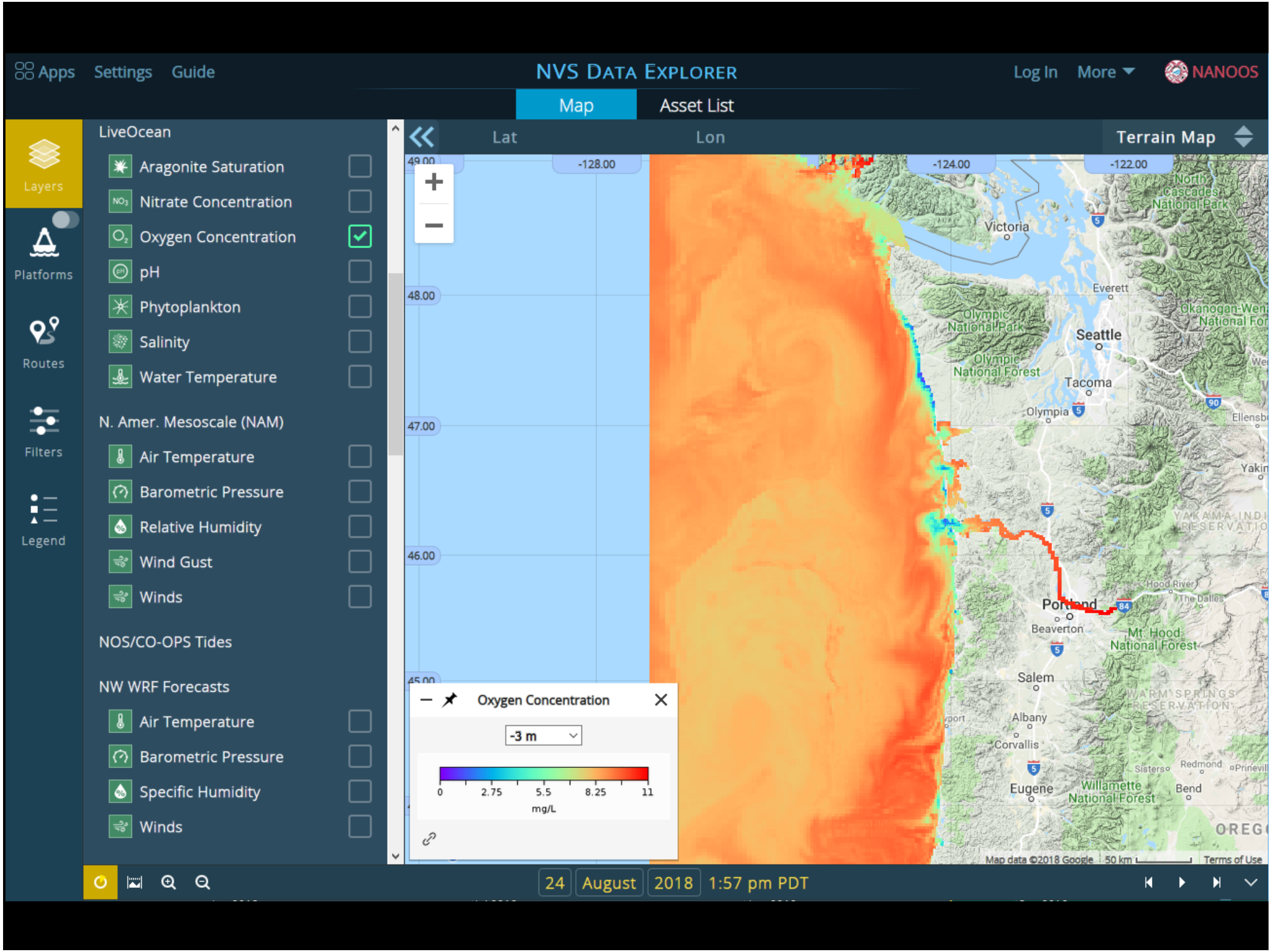
2014 2015 2016 2017 2018 2019

2014-Present

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



Barth, Shearman, Erofeev, Pierce, Bjorkstedt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Phytoplankton
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N. Amer. Mesoscale (NAM)
Air Temperature
Barometric Pressure
Relative Humidity
Wind Gust
Winds
NOS/CO-OPS Tides
NW WRF Forecasts
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Corvallis
Eugene
Bend
Redmond
Sisters
Olympic National Park
Olympic National Forest
North Cascades National Park
Mt. Hood National Forest
Willamette National Forest
Oxygen Concentration
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5.5
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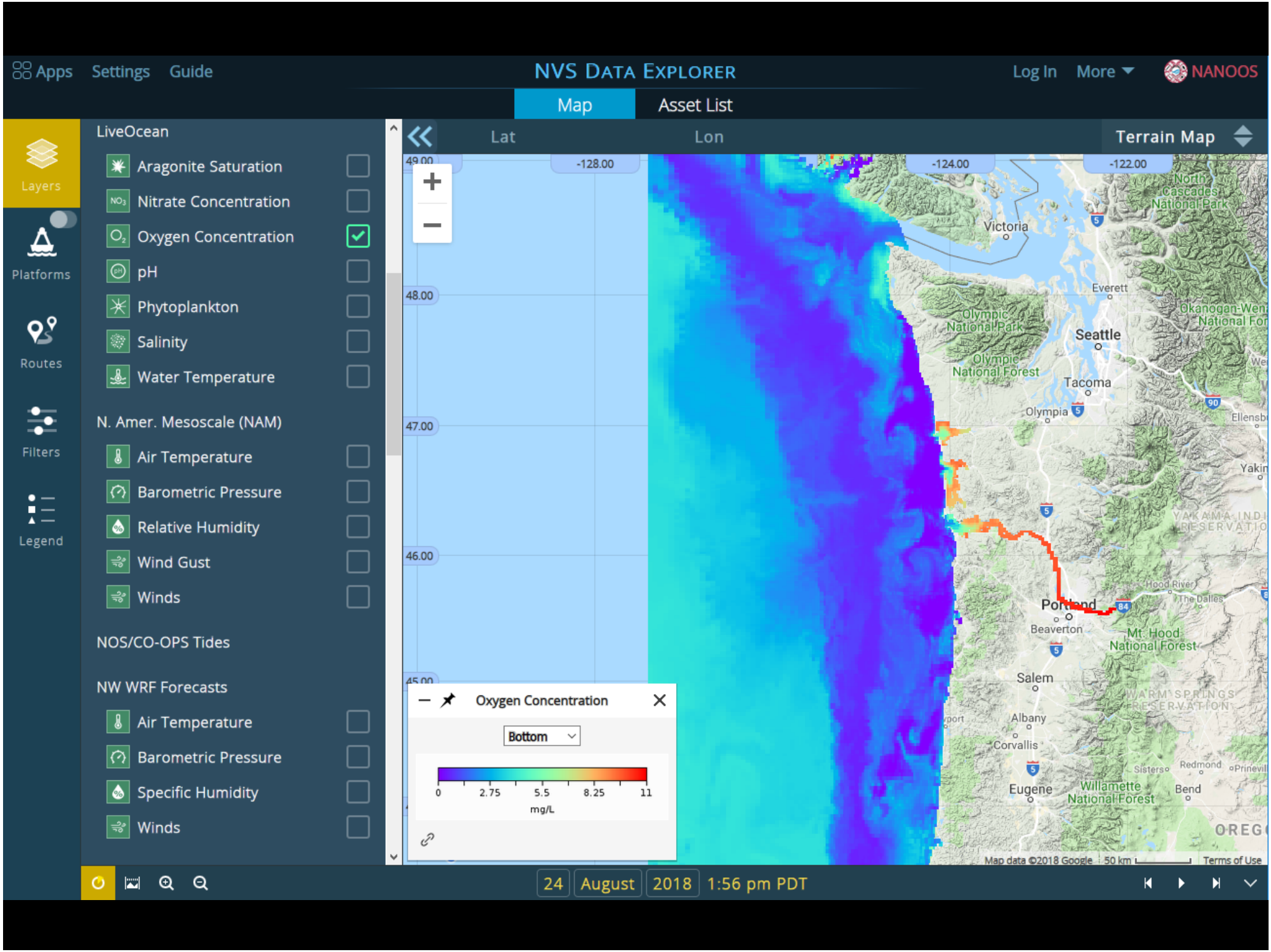
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Willamette National Forest
Bend
Redmond
Sisters
Hood River
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Oxygen Concentration
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mg/L
Map data ©2018 Google
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Terms of Use
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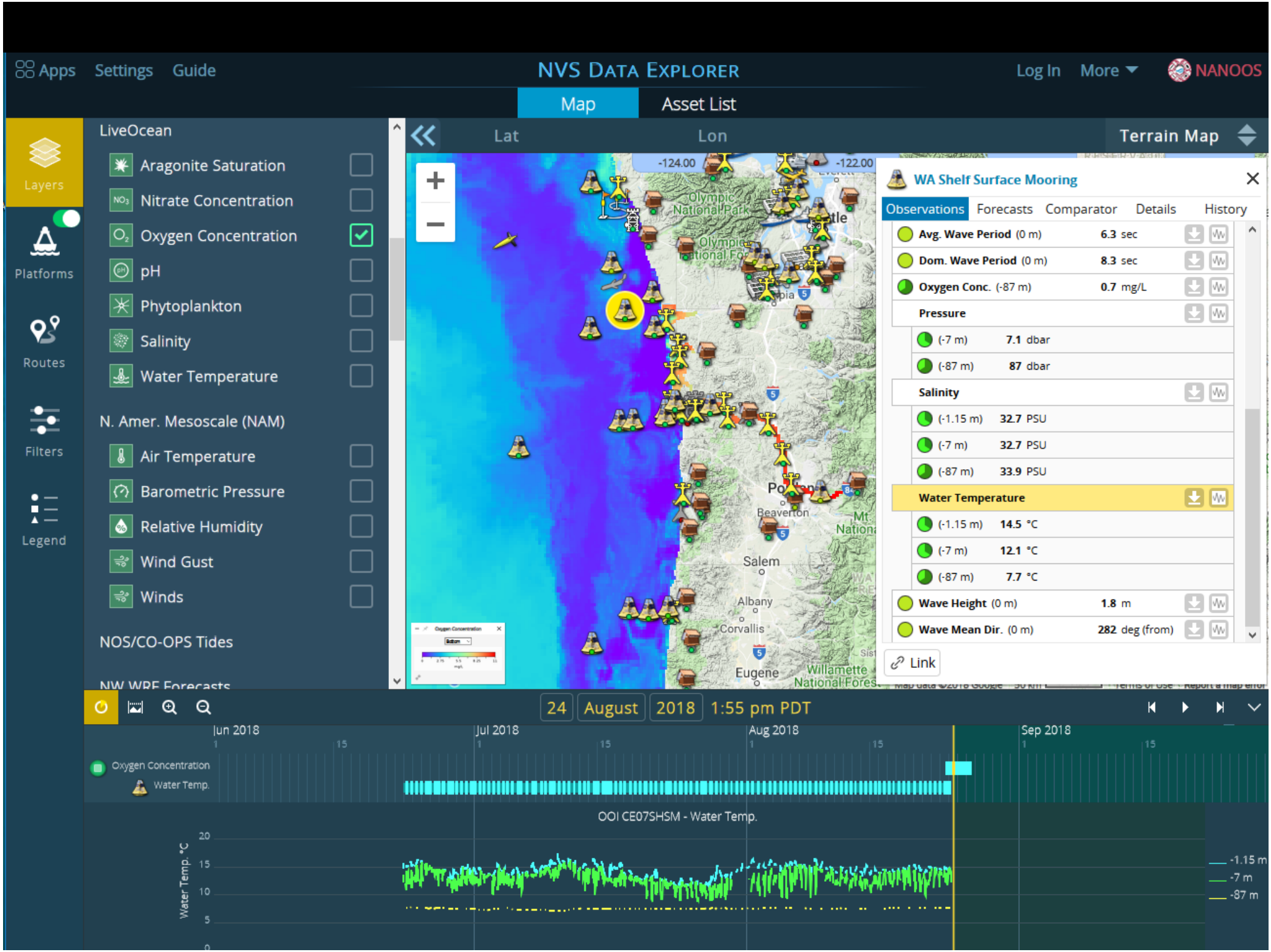
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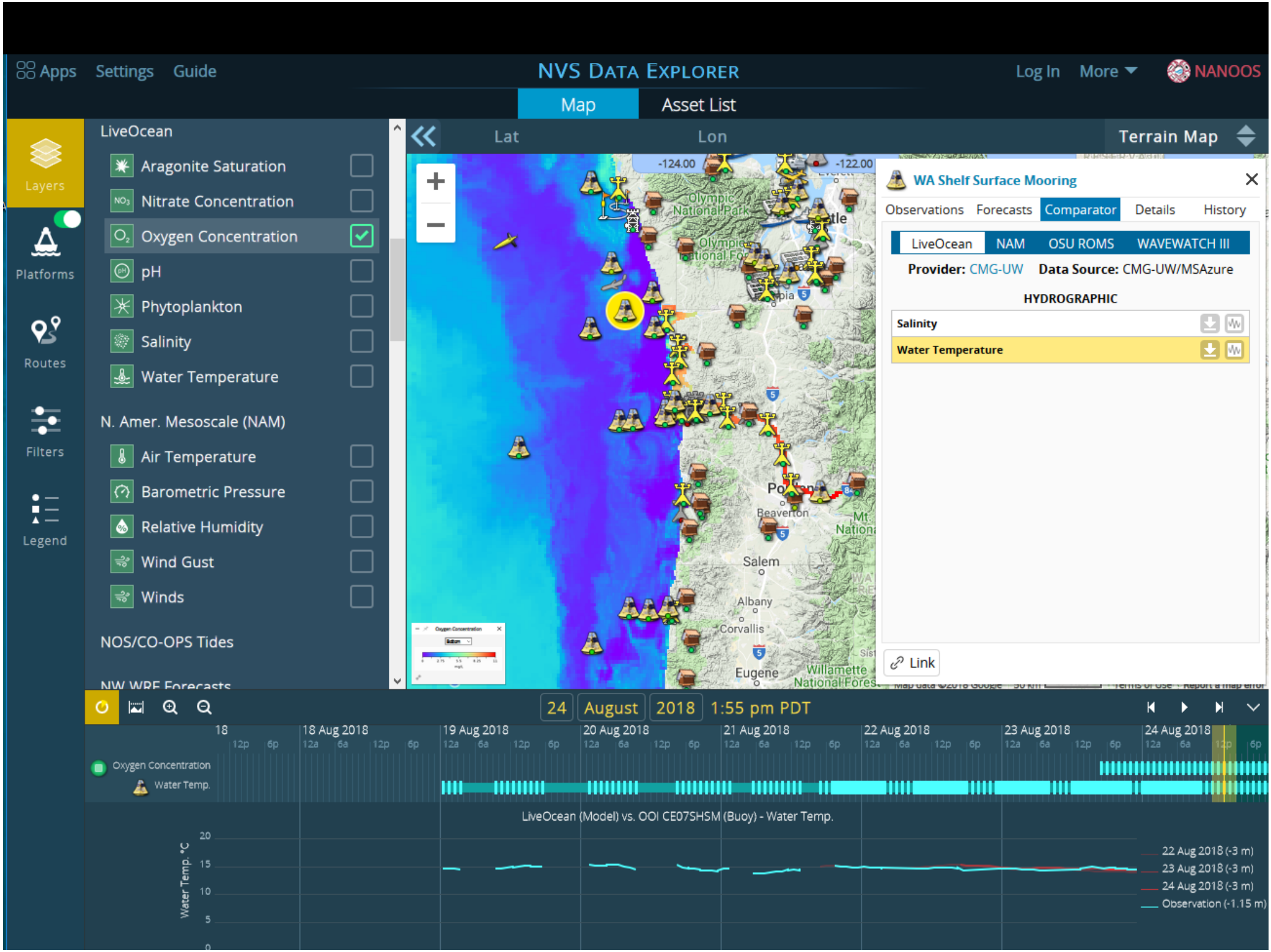
Portland
Beaverton
Salem
Albany
Corvallis
Eugene
Willamette National Forest
WA Shelf Surface Mooring
Observations
Forecasts
Comparator
Details
History
Avg. Wave Period (0 m) 6.3 sec
Dom. Wave Period (0 m) 8.3 sec
Oxygen Conc. (-87 m) 0.7 mg/L
Pressure
(-7 m) 7.1 dbar
(-87 m) 87 dbar
Salinity
(-1.15 m) 32.7 PSU
(-7 m) 32.7 PSU
(-87 m) 33.9 PSU
Water Temperature
(-1.15 m) 14.5 °C
(-7 m) 12.1 °C
(-87 m) 7.7 °C
Wave Height (0 m) 1.8 m
Wave Mean Dir. (0 m) 282 deg (from)
Link
24 August 2018 1:55 pm PDT
Jun 2018
Jul 2018
Aug 2018
Sep 2018
Oxygen Concentration
Water Temp.
OOI CE07SHSM - Water Temp.
Water Temp. °C
20
15
10
5
-1.15 m
-7 m
-87 m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Olympic National Park
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Details
History
LiveOcean
NAM
OSU ROMS
WAVEWATCH III
Provider: CMG-UW
Data Source: CMG-UW/MSAzure
HYDROGRAPHIC
Salinity
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Link
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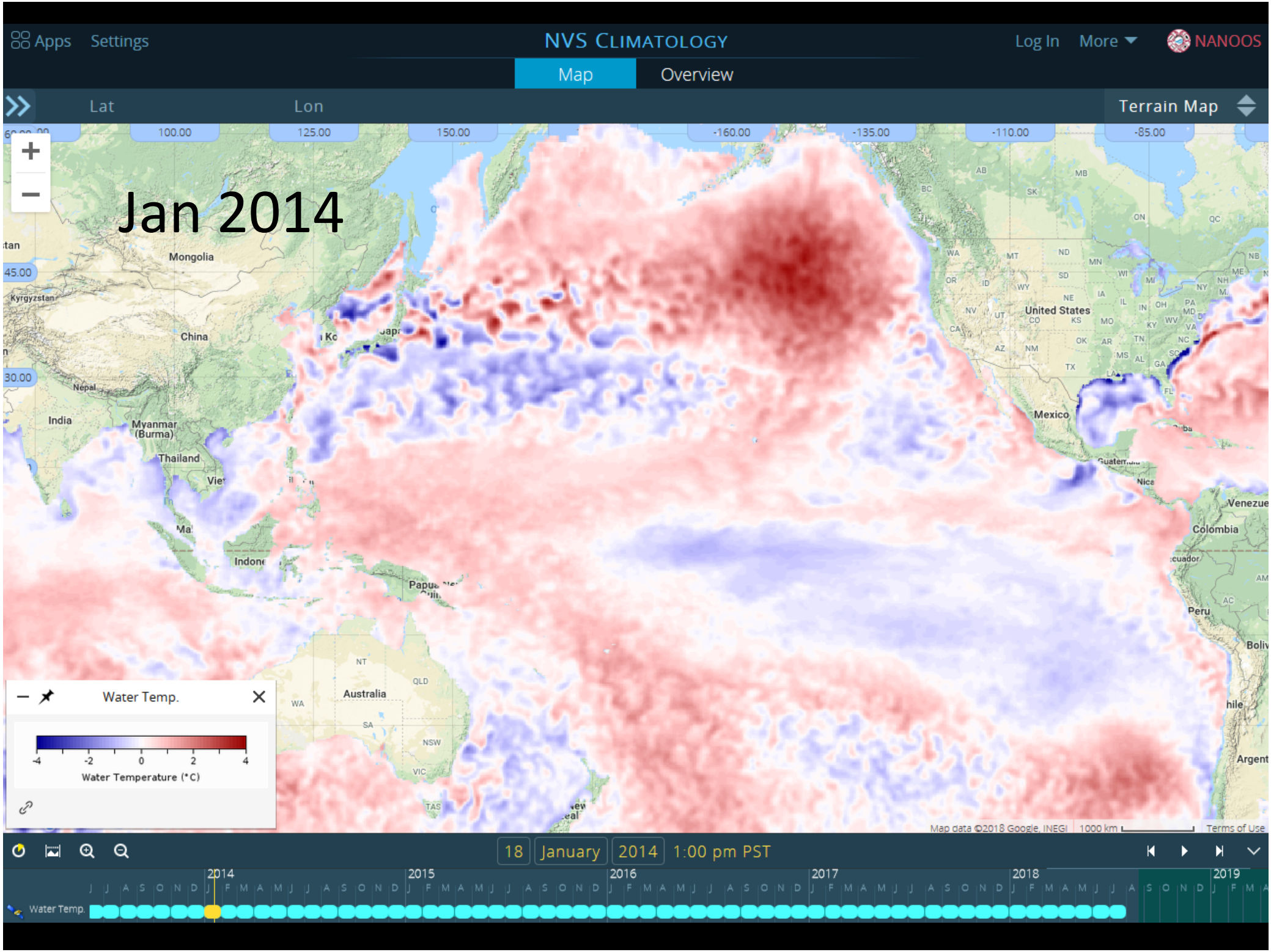
18 Aug 2018
19 Aug 2018
20 Aug 2018
21 Aug 2018
22 Aug 2018
23 Aug 2018
24 Aug 2018
Oxygen Concentration
Water Temp.
LiveOcean (Model) vs. OOI CE07SHSM (Buoy) - Water Temp.
Water Temp. °C
22 Aug 2018 (-3 m)
23 Aug 2018 (-3 m)
24 Aug 2018 (-3 m)
Observation (-1.15 m)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India
Myanmar (Burma)
Thailand
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Mexico
Colombia
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Water Temperature (°C)
Map data ©2018 Google, INEGI
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Terms of Use
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2019
Water Temp.

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