



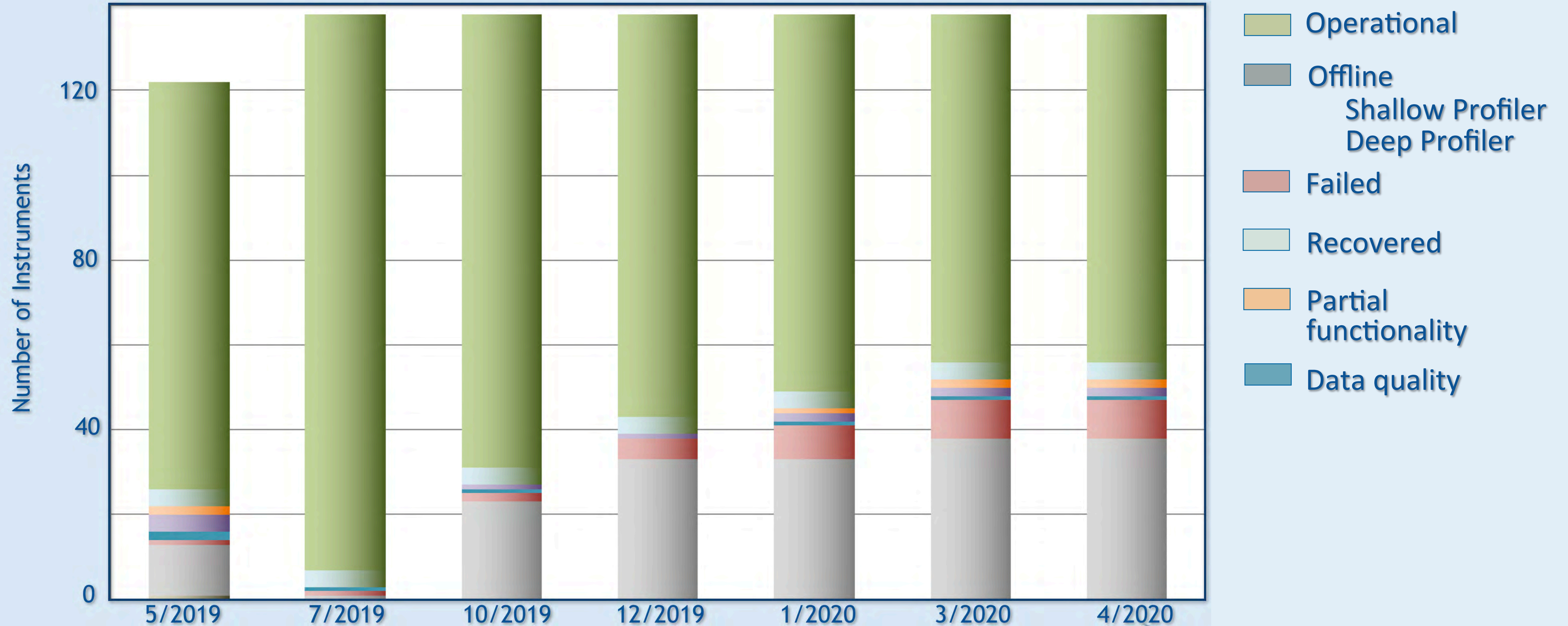
Regional Cabled Array

Debbie Kelley and RCA Team, University of Washington

May 13, 2020



RCA Instrument/Infrastructure Status

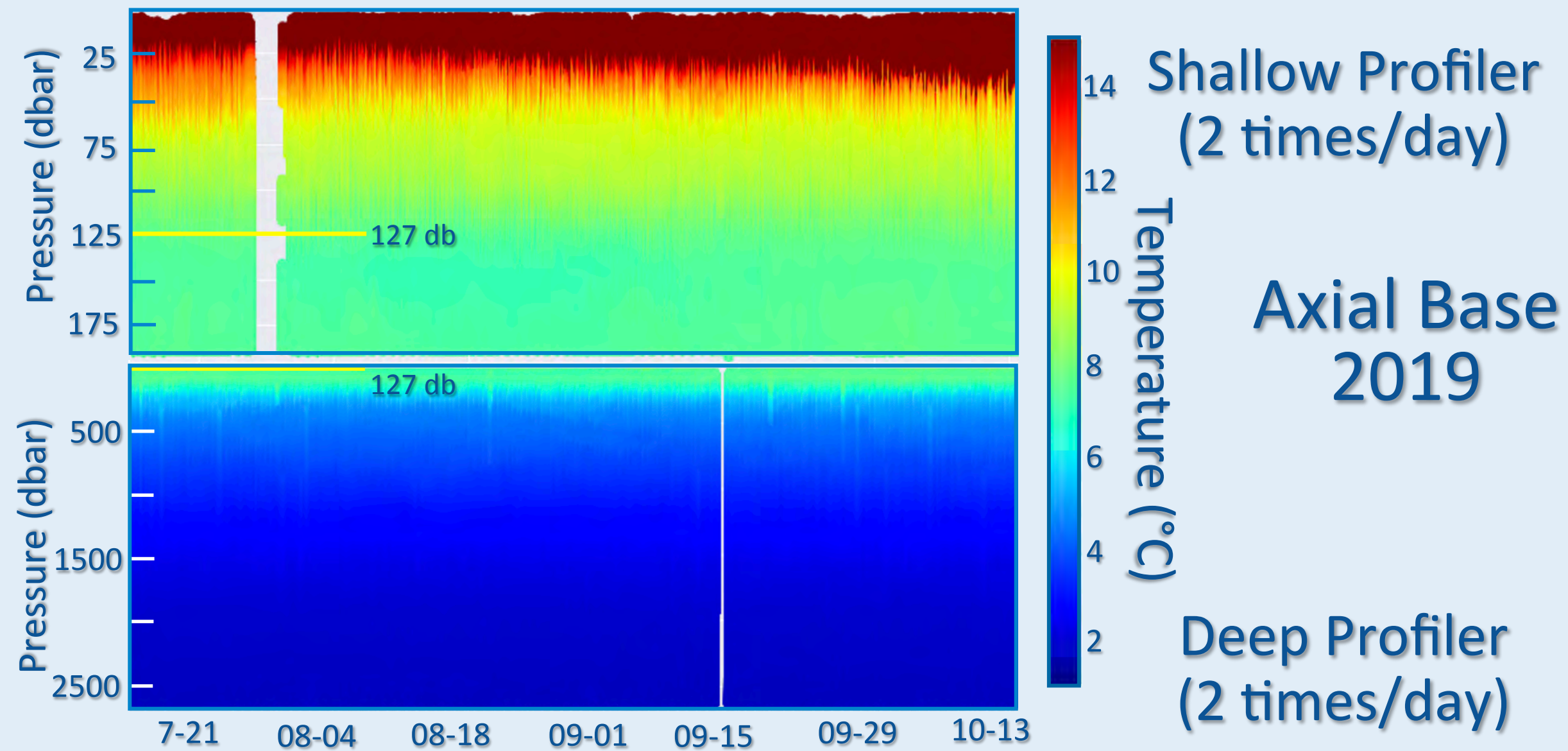


↑
2019 O&M
Cruise

65% operational
25% offline

3% not deployed
7% failed

Profiler Mooring Status



Shallow Profilers - Over 40,000 profiles completed since 2015

Axial Base Deep Profiler

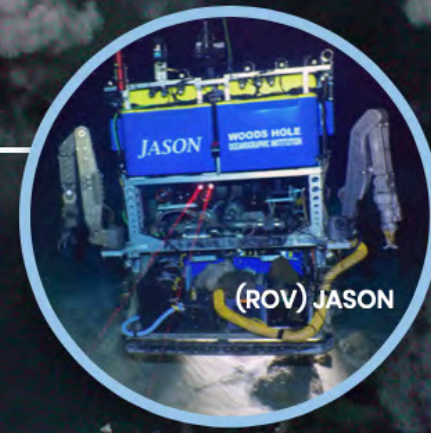
2018/2019 1.9 million meters traversed

2019/2020 2.0 million meters traversed

- Shallow Profiler Moorings Slope Base and Oregon Offshore - low oil levels pressure in science pod winch controller, taken offline; all three PIA instrumented platforms operational
- Deep Profiler Moorings - 3 docking stations working, Slope Base vehicle continued to go up and down several months, but would not communicate

VISIONS'20

EXPEDITION - JULY TO AUGUST 2020



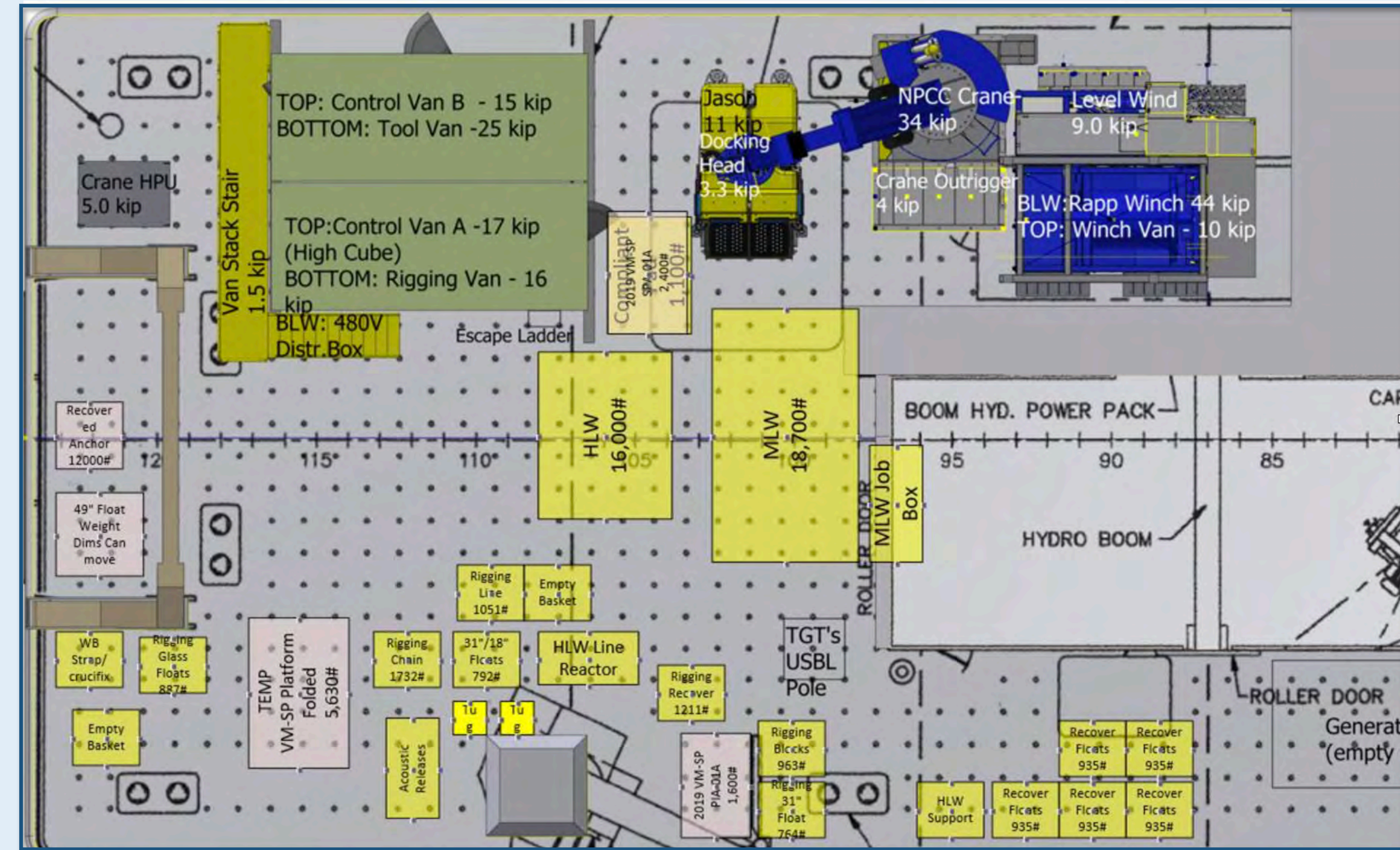
@VISIONSops

RCA Maintenance Cruise Status TN380

- Onboard the *R/V Thompson* with the *ROV Jason* - Mobilize July 20 - Return August 30, 2020
Newport - Newport

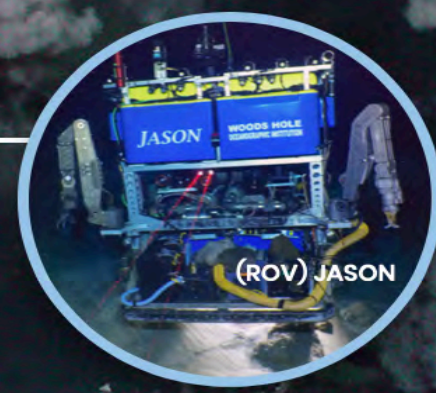
Evolving considerations

- UW labs tightly controlled access starting week of May 4 (APL) an 11 (School of Oceanography)
- Supply Chain
- 2 week quarantine Newport or Seattle
- 3-5-7 day quarantine depending on testing status
- Minimize staffing - No VISIONS students
- Status of TGT power for *Jason* and location of 20 ft generator van



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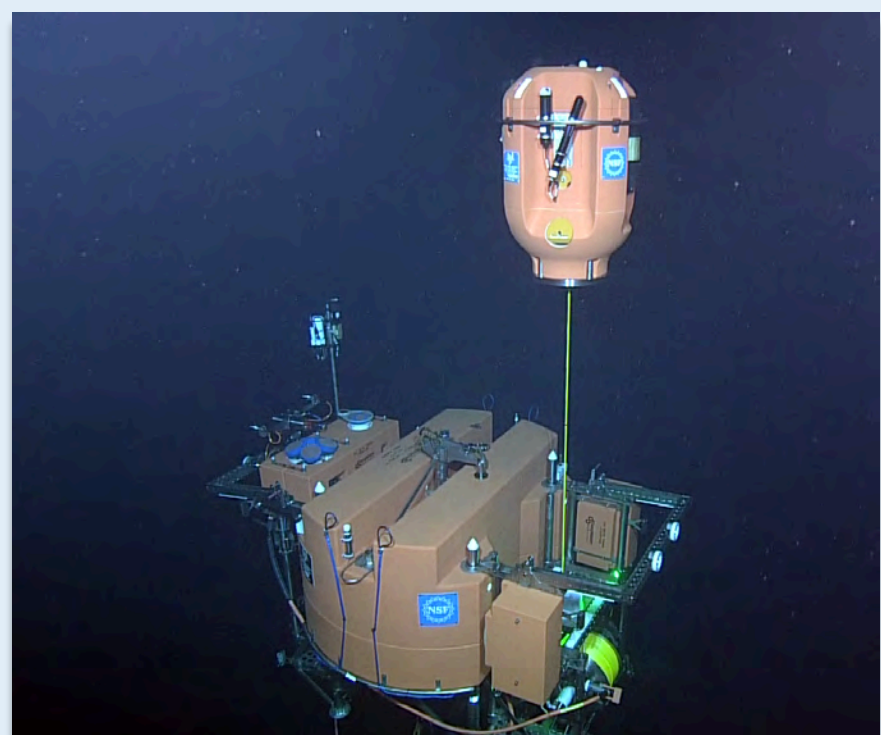
Newport - Newport

Four legs

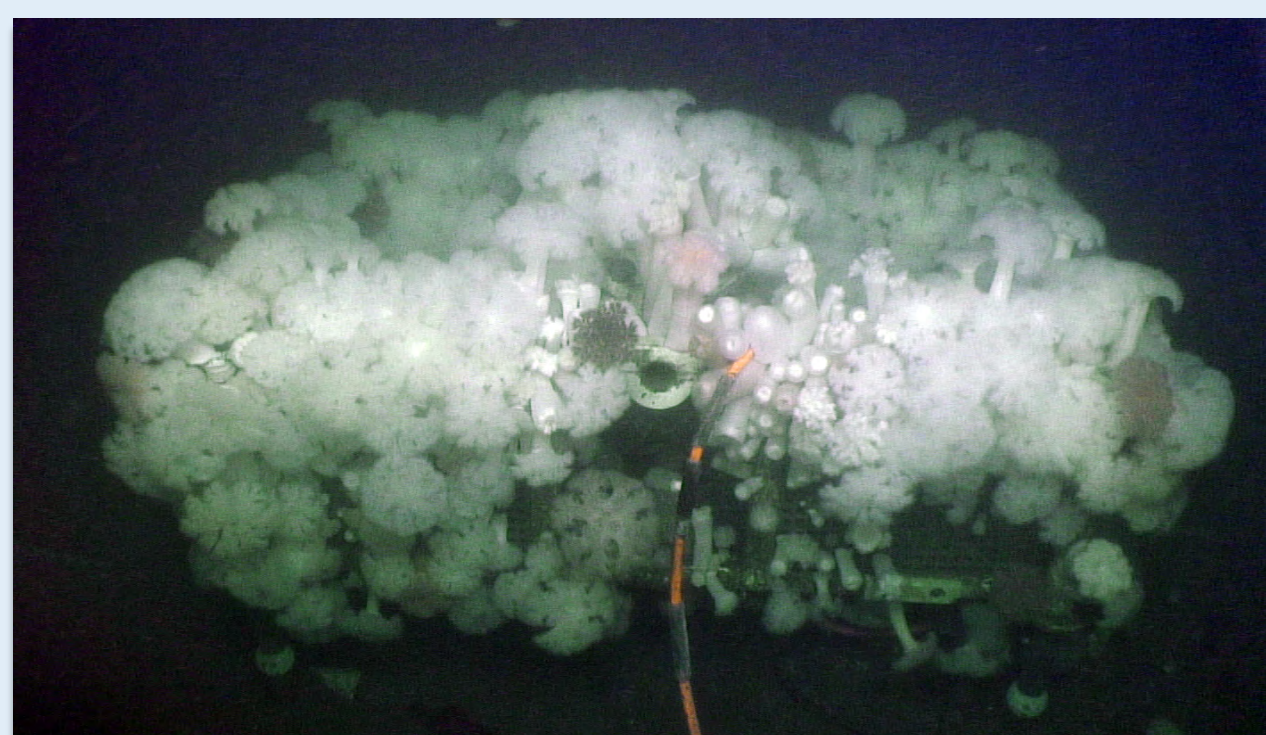
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- First full turn of a two-legged shallow profiler mooring - will require coming into port to spool cable due to limited deck space; 6 science pods
- Turn 3 Deep Profiler Vehicles
- Turn 6 Secondary Junction boxes, 2 BEPs
- Turn >100 OOI Core Instruments
- MARUM: Overview and quantification sonars, 4 K camera
- ONR-Reimers: Recovery of Benthic Platform - microbial fuel cells
- NSF-Chadwick: Install two CTD's Axial
- Postponed to 2021: ONR Energy Extraction (2), NASA InVADER (2), BOEM (1), Wilcock (1), Pythias (1)



Shallow Profiler

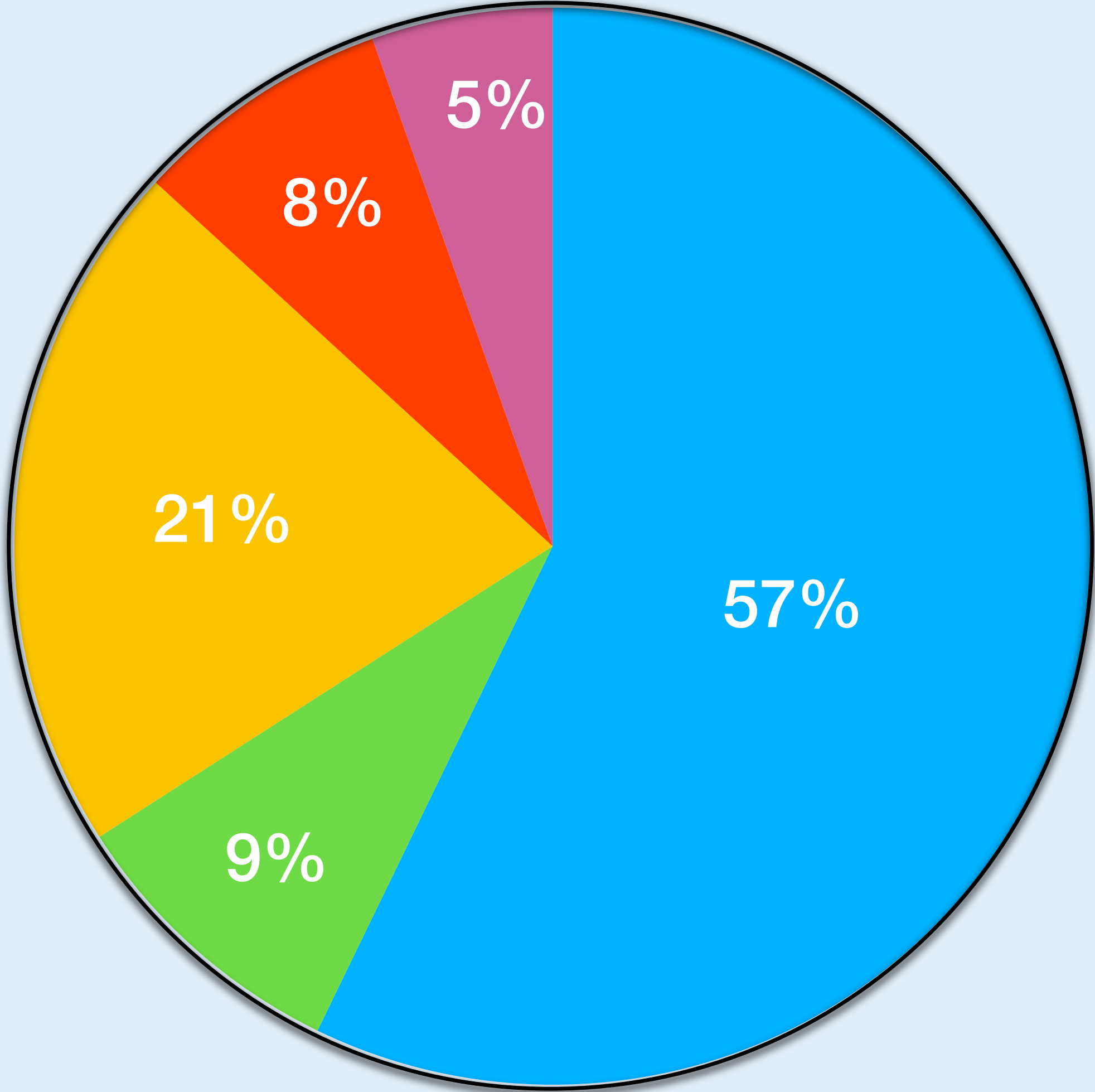


MJ01C OR Shelf



OR Offshore DP
Sable Fish Swarm

RCA Externally Funded Programs

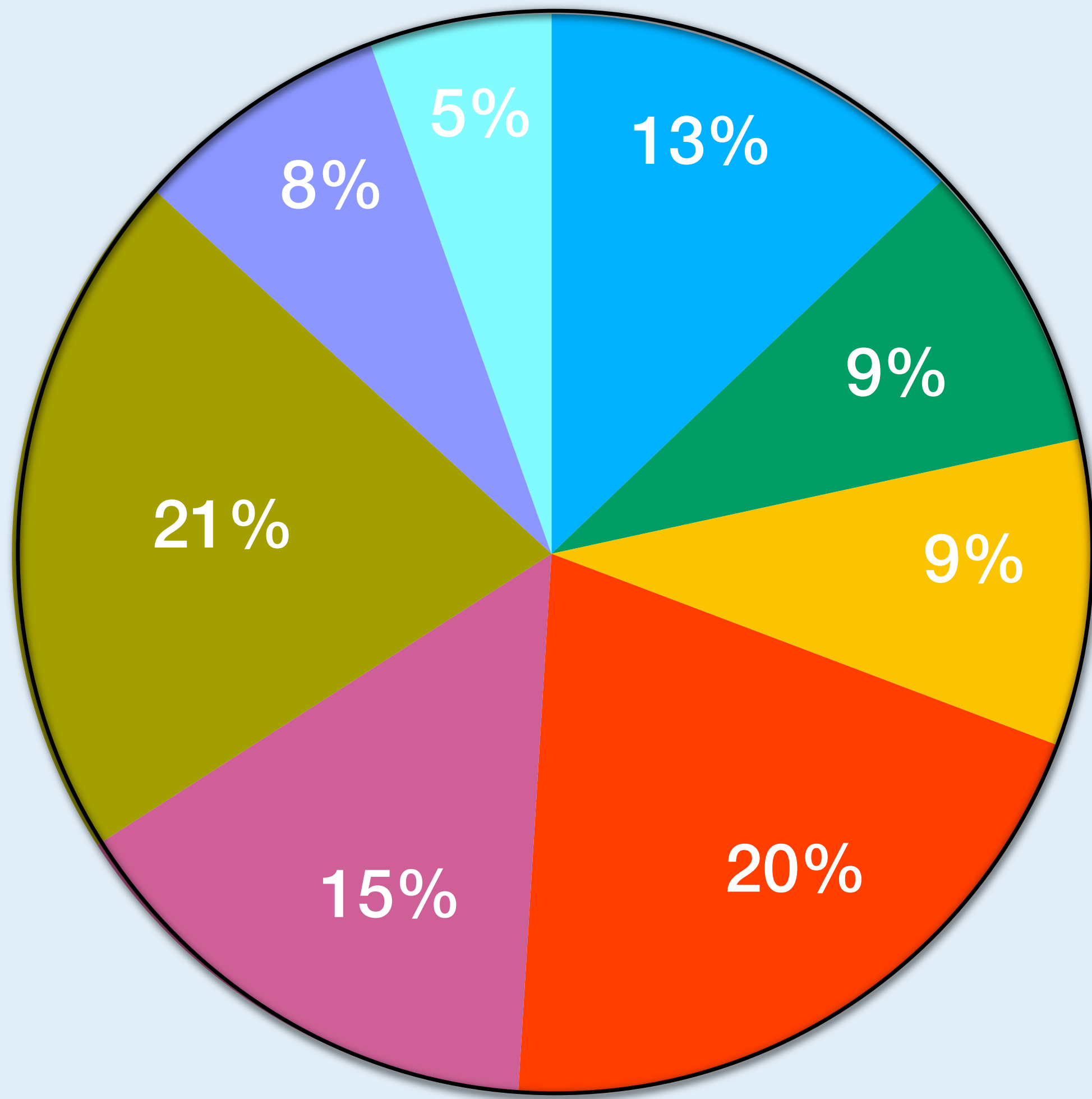


- Infrastructure Added onto the RCA
NSF, ONR, NASA, International
- Research using OOI Data
- Field Programs not including ship time
- Education
- Foundation - Data, Instruments,
Expansion of RCA for early warning
system

Total >\$27M & >\$33M with ship/ROV time



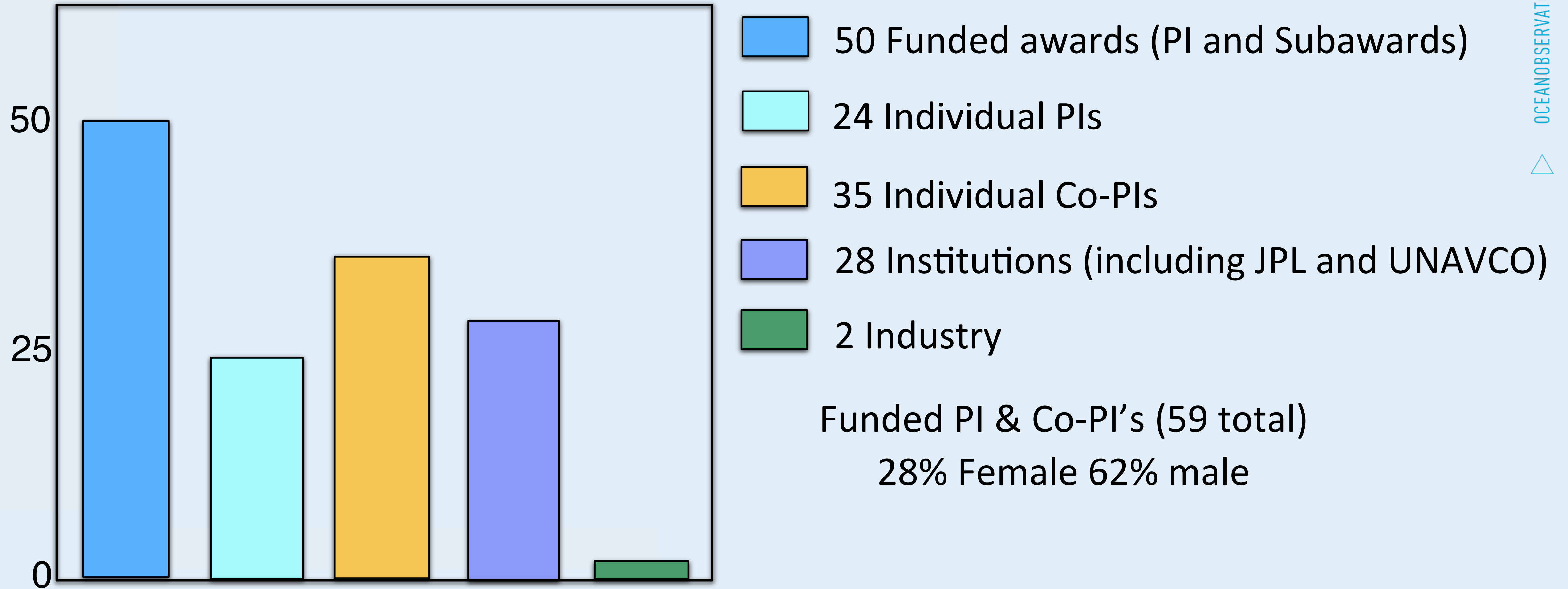
RCA Externally Funded Programs By Agency



- NSF PI Added cabled Instrumentation
- NSF Field studies not including ship time
- Germany PI added cabled instrumentation and ship/ROV support
- NASA PI added instrumentation and ship/ROV support
- ONR PI added instrumentation
- NSF PI Research using RCA Data
- NSF Education (not including Rutgers)
- Foundations Education, RCA offshore early warning detection expansion, data

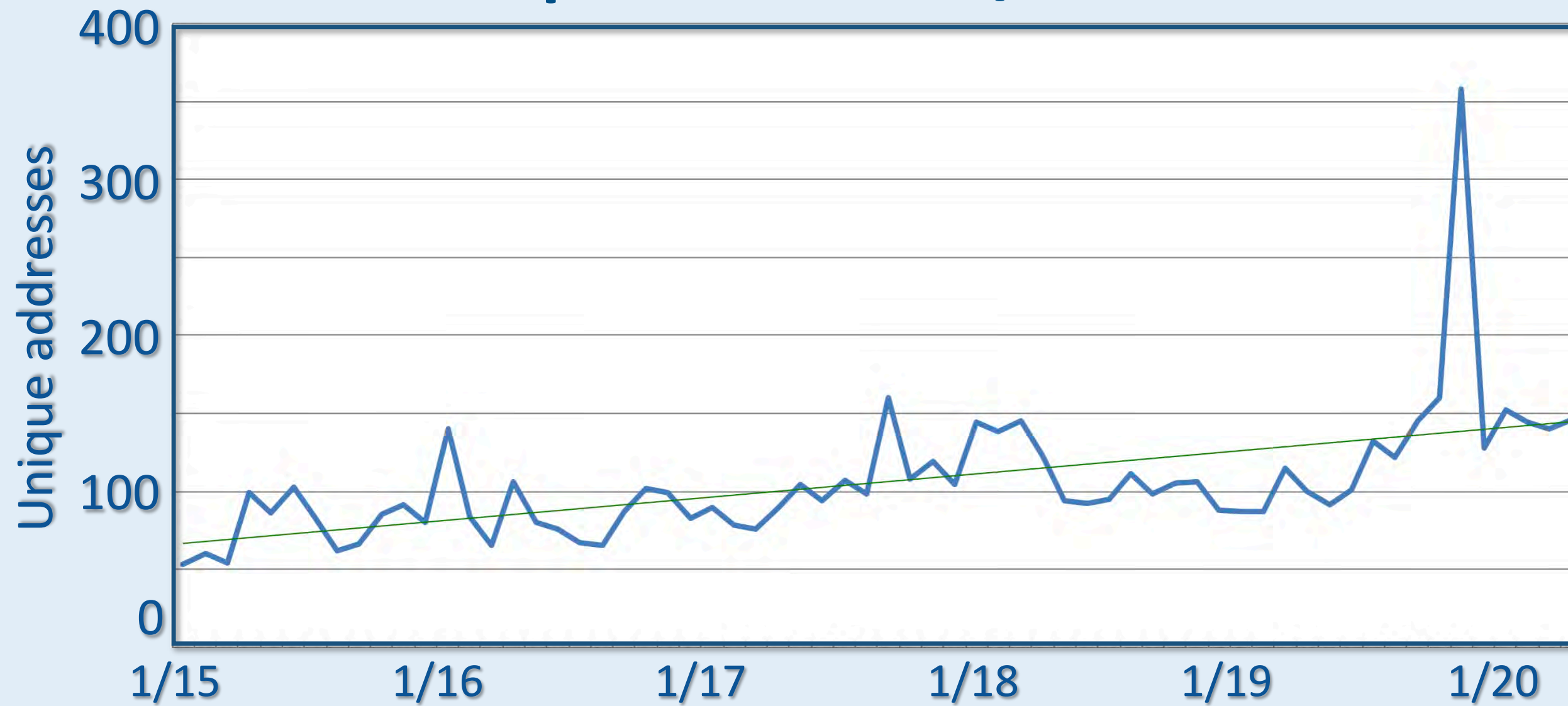
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Representation for RCA Awards

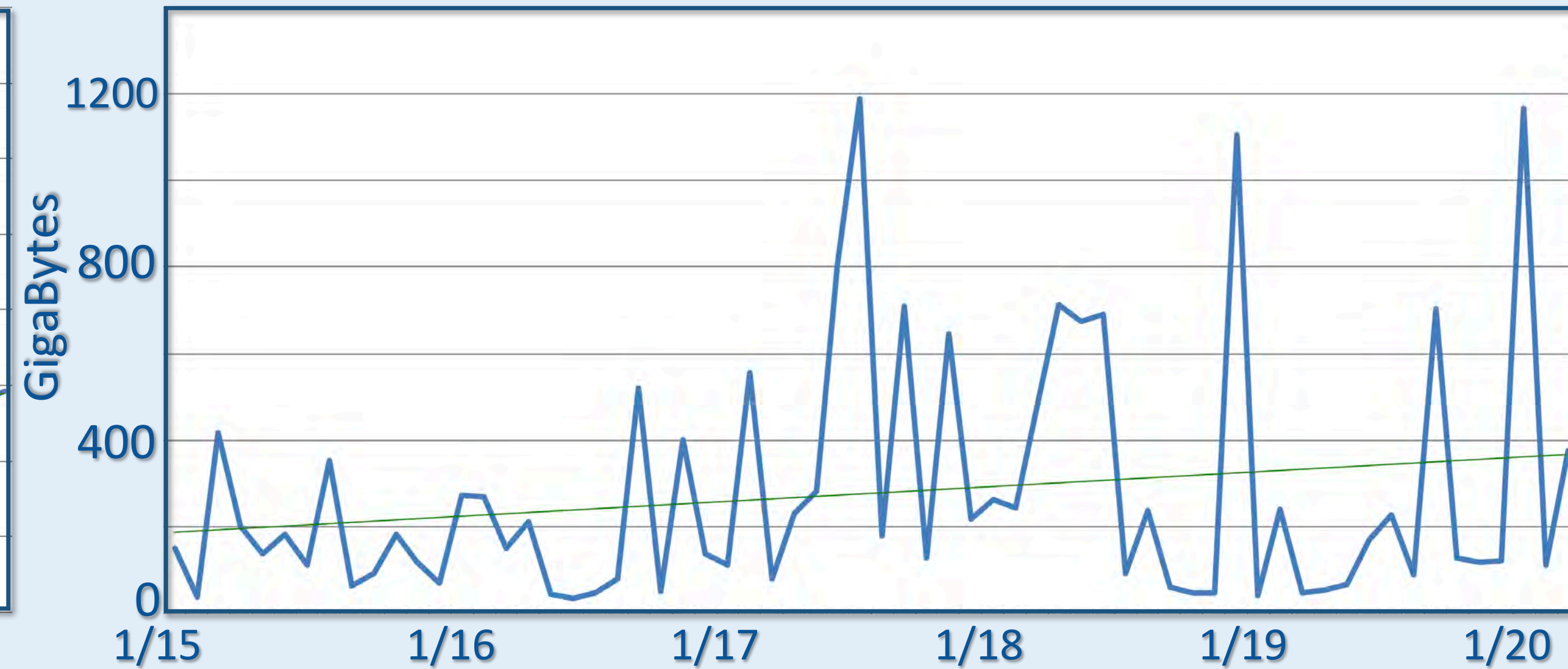


IRIS: Seismic and Pressure Data

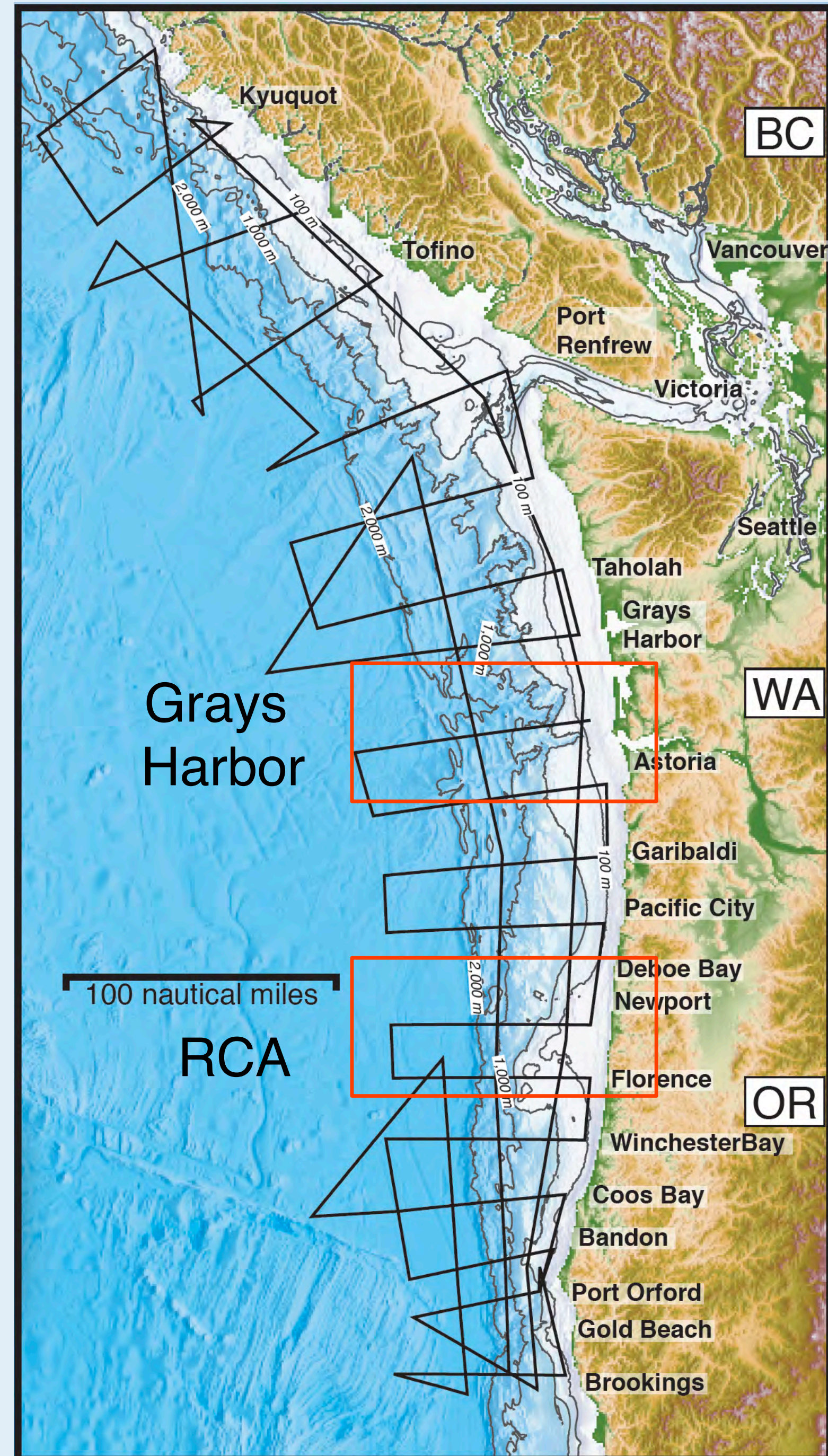
Unique addresses/month



Total Gb downloaded/month

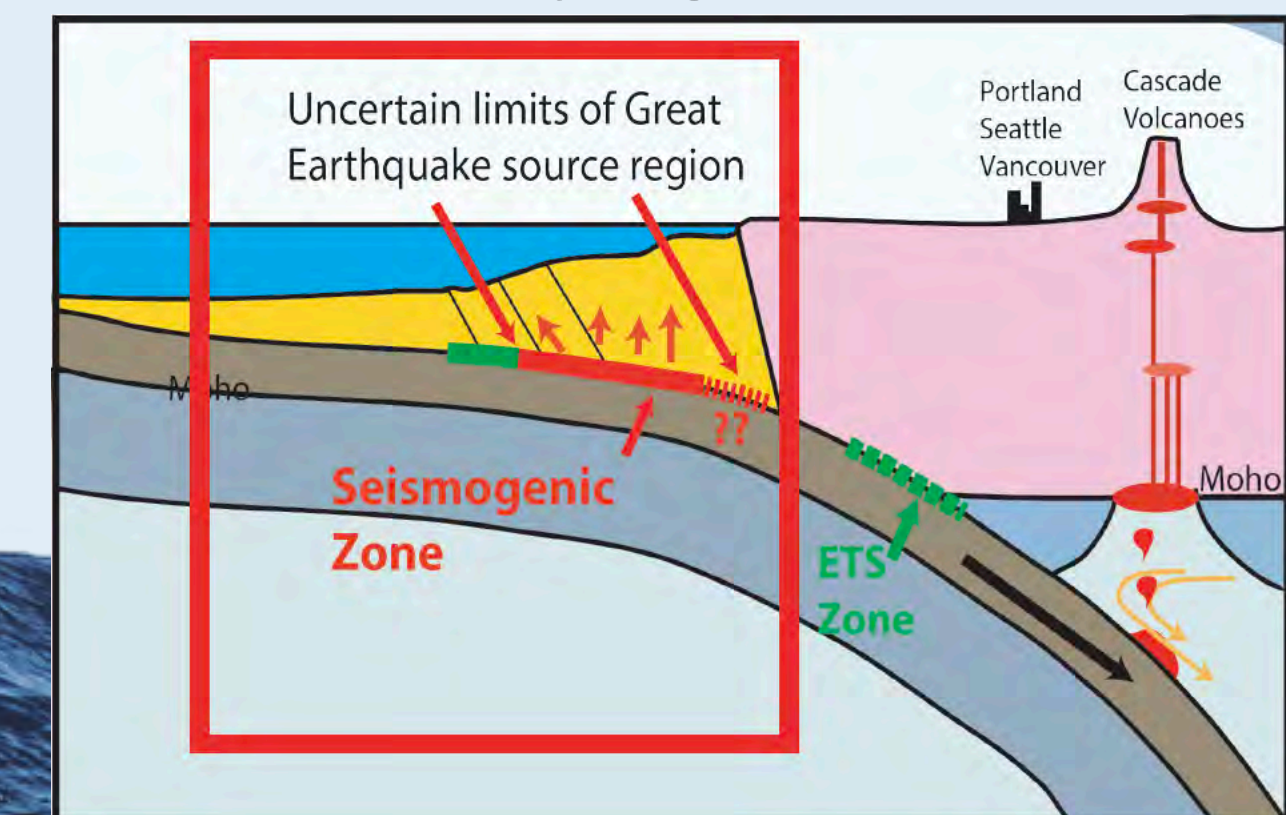


- Number of repeat users continues to increase - >600 (>\$1M NSF awards using RCA seismic data on IRIS)
- Total Gigabytes Download 17,830
- NOAA Tsunami Research Center will begin shortly using M2M for real-time data from the pressure sensor at Slope Base (2900 m) as an initial test case



Collaborative Research: Illuminating the Cascadia plate boundary zone and accretionary wedge with a regional-regional-scale ultra-long offset multi-channel seismic study: S. Carbotte LDEO, P. Canales (WHOI); S. Han and G. Christeson (U. Texas, Austin); NSF-OCE

- Utilize the R/V *Langseth* to collect deep penetration 2-D marine seismic reflection data - will be coordinated with concurrent marines and land deployments of seismometers
- First regional scale seismic imaging investigation along the entire length of the Cascadia Subduction Zone - one of the least well characterized heavily populated mega thrust regions.
- Detailed images to constrain physical properties of slowly deforming continental and slope sediments above the earthquake generating fault(s), the fault zone, and deep into the underlying subducting oceanic crust



RCA Engagement; Talks, Field Programs, Proposals, etc.

Fall AGU San Francisco - Kelley

- ▶ DESSC Early Career Workshop Keynote Speaker
- ▶ Invited “Advances in Seafloor Instrumentation”
- ▶ Invited Speaker Union Session “100 Years of Technological Advances in Earth and Space” Science [The Changing Ocean: 100 Years of Oceanographic Sensing]
- ▶ Kelley-Chadwick Chair/Co-Chair “Advancements in understanding Seafloor Volcanism and Life: Axial Seamount a Wired Submarine Volcano Observatory”

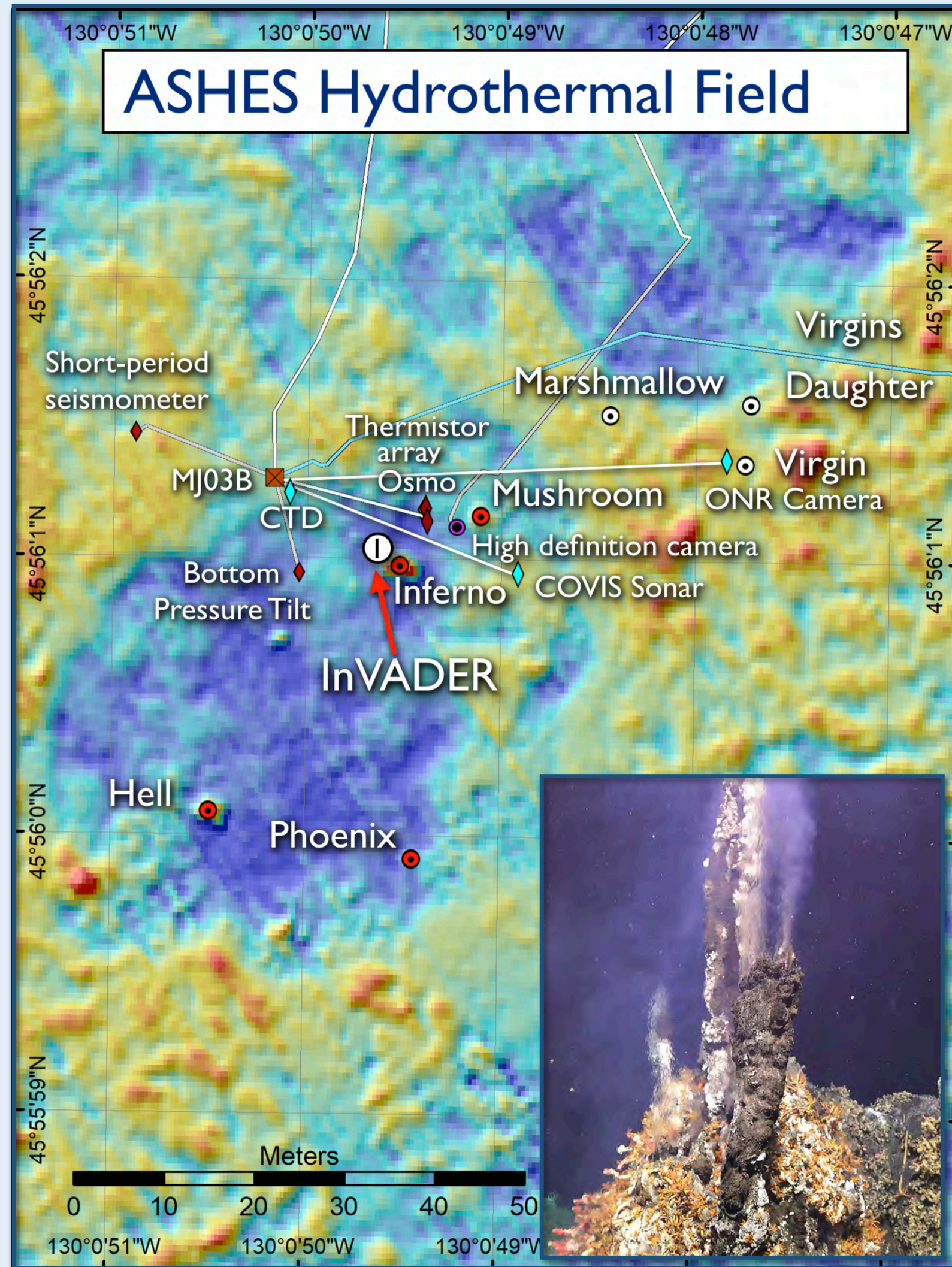
Ocean Sciences San Diego - Vardaro

- ▶ Plugged in: Novel sensor development by external researchers for deployment on the Ocean Observatories Initiative Regional Cabled Array

M. Harrington (APL) Hydrophone tool

Whale calls 125 km off OR -
Slope Base

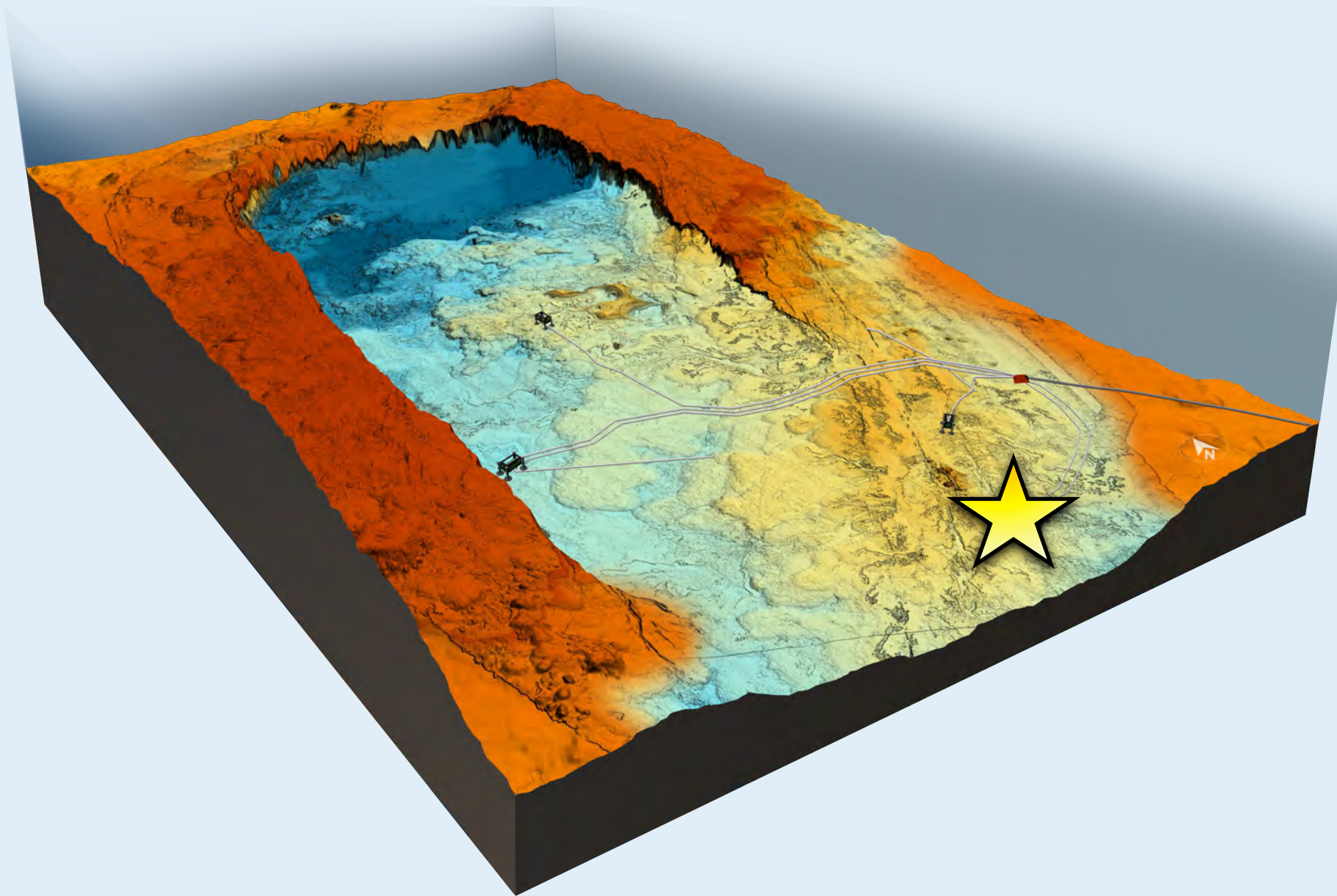
NASA - In Situ Analyses Divebot for Exobiology Research InVADER (4-5 year award); P. Sobron - SETI PI and 9 Co-PI's



- Design, build and implement ~ 4.6 m tall platform with three raman laser systems, laser line scanner, and stereo imaging cameras for real-time visualization to:

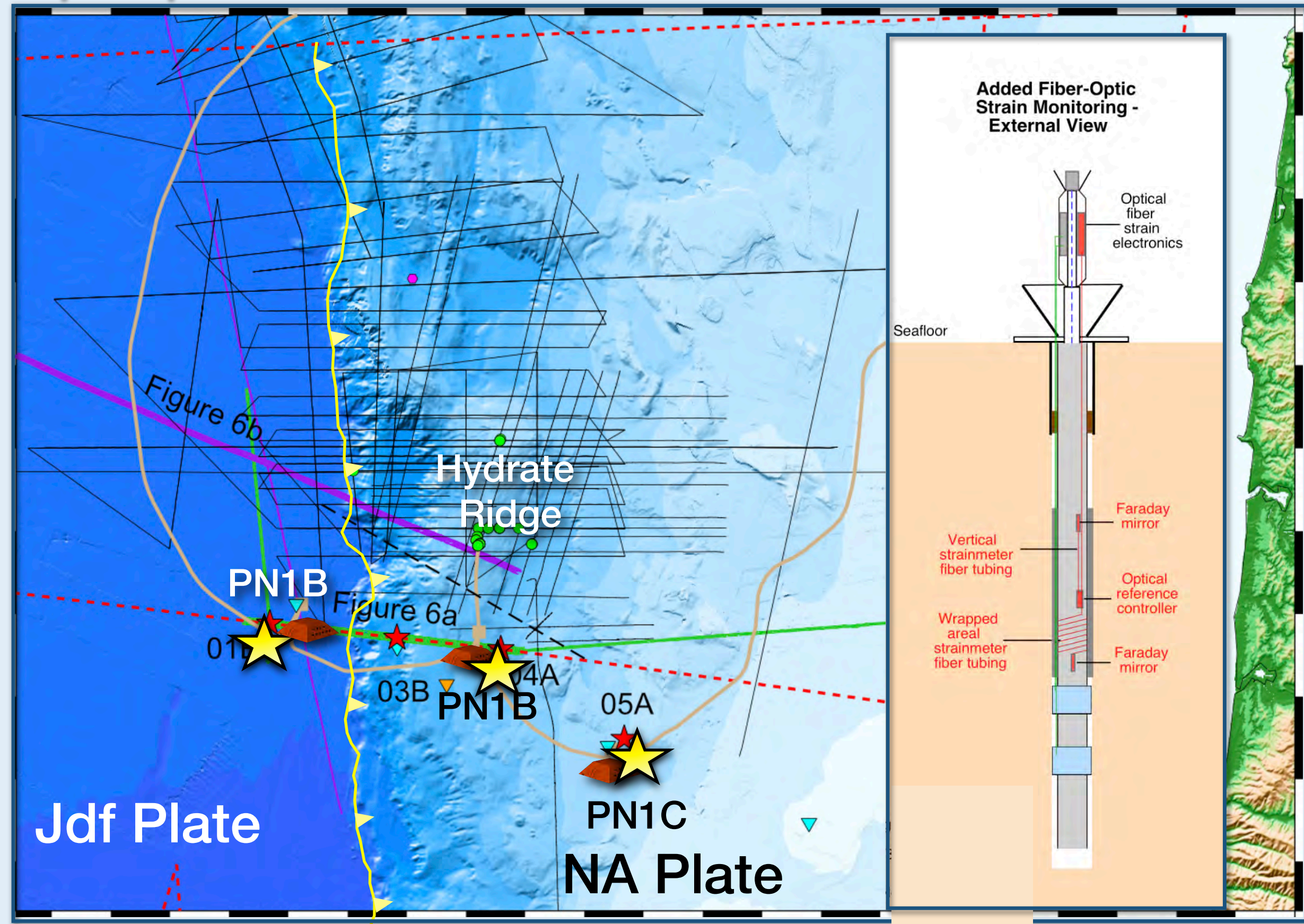
Validate strategies and adaptive missions, and signatures for life in extreme environments (on other watery planets)
- Hydrothermal fluid and rock sampling (development of ROV rock drill), fluid gas and chemical analyses, microbial genomic characterization, extensive site characterization, machine learning and creation of “virtual” world
- Significant outreach component in collaboration with Citrus College, JPL and UW – Kick off community & JPL event in LA January 2020 (Kelley keynote speaker)
- BOEM project 2021

IODP Full Proposal: Integrating subseafloor microbial, hydrogeological, geochemical, and geophysical processes in zero-age, hydrothermally active oceanic crust at Axial Seamount, Juan de Fuca Ridge; J. Huber and 19 proponents



- Establish reentry holes, case, drill, core and make measurements in five basement holes centered on and radiating south of the International District Hydrothermal Field - 150 m to 500 mbsf
- Holes near field spaced closely together for-cross hole experiments, proximal sampling of fluids, rocks, and microbes (unprecedented access to the deep biosphere)
- Cementation and reentry platforms will provide foundation for follow-on installation of CORK-Lite cabled borehole observatories, including a downhole broadband seismometer
- Significant addition of instrumentation in field for monitoring prior and post drilling

IODP Pre Proposal: Cabled borehole observatories to investigate plate boundary mechanics of the Cascadia Subduction Zone - Oregon transect. W. Wilcock - 16 proponents



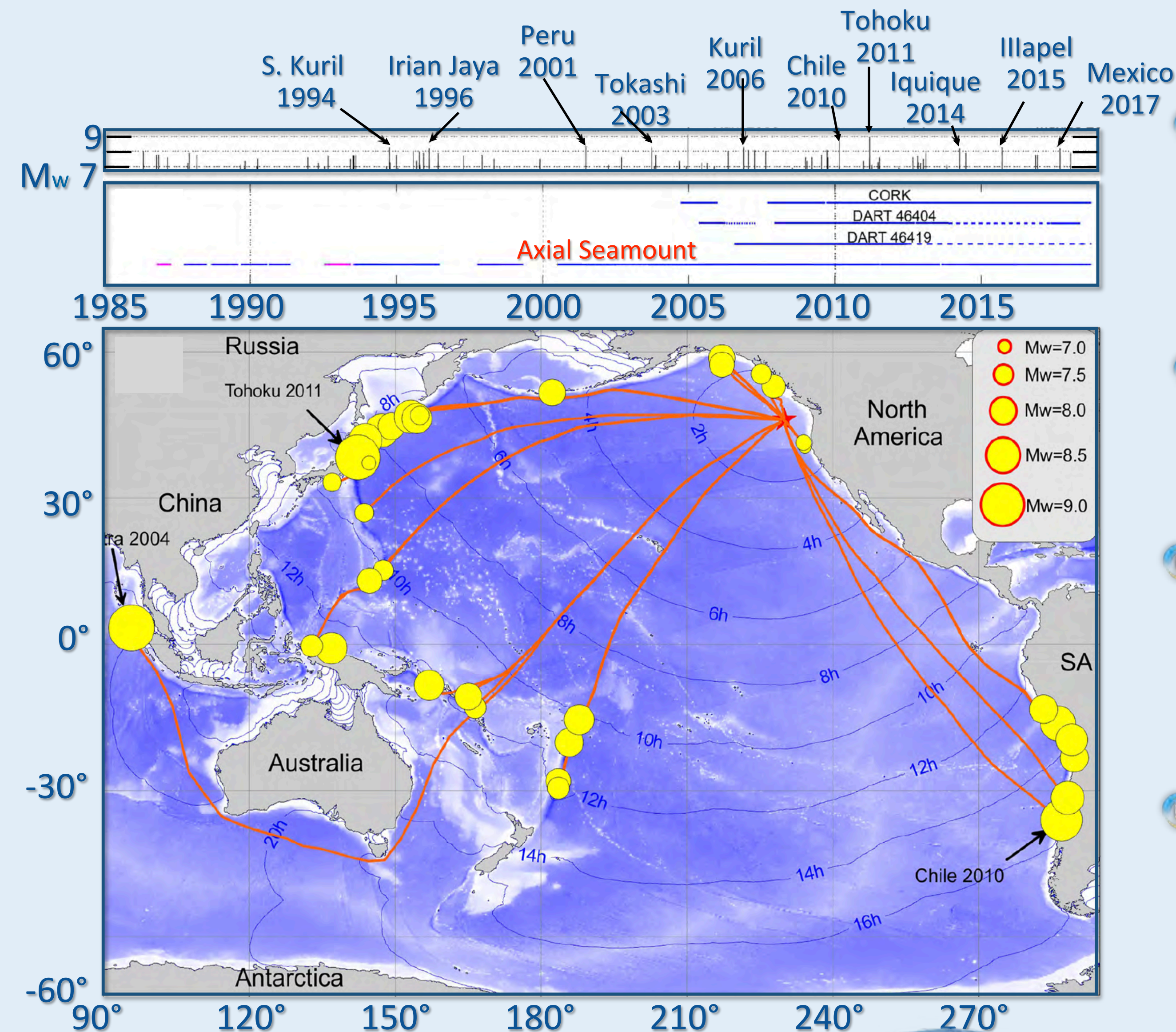
● IODP holes — Seismic Lines ★ Proposed Sites

- Sites incoming plate to shoreward of the deformation front
- Drill and core to 500 m and establish three cabled CORKED observatories of RCA Primary Nodes Slope Base (PN1A), South of Southern Hydrate Ridge (PN1B) and Oregon Offshore (PN1C)
- Geodetic and seismic observations suggest that the megathrust is only partially locked here in contrast to full locking of Cascadia to the north and south - distinct clusters of earthquakes along the thrust

CORKS: Downhole geophysical instrument package - a string of temperature sensors, a seismometer and tiltmeters and outside the casing a fiber optic strain meter (Zumberge et al., 2018)

RCA Science Highlight: Toward a Universal Frequency of Occurrence Distribution for Tsunamis: Statistical Analysis of a 32-Year Bottom Pressure Record at Axial Seamount

Fine et al., 2020 GRL



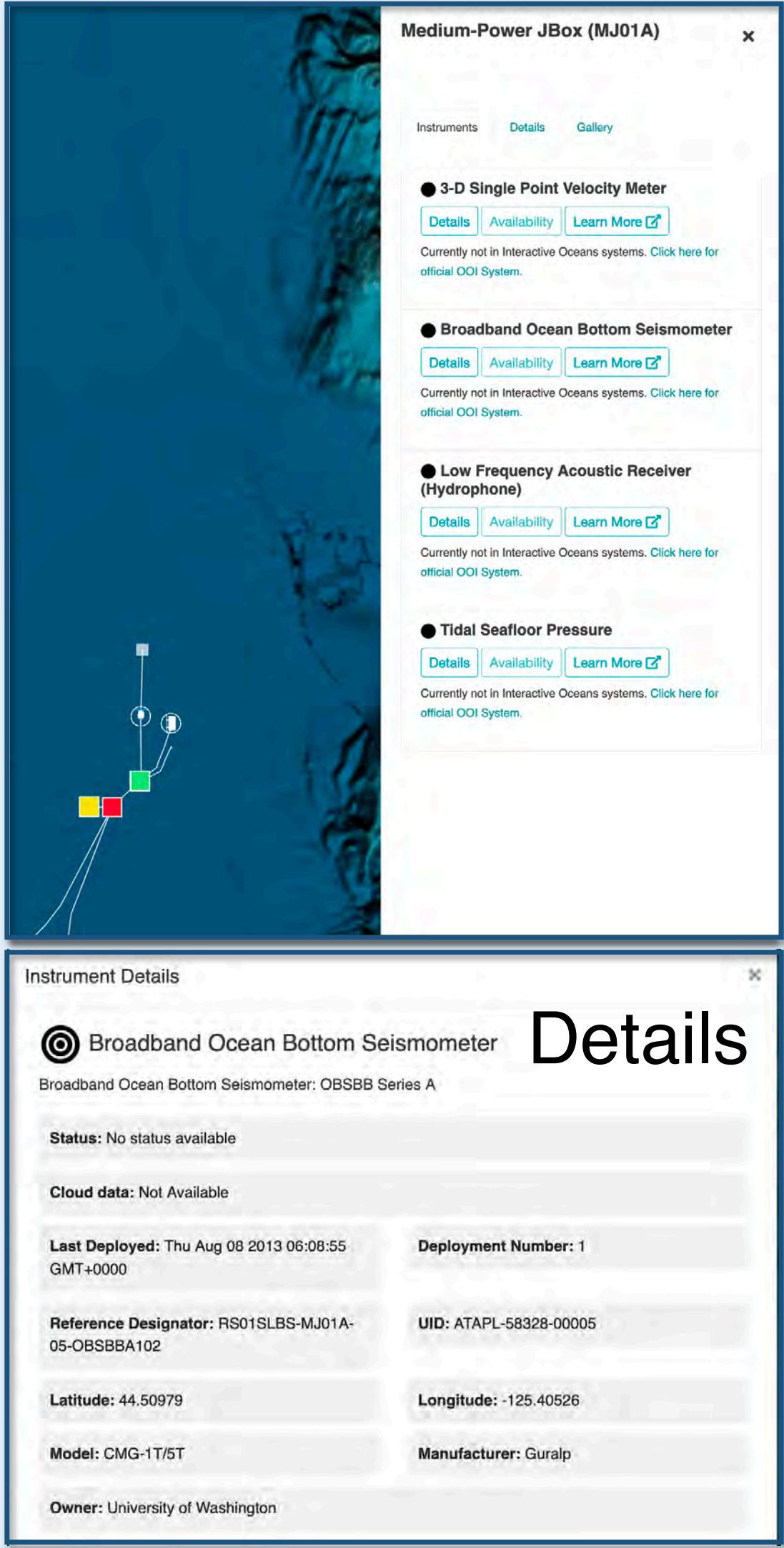
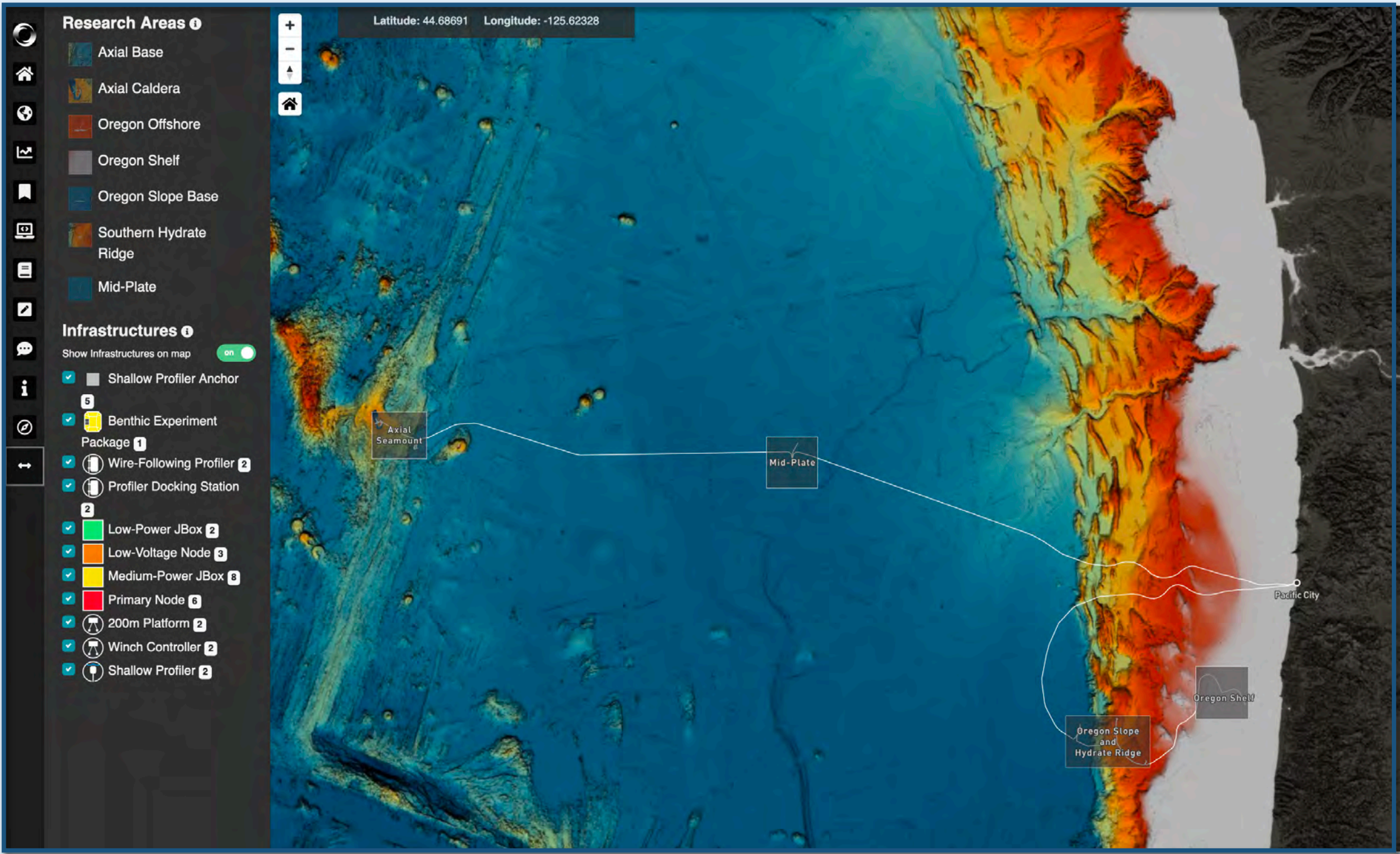
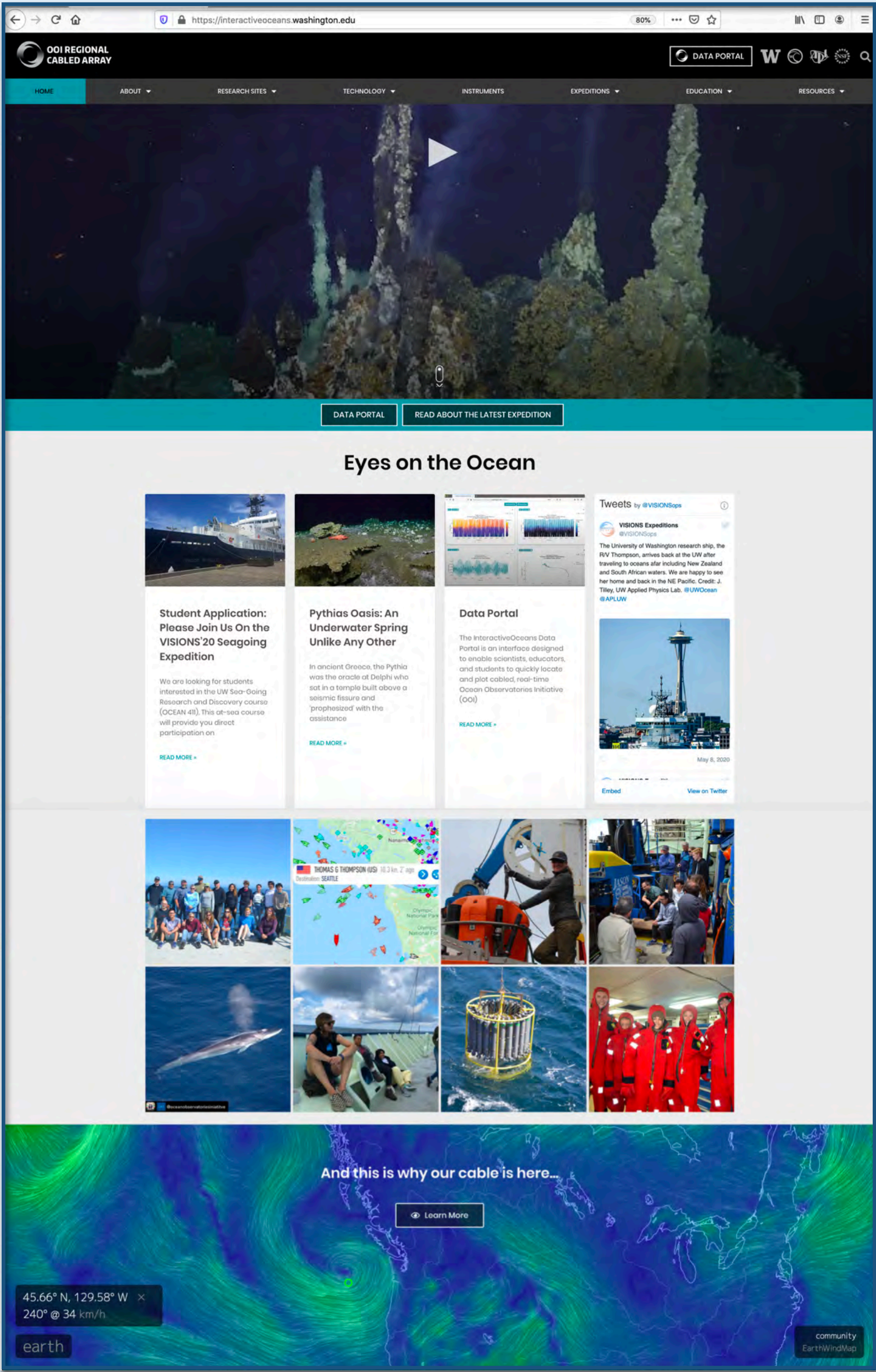
32 year records from bottom pressure recorder data and RCA-OOI bottom pressure data, including bottom pressure tilt instruments, provide one of the longest open ocean pressure records

Axial Seamount data and a few other sites were used to create a precise size (M_w) frequency model for global tsunamis

41 tsunamis identified from long-term pressure records at Axial and nearby sites (e.g. Cleft). Many recorded on 6 instruments. Numerous tsunamis during last two decades were unknown to previous researchers

Kawka: Discussions with A. Diego - Head of NOAA Center for Tsunami Research re accessing RCA pressure data via M2M

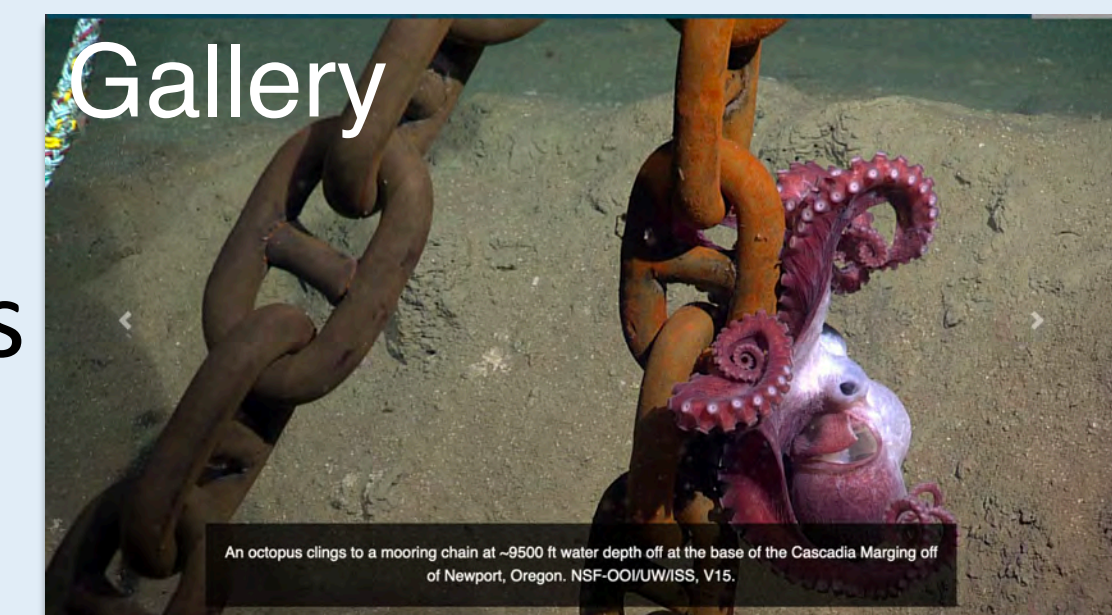
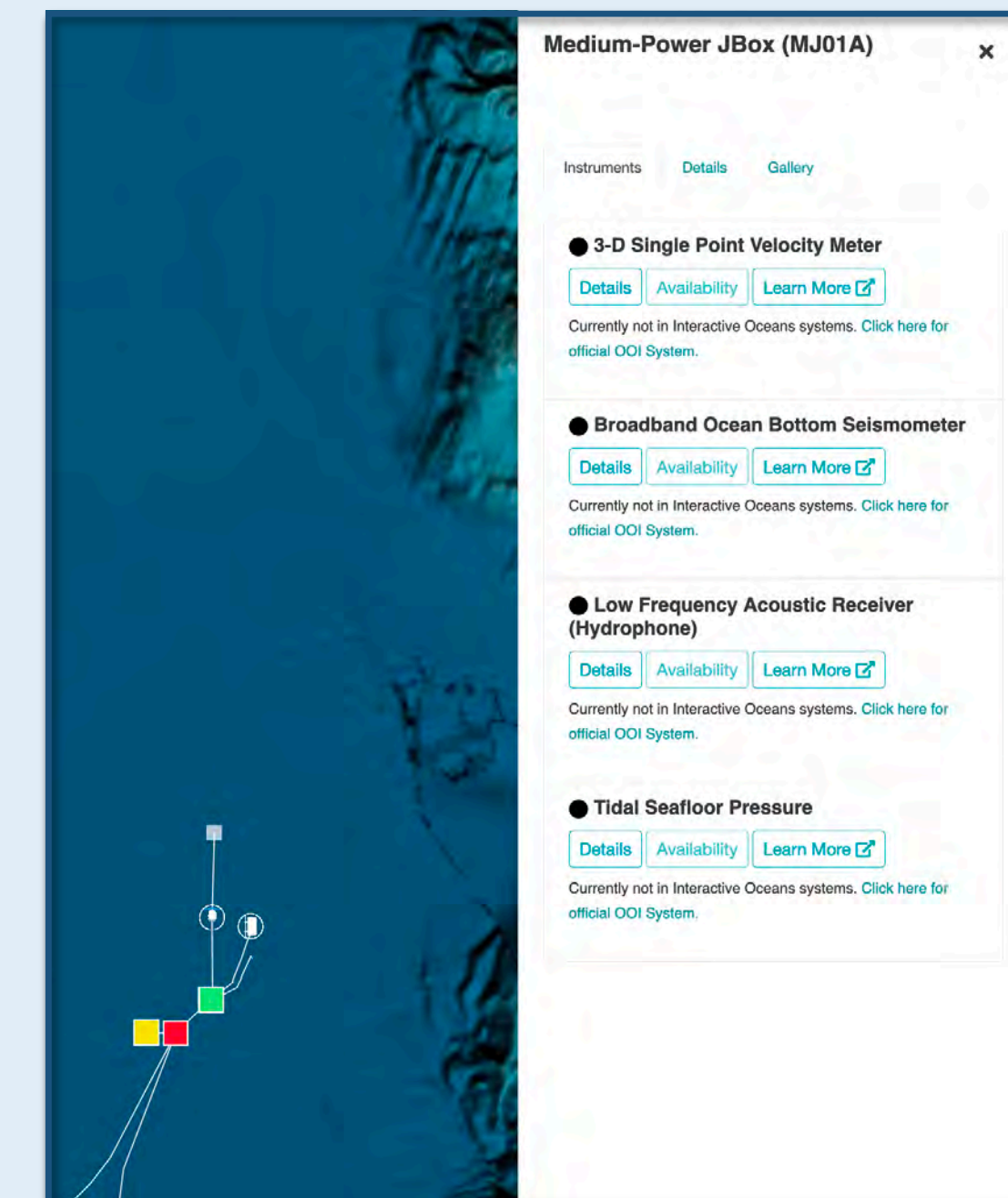
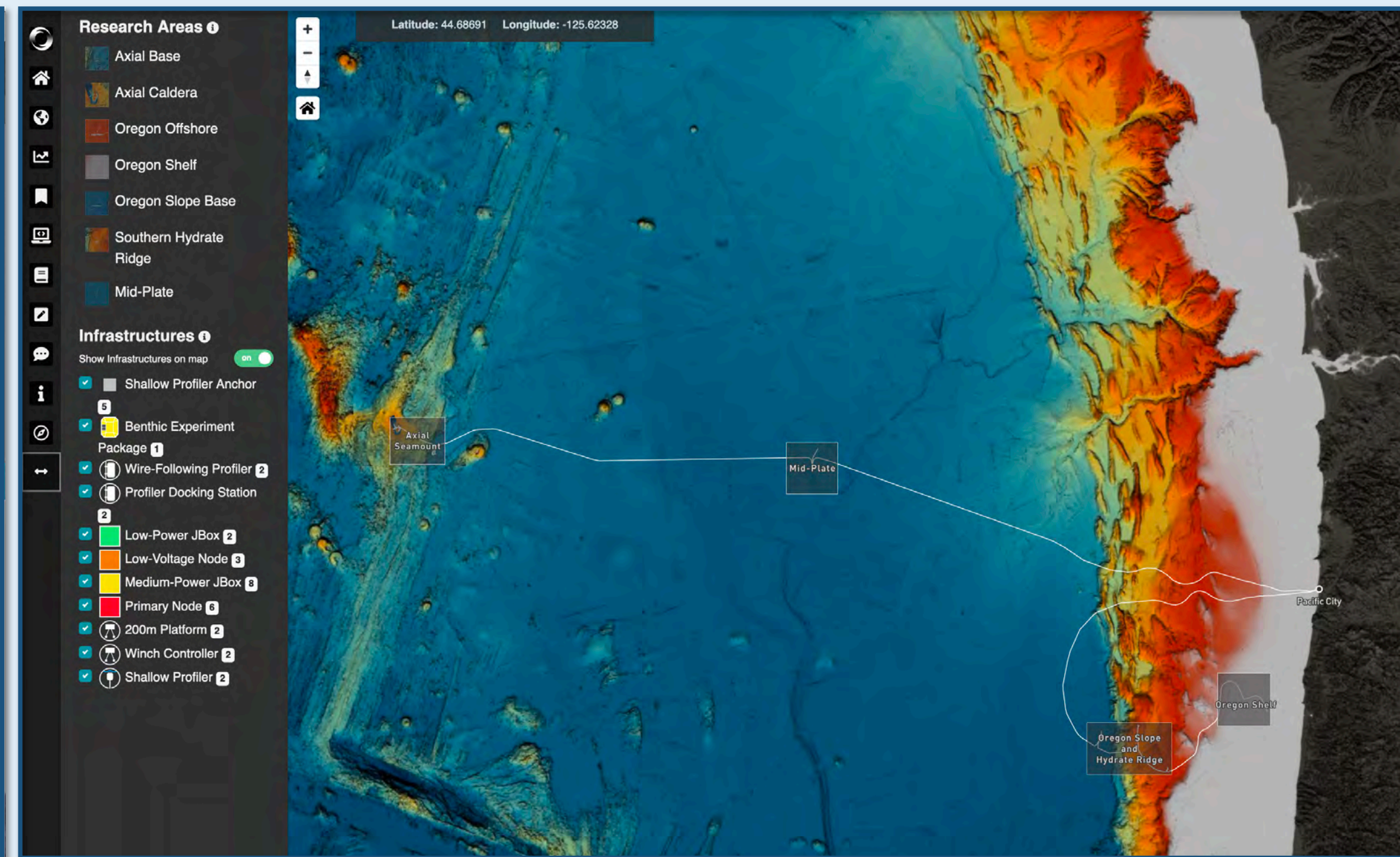
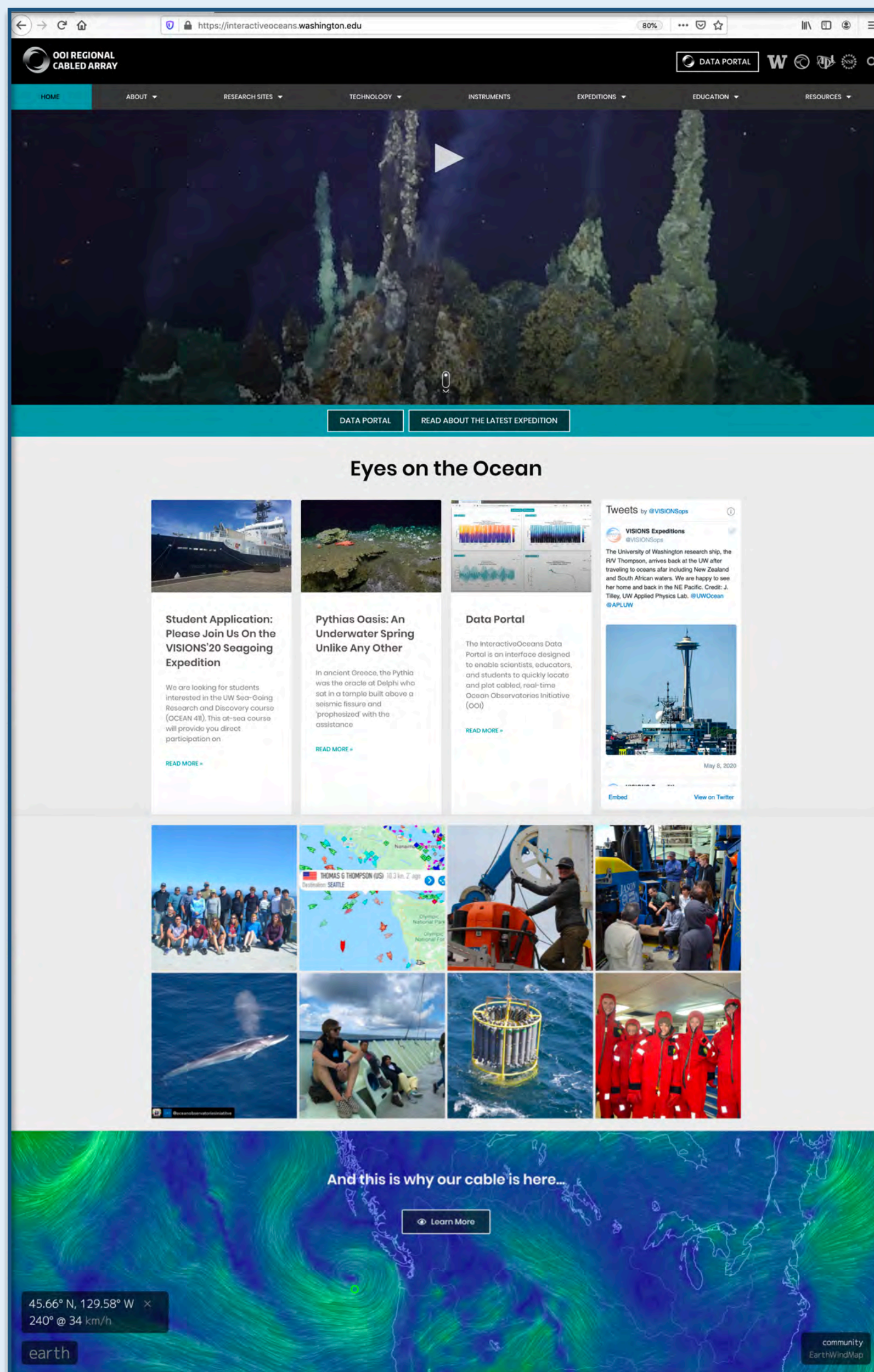
AWS-Cloud Hosted Interactiveoceans UW Educational Site



- Continue to enhance-harden functionalities
- Currently harvesting data from 140 instruments on RCA and Endurance
- Highly interactive visualization capabilities - multiple plots, multiple instruments, modifying heat maps



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Interactiveoceans Data Portal: Multiple Interactive Plots

Plot 1

Site

Oregon Slope Base Shallow Profiler Mooring

Infrastructure

Shallow Profiler (SF01A)

Instruments

☒ Conductivity-Temperature-Depth

☐ pH Sensor

☐ Fluorometer (CDOM)

☐ Photosynthetically Available Radiation (PAR) Sensor

☐ Nitrate Sensor

☐ Carbon Dioxide Sensor

X-Axis

Time

Y-Axis

Pressure

Color Bar

☒ Dissolved Oxygen

Color Range: 0 to 400

Colorbar: thermal

Date Range

05/06/2020

Start Date

05/07/2020

End Date

Time Range

12:00:00 AM

Start Time

12:00:00 AM

End Time

Discrete Samples

☐ Enable Discrete Samples

Submit

Interactive Oceans Data Portal

https://app.interactiveoceans.washington.edu/visualize

67%

+ Add New Plot

Explore Map

Plot Annotations 0

Select Parameters

Edit Styling

Pressure vs Time at Oregon Slope Base Shallow Profiler Mooring (SF01A)

Temperature °C

Pressure dbar

Time UTC

Plot Annotations 0

Time vs Pressure at Oregon Slope Base Shallow Profiler Mooring on Shallow Profiler (SF01A)

Dissolved Oxygen μmol/kg

Pressure dbar

Time UTC

Plot Annotations 1

Time vs Pressure at ASHES Vent Field on Medium-Power JBox (MJ03B)

Pressure dbar

Time UTC


Plot Annotations 0


Salinity vs Pressure At Oregon Slope Shallow Profiler Mooring on Shallow Profiler (SF01A)

Salinity

Discrete Salinity

Pressure dbar

 OCEAN OBSERVATORIES INITIATIVE

 NSF

Interactiveoceans Data Portal

Plot 1

Site
Oregon Slope Base Shallow Profiler Mooring

Infrastructure
Shallow Profiler (SF01A)

Instruments
☒ Conductivity-Temperature-Depth ☐ pH Sensor
☐ Fluorometer (CDOM)
☐ Photosynthetically Available Radiation (PAR) Sensor ☐ Nitrate Sensor
☐ Carbon Dioxide Sensor

X-Axis
Time

Y-Axis
Pressure

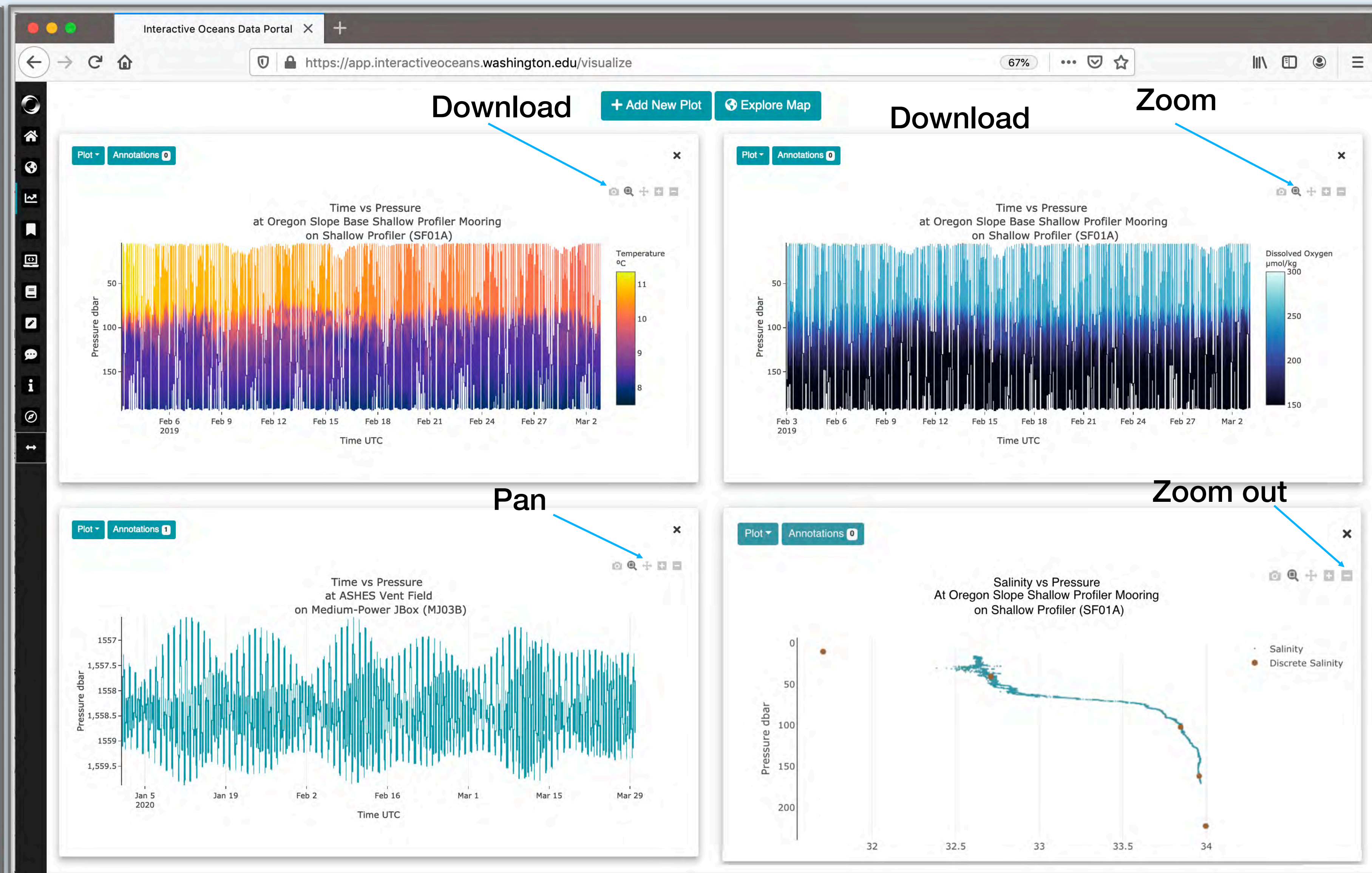
Color Bar
☒ Dissolved Oxygen
Color Range: 0 to 400
Colorbar: thermal

Date Range
05/06/2020 Start Date
05/07/2020 End Date

Time Range
12:00:00 AM Start Time
12:00:00 AM End Time

Discrete Samples
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Submit





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Questions?



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