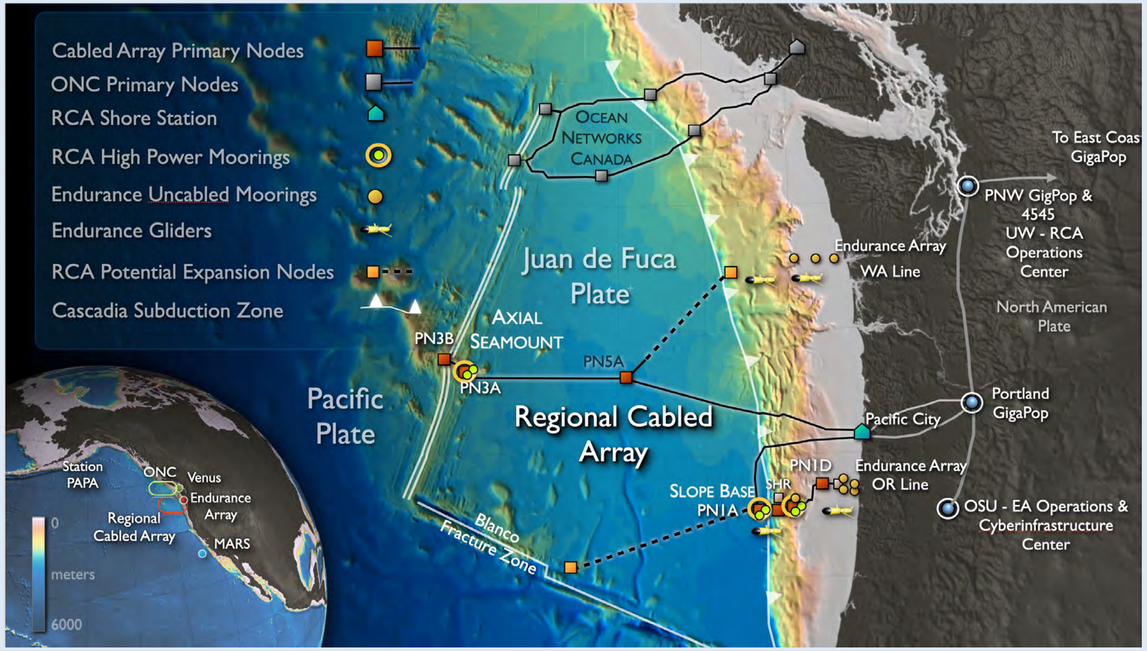
OOI NE Pacific Arrays Workshop Breakout Session

- **Breakout Session #2: Major Science Questions**
  - Seafloor/Geophysics Worksheet – Deb Kelley
  - Biogeochemical fluxes (ocean acidification, nutrient cycling) Worksheet – Dax Soule
  - Physical-biological interactions (turbulence, cross-shelf exchanges, optical attenuation, populations) Worksheet – Dax Soule
  - Large scale climate patterns and processes, including the Warm Blob Worksheet – Kendra Daly
- **Breakout Session #3: Geographic Region**
  - Axial and Ridges Worksheet – Deb Kelley
  - Shelf to Slope Base, including hypoxia and fisheries Worksheet – Paulinus Chigbu
  - Open Ocean and Station Papa Worksheet – Kendra Daly

Break out by Region: Axial Seamount



Only place in world with two cabled systems on a single mid-ocean ridge spreading center (ONC-RCA)

Endeavour Segment (ONC): no historic eruptions, tectonic phase, incredibly active hydrothermal (50 m tall chimneys) systems

Axial (RCA) magnetically robust, frequent eruptions, limited hydrothermal venting (most chimneys <10 m)

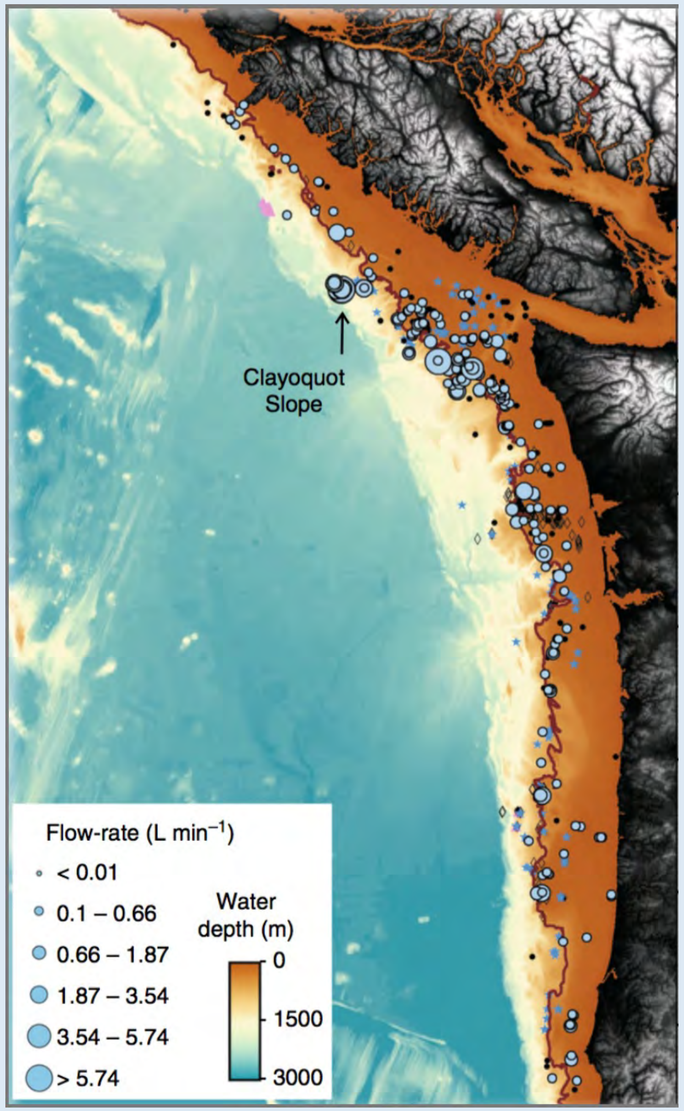
Subseafloor biosphere
Real-time detection of life

Short long-term plume activity
(hydrothermal and megaplumes)

Life cycle of volcanoes - deformation, seismic activity, hydrothermal systems and life

Debs' suggestion - Ripe for a Community Workshop

Major Science Questions - Seafloor/Geophysics



Reidel et al., 2018

Many questions (life cycle of volcanoes), needs (instruments - pressure, seismometers, moorings, life etc) overlap with mid-ocean ridge focus

Is the Cascade subduction zone mega thrust locked to the trench off central Oregon?

Is there episodic tremor and associated low frequency and very low frequency earthquakes on the shallow megathrust?

What are the actual local cold seep fluxes (methane) and how much do they vary over time and what controls the long-term changes? (>1000 bubble plume flares - ONC and RCA only sites with real-time, long-term monitoring)

Breakout Group – Shelf to Slope Base, including hypoxia and fisheries

- **Part 1: Research topics/themes relevant to these regions that OOI and other observing assets can facilitate.**
  - Marine heat waves, Ocean acidification, hypoxia/deoxygenation, HABs, changing biodiversity, hazards, subduction zone megathrust fault dynamics, fisheries, carbon flux/export to the benthos, carbon flux/export from shelf to deep ocean and/or retention of carbon on the shelf, alongshelf processes, upwelling, changes in spring transition, eddy vs. mean fluxes, impacts from changes in volume and timing of freshwater inputs, basin scale processes (e.g., PDO and ENSO), microscale processes (mixing, turbulence), causes of stratification, seafloor geodesy, Marine mammal distributions, movement, behavior, and trophic interactions
- **Part 2: What are the specific locations, infrastructure, and measurements (sensors) required to address the science questions in this region?**
  - OOI-focused modeling workshop
- **Part 3: What would you like to do in the future using OOI in this region?**
  - Sensors to measure biodiversity (IFCB)
  - eDNA
  - Time for OOI data scientists to link with ocean scientists (like the "ONC model")
    - ONC needs to support scientists without proposal funding, but helps keep publication rates up
  - Gas tension device - net community production
    - Could build off existing optodes with air calibration (surface piercing profilers)
  - Microstructure profiles
  - Current profiling one-point current meters are not fast enough
  - Coastal profiling float (MBARI, under development)
  - DAS across the shelf for marine mammal PAM in real time (complemented by glider PAM?)

OCEAN OBSERVATORIES INITIATIVE FACILITY BOARD
OOIFB

Biogeochemical Fluxes

- Big questions:
  - What are the dominate drivers of OA in the deep ocean
  - How are zooplankton communities impacted by OAH
- Needs:
  - Measure changes of fluxes to the seabed (BCG, Oxygen, Carbon, Nutrients)
  - Characterize the processes influencing vertical carbon export
  - OOI to facilitate data skills development (mechanics -> interpretation)
  - Analysis to determine what sensor packages could inform climate policy.

OCEAN OBSERVATORIES INITIATIVE FACILITY BOARD
OOIFB

Physical-biological Interactions

- Big questions:
  - What is the relative importance of advection (horizontal, vertical) vs. local sources/sinks of biological, chemical or physical properties in determining the myriad of processes that are driven by physical – interactions
- Needs:
  - Increased taxonomic resolution across multiple trophic levels
  - Increased spatial and temporal resolution.
  - Increased spatial extent and temporal (duration) coverage.
  - Swarm Study using OOI Gliders.

OOI NE Pacific Arrays Workshop

➢ Large scale climate patterns and processes, including the Warm Blob Worksheet

- Is the OOI dataset long enough for detecting change in marine heat waves?
  Comment: current deep sea CTD instruments sensitive enough to detect emerging changes.

- Problems with sensor stability over time could cause problems when using the instruments we have for long term climate work.

- Could any of the data when it comes from these instruments that drift be fixed afterwards with post calibration etc.? or concurrent sampling, sampling overlap?

Response: egregious problems noted through annotations – can be found via data explorer, but if drift gets too bad, a QARTOD flag is also set in addition to the annotation. A subtle change that looks plausible will not be detected/flagged by our QC methods. But doing the best we can to ID problems. There are known drifts, biofouling, or clock problems. We don't correct for those right now. If a slight drift, might be real, might be the sensor, and not nec. clear. Not up to the data team — they don't have capacity to work through all of these. But when people reach out to us, definitely.

- OOI was not initially intended as "climate sensing array"

- Determining drift and uncertainty is a challenge. What level of accuracy are we willing to give up? Tradeoff between need for dense array of measurements (short covariance scale) and need for accuracy in measurement at a single location.

➢Breakout Session #3: Geographic Region

➢Open Ocean and Station Papa Worksheet – Kendra Daly

- Profiling mooring at Sta. P is aliased at the moment (every 20 hours) –

Recommend burst profiling, e.g. 4 profiles consecutively, then rest for about 4 days.

- Need full depth profiles of horizontal velocity and vertical displacement.

Recommend: Add ADCP and CTD at top of Apex Profiler mooring, add single-point current meter and CTD between the two MMPs and at the bottom.

- What caused the absence of nutrients at Papa in 2019?

Recommend adding more SUNA sensors, possibly to station keeping glider.

- Need to work more as a collaborative team with PMEL to make data available seamlessly to potential users. Also need to enable intercomparisons between the more unique sensors. OOI could build a stand-alone air-sea flux parameterization package that NOAA could maintain on their surface buoy.

- Consider adding wave power generation at Papa. Could add more BGC sensors and seafloor seismic sensors (bottom pressure recorders, seismometers, standard suite of EOVs, acoustic transponders for seafloor geodesy, hydrophone).

- How to engage the Station Papa community to engage at the nitty-gritty level -- some sort of coordinated Papa working group, requires a sustained effort. Can’t just talk about this occasionally. This is an important site because of its history and the continuity of the data at the same deep-sea location.