Geographic Region: Axial and Ridges

Main points:

Themes we're interested in mostly already well defined by RIDGE program:
- What is the baseline for Axial? What is the base variability?
- Event response
- What are the linkages from the subseafloor to the water column?
- What does recovery to baseline look like and how long does it take?

Temporal coverage is good. Spatial coverage is good for seismic instruments. Combined they allowed before/during/after observations of Axial's eruption.

It is unclear what data is available (and when) without actually accessing the data. Actually accessing the data is difficult. It takes time to actually put together datasets to even get to the process of evaluation/analysis.
E.G.: PPSDN (DNA sampler) is not available on the data portal. Coordinate of TMPSF (3D thermistor array) are not available to users.
Recommendation: A scientist prepares data/tools for a specific dataset and shares them with the community.

Lack of biological and physical oceanography measurements. CO instruments had poor coverage and many failed.

Missing water column measurements in/around the caldera.

More physical (e.g. circulation) and chemical (e.g. hydrothermal transport) models are needed to contextualize observations. In the same vein more observations/instruments are needed to form/validate models.

Needs for the future:

- Moorings in the caldera
- Seismometers/hydrophones outside caldera
    - Make a SOSUS-lite out of current OOI assets

Raw notes:

What can we do now that we couldn't before?

> Monitoring of ongoing events, like eruptions, especially with seismometers/cameras. Chemistry side is very limited now, so something has to change if we want to look at the hydrothermal chemistry link. No instruments in plumes yet.
>
> Using CamHD to get flow rate and other computer vision products. Challenge is that the video is not continuous.
>
> What's out there now: pH and H2S that works at high temp. Deployed for 1 year and isn't in right now. Mass spec connected to time series sampler is working and measure CH4, CO2, +more, etc.
>
> Relate changes in fluid chemistry/flow to bio studied.
>
> No ADCP, but there is a point velocity center. So many microdynamics next to a vent you will miss flux with ADCP.
>
> Temporal coverage is good, but most measurements do not extend into the water column. **Need a way to sample chemistry/biology from subseafloor to ocean surface in the caldera. I.e. a mooring.**
>
> How does water move through the hydrothermal system during/after an eruption? How does this relate to event plumes?

Aside:

> Problems with actually accessing data. People do not want to spend months figuring the data interface and compiling useable datasets before getting into analysis.
>
> Questions about which datasets are available. E.G. PPSDN (DNA sampler) is not available on the data portal. Coordinate of TMPSF (3D thermistor array) are not available to users.

What covers the eruption?

> Res-probe fell out (or cracked).
>
> Dave Butterfield's poster shows chloride during eruption from RAS (which parts?). Doesn't see evidence for brine covering that part of the caldera.

Took sample a couple days before event and a week after event.

Problems

Many vent chemistry sensors failed/weren't functioning during the eruption. Not very reliable in general.

Geographic Region: Shelf to Slope

topics/themes relevant to OOI (coupling of physics-chem-bio/ multi-disciplinary studies)

- Cross-shelf exchange of elements
- Riverine inputs
- Data can be used to educate the general public and students HOWEVER the data is not readily accessible for the non-specialist to connect the general public to the data
- Air-sea gas exchange and how this links to OA and biological pump, solubility pump, net ecosystem metabolism
- Study of episodic events and decadal events on ocean processes (e.g. the blob)
- Coupling between pelagic and benthic and how this is tied to physics
- Biophysical interactions and animal behavior
- Biological responses to upwelling
- Mixing measurements; characterizing mixing also highly relevant to biological rates, nutrient injections and linkages between physics, chemistry and biology
- Internal waves
- How expanding OMZ impact zooplankton
- Temporal change in plankton biomass and productivity
- Longer term measurements on hydrate ridge, passive acoustics (need access to acoustic data!)
- duration and frequency of gas seeps at southern hydrate ridge; ADCP data are currently being used
- OOI data for ocean acidification; specifically adjacent to the Olympic Marine sanctuary
- Usable products for resource managers (e.g. fisheries, HABs)

What would you add to the future OOI (themes are extending spatial footprints, pairing experiments to existing assets and added instrumentation/capacity)

- Outreach and data access/visualization need improvement for public engagement ; potential interaction with IOOS groups to make this happen
- Mixing measurements; on gliders and other platforms
- Additional work needs to be done to the data portal to make the data more accessible to the general public in order for educators to ‘tell a story’ with the data
- Higher resolution spatial sampling is needed to better understand biophysical interactions, turbulence and internal waves
- Small scale single cruise process experiments can be built along the array to address questions occurring at scales smaller than current array spacing
- Connections to models and satellite imaging needs to be made
- Mobile sampling for lagrangian sampling to pair with eulerian arrays; drifters or wave gliders for example
- An array of hydrophones is needed to localize methane seeps; a multibeam echosounder can be added to the sea floor
- Improved monitoring of gas seeps ; upward looking acoustics for bubble detection
- More gas sensors for gas budgets (nitrogen sensors)

- Modifications needed to measure vertical mixing via OOI assets; arrays are the backbone but higher resolution bottom measurements and measurements in the pycnocline needed to observe variability in vertical mixing and internal waves
- Imaging systems for plankton (Isssss…..) on profiling instruments and bottom moored platforms
- ESP like or IFCB like technologies that allow capture of particulate material or measurements of in situ rates
- Sensors, approaches that validate models of nutrient cycling and detection of HABs and HAB toxins
- Establish calibration protocols for acoustic sensors
- Echosounders or acoustics on gliders
- Approaches that allow detection of sediment resting cysts for HAB species

Other

- Need to focus on larger research questions that can be addressed with the reduction in the OOI support levels, e.g. NAS report recommends elimination of southern array

Open Ocean & Station Papa

Goal of Session – *Gain insight into how ocean observing assets at Open Ocean and Station PAPA can help you answer critical science questions*

Task for Session - List research topics/themes relevant to Open Ocean and Station PAPA that OOI and other observing assets can facilitate that you could not do before. What would you like to do in the future using OOI?

Open Ocean and Station PAPA

- High resolution and realtime timeseries allows better/quicker insight into anomalies (including subsurface), e.g. the blob
  - AGU special collection: Mid-latitude marine heatwaves: Forcing and impacts
- Data assimilation for models, realtime data are essential
- Long timeseries, sustained observations to contextualize other long timeseries in the region
  - Goal is to examine long time scales, e.g. climate change, decadal variation
- Concurrent, sustained observations of physical, chemical and biological properties throughout the water column
  - Goal is to examine physical-biogeochemical interactions
  - Key question: could resolve diel variability

Open Ocean and Station PAPA

- Can capture meso-scale and submesoscale features/ processes/timescales
- Upper ocean, mixed-layer processes
  - Key questions: disentangling waves and winds
  - advection speed of a storm
  - forcing of inertial oscillations
- Bifurcation of current along the coast of North America
- Open ocean fronts, OOI gliders and flanking moorings can give spatial context and sustained observations
- Resolving inertial oscillations (can OOI resolve this or is sampling too infrequent?)

Open Ocean and Station PAPA wish list

- High-resolution profiles in upper 150 m
- Inverted echosounders (inferring dynamic height)
- Automated Iron measurements
- Acoustic node for ATOC (vertical array of hydrophones)