OOI PDX Meeting – Day 2

Afternoon Breakout Session Major Science Questions:

Seafloor/Geophysics

1. NOVAE Workshop April 2015 was a great way to create interest groups. Interests in having a second meeting. Getting young people involved. Workshops are perceived to be helpful for generating research ideas, sharing data, creating interest groups.

2. Subduction zone. Cascadian subduction zone long-term seismic monitoring with OOI Hydrate Ridge seismometer array. Also, several efforts are underway to develop seafloor geodesy at Cascadia subduction zone. Another technology is optical fiber strain meter to measure the movement of seafloor near the subduction zone. Autonomous brandband seismometer with tilt meter at CORK site. Will be interesting to look for long range connections between cabled observatory sites and responses to large earthquakes.

3. Methane seeps/hydrate ridge OOI Cabled Array site. Methane seeps may be explosive with large morphologic changes from year to year. Seafloor topography and biology change rapidly. Ship-based multi-beam sonar data available. Time series data are important in this area and monitoring by hydrophone.

4. A 3-D seismic survey could be an exciting new dataset to collect at Axial. 3-D survey would better resolve the detailed geometry of magma reservoir and the properties of the crust above the magma chamber.

5. Heterogeniety of upper crustal permeability and its impact on subsurface hydrothermal circulation & microbiology. How to measure it? Drilling? Modeling? 3D Seismic velocity can provide information on crustal porosity and permeability. Electro-magnetic surveys can also provide information on crustal properties.

6. There is a workshop proposal to do drilling at Axial Seamount to study microbes below the seafloor. Direct sub-seafloor measurements. Drilling 100 m holes into a vent field. Drilling into zero-age crust is challenging. Could do perturbation experiments. Insert a CORK into a black smoker to inject tracer. Significant downflow at hydrate ridges. Current meter (tracer injection) measuring flow into and out of surface at the sediment-water interface.

7. Time-series heat flux measurements at Axial volcano. Moorings in water column to measure integrated hydrothermal plume output. Also thermistor blankets and seafloor temperatures arrays could contribute.

8. Ability to track whales using geophysical instruments (seismometers). Hydrophone data is also important. Small hydrophone arrays for community outreach.

9. Seafloor compliance measuring the stiffness of seafloor and these data could change with magma movements. Can be done with broadband seismometer and bottom pressure recorders. Data already exists at Axial.

Biogeochemical Fluxes OA, Nutrient Cycling and Hypoxia
Goal is to create research topic interest groups
How is research on fluxes facilitated???

I. Kinds of flux studies OOI can facilitate:

1. Process (rate) studies interwoven into time series and spatial patterns of biogeochemical parameters.
2. Studies that aim to develop flux proxies. For example, optical backscatter (more intense high frequency burst sampling) as proxy for particle fluxes.
3. Creation and monitoring of disturbance vs. pristine sites, e.g., OA chambers, bottom trawling
4. OOI offers new sites for air-sea flux measurements- Can examine how marine boundary layers alter air-sea fluxes. Eddy covariance gas fluxes above and below air-sea interface.
5. Mesoscale eddies: where do models work in capturing these effects. How do mesoscale processes affect biogeochemical fluxes and community structure?
6. Fresh water influenced fluxes of heat, nutrients, pCO2, terrestrial organic carbon and the seasonal variability and interannual variability of freshwater effects.
7. Deep-ocean to shelf fluxes- internal waves, tides.
8. Vertical migrations on different time scales: moored bioacoustics sensors

II. OOI Community Efforts that could facilitate biogeochemical flux studies:

1. Develop routine surveys around each platform to extend footprint: OOI needs to develop this into service cruises (e.g. push cores, ROV surveys, plankton tows). BBL water samples- more than check samples. Distribute samples to interested teams similar to HOTS, BATS teams.
2. Add additional imagery (acoustic, laser, photographic) and sediment trap systems to document vertical flux events. Scope requirements for these systems.
3. Add benthic rovers as platforms for time-series benthic flux measurements
4. Create strong synergies between in situ data, process studies and models. "Where models and measurements deviate is where new science arises."
5. Develop more effective approaches for working groups to collaborate. Need better community-level accepted ways of sharing data and ideas. Ways to maintain community interactions outside of workshops, conferences and emails.
6. Encourage proposals with data sharing plans, reproducibility plans, return of data products to OOI sphere.
7. Document flux of young scientists and technicians into Ocean Observing science ☺. Document ways ocean observing is attracting talented people to ocean sciences (i.e. broader impacts).

Biological- Physical Interactions

Goal of session

How do we form teams to develop projects that can be supported by the OOI infrastructure?

> NSF/UNOLS/OOI can support the development of work groups to promote proposals form new interdisciplinary teams to generate several proposals. 20-30 people per work group would work. Several themes could be advanced if more people were interested.

Research Questions

We can start to address questions on the shelf and in the deep ocean about bio-physical interactions at multiple scales – from microscale to mesoscale, both in spatial and temporal terms. Ocean-shelf interactions and connectivity can be resolved.

1. At the microscale we can ask questions about how flow fields and turbulence influence the patterns and behavior of organisms. Turbulence effect the mortality, growth, feeding, and escape behavior.

2. At the mesoscale, we can start to look at along shore and across shelf transport of organisms and fluxes on nutrients. We can simultaneously observe the biology in its physical environment across multiple scales. We can explore trophic interactions at various levels (biomass in the plankton by size class, fish concentrations and size by backscatter).

3. The persistence of observations at high temporal resolutions will enable us to detect episodic events. The observations can be used to establish statistics, essentially we can start to see what is normal and what is not.

We have a wish list…

New technology needed to achieve some future goals:

- Flowcam/Cytobots can count particles and are moving towards organism identification.
- Molecular biology tools for identification are becoming available.
- Experts need to be integrated to the OOI system.
- Smart sampling should be developed – e.g. automated sample collection

DRAFT…….. Craig McNeil and Steve Mihaly

Climate Scale Discussions

OOI provides unprecedented temporal and spatial resolution. A key difference of OOI is the ability to measure fluxes (not just scalars). We can study processes and mechanisms (coastal upwelling) in detail. We can observe responses to episodic forcing, some of which may be scenarios for the future (like warm blob). We can observe the cumulative, longer term, effects.
Examples of variability include interannual (ENSO), decadal (PDO), and episodic events (warm blob, volcanic ash events).
Some examples of variability in forcing and ocean response are:

Atmospheric forcing	**Ocean response**
Global warming	rising SST, sea-level rise, increasing ocean heat content, increased stratification, deoxygenation!
Rising CO_2	(global warming) ocean acidification
Winds	waves, mixing, coastal upwelling (impacts on all trophic levels, HABs, etc.)
Precipitation	freshwater fluxes, stratification

More general ideas: good to identify and think about ‘chokepoints’.