Ocean Carbon and Biogeochemistry (OCB) Summer Workshop July 17, 2012

STUDENT PRESENTATIONS

Carly Buchwald (MIT/WHOI)
Carolina Cisternas-Novoa (Stony Brook Univ.)
Jessica Cross (Univ. of Alaska, Fairbanks)
Kristen Fogaren (University of Hawaii)
Ogunro Oluwaseun (New Mexico Institute of Mining & Technology)
Stephanie Owens (MIT/WHOI)
Aaron Strong (Stanford Univ.)
Leslie Wickes (College of Charleston)
Yongjin Xiao (Virginia Institute of Marine Science)
Research Goal:

To determine when, where and at what rates nitrogen cycling processes are happening in the water column in oxygen deficient zones by interpreting $\delta^{15}$N and $\delta^{18}$O isotope profiles of nitrite ($\text{NO}_2^-$) and nitrate ($\text{NO}_3^-$).
To Interpret Isotope Profiles:

Culture Experiments
-Nitrification isotope systematics
-Single and co-cultures
-Bacteria and archaea


To Interpret Isotope Profiles:

Nitrite Abiotic Experiments

-the nitrite $\delta^{18}O$ abiotically equilibrates with water at a set rate dependent on (pH, T, S)

CAN BE USED AS A CLOCK
Carolina Cisternas- Novoa
Ph.D Student at Stony Brook University.
Advisor: Dr. Cindy Lee

• My research is concerned with the origin and fate of particulate organic matter in the ocean, particularly with the distribution and processes related to gel particles, TEP (Transparent Exopolymer Particles) and CSP (Coomassie Stainable Particles).

• This research emphasizes the role of gel particles in aggregation and the potential effect that future ocean multi-stressors, such as temperature and ocean acidification, could have on them.
My Current Work is within two larger projects:

**ADAGIO (AciDification effects of AGgregation In the Ocean) Project**
- Study of the role of gel particles on aggregate formation and the effect of ocean acidification on their abundance and on POC export.
- Study of changes in the composition of gel particles in seawater at different CO₂ levels and temperatures.

**BaRFlux Project**
- Study of the distribution, relative abundance, and contribution of TEP and CSP to sinking material in an oligotrophic oceanic environment (Bermuda Rise).
Natural mechanisms for suppression of $\Omega$ and pH, combined with the anthropogenic load of CO$_2$ absorbed by the oceans, result in seasonal undersaturations on the Bering Sea shelf.
Recently we have observed seasonal calcite undersaturations over the northern shelf concurrent with excess TA, similar to what we observe in deep waters originating from the Bering Sea Basin.

This indicates the first evidence of shallow-water carbonate mineral dissolution as a result of acidification processes in the Bering Sea.
Kristen Fogaren, University of Hawaii, Department of Oceanography

- Permeable sediment biogeochemistry
- Currently working on PhD proposal

B) Reflectivity trend for 1980 to 1992 as shown by Herman et al., 2001
Improving Estimates of Upper Ocean Particle Flux
Stephanie Owens (with Ken Buesseler), MIT-WHOI

**Methods**

${}^{238}\text{U} - {}^{234}\text{Th}$ Disequilibrium


**Sediment traps**


**Spatial variability of particle flux (in prep)**

Basin-scale variability - U.S. & Dutch GEOTRACES Transects
Regional-scale variability – West Antarctic Peninsula survey
Basin-scale variability
GEOTRACES Transects

Equilibrium

SOUTH ATLANTIC

Regional-scale variability
West Antarctic Peninsula survey

January 2010
$^{238}\text{U} - ^{234}\text{Th}$
Silicon Biogeochemistry: Land-Ocean Interactions and Coupled Human-Natural Systems

Aaron Strong
Stanford University
OCB 2012
Deep-water coral in the naturally ‘acidic’ conditions of the Southern California Bight

Leslie Wickes, College of Charleston
Deep-water coral in the naturally ‘acidic’ conditions of the Southern California Bight.
A satellite-data assimilative study of the lower trophic level ecosystem on the northeast U.S. continental shelf

Yongjin Xiao (Virginia Institute of Marine Science)

**Dissertation:** The impacts of climate change on phytoplankton community structure along the U.S. eastern continental margin

1. **1D model comparison**
   - Optimal ecosystem model

2. **3D ROMS simulation**

3. **Climate sensitivity experiments**

**Ecosystem models (NPZD):**
- 1P1Z
- 2P1Z
- 2P2Z
- 3P1Z
- 3P2Z

**Parameter optimization (variational adjoint method)**

**Assimilating satellite data**

**Question:** How many phytoplankton and zooplankton compartments should be included in the model?

- 6 sites in the MAB
- Satellite-derived data:
  a) Total Chl
  b) Size-differentiated Chl
  c) Particulate organic carbon (POC)
Results – model comparison

**Question:** How many phytoplankton and zooplankton compartments should be included in the model?

- After assimilation, the 2P models fit the data best
- Additional zooplankton compartment did not improve the model skill

For this system, the 2P1Z model is the best choice (see my poster for a more detailed study on the 2P1Z model).