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)

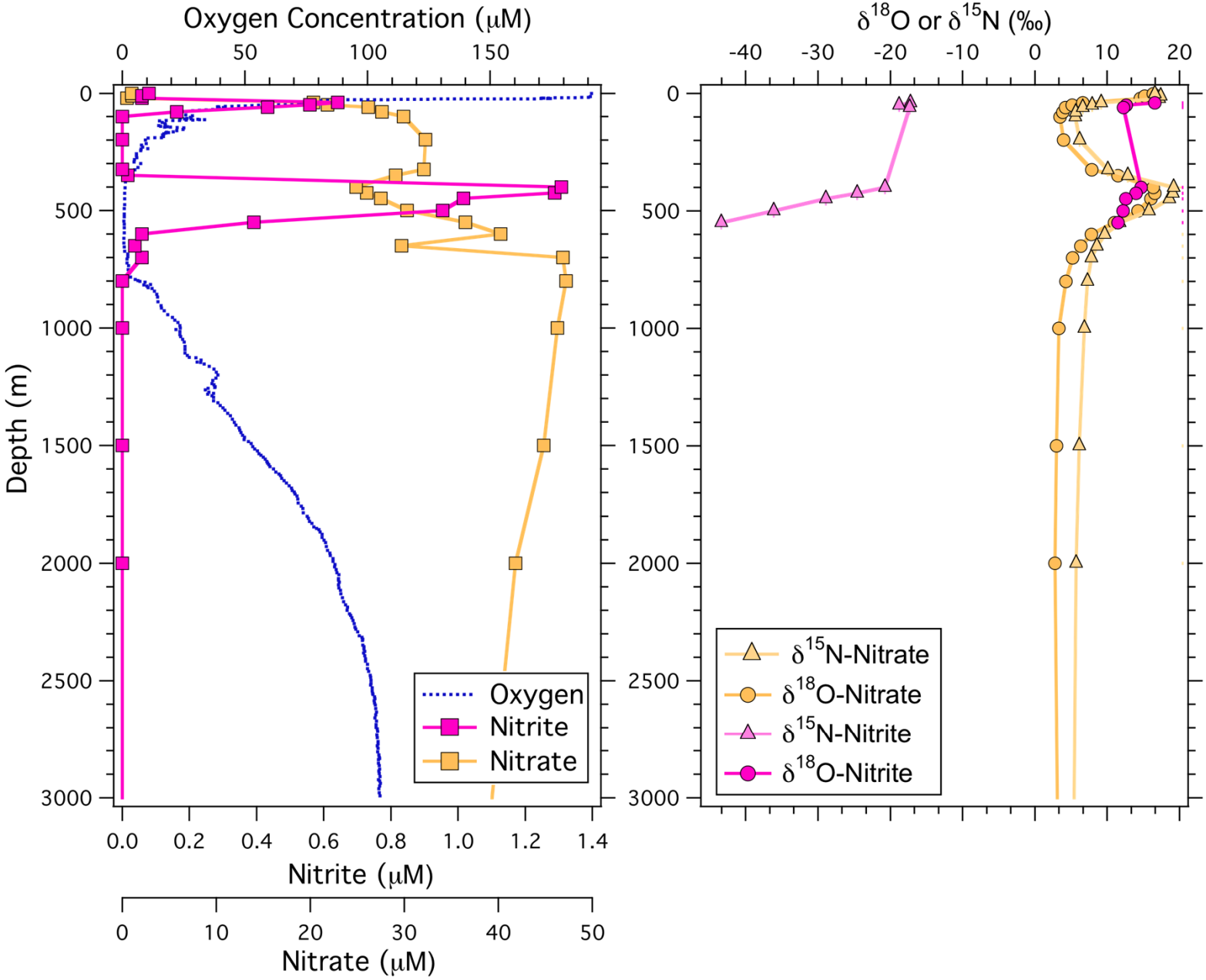
Nitrogen cycling in ODZ's: Insights from $\delta^{15}N$ and $\delta^{18}O$ of nitrite and nitrate

Carly Buchwald
MIT/WHOI Joint Program

Research Goal:

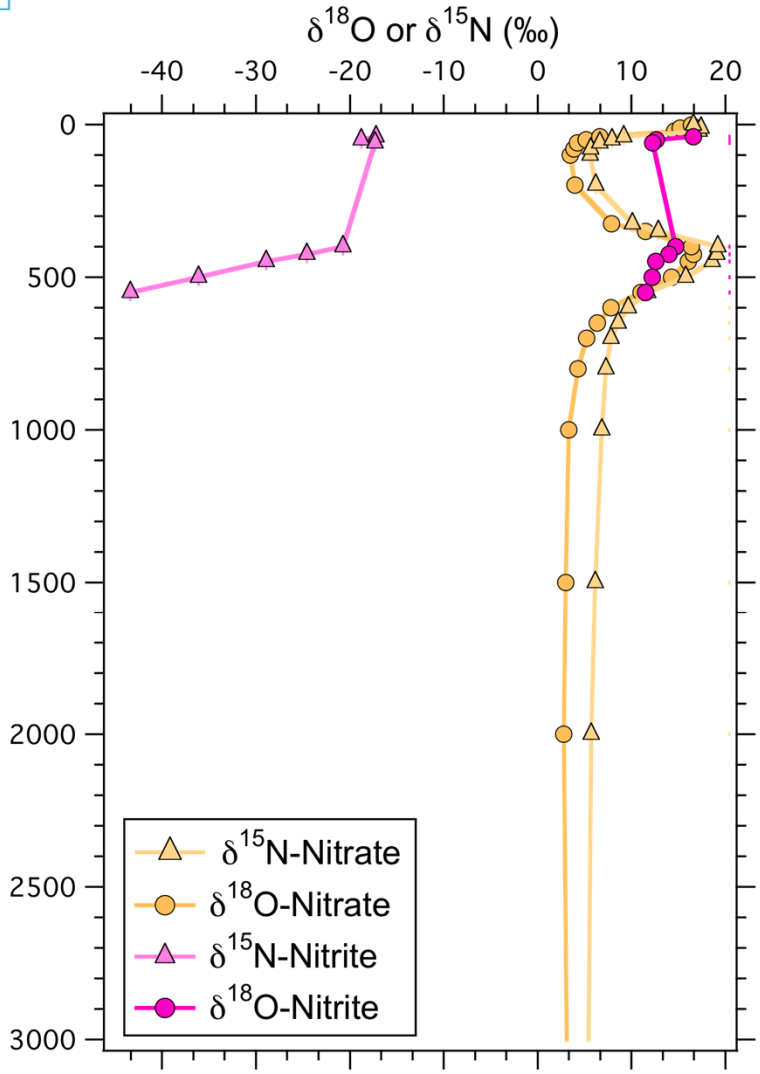
To determine when, where and at what rates nitrogen cycling processes are happening in the water column in oxygen deficient zones by interpreting $\delta^{15}N$ and $\delta^{18}O$ isotope profiles of **nitrite (NO_2^-)** and nitrate (NO_3^-).

Costa Rica Upwelling Dome July 2010



To Interpret Isotope Profiles:

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



Buchwald, C. and K. L. Casciotti. 2010. **Oxygen isotopic fractionation and exchange during bacterial nitrite oxidation.** Limnol. Oceanogr. 55: 1064-1074.

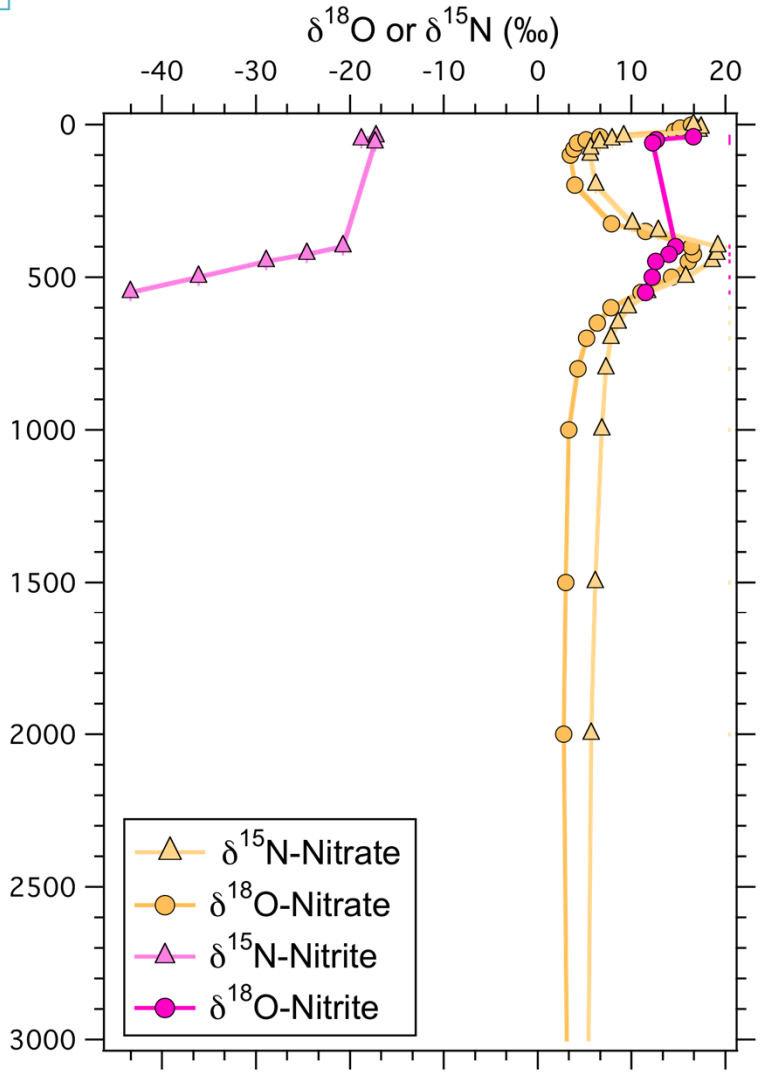
Buchwald, C., A. E. Santoro, M. R. McIlvin and K. L. Casciotti. 2012. **Oxygen isotopic composition of nitrate and nitrite produced by nitrifying co-cultures and natural marine assemblages**. Limnol and Oceanogr. accepted.

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.

SoMAS

Stony Brook University | The State University of New York

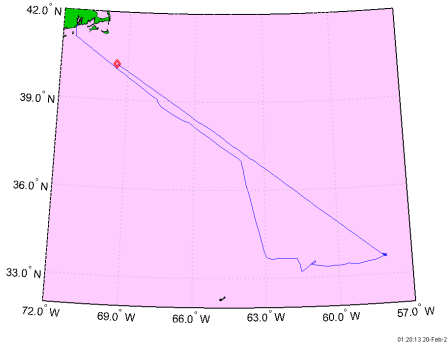
My Current Work is within two larger projects:

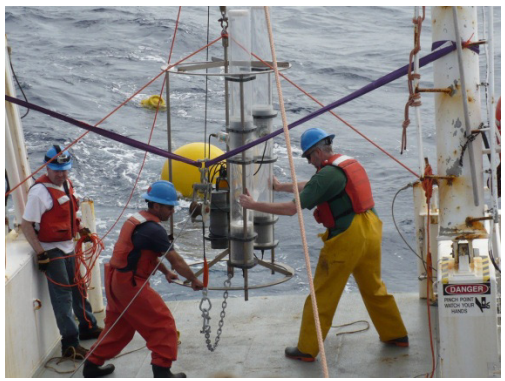
ADAGIO (AciDification effects of AGgregation In the Ocean) Project

- 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 CO_2 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).

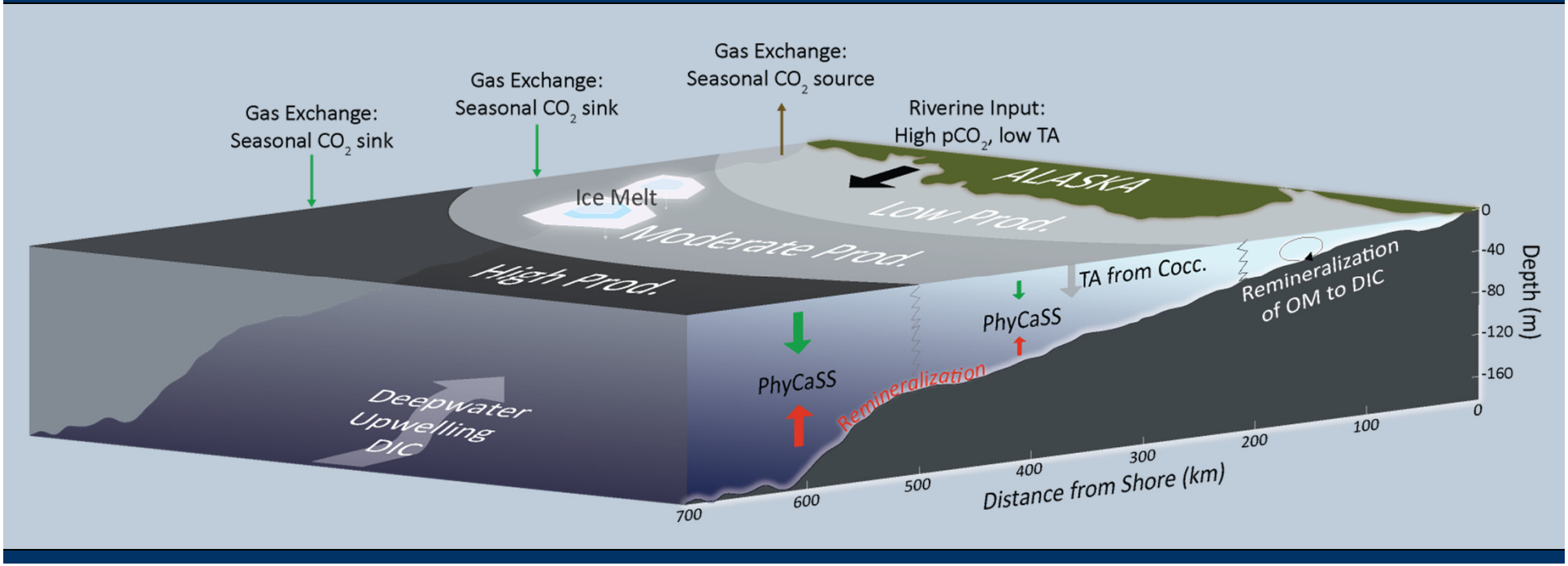




Ocean Acidification in the Bering Sea

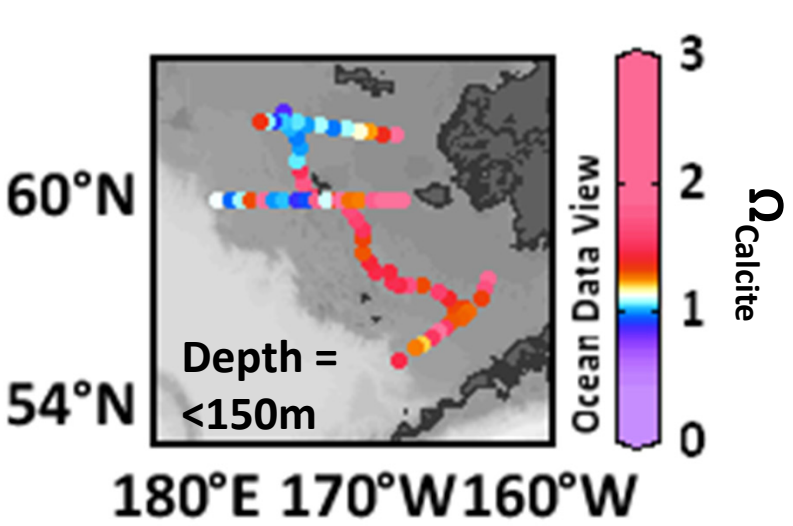
Jessica N. Cross[1] and Jeremy T. Mathis[2]

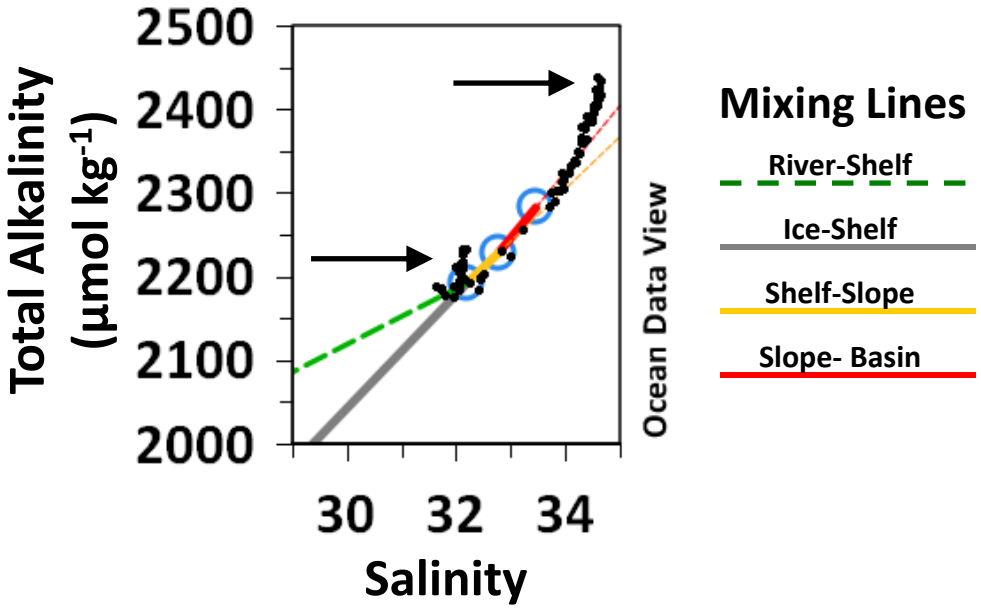
1. University of Alaska, Fairbanks, School of Fisheries and Ocean Sciences, 245 O'Neill Bldg. Fairbanks, AK 99775
2. National Oceanic and Atmospheric Administration, Pacific Marine Environmental Lab, 7600 Sand Point Way, Seattle, WA 98115



- Natural mechanisms for suppression of Ω and pH, combined with the anthropogenic load of CO_2 absorbed by the oceans, result in seasonal undersaturations on the Bering Sea shelf.

Carbonate mineral dissolution





- 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.**

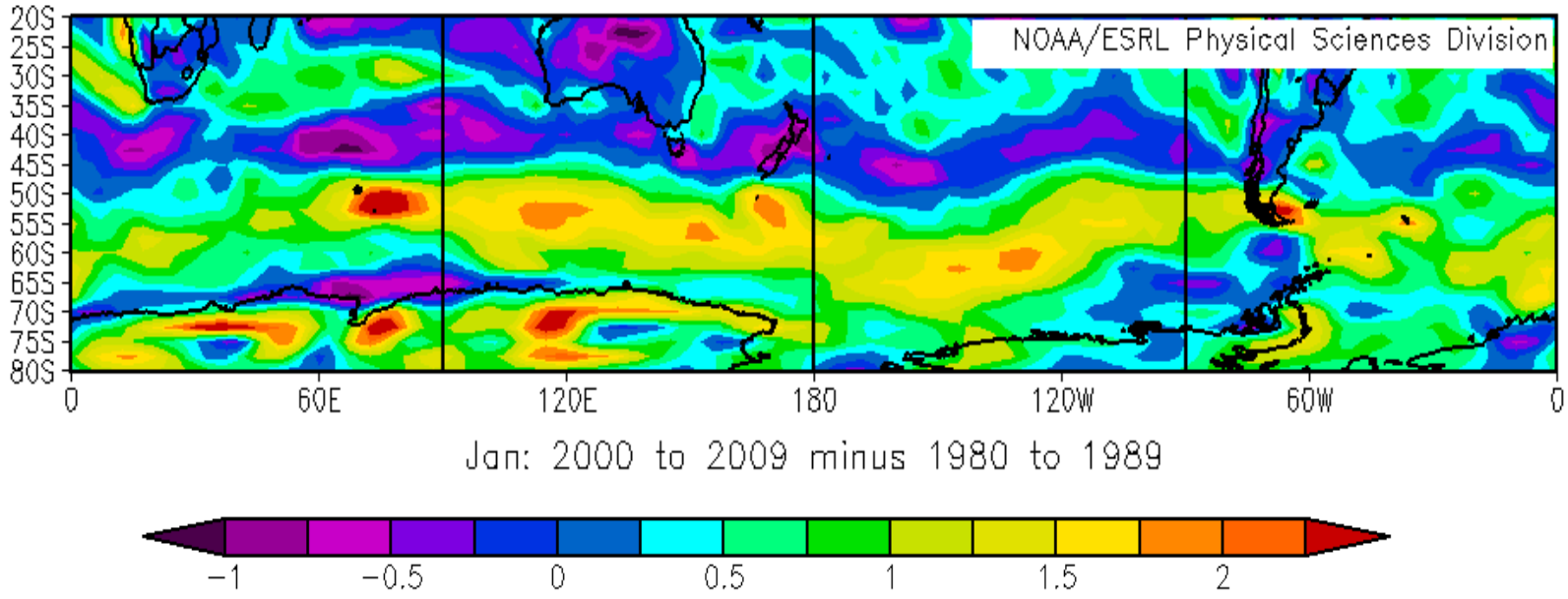
Kristen Fogaren, University of Hawaii, Department of Oceanography

- **Permeable sediment biogeochemistry**
- **Currently working on PhD proposal**

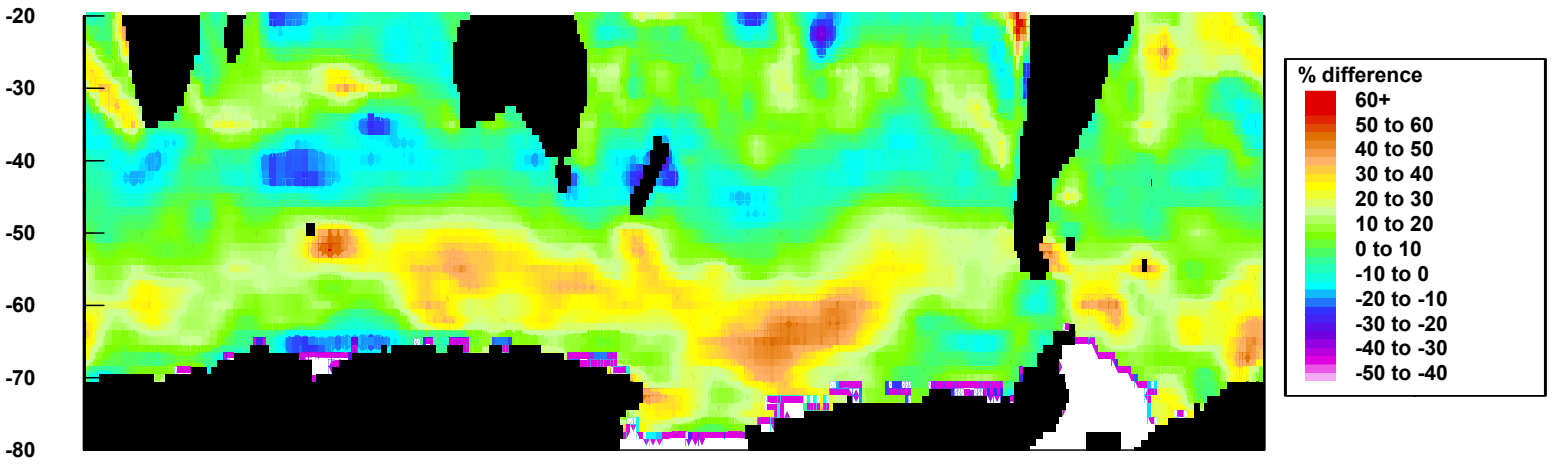
Ogunro Oluwaseun
New Mexico Institute of Mining & Technology

A) Difference in January scalar winds: 2000-2009 vs 1980-1989,
B) The percent difference in DMS flux between 2000-2009 and 1980-1989

A)



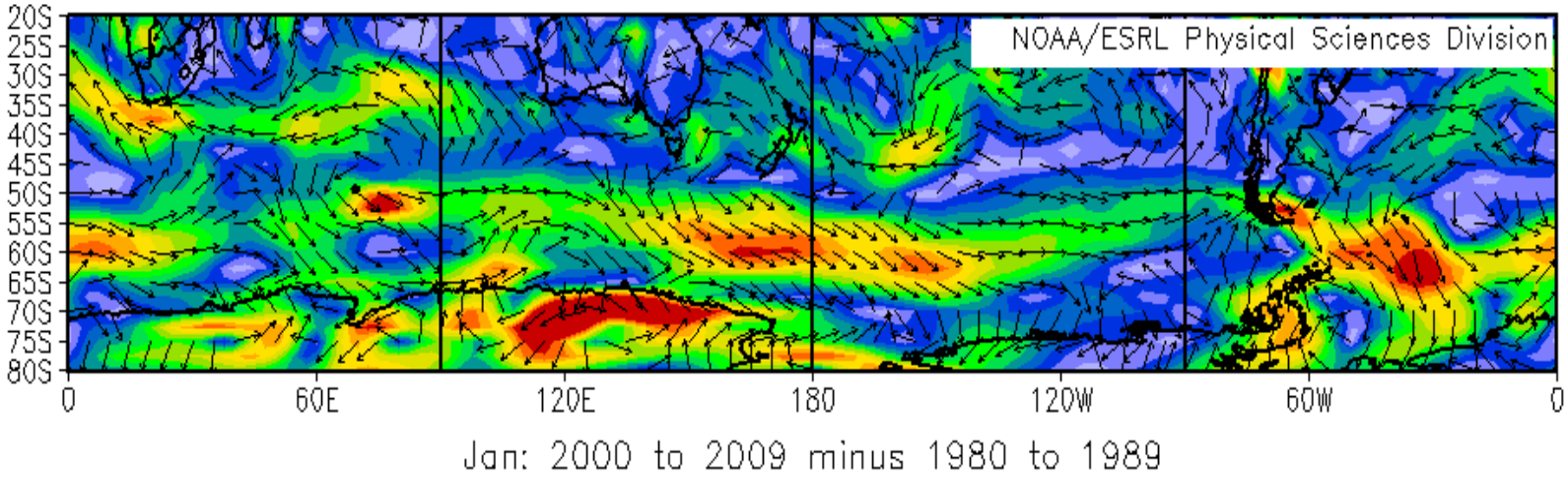
B)



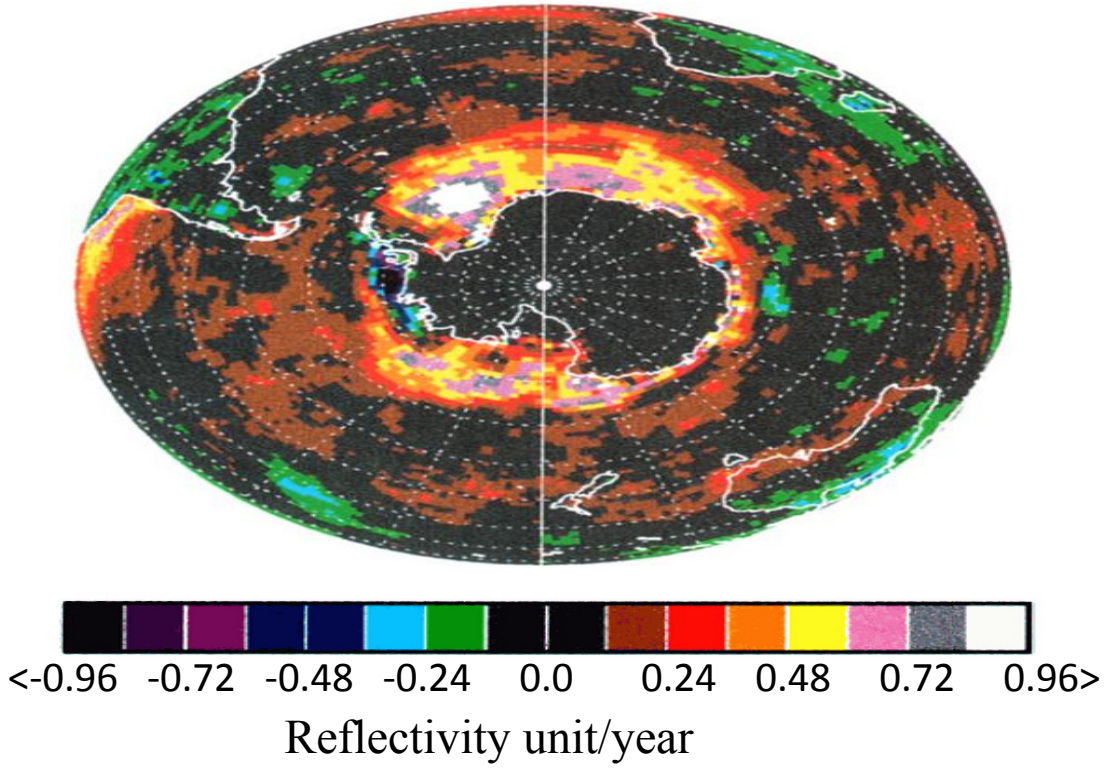
A) Difference in January vector winds: 2000-2009 vs 1980-1989

B) Reflectivity trend for 1980 to 1992 as shown by Herman et al., 2001

A)



B)



Improving Estimates of Upper Ocean Particle Flux

Stephanie Owens (with Ken Buesseler), MIT-WHOI

Methods

^{238}U–^{234}Th Disequilibrium

Re-evaluating the ^{238}U–salinity relationship in seawater: Implications for the ^{238}U–^{234}Th disequilibrium method. Owens, S.A., Buesseler, K.O., & K.W.W. Sims, *Marine Chemistry,* 2011

Sediment traps

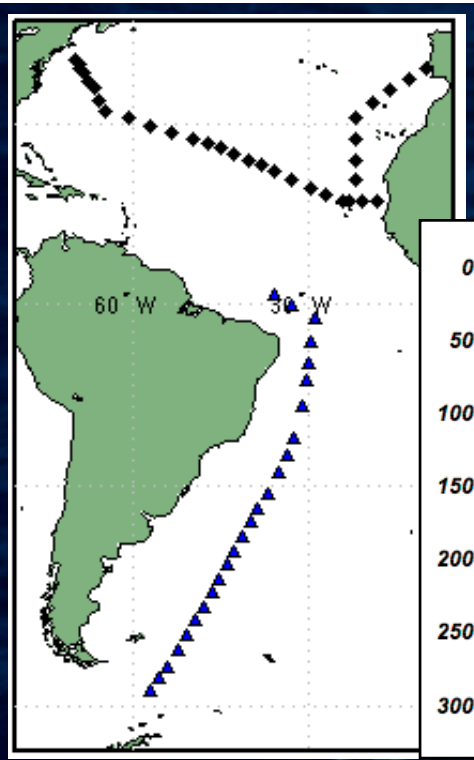
A new time series of particle export from neutrally buoyant sediment traps at the Bermuda Atlantic Time-series Study site. Owens, S.A., Buesseler, K.O. Lamborg, C.H., Valdes, J., Lomas, M.W., Johnson, R.J., Steinberg, D.K., Siegel, D.A., *submitted,* 2012

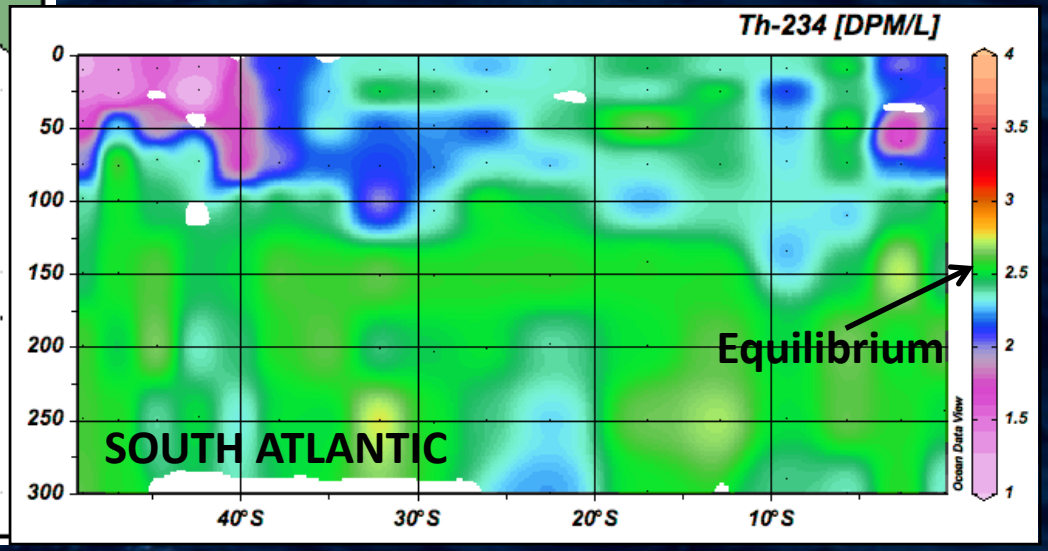
Spatial variability of particle flux *(in prep)*

Basin-scale variability - U.S. & Dutch GEOTRACES Transects

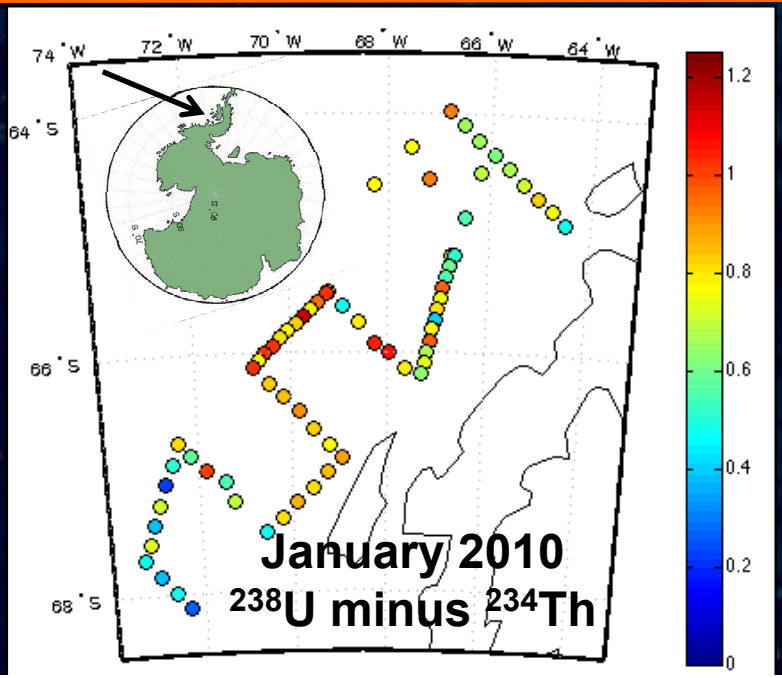
Regional-scale variability – West Antarctic Peninsula survey

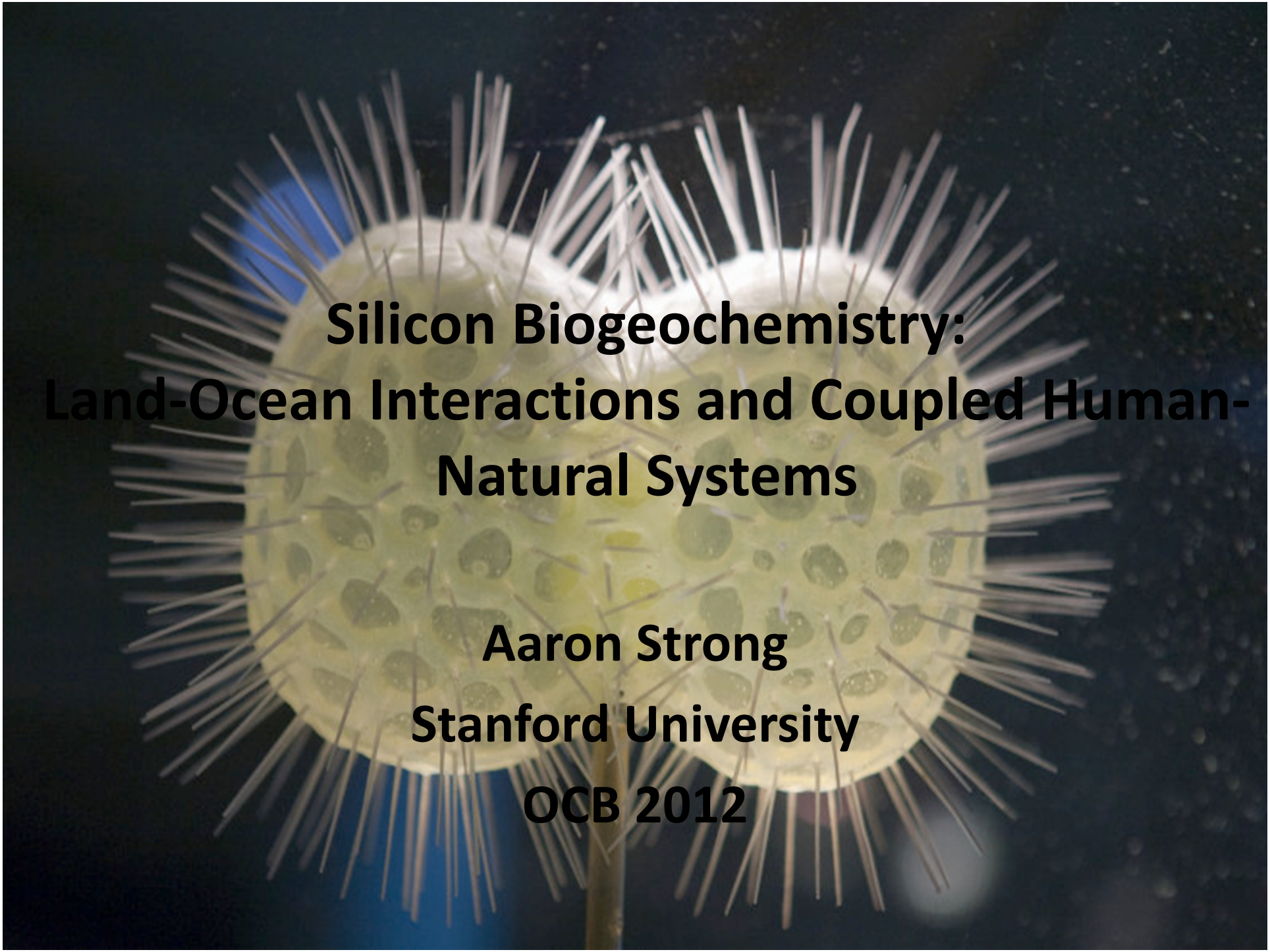
Basin-scale variability
GEOTRACES Transects





Regional-scale variability
West Antarctic Peninsula survey



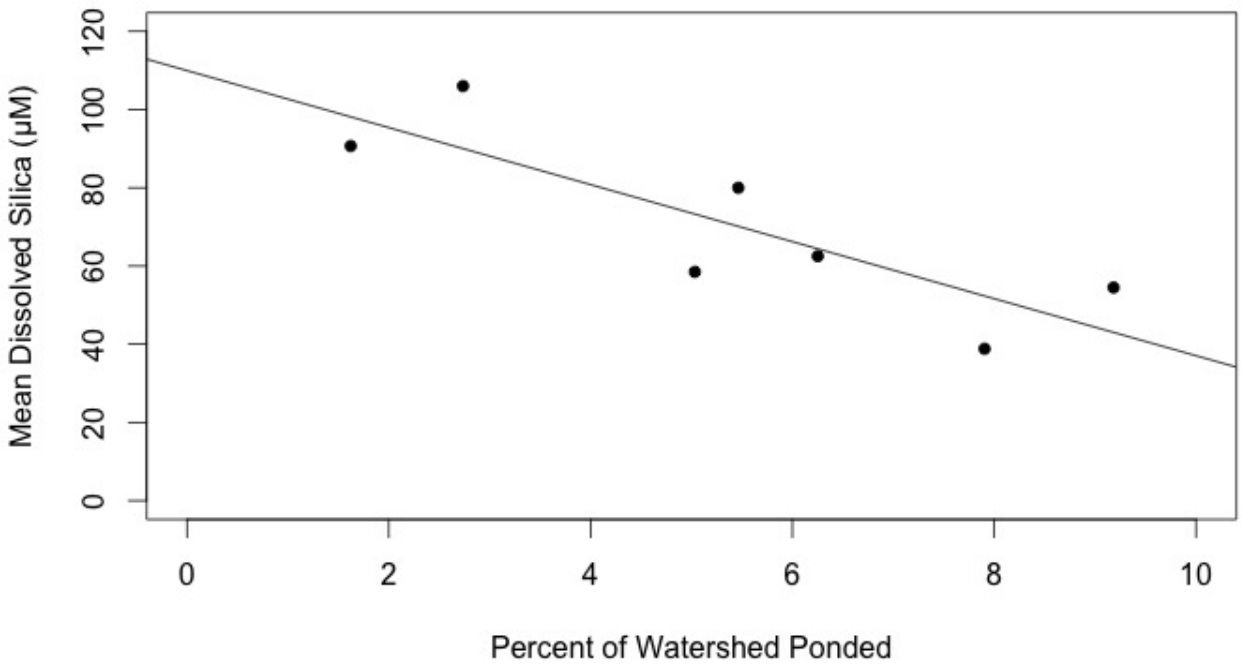


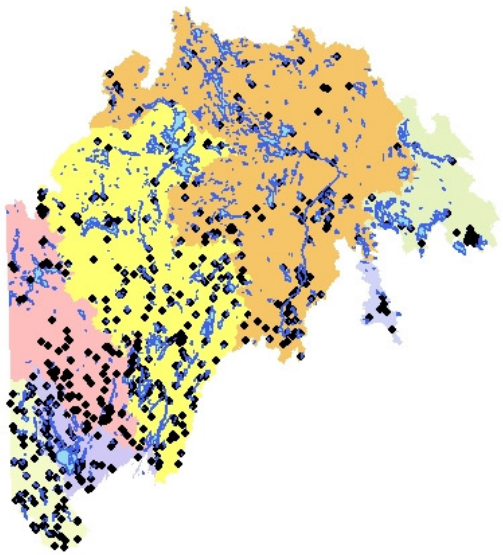
Silicon Biogeochemistry: Land-Ocean Interactions and Coupled Human-Natural Systems

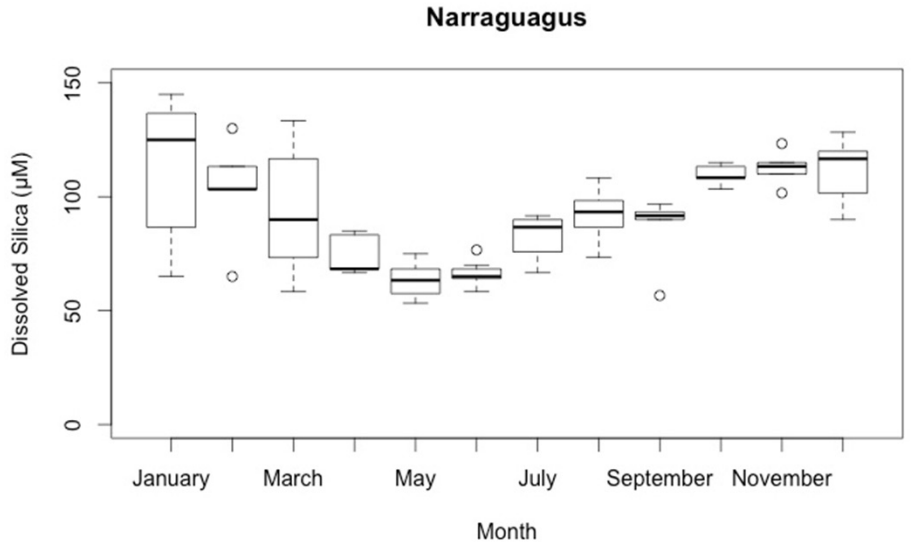
Aaron Strong

Stanford University

OCB 2012

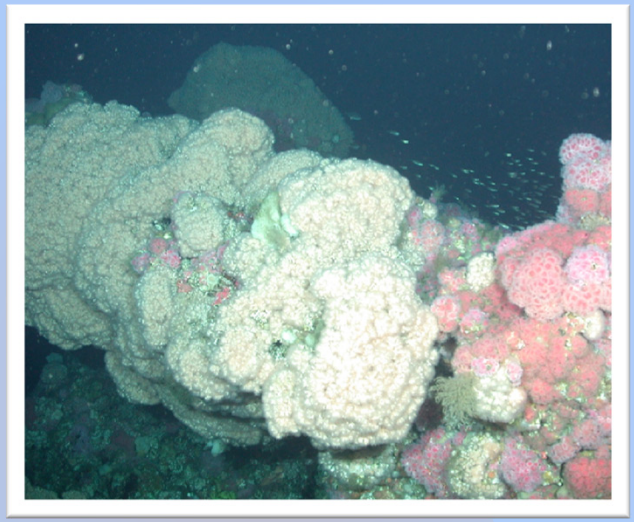

Seven Maine Rivers: Ponding vs. Dissolved Silica
Mean Dissolved Silica (µM)
0
20
40
60
80
100
120
0
2
4
6
8
10
Percent of Watershed Ponded

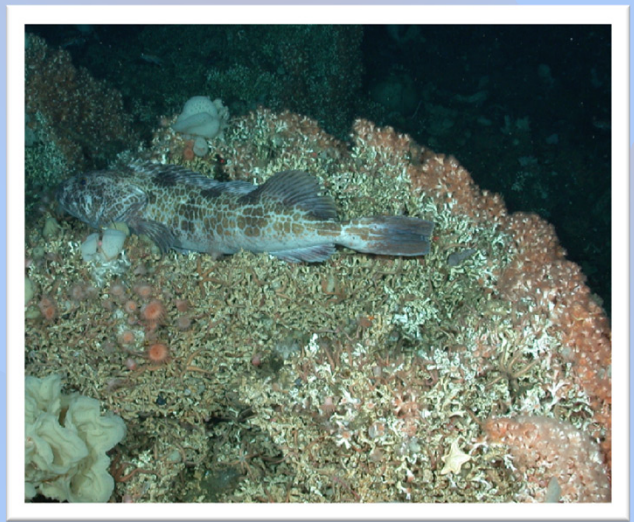



Narraguagus
Dissolved Silica (µM)
0
50
100
150
January
March
May
July
September
November
Month

Deep-water coral in the naturally 'acidic' conditions of the Southern California Bight

Leslie Wickes, College of Charleston

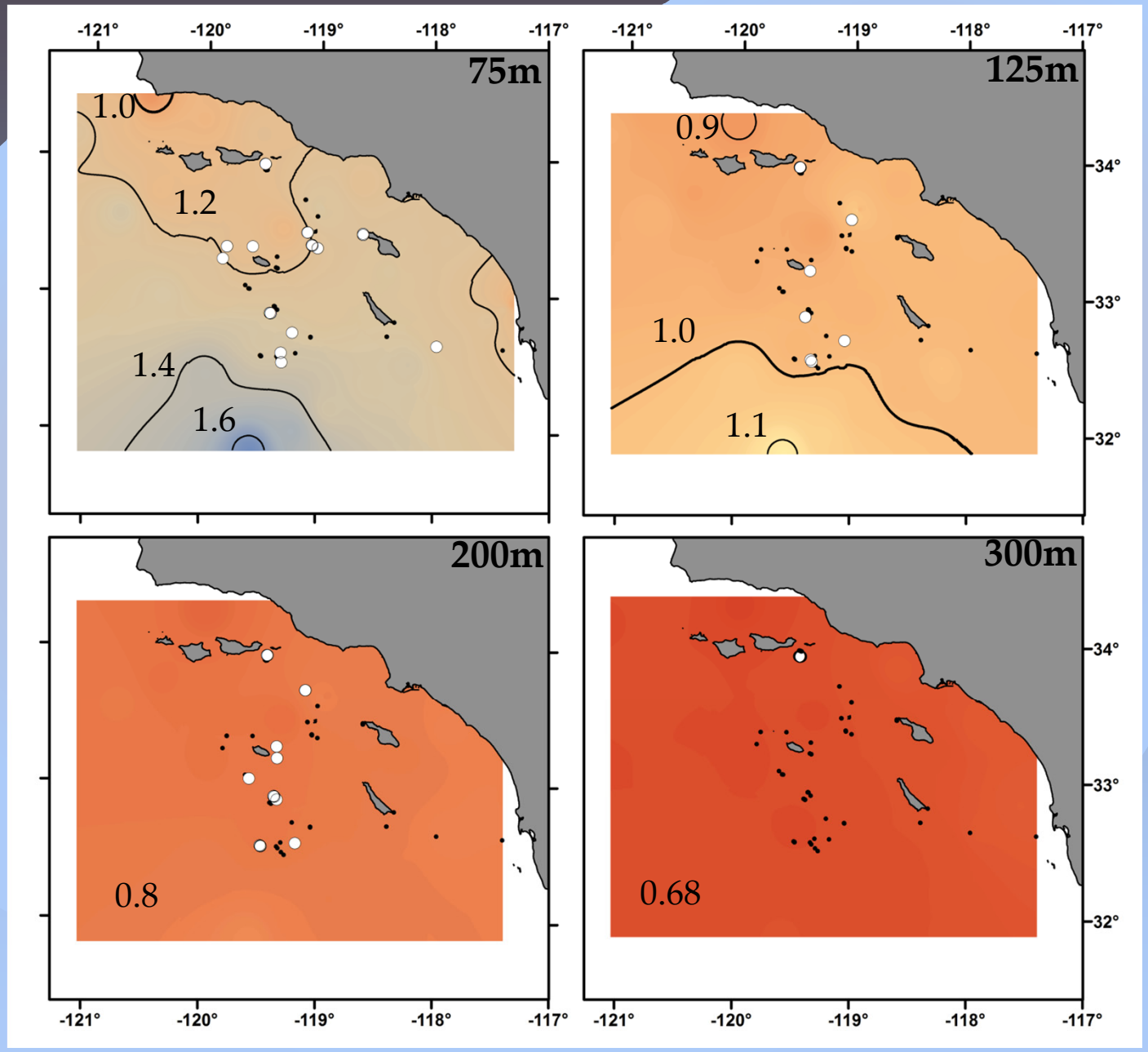




Deep-water coral in the naturally 'acidic' conditions of the Southern California Bight

Oxygen:
3.05 ± 0.7 ml/l

Temp:
10.0° ± 0.6



O:
2.64 ± 0.6 ml/l

T:
9.6° ± 0.5

O:
1.78 ± 0.4 ml/l

T:
8.8° ± 0.5

O:
1.04 ± 0.2 ml/l

T:
7.9° ± 0.5

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

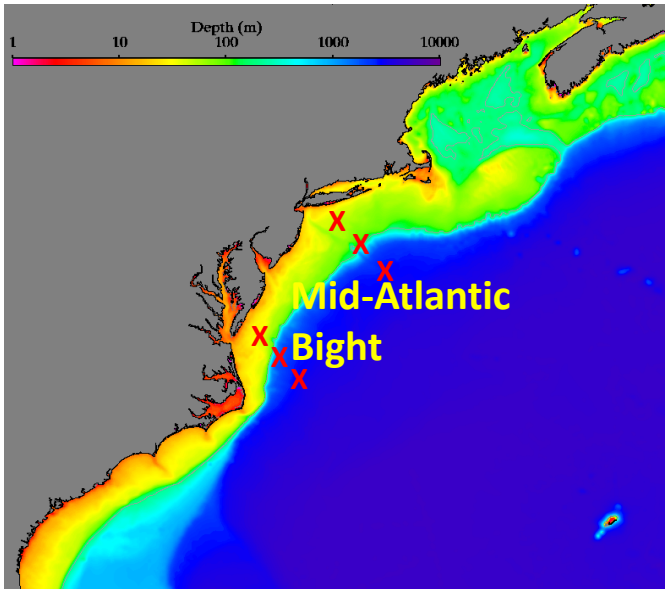
1. **1D model comparison**
   - Optimal ecosystem model
2. **3D ROMS simulation**
3. **Climate sensitivity experiments**

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

\+ 1D Physics

\+ Parameter optimization (variational adjoint method)

Assimilating satellite data

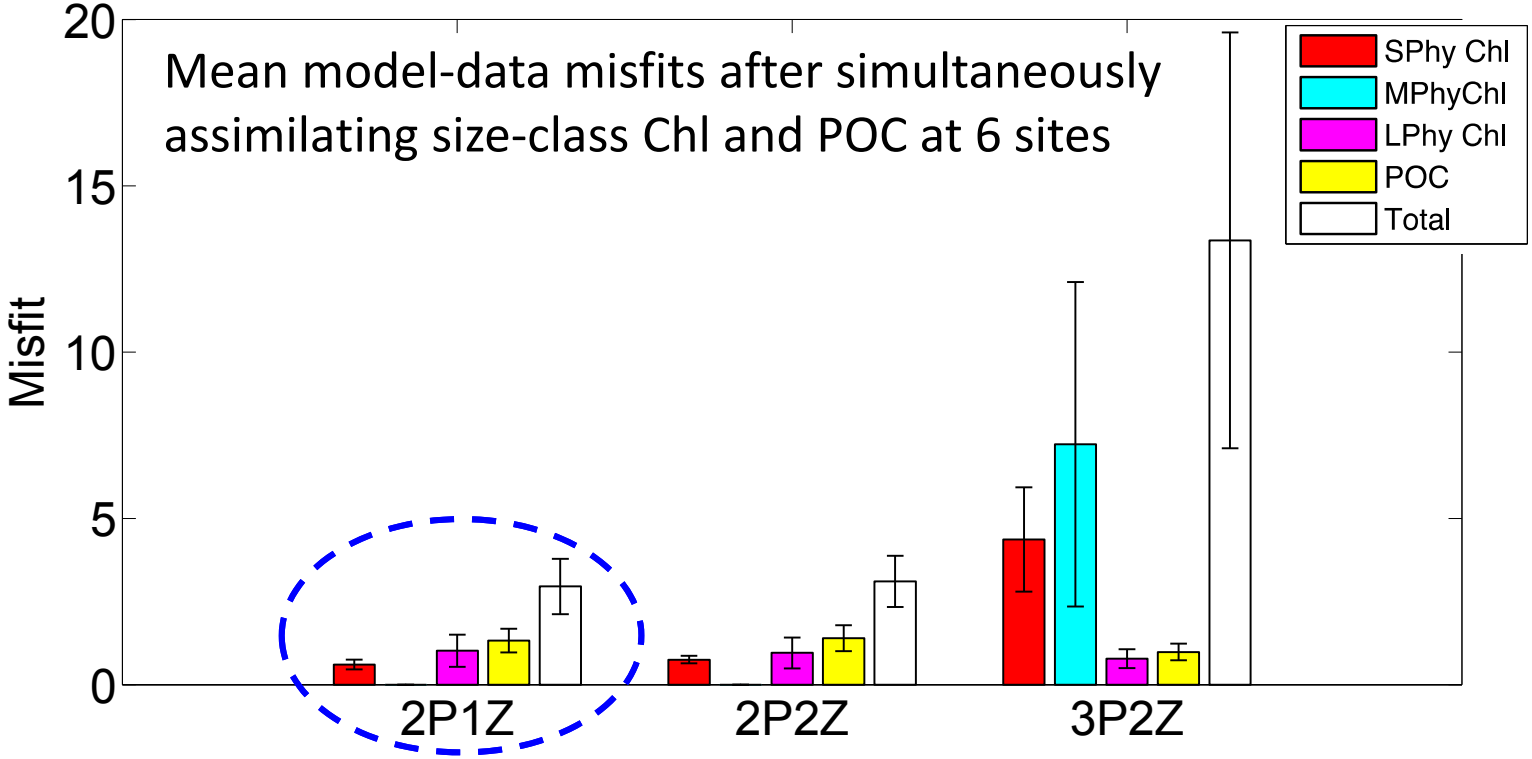


- 6 sites in the MAB
- Satellite-derived data:
  a) Total Chl
  b) Size-differentiated Chl
  c) Particulate organic carbon (POC)

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

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).