Diatom community composition shifts in response to eddies in the California coastal transition zone

Zuzanna M. Abdala[1], Sveinn Einarsson[1], Kimberly Powell[1], Jessica Fitzsimmons[2], Tyler Coale[3], Claire Parker Till[4], P. Dreux Chappell[1]
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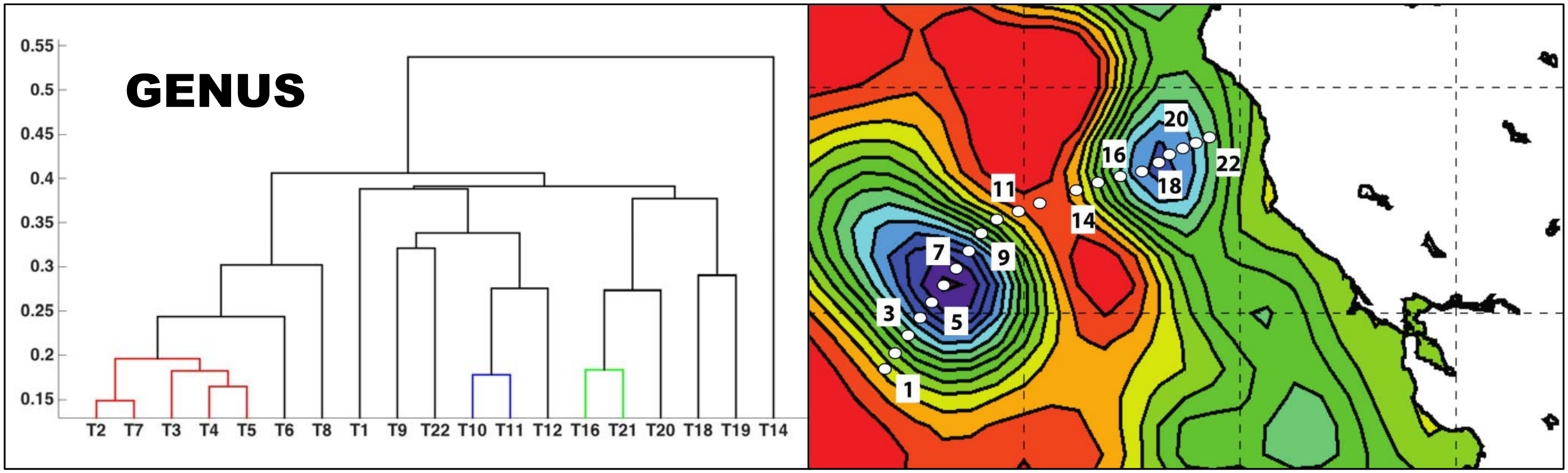
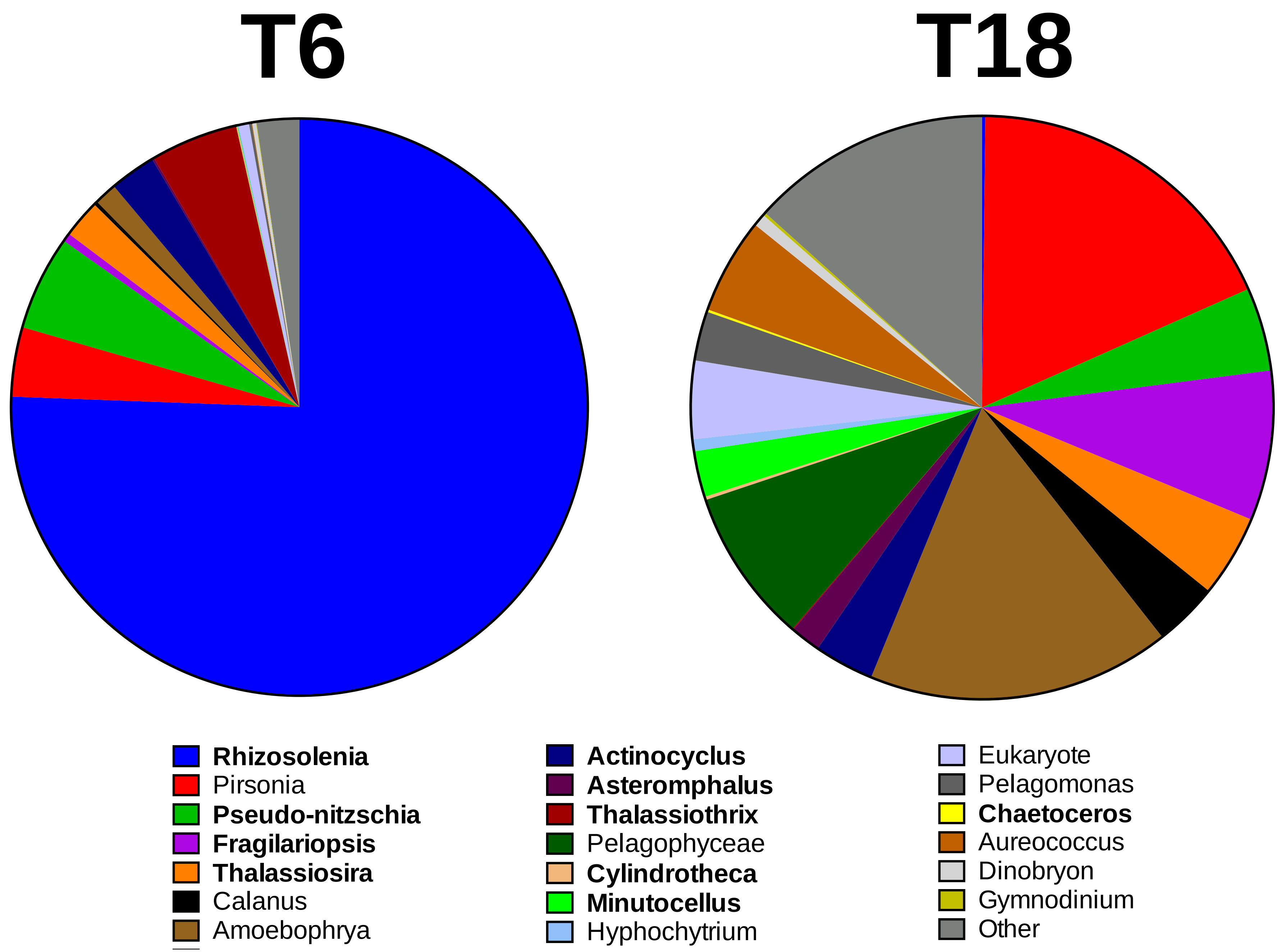
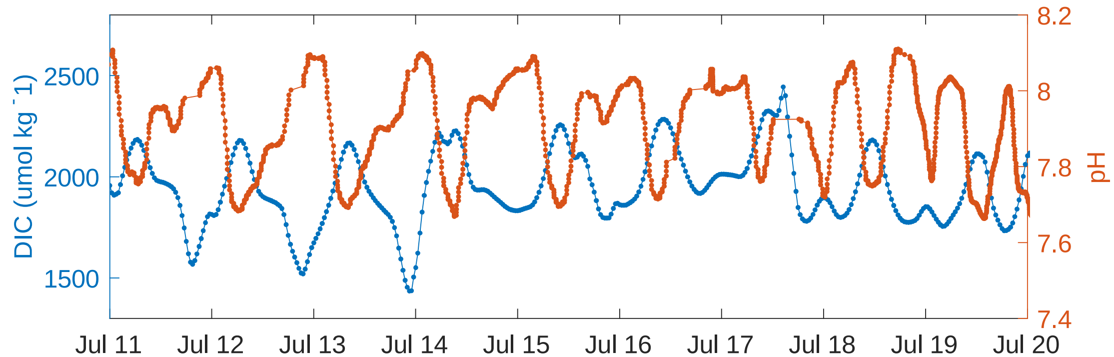
(3) Scripps Institution of Oceanography, University of California, San Diego, CA, USA (4) Ocean Sciences Department, University of California, Santa Cruz, CA, USA

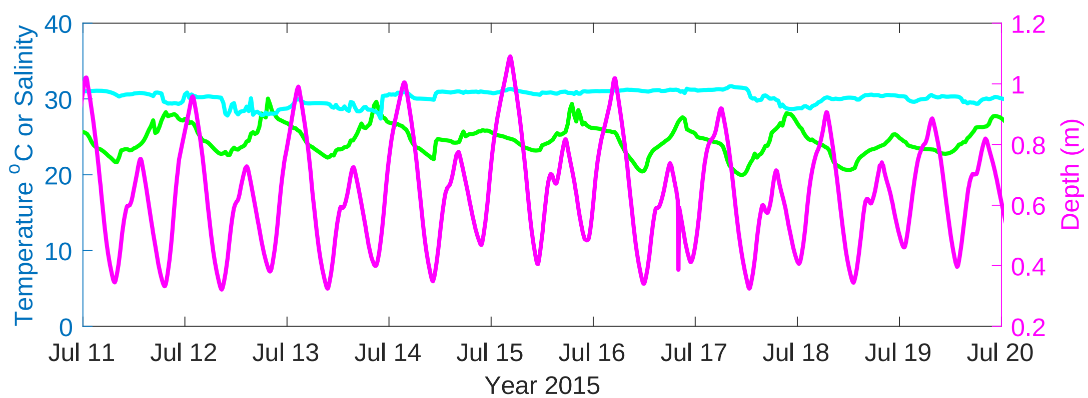


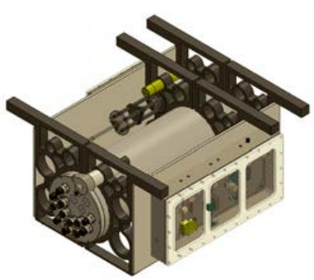

T6
T18
Rhizosolenia
Pirsonia
Pseudo-nitzschia
Fragilariopsis
Thalassiosira
Calanus
Amoebophrya
Actinocyclus
Asteromphalus
Thalassiothrix
Pelagophyceae
Cylindrotheca
Minutocellus
Hyphochytrium
Eukaryote
Pelagomonas
Chaetoceros
Aureococcus
Dinobryon
Gymnodinium
Other

Use high-resolution in situ sensors to estimate lateral dissolved inorganic carbon flux over tides and seasons

Sophie Chu
PhD Candidate
MIT-WHOI

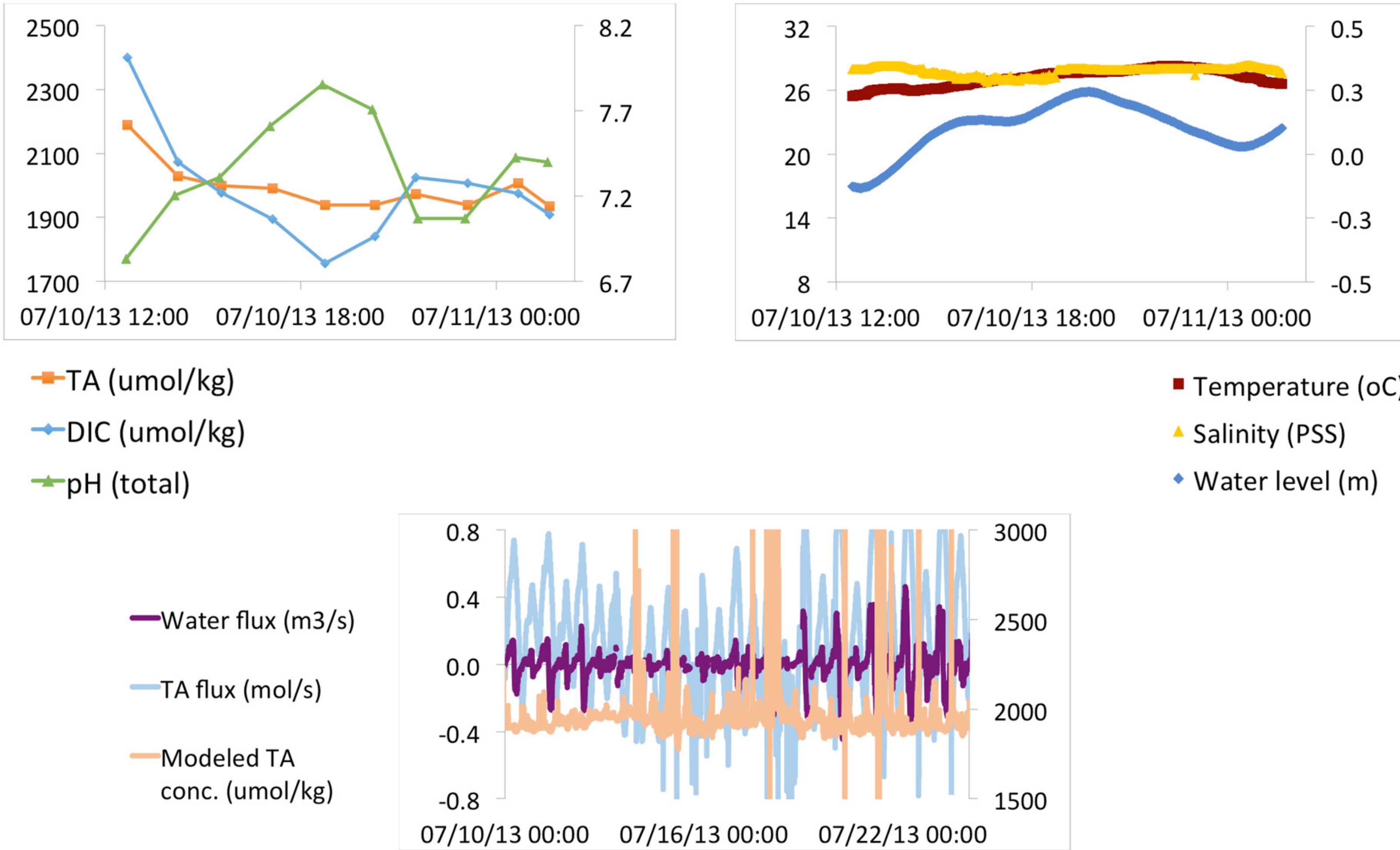




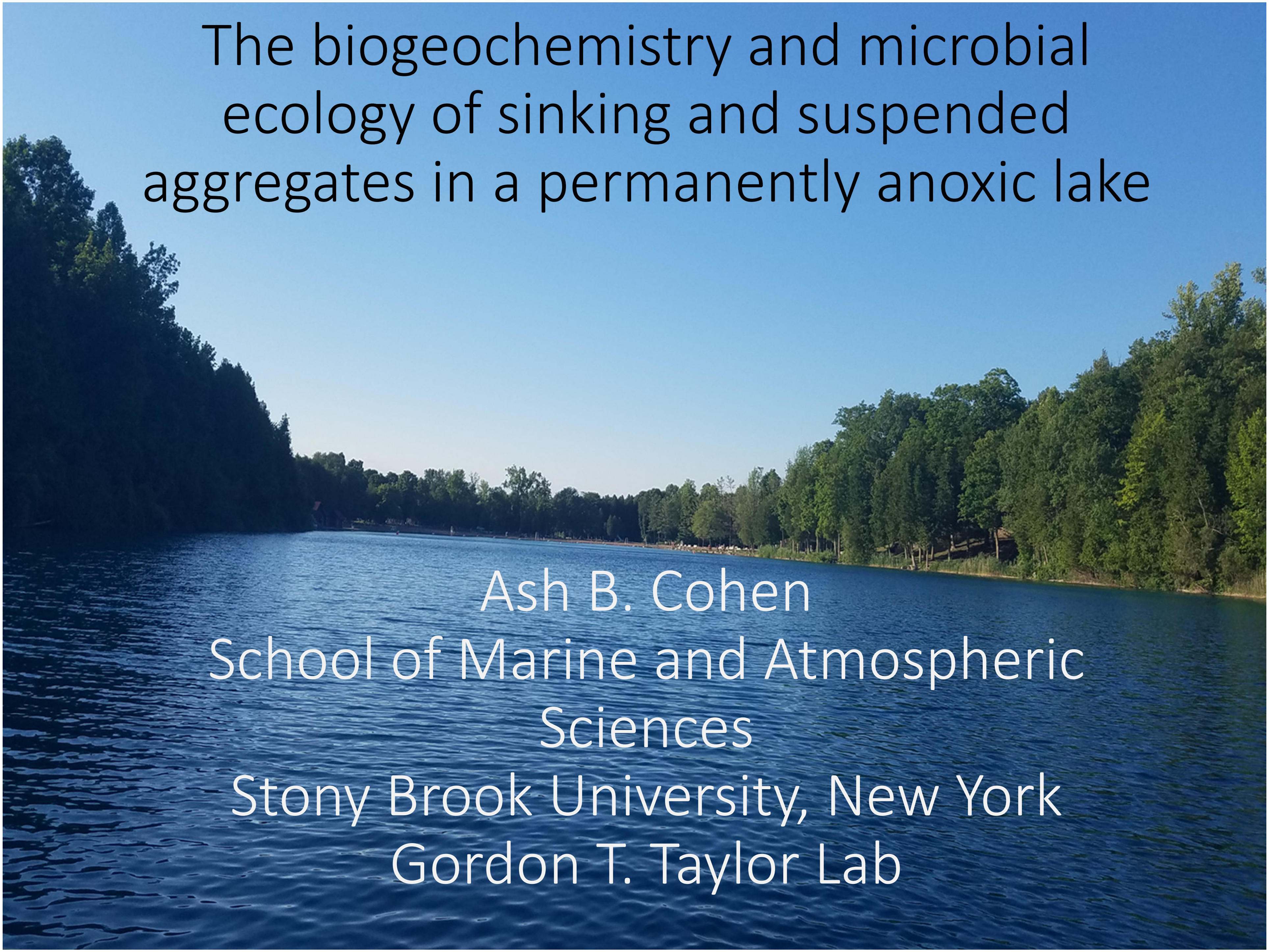


CHANnelized Optical Sensor
(CHANOS)

Model a high-resolution total alkalinity lateral flux from a salt marsh using in situ sensors and bottle samples



The biogeochemistry and microbial ecology of sinking and suspended aggregates in a permanently anoxic lake



Ash B. Cohen
School of Marine and Atmospheric Sciences
Stony Brook University, New York
Gordon T. Taylor Lab

Motivation

- Lacustrine macroaggregates (MAs) are 60% dry weight OC, therefore an important vehicle for OC sequestration if they sink

- Quality and quantity of OM that reaches the sediment-water interface is determined by the competing factors:
  1. Gravitational settling
  2. Advection
  3. Remineralization by heterotrophs

Motivation

- MAs potentially important in anoxic systems:
  1. Enhancement of shear at redoxcline
  2. Aggregation of “sticky” purple bacteria and chemolithoautotrophs at RTZ
  3. Addition of dense carbonate material during whiting events

- MAs also “hot spots” of microbial activity- Which phenomenon is more prevalent? Microbial remineralization or relatively quick sequestration? How do these competing factors affect the biogeochemistry of an anoxic system?

Slide 7

GTT2 What these questions pertain to is a little unclear
Gordon, 7/19/2016

GTT1 consider using "redoxcline" instead
Gordon, 7/19/2016

How do MAs influence the system's microbial ecology?

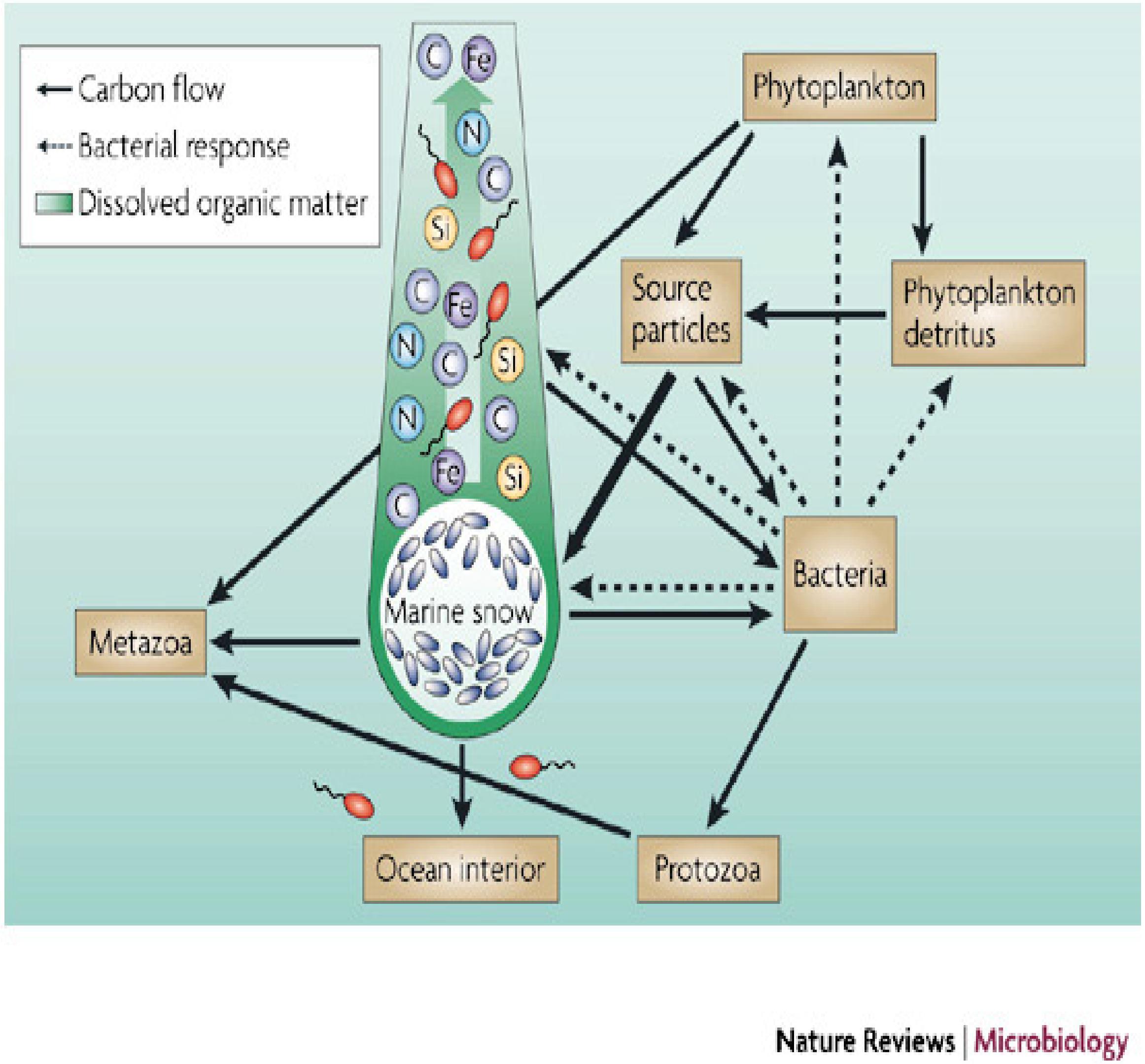
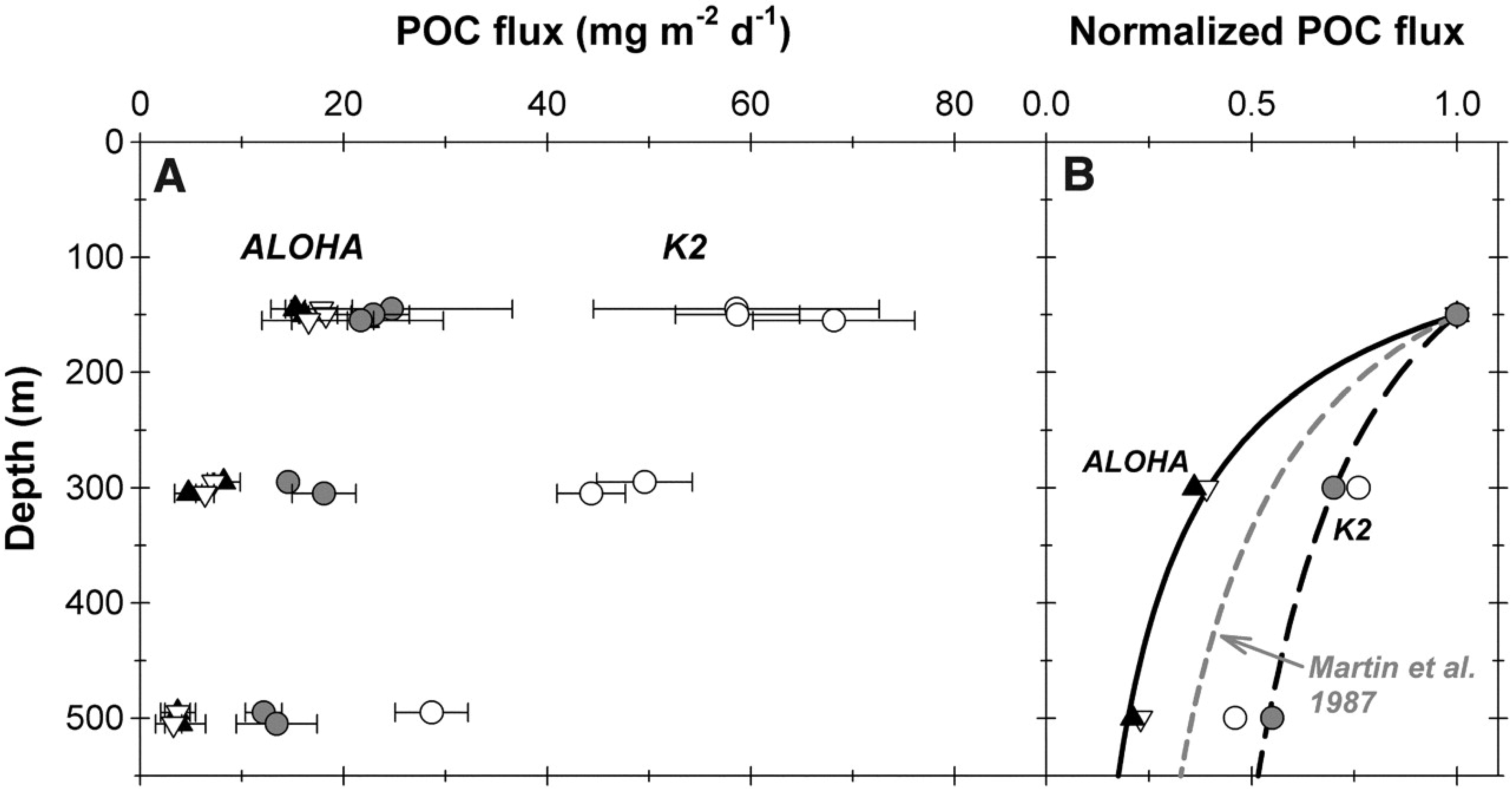


Image Source: Azam and Malfatti, 2007

Slide 8

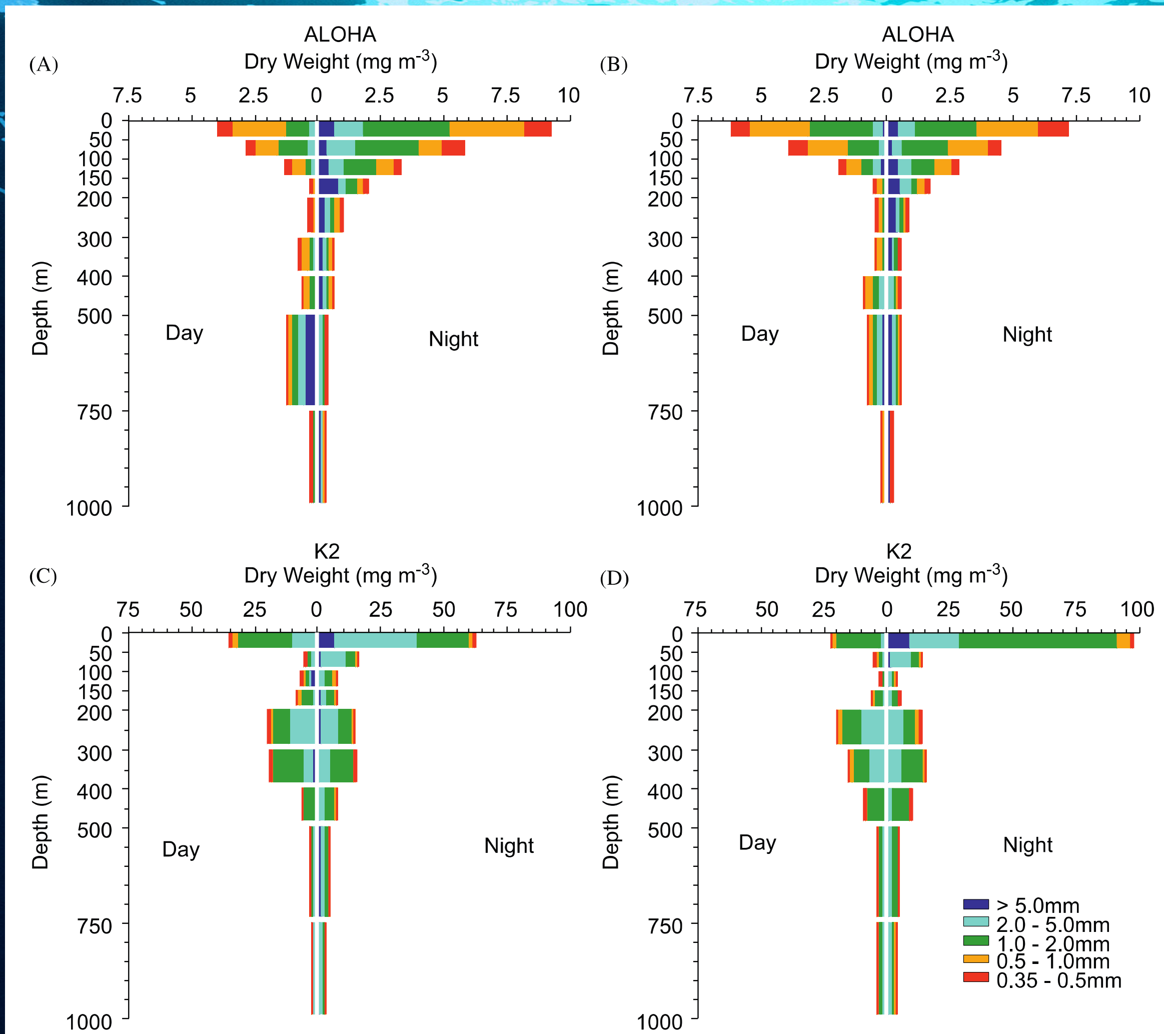
GTT3 How about "How do MAs influence the system's microbial ecology?"
Gordon, 7/19/2016



Buesseler et al. / Science 316 (2008) 567–570

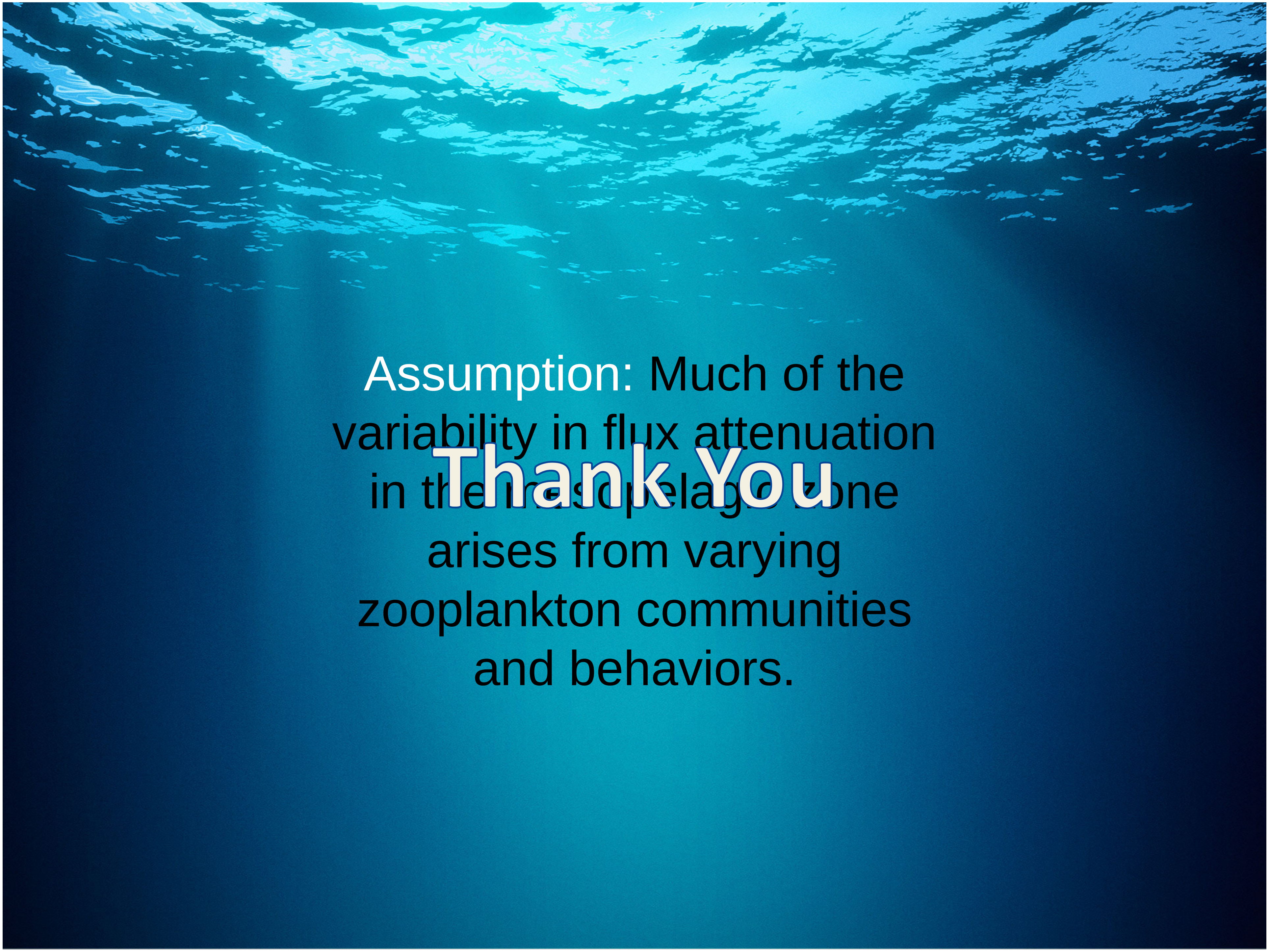
Internal processes include:

- Pelagic food web structure
- Particle/aggregate size and type
- C demand of bacteria and zooplankton



D.K. Steinberg et al. / Deep-Sea Research II 55 (2008) 1615–1635

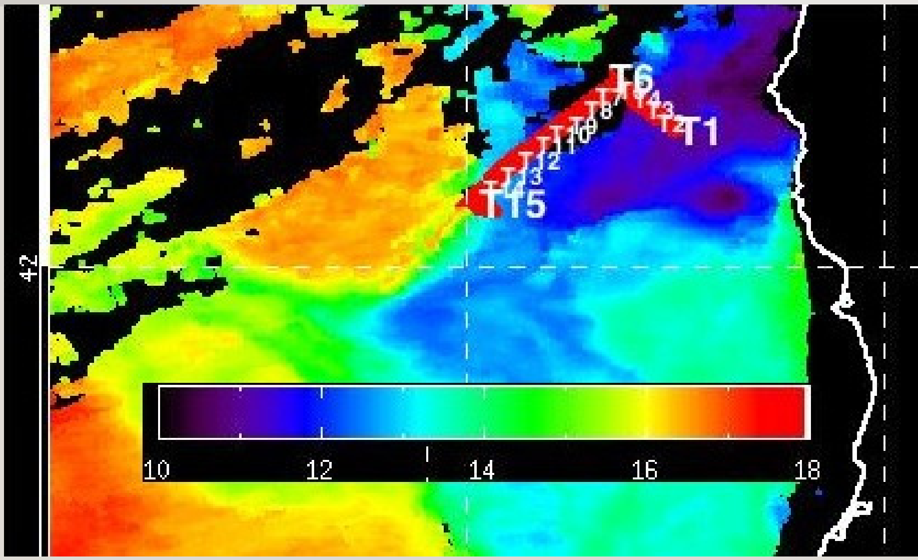
- Different patterns in community structure between the two sites
  - Larger animals at K2
- Higher transfer efficiency at K2
  - Buesseler et al. 2007
  - Larger animals -> larger fecal pellets -> expedites transfer of POC
  - Higher degree of diel migration at K2

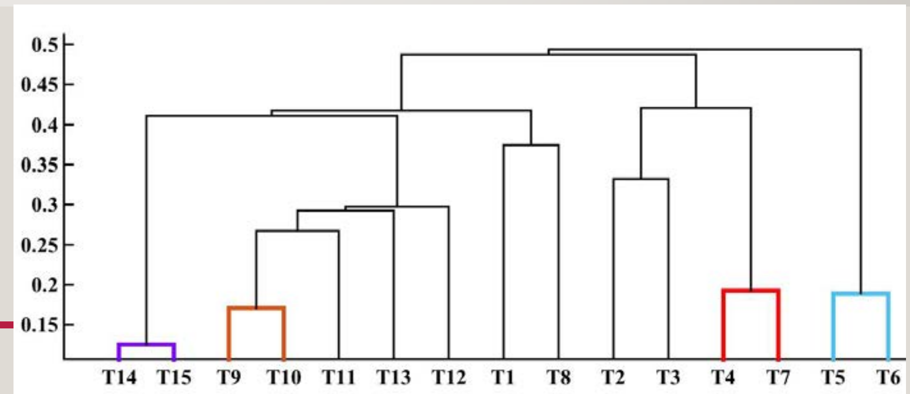

Assumption: Much of the variability in flux attenuation in the mesopelagic zone arises from varying zooplankton communities and behaviors.
Thank You

Diatom community composition along Oregon Coast upwelling in relation to environmental variables

Sveinn Einarsson[1], Zuzanna M. Abdala[1], Kimberly Powell[1], Benjamin Twining[2], Claire P. Till[3], Tyler Coale[4], P. Dreux Chappell[1]

[1] Ocean, Earth and Atmospheric Sciences, Old Dominion University, Norfolk, VA, USA [2]Bigelow Laboratory for Ocean Sciences, East Boothbay, Maine, USA [3]University of Santa Cruz, Santa Cruz, California, USA [4]Scripps Institution of Oceanography, San Diego, California, USA

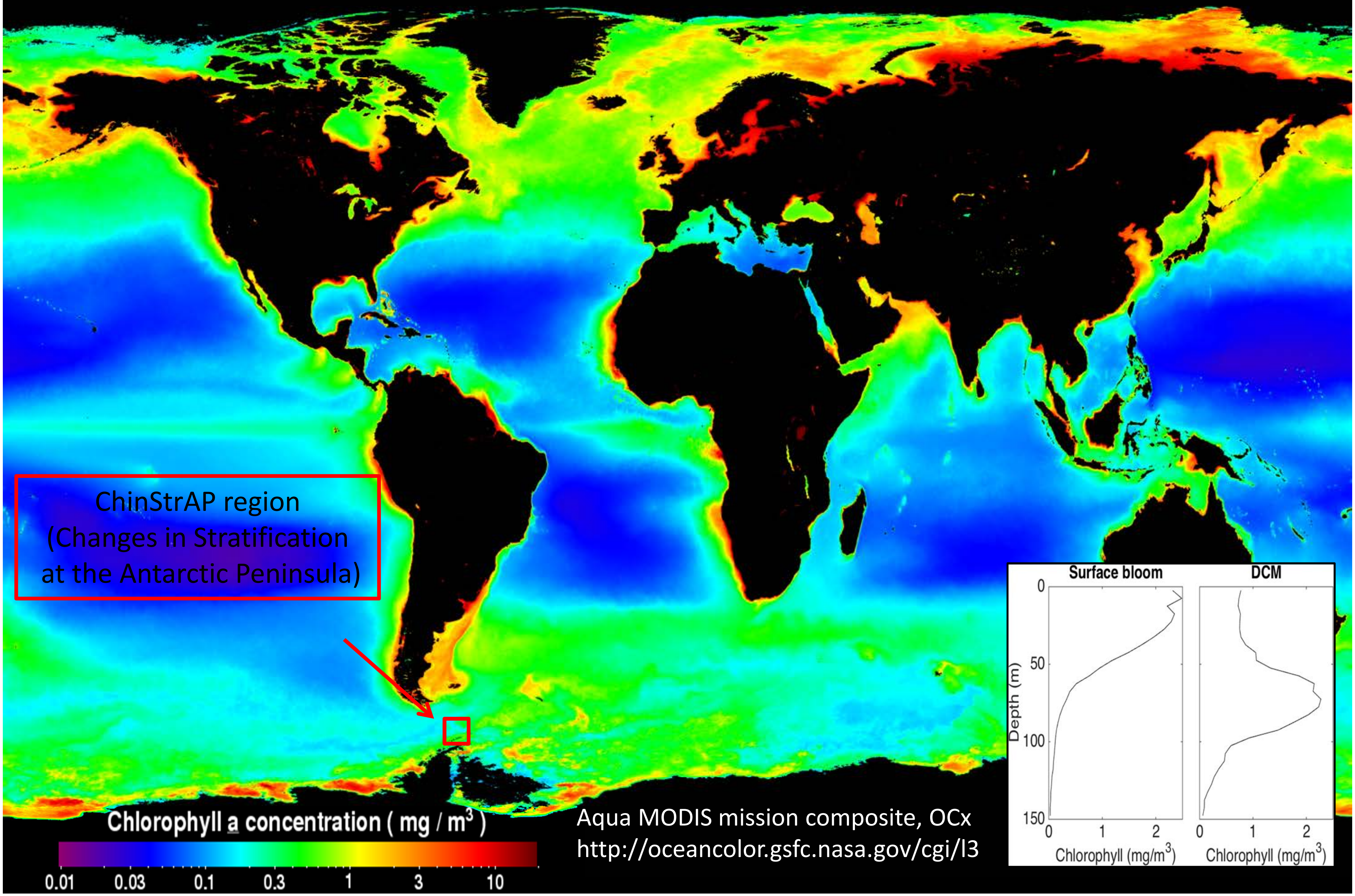




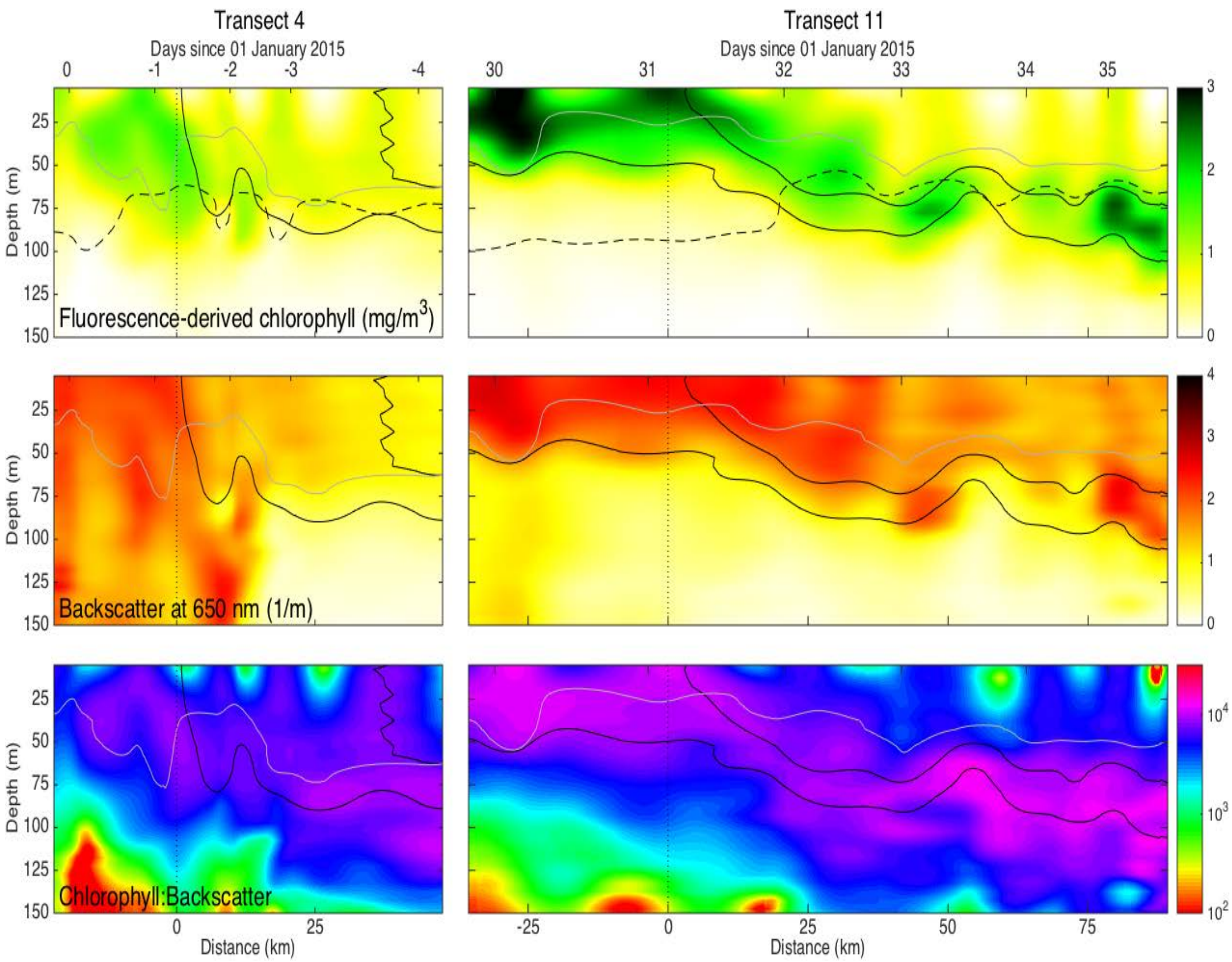
Particulate Aluminum	Particulate Scandium	Particulate Iron	Copper	Silicate	Phosphate
0.6422	0.5915	0.5739	0.5293	0.5293	0.5106
Sea surface temperature, salinity, dissolved copper, and particulate aluminum and scandium					
0.7275					

An advective mechanism for Deep Chlorophyll Maxima (DCMs) in southern Drake Passage

Zachary K Erickson and co-authors



What causes DCMs? (Hint: advection!)



Black contours are isopycnals (1027.2 and 1027.35 kg/m^3); grey line is mixed layer depth; black dashed line is euphotic depth (1% surface PAR)

1-D

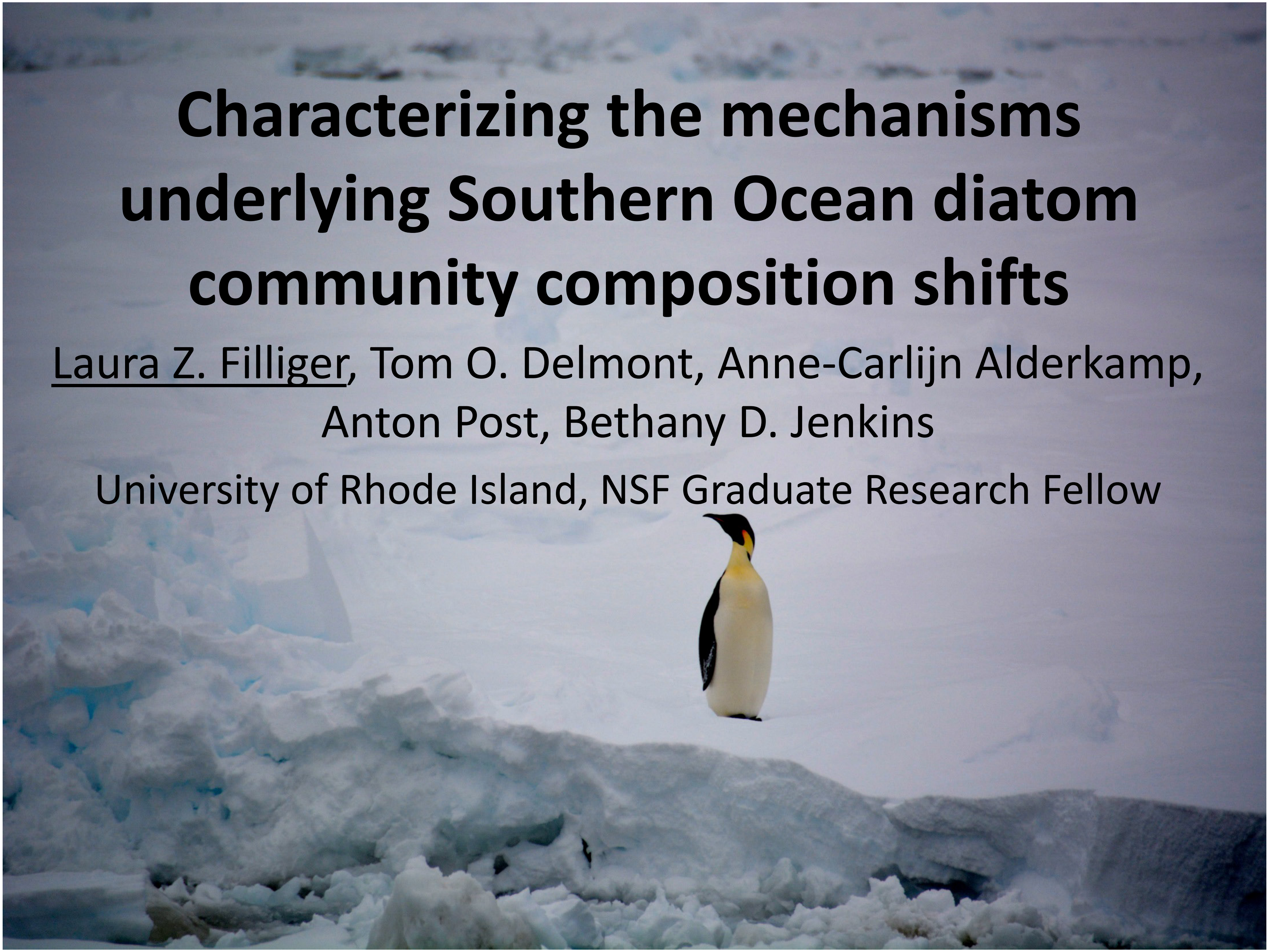
- Photoacclimation
- Sub-surface production
- Thin phytoplankton layers

2-D

- Along-isopycnal subduction aligned with a seasonal potential vorticity gradient

3-D

- Cross-frontal subduction by mean flow (large downstream advection)
- Cross-frontal subduction by eddies

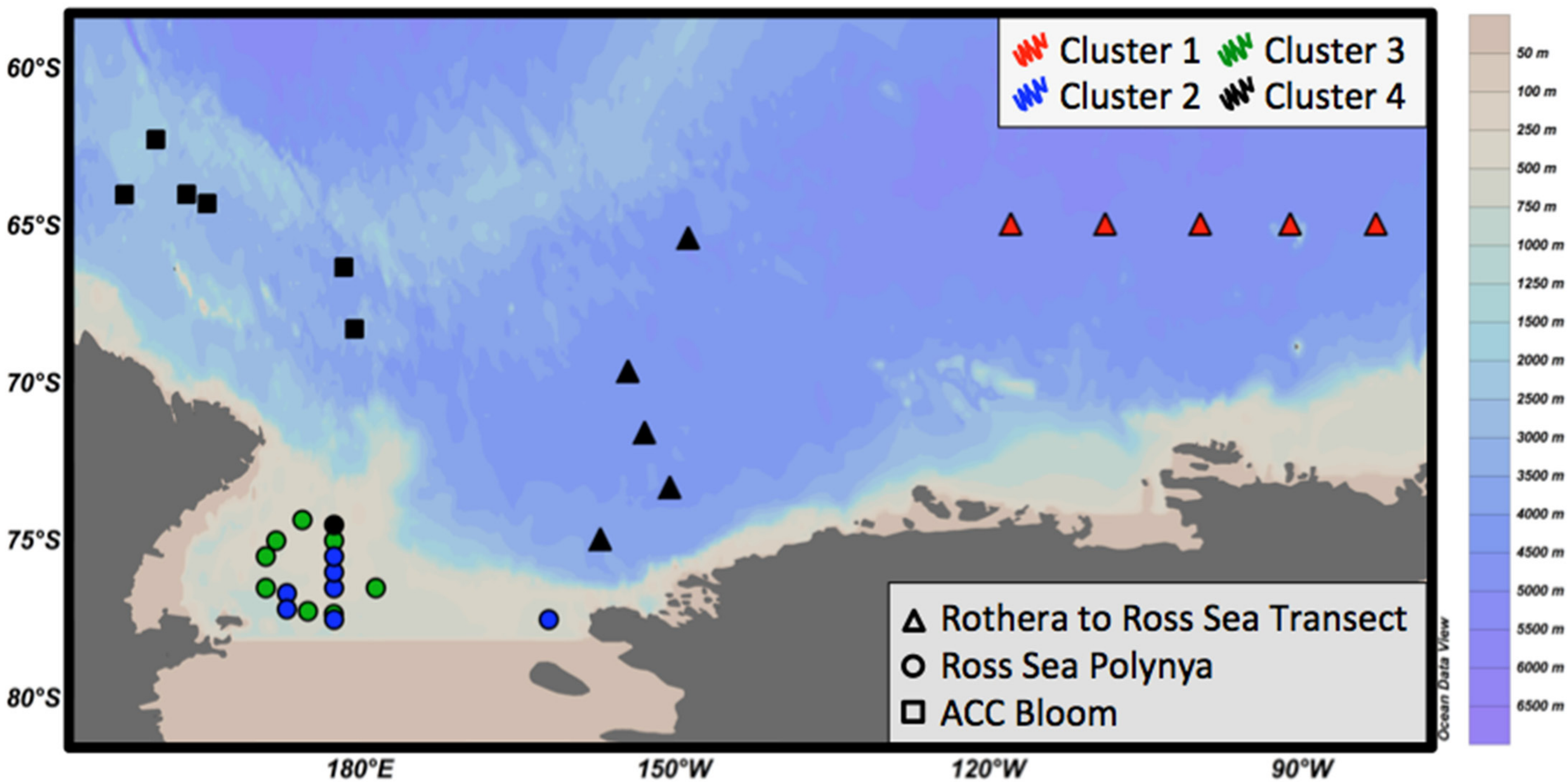


Characterizing the mechanisms underlying Southern Ocean diatom community composition shifts

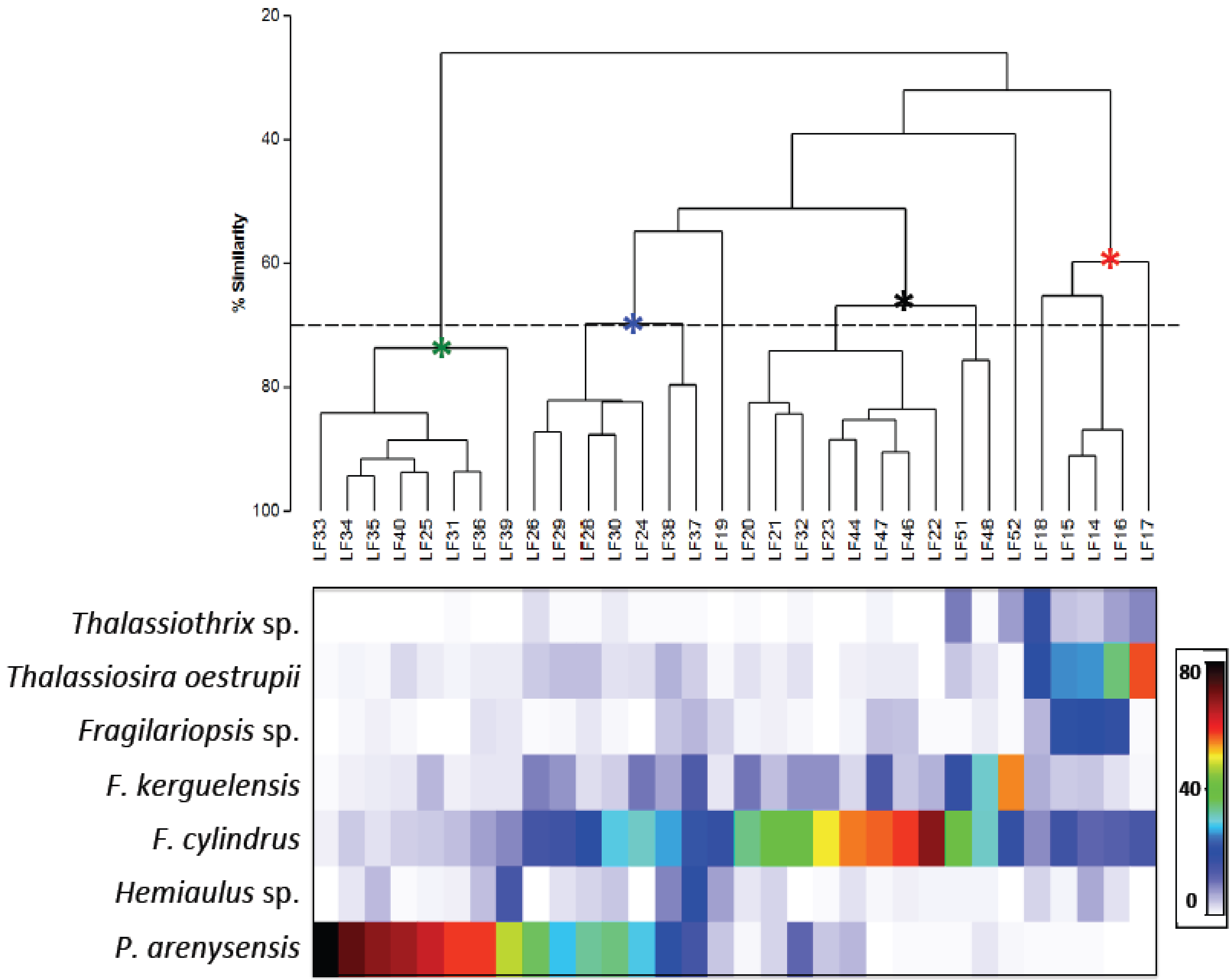
Laura Z. Filliger, Tom O. Delmont, Anne-Carlijn Alderkamp, Anton Post, Bethany D. Jenkins

University of Rhode Island, NSF Graduate Research Fellow

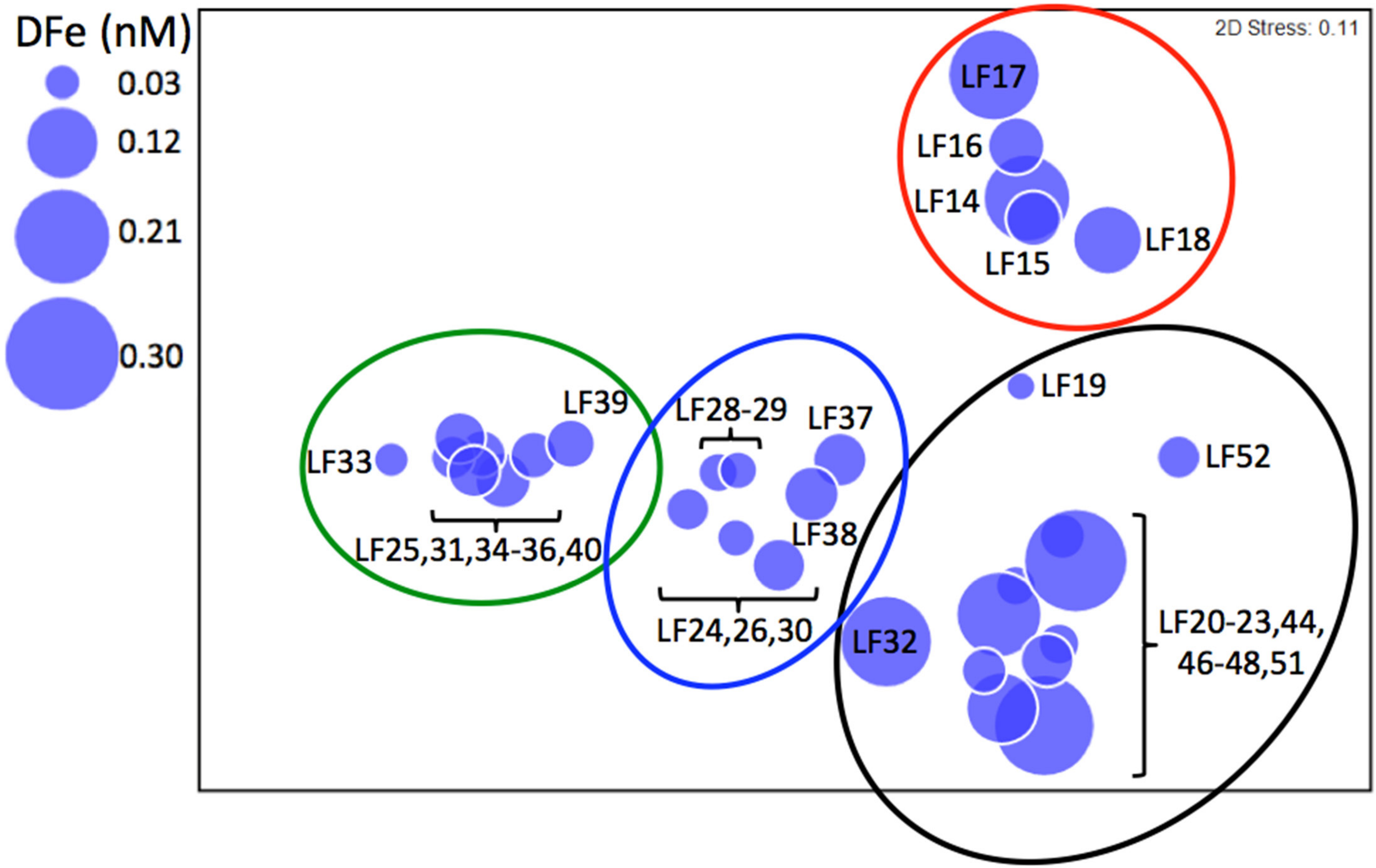
- Can we delineate the Fe stress response in Southern Ocean diatoms?
- Determined if Fe and/or other environmental variables drive diatom community composition in three different regions of the SO



Samples are split into four main clusters



Dissolved Fe and salinity drive biological patterns observed



Diapycnal mixing inhibits ocean carbon storage

Andrew Gunn[1,2,3], Maxim Nikurashin[2,3]

[1]Now at Department of Earth and Environmental Science, University of Pennsylvania, Philadelphia USA. Email: andle@sas.upenn.edu.

[2]Institute for Marine and Antarctic Studies, University of Tasmania, Hobart Australia.

[3]ARC Centre of Excellence for Climate Systems Science, Australia.

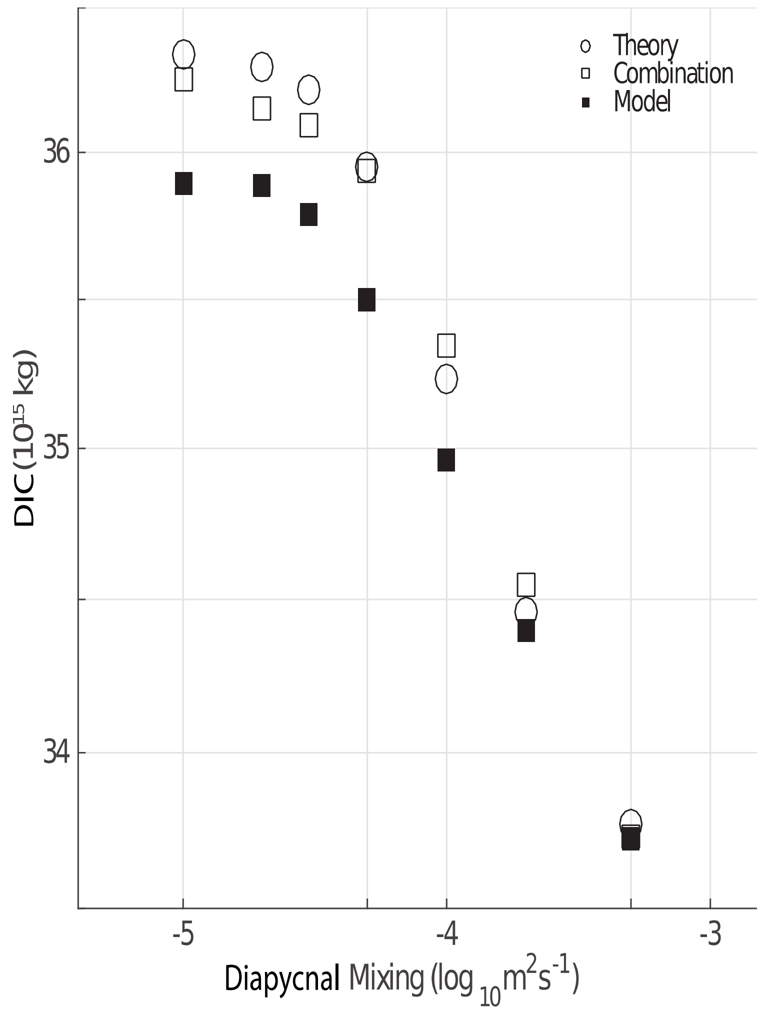
Diapycnal mixing inhibits ocean carbon storage

Andrew Gunn, Maxim Nikurashin

- Present an idealized analytical theory showing how ocean carbon depends on diapycnal mixing via the MOC, air-sea CO_2 exchange and biological productivity

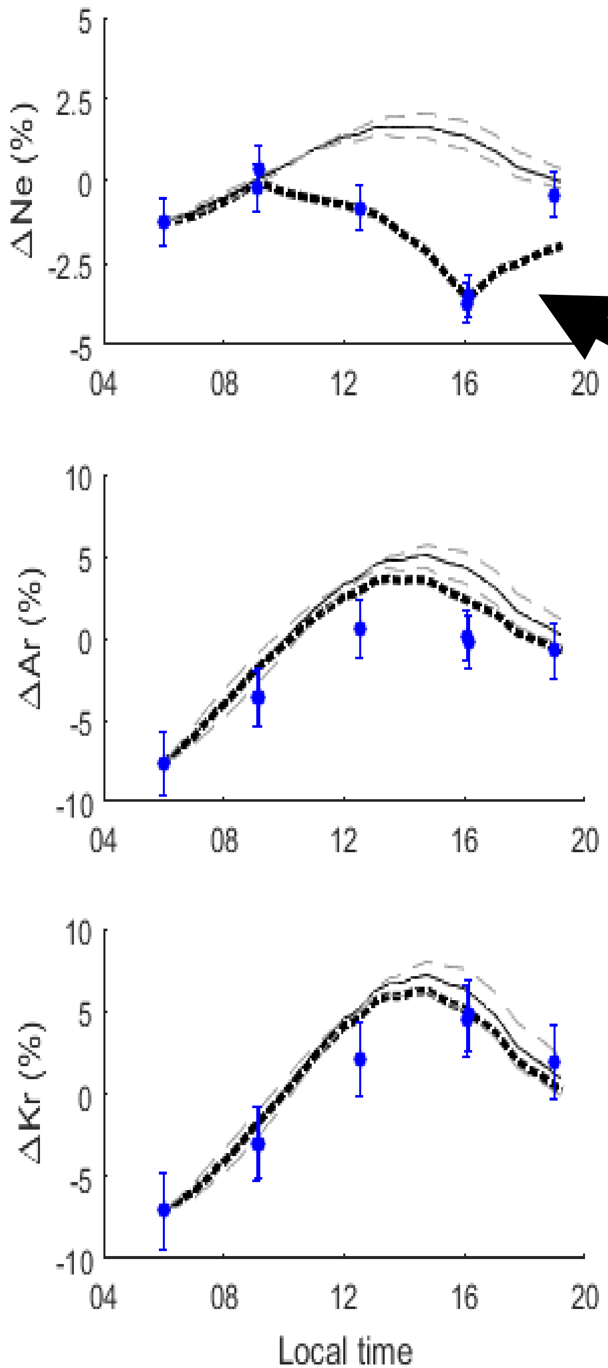
- Compare the results to a global 2.8° MITgcm with a simple biogeochemical package

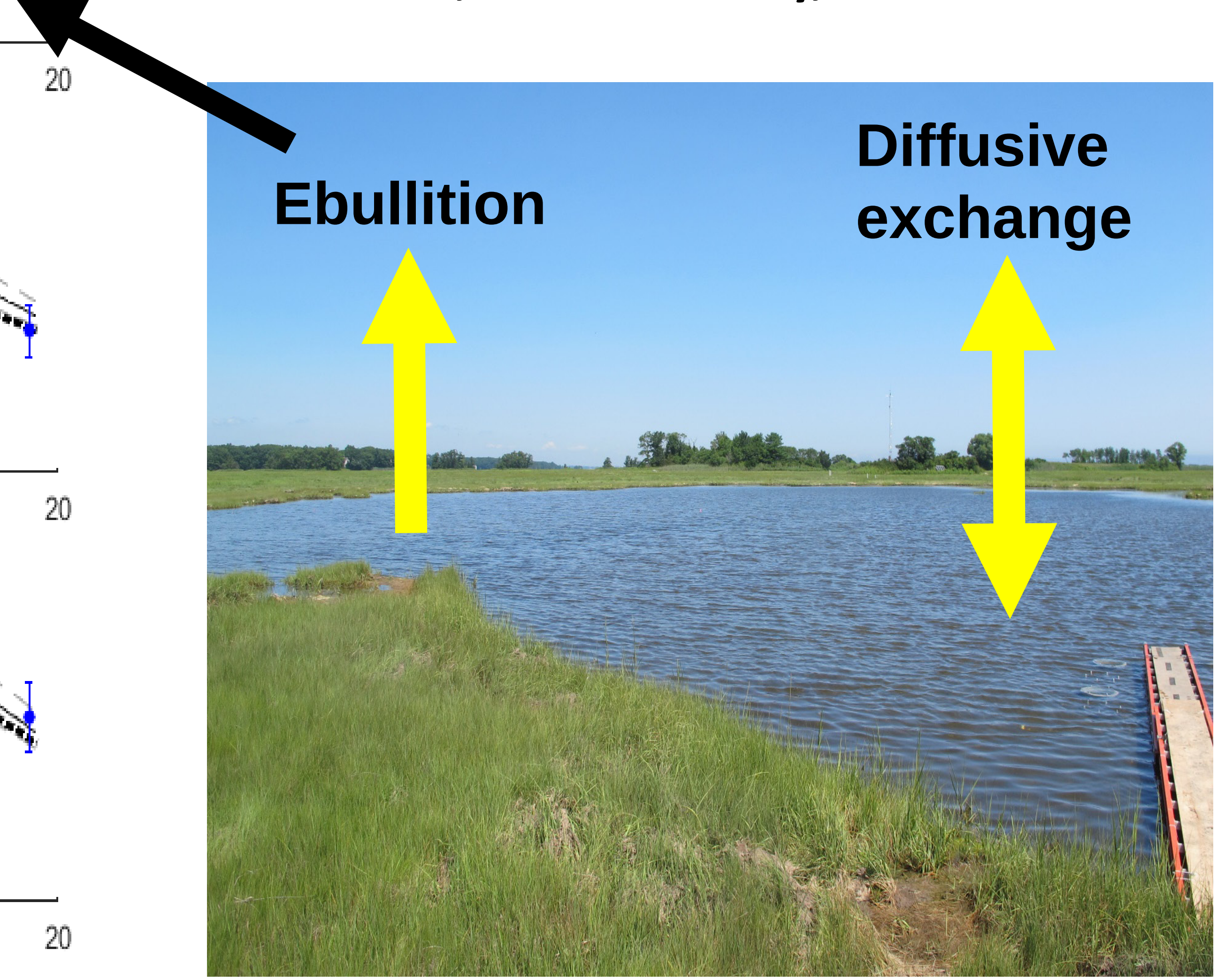
- Both agree that diapycnal mixing reduces the ocean carbon store



Using noble gases in a salt marsh pond to compare common gas exchange parameterizations and constrain efflux of oxygen by ebullition

Evan Howard, Rachel Stanley, and Inke Forbrich





Using noble gases in a salt marsh pond to compare common gas exchange parameterizations and constrain efflux of oxygen by ebullition

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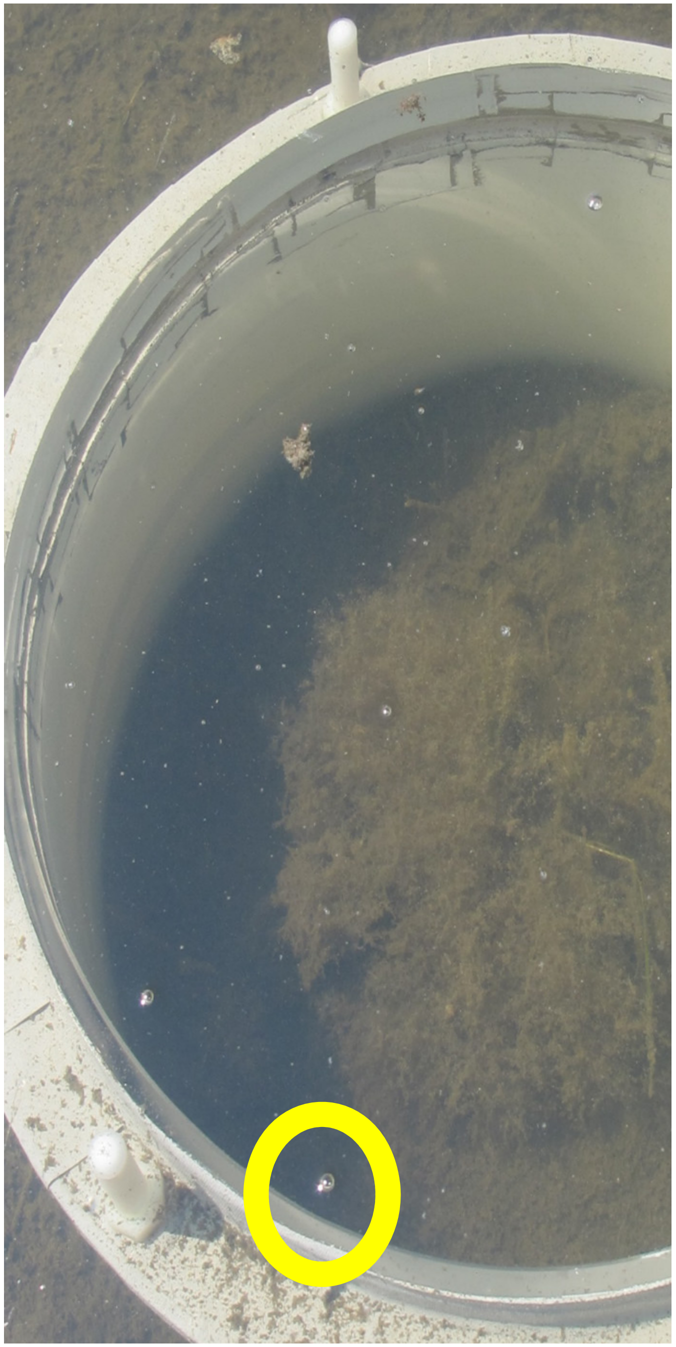
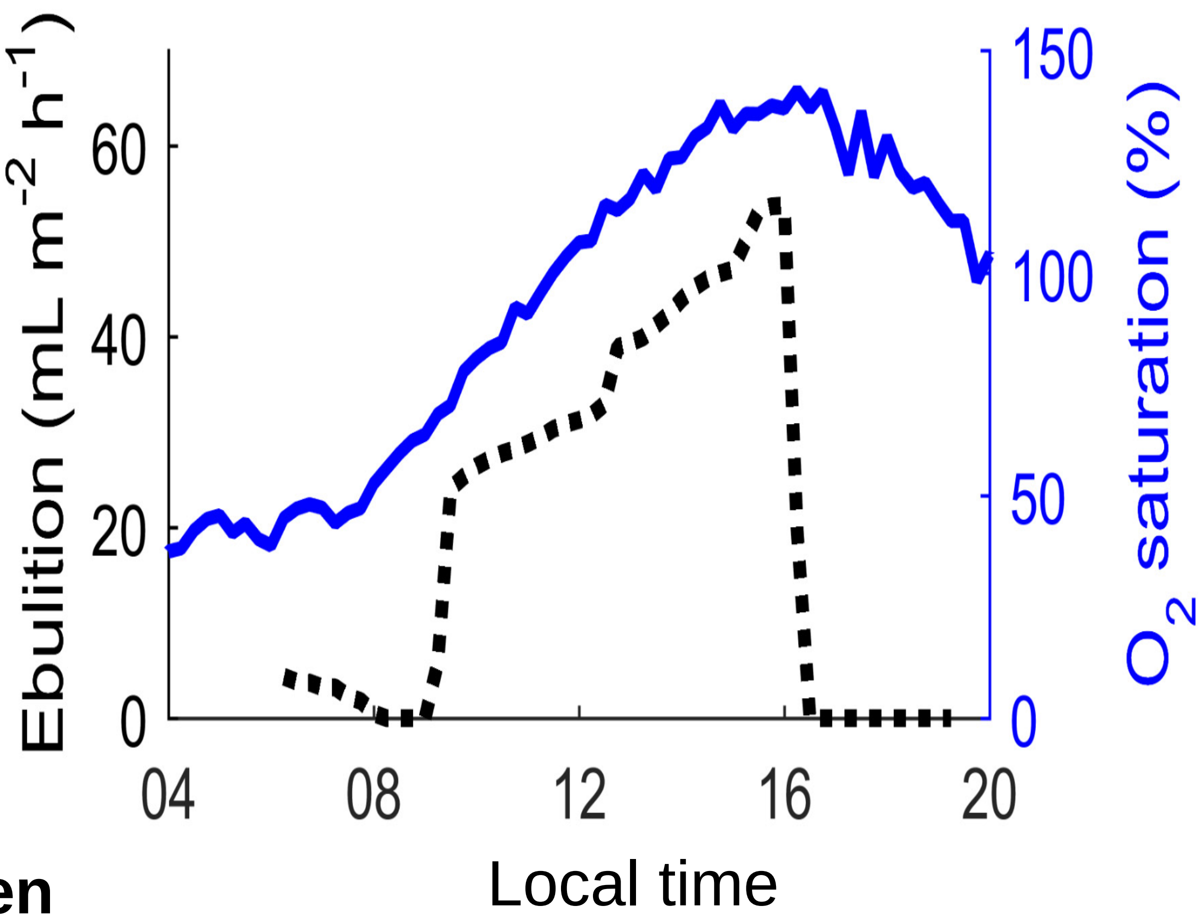
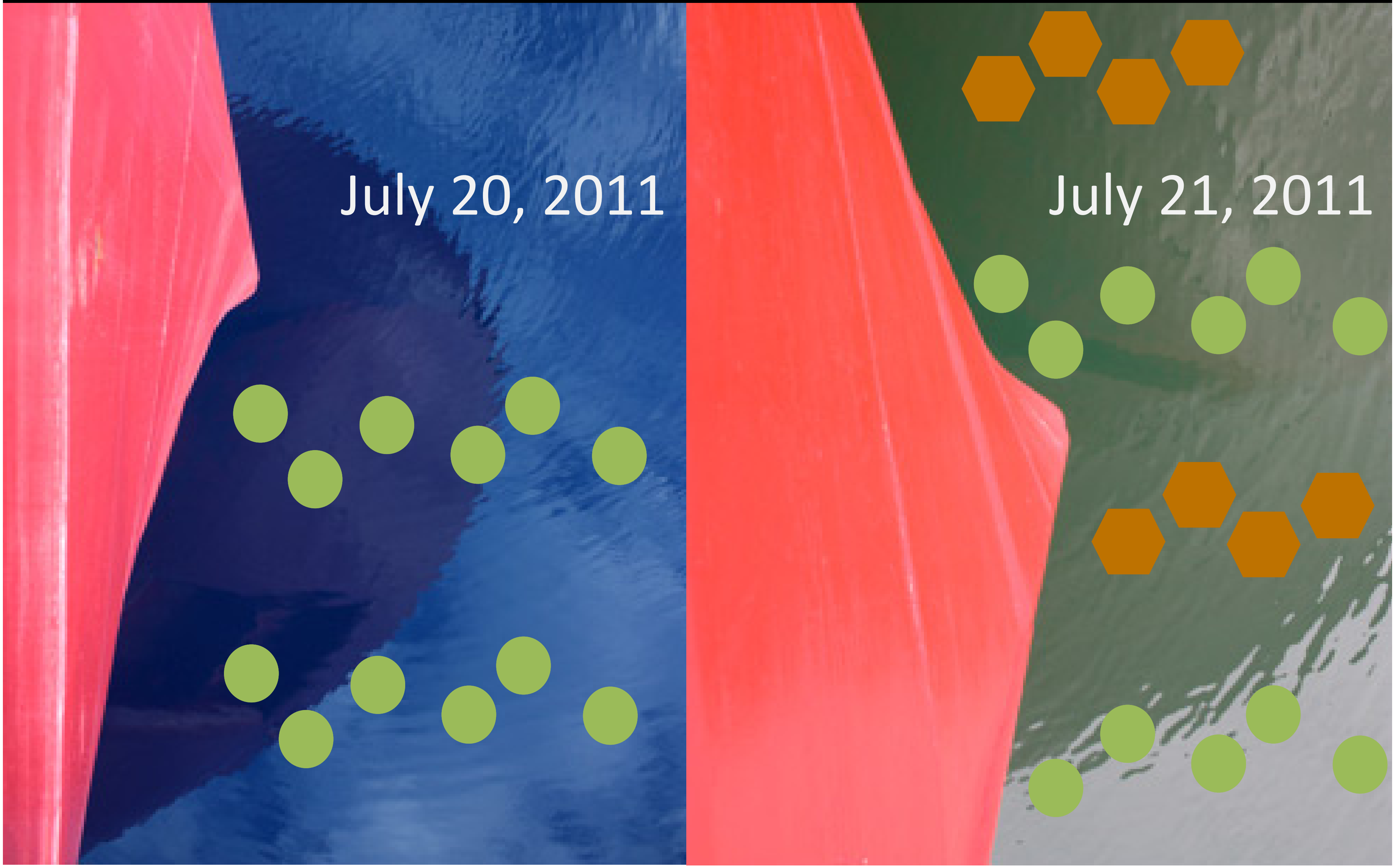


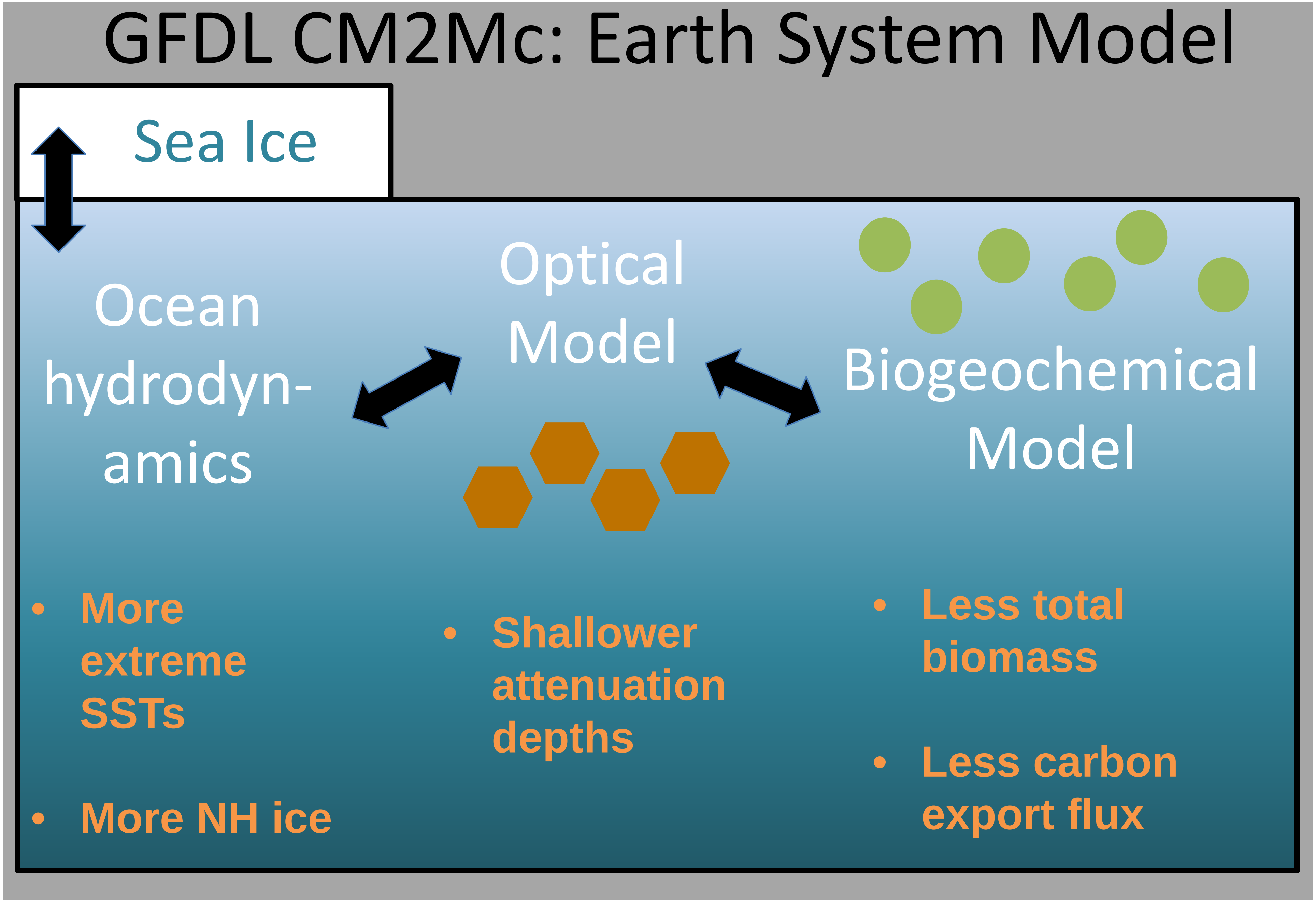
Photosynthetic oxygen



blogs.nasa.gov/icescape/



CDM in an IPCC-class climate model, Grace Kim, JHU


GFDL CM2Mc: Earth System Model
Sea Ice
Ocean hydrodyn-amics
Optical Model
Biogeochemical Model
• More extreme SSTs
• More NH ice
• Shallower attenuation depths
• Less total biomass
• Less carbon export flux

OCB 2016. **Hyewon Kim, Lamont-Doherty Earth Observatory, Columbia University**

Palmer Station Antarctica LTER

HOME ABOUT RESEARCH DATA EDUCATION & OUTREACH PUBLICATIONS

Welcome to Palmer Station Antarctica LTER
A member of the Long Term Ecological Research Network

Palmer LTER (1991-)

Working hypothesis
"Sea ice as a mediatory physical forcing factor for polar ecology & biogeochemical cycling in the era of climate change"

LTER cruise sampling
R.V. LMG
Every January

Station deployment
Palmer Station
Biweekly sampling
(October-March)

Research Questions
"How ecosystem and biogeochemical functions interact with climate and upper ocean dynamics"

OCB 2016. **Hyewon Kim, Lamont-Doherty Earth Observatory, Columbia University**

Analysis of observations

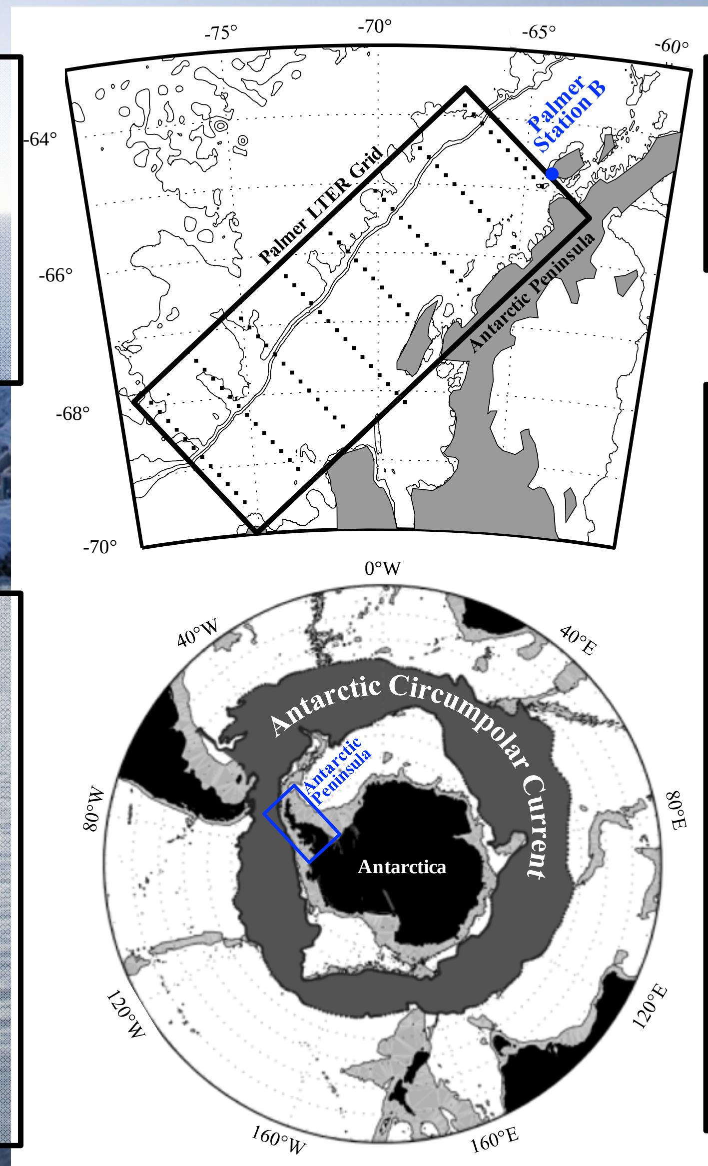
Palmer Station (64.8ºS, 64.1ºW)

Dissolved inorganic nutrients
Phytoplankton
Heterotrophic bacteria

Major findings:

1. Climate (SAM, ENSO) and physical forcing mechanisms influence the interannual variability of seasonal nutrient and bloom dynamics.

2. Heterotrophic bacteria are closely coupled with phytoplankton due to the lack of terrestrial DOC in Antarctic waters.



Modeling

Nonlinear modeling for revealing "causality" Convergent Cross Mapping (CCM)

In progress …

CCM framework:
Model time series (ecosystem model)

Bermuda Atlantic Time Series as a test-bed

Sensitivity tests
Model development, selection

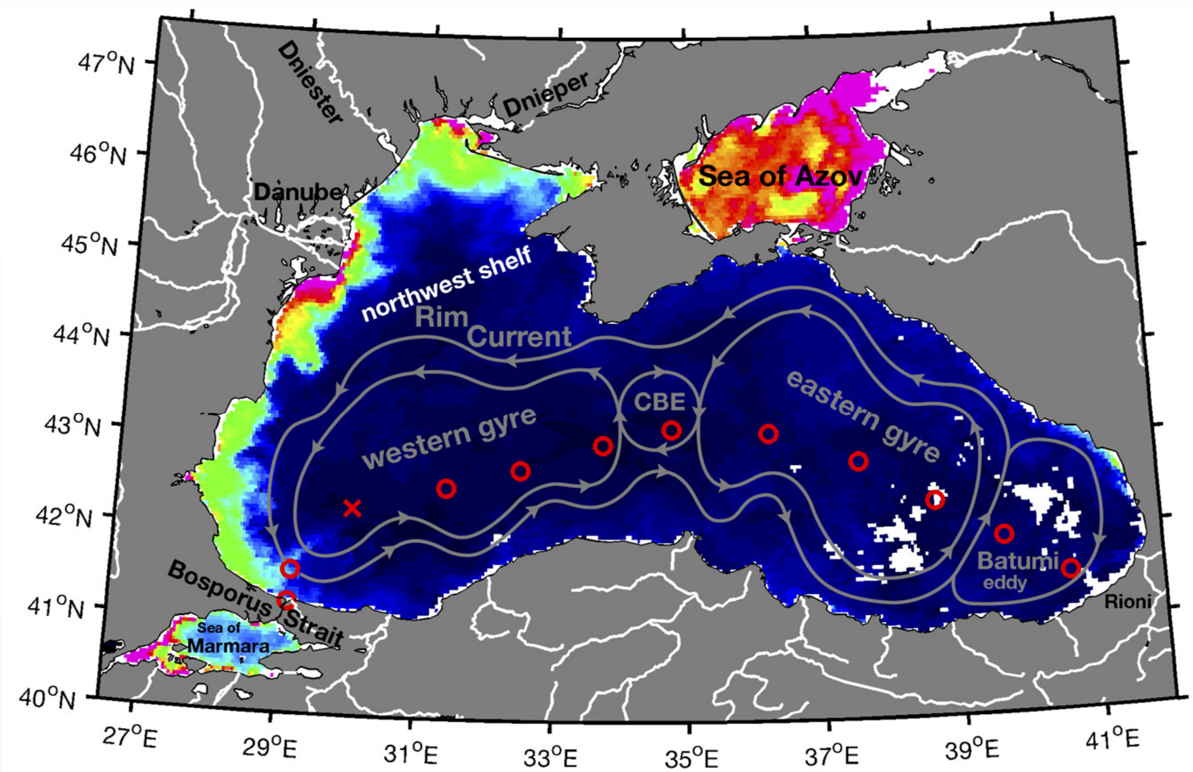
The strength of mutual casual relationships "phytoplankton-bacterial coupling" "carbon flow and physical forcing"

Andrew Margolin, final-year PhD student
Hansell Lab, RSMAS, University of Miami

Net removal of dissolved organic carbon in the anoxic waters of the Black Sea

Andrew R. Margolin [a,*], Loes J.A. Gerringa [b], Dennis A. Hansell [a], Micha J.A. Rijkenberg [b]

[a] Rosenstiel School of Marine and Atmospheric Science, University of Miami, 4600 Rickenbacker Causeway, Miami, FL 33149, USA
[b] NIOZ Royal Netherlands Institute for Sea Research, Department of Ocean Systems (OCS), Utrecht University, P.O. Box 59, 1790 AB Den Burg, Texel, The Netherlands

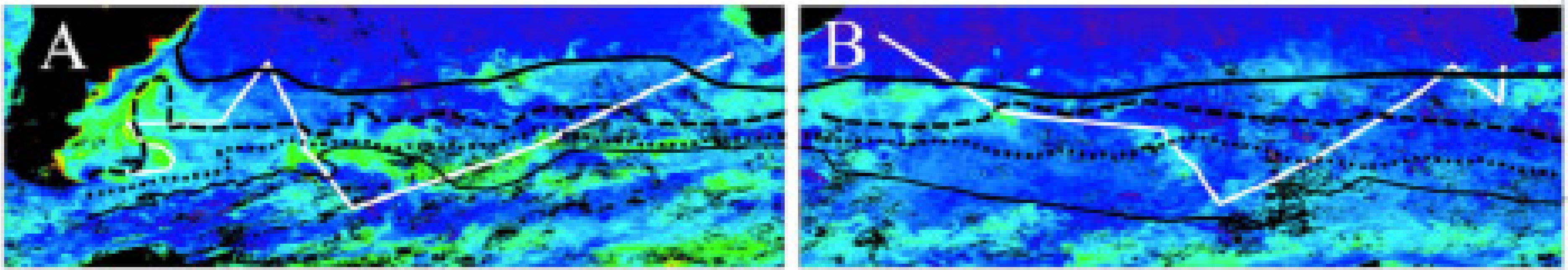


Environmental Impacts on Carbon Biogeochemistry in Marginal Seas

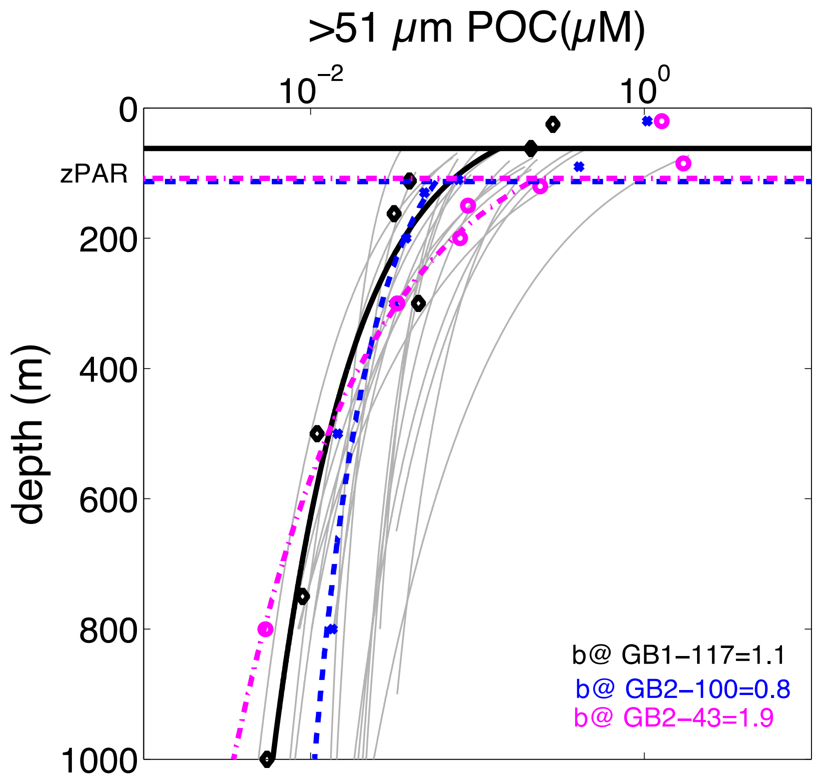
1) **DOC in Black Sea** (Margolin et al., 2016, *Mar. Chem.*)
2) Chromophoric dissolved organic matter (CDOM) in Black Sea
3) DOC, CO_2 in deep Gulf of Mexico & Caribbean

+) DOC, CO_2 in Arctic Ocean

Water-column transformation of particle organic carbon composition in the Southern Ocean Great Calcite Belt



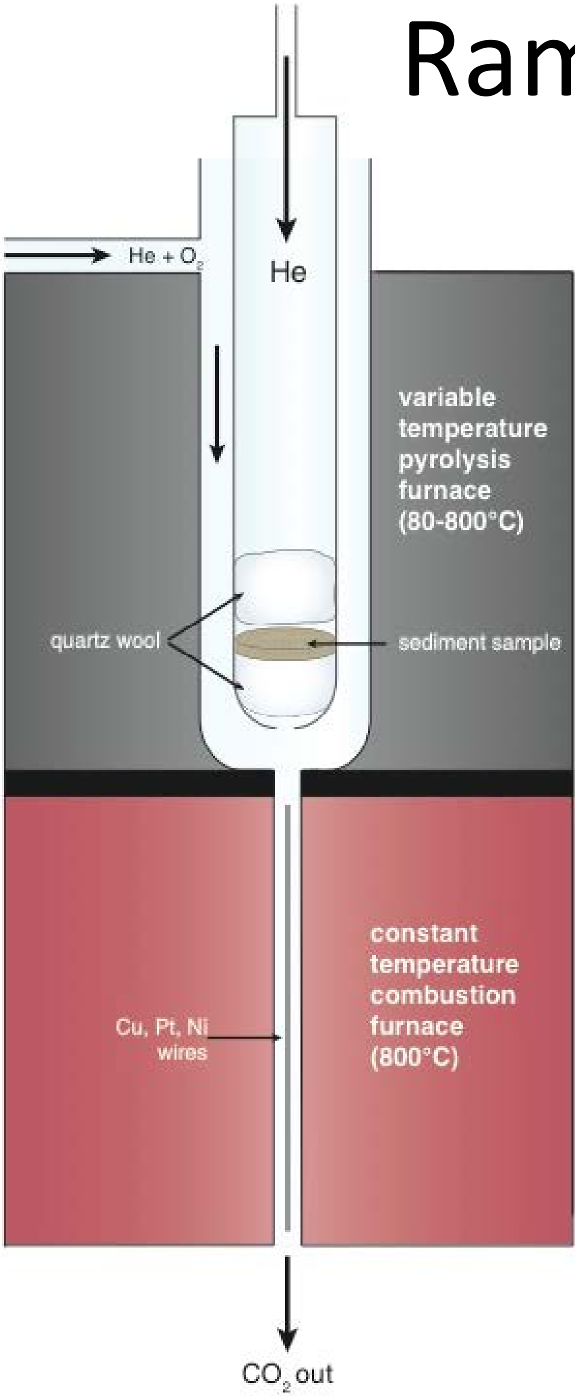
Sarah Rosengard
srosengard@whoi.edu



Advisors:
Phoebe Lam,
Valier Galy,
Ann McNichol

Images: Balch et al. 2016 (accepted); Rosengard et al. 2015

Ramped Oxidation



(1) Thermal stability

Particulate carbon "End-members"

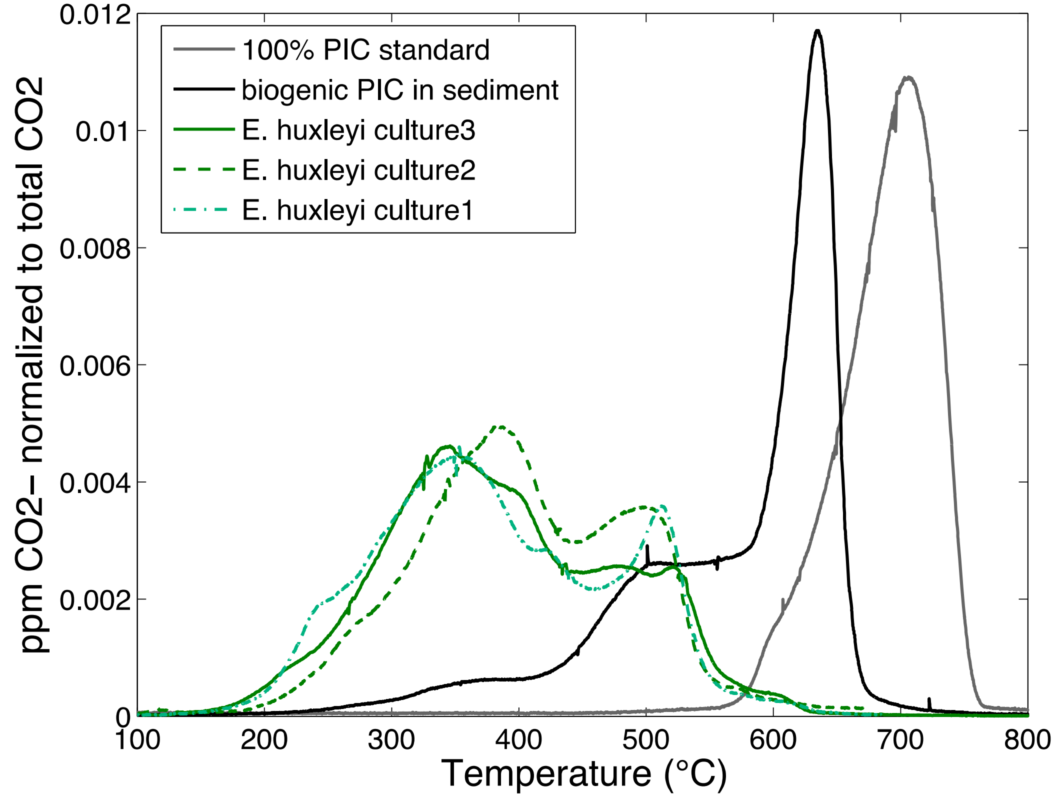
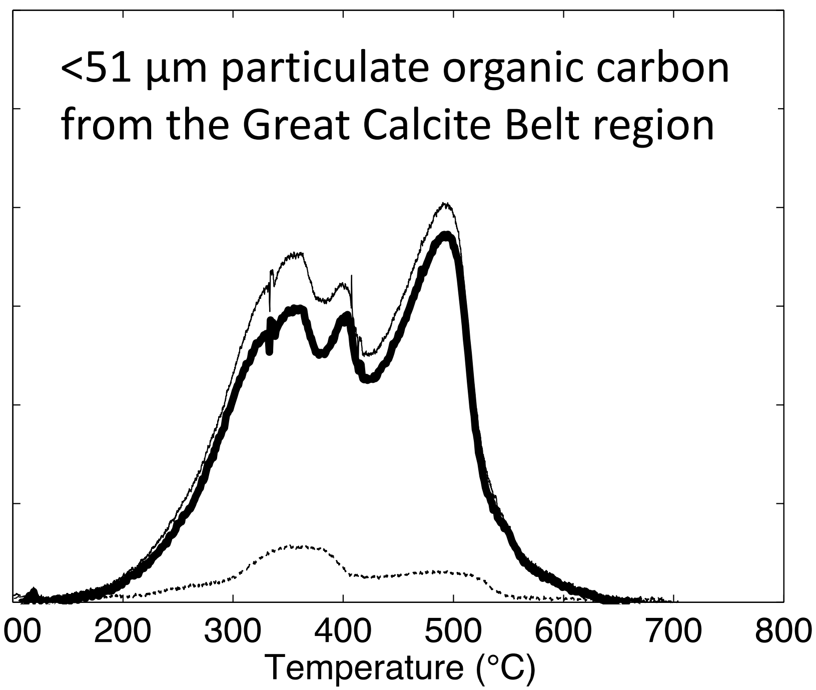
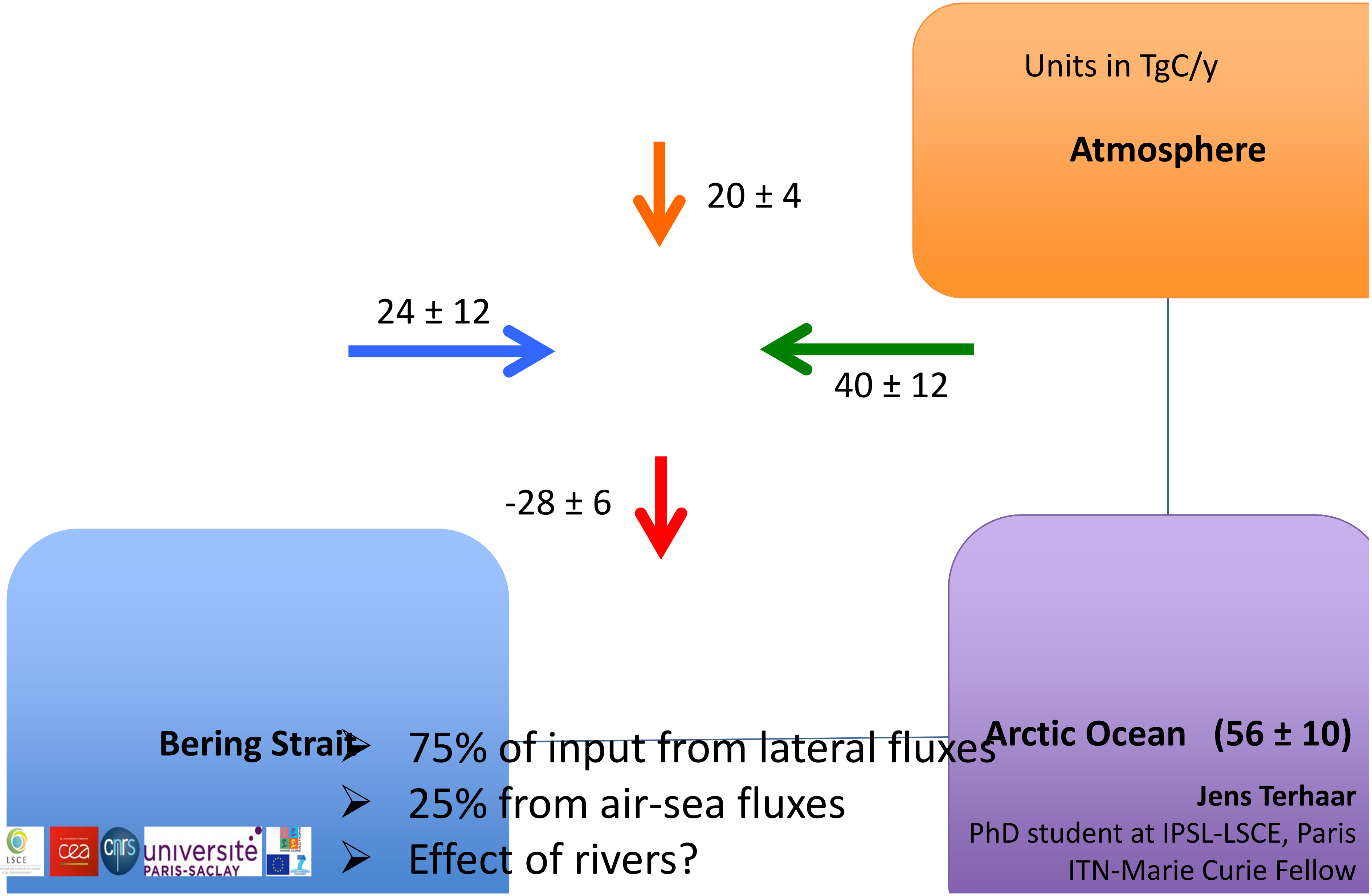


Image: Kyrstin Fornace

(1) Thermal stability
(2) Fraction-specific isotope composition



Arctic budget of C_{ant} (2003 to 2012)

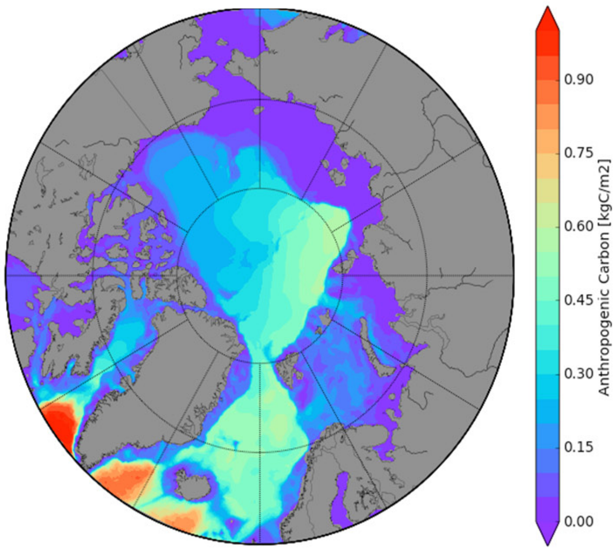


- 75% of input from lateral fluxes
- 25% from air-sea fluxes
- Effect of rivers?

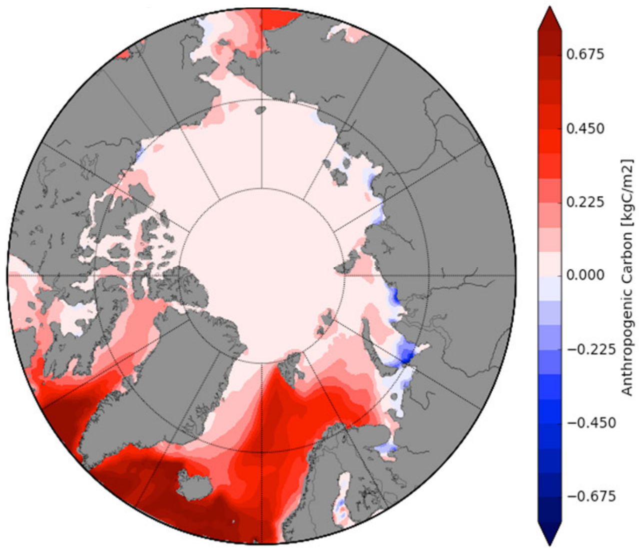
Jens Terhaar
PhD student at IPSL-LSCE, Paris
ITN-Marie Curie Fellow

C_{ant} transport in the Arctic

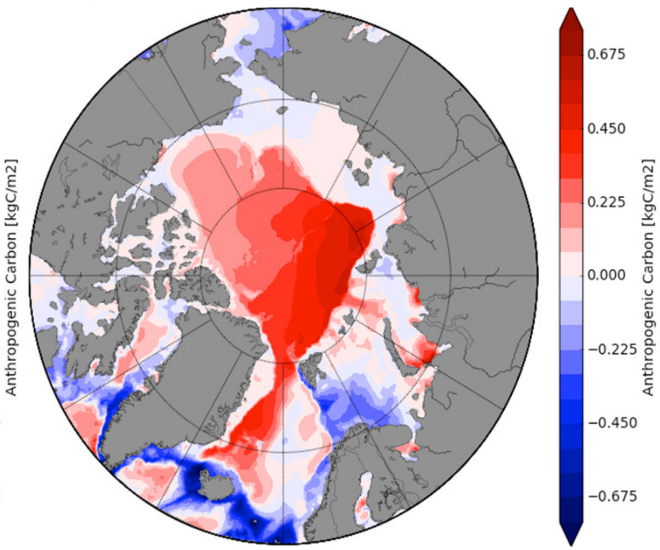
C_{ant} inventory



Cumulative Flux



Transport = Inventory - Flux



- Cumulative air-sea flux of 1.1 PgC until 2007 (including Greenland & Norwegian Seas)
- Arctic inventory: 2.7 PgC in 2007
- Some outgassing over Siberian shelf

Jens Terhaar
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ITN-Marie Curie Fellow