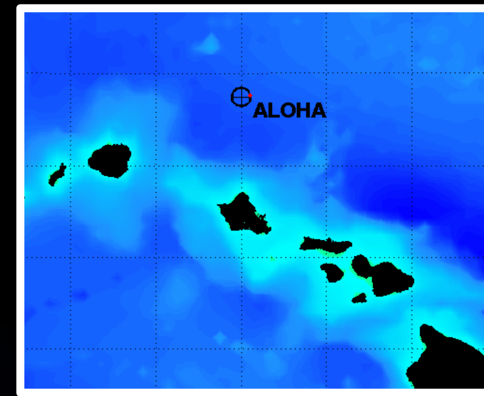
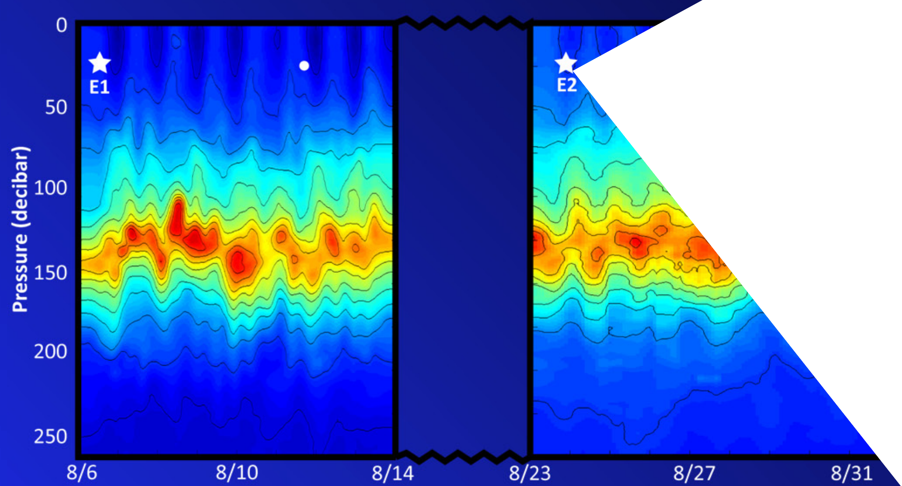
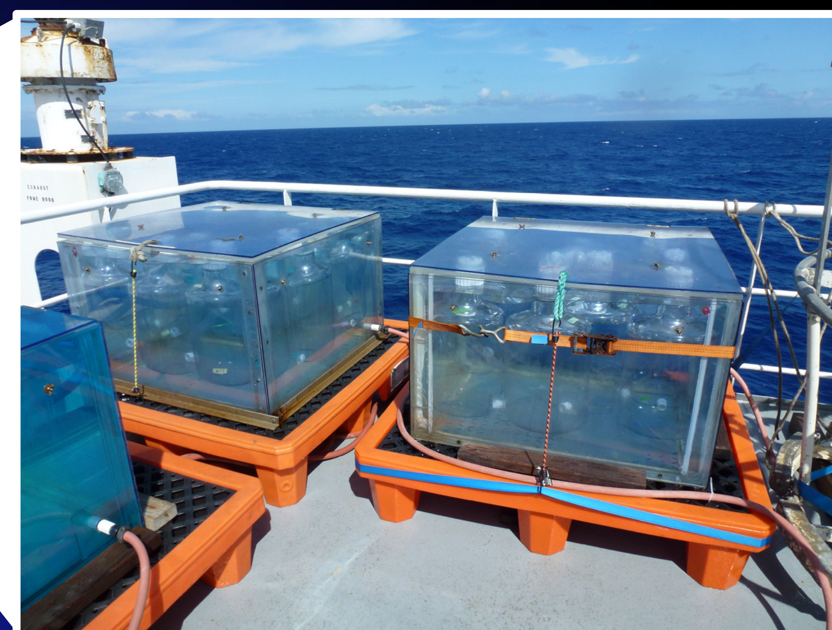
Eukaryotic metatranscriptomics illuminates physiological response of phytoplankton to nutrient pulses at Station ALOHA



HOE-DYLAN cruises:
High-frequency sampling

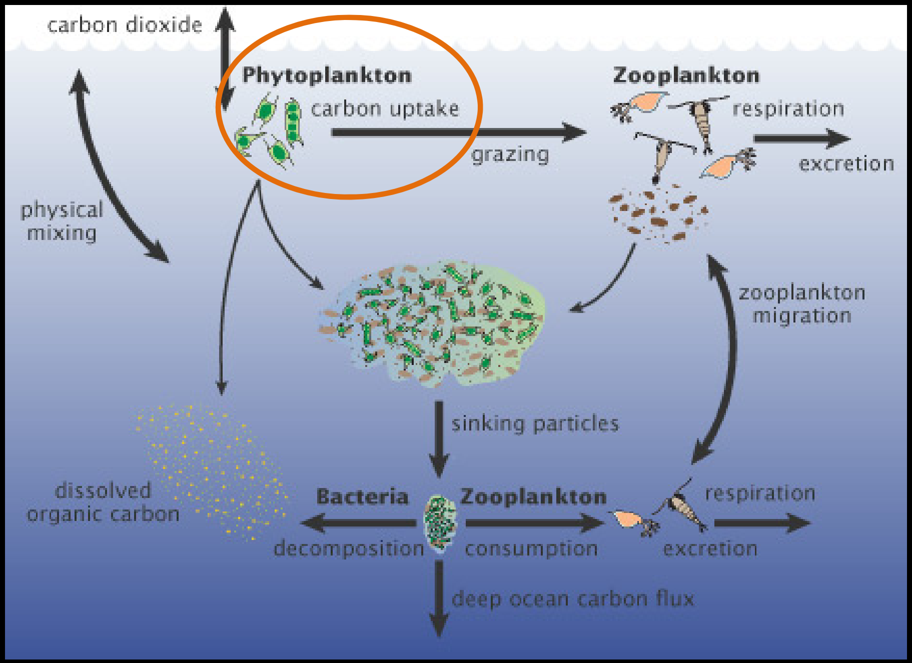




Harriet Alexander, MIT-WHOI Joint Program

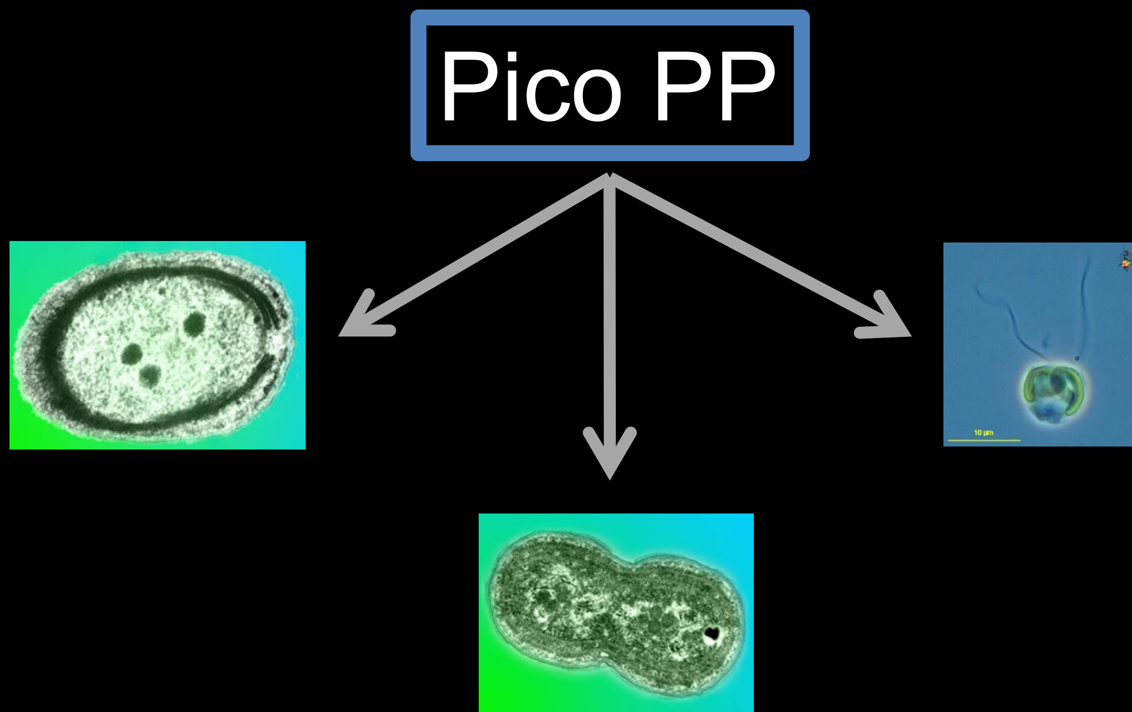
Bridget Bachman
PhD Candidate
Advisor: Tammi L. Richardson

"How do plankton size, community composition and trophic interactions modify carbon export from the euphotic zone in the Sargasso Sea?"



1. Size-fractionated chl *a* (HPLC-Chemtax)
2. Microscopy/FCM
3. Size-fractionated rates of primary productivity
4. Incorporate these data (+other) into inverse food web models

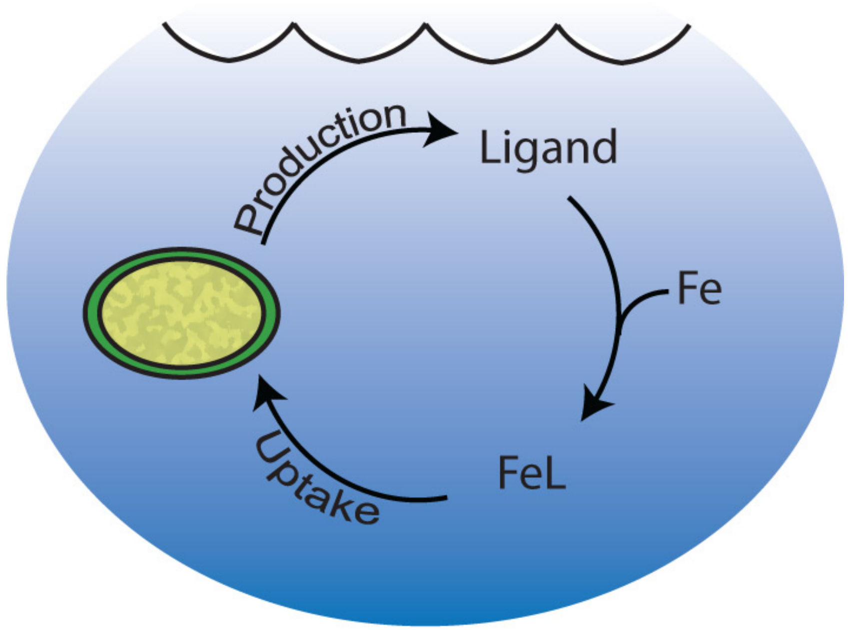
How do the three dominant picophytoplankton groups in the North Atlantic (*Pro*, *Syn* and picoeukaryotes) differ in their absolute and relative contributions to abundance, carbon biomass and rates of carbon fixation?



Using ^{14}C-incubations and flow cytometric sorting

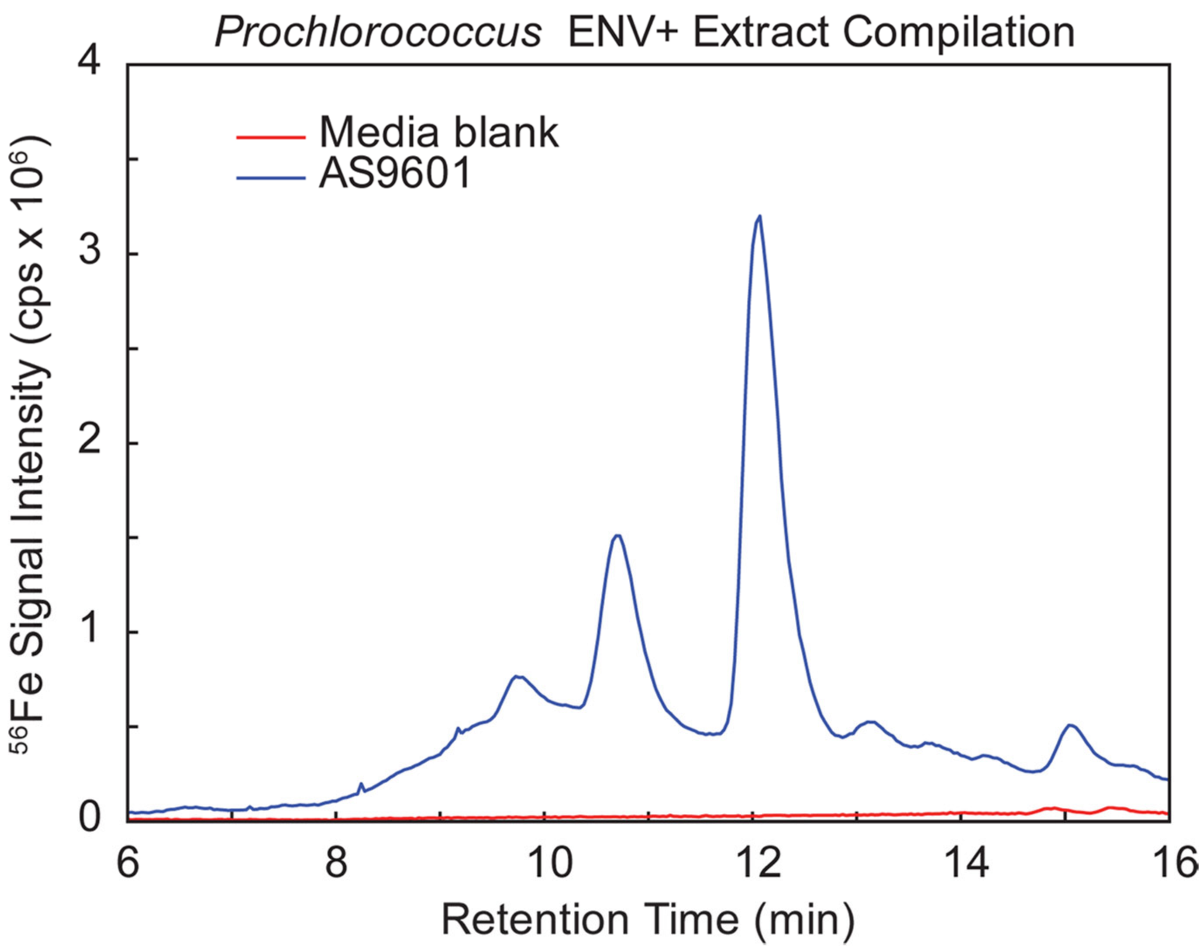
Iron ligands produced by Prochlorococcus

Rene Boiteau
Daniel Repeta
Jessica Fitzsimmons
Edward Boyle
Sallie Chisholm



Microbial Fe Ligand Cycle

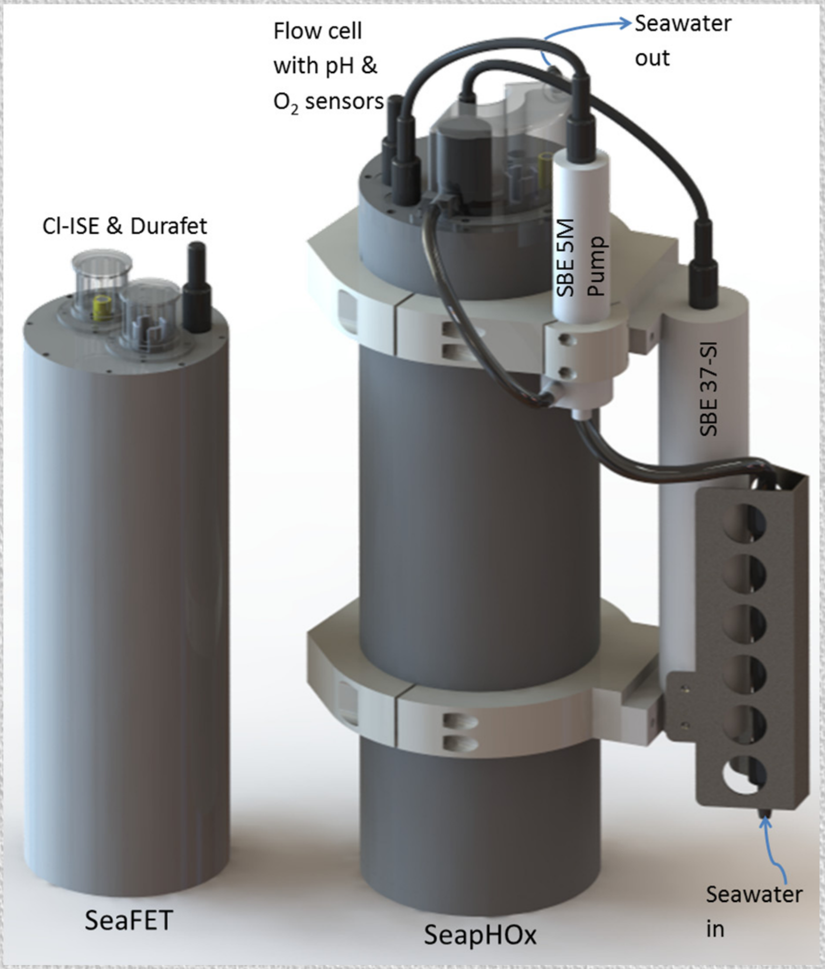
Prochlorococcus Ligands



Phil Bresnahan (PhD Candidate)
Advisor: Prof. Todd Martz

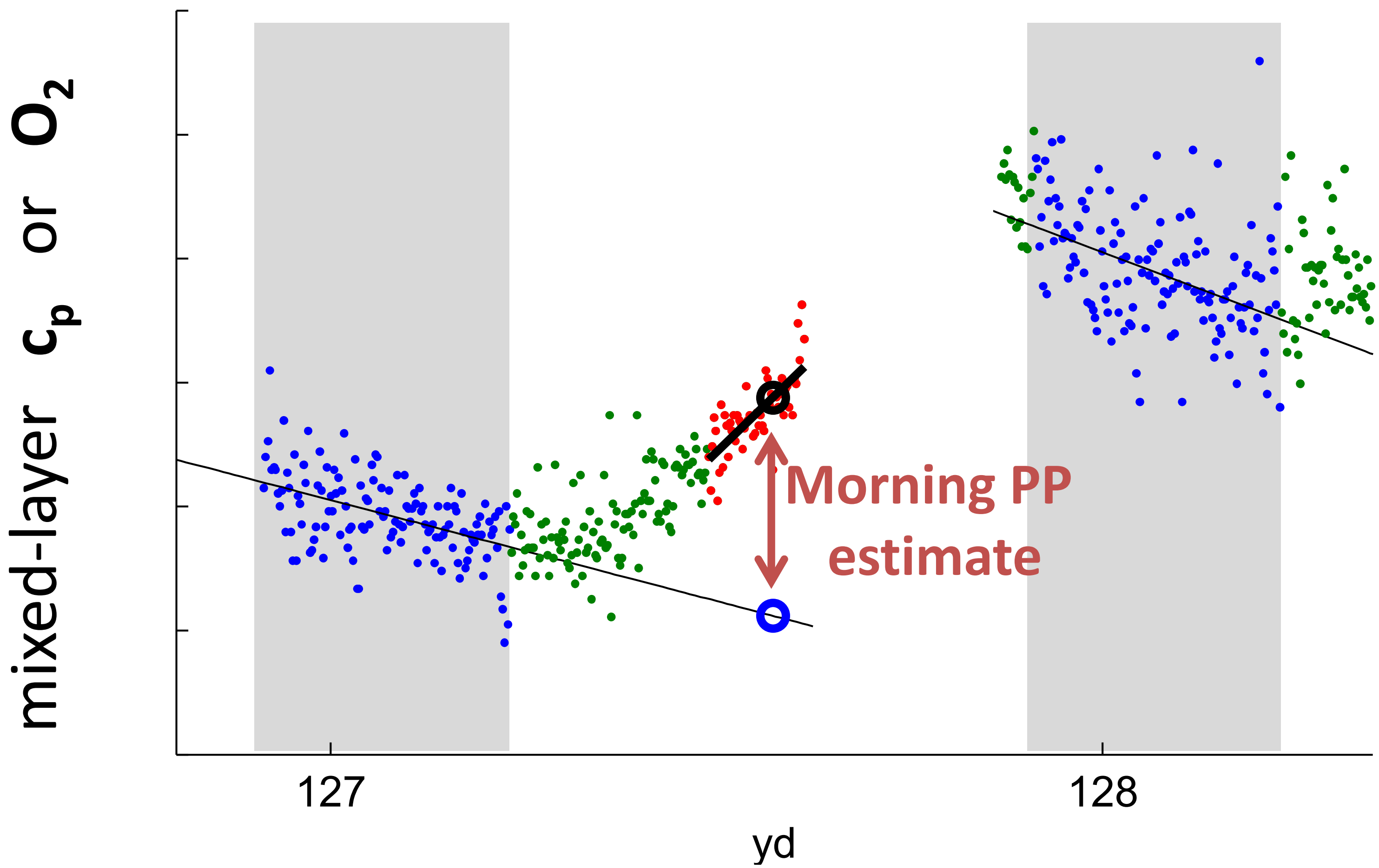
SCRIPPS INSTITUTION OF OCEANOGRAPHY
UC San Diego

- Scientific interests:
  - Inorganic carbon system sensor development & evaluation
  - Coastal chemistry
  - Global change outreach
- Poster: Best practices for autonomous measurement of seawater pH with the Honeywell Durafet
  - Focus on quantifying accuracy & detecting sensor drift
  - Sensor values compared to discrete samples and regional empirical relationships (Alin et al., 2012)

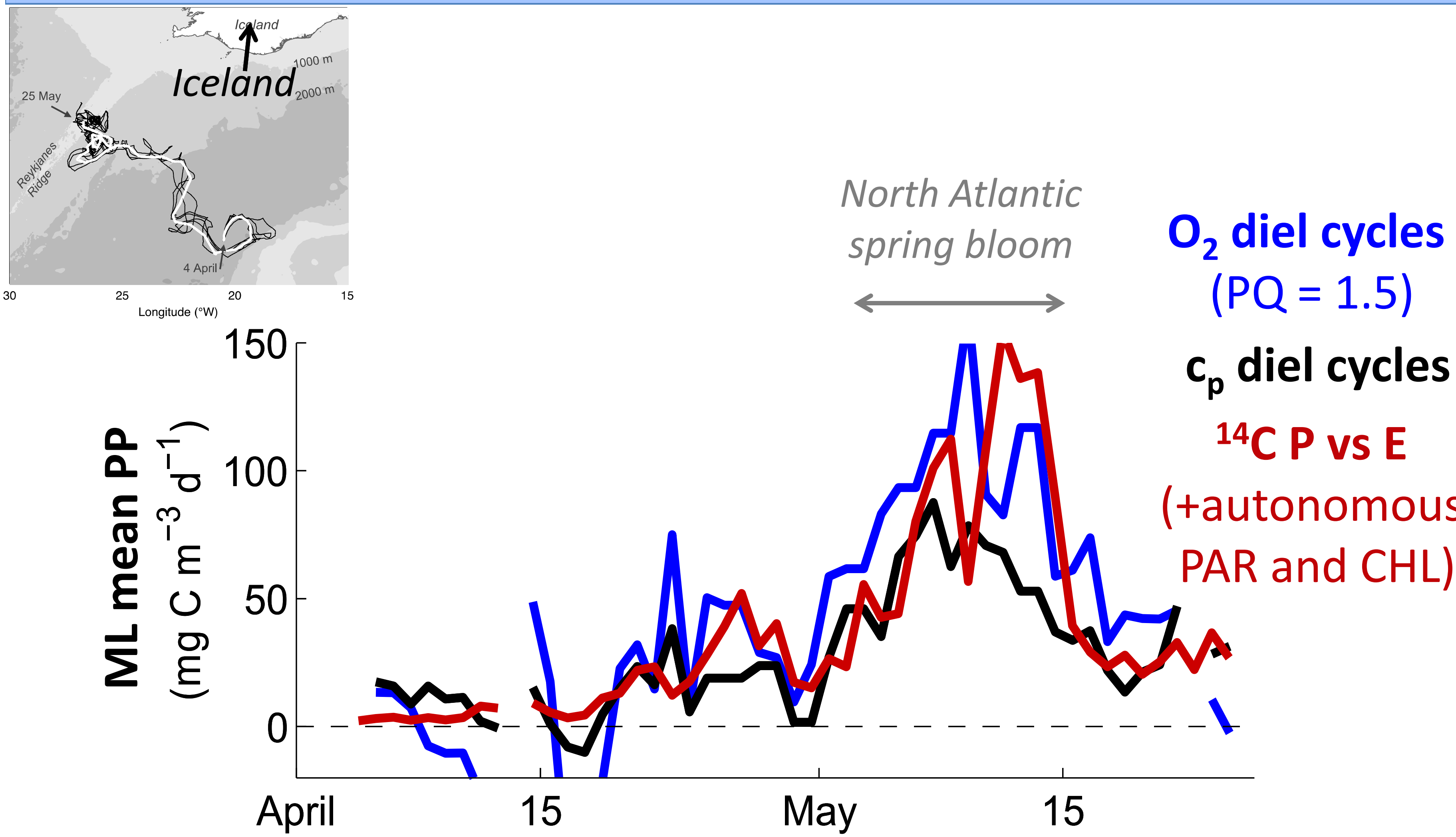


We can obtain **autonomous PP estimates** from **diel cycles** in Lagrangian float O_2 and c_p

Nathan Briggs – University of Maine



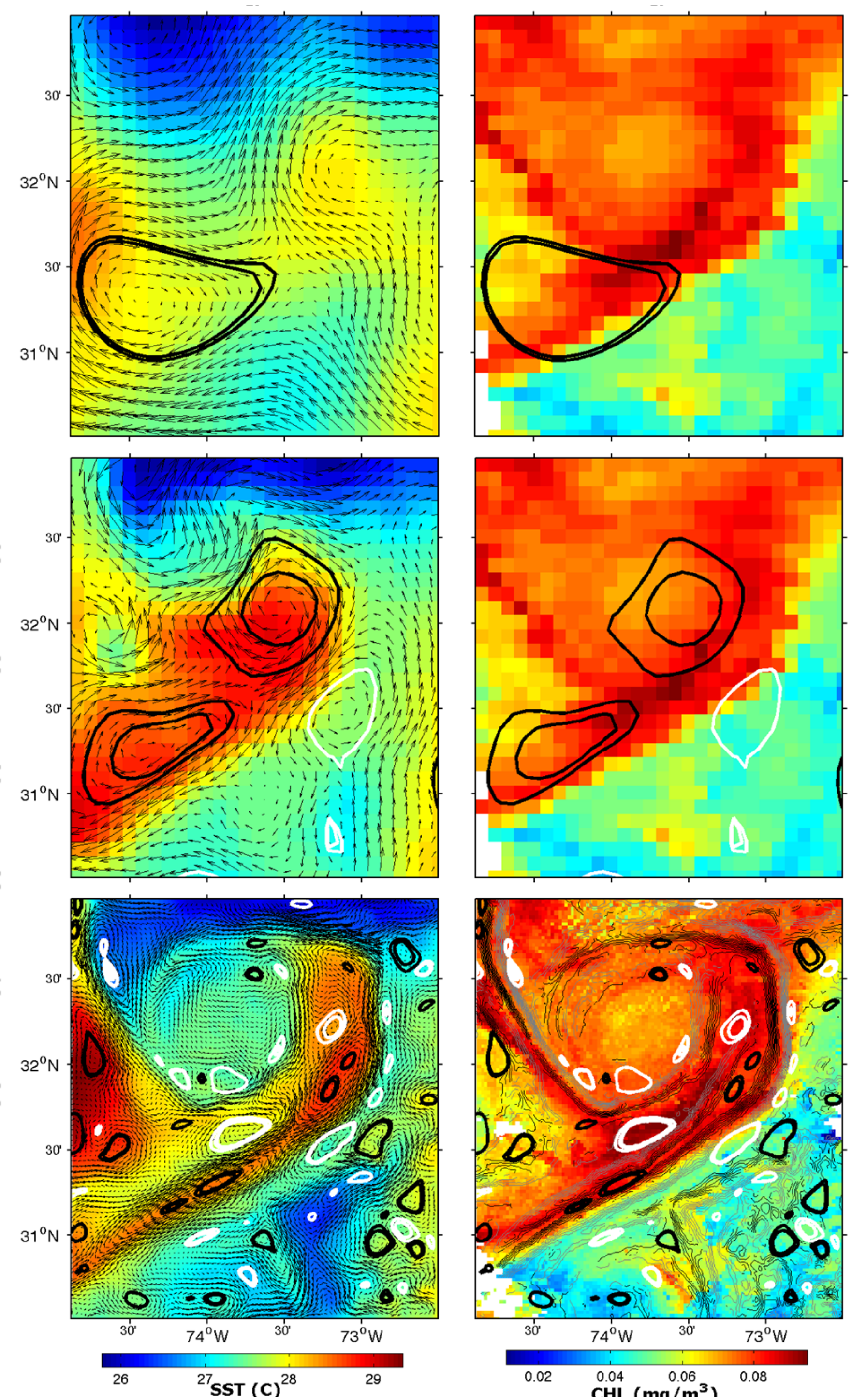
Autonomous PP agrees **quantitatively** (±30%) with independent estimates (from ^{14}C P vs E)

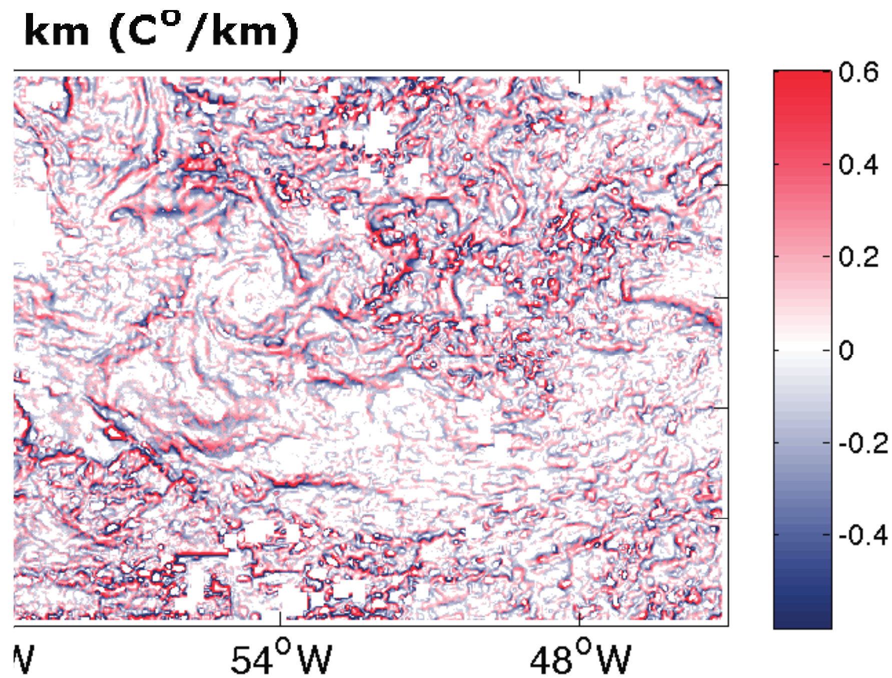



Research Interests:
Influence of physical forcing on phytoplankton spatial patchiness and community size structure at various scales:
• Mode water circulation
• Mesoscale eddies
• Submesoscale process
Haidi Chen
Atmospheric and Oceanic Science
Haidi Chen @ UW-Madison
University of Wisconsin, Madison
Advisor: Galen McKinley
Biogeochemistry Research Group

Observed dominance of submesoscale fronts to oligotrophic chlorophyll

supply at oligotrophic gyre:
Mesoscale v.s. Submesoscale





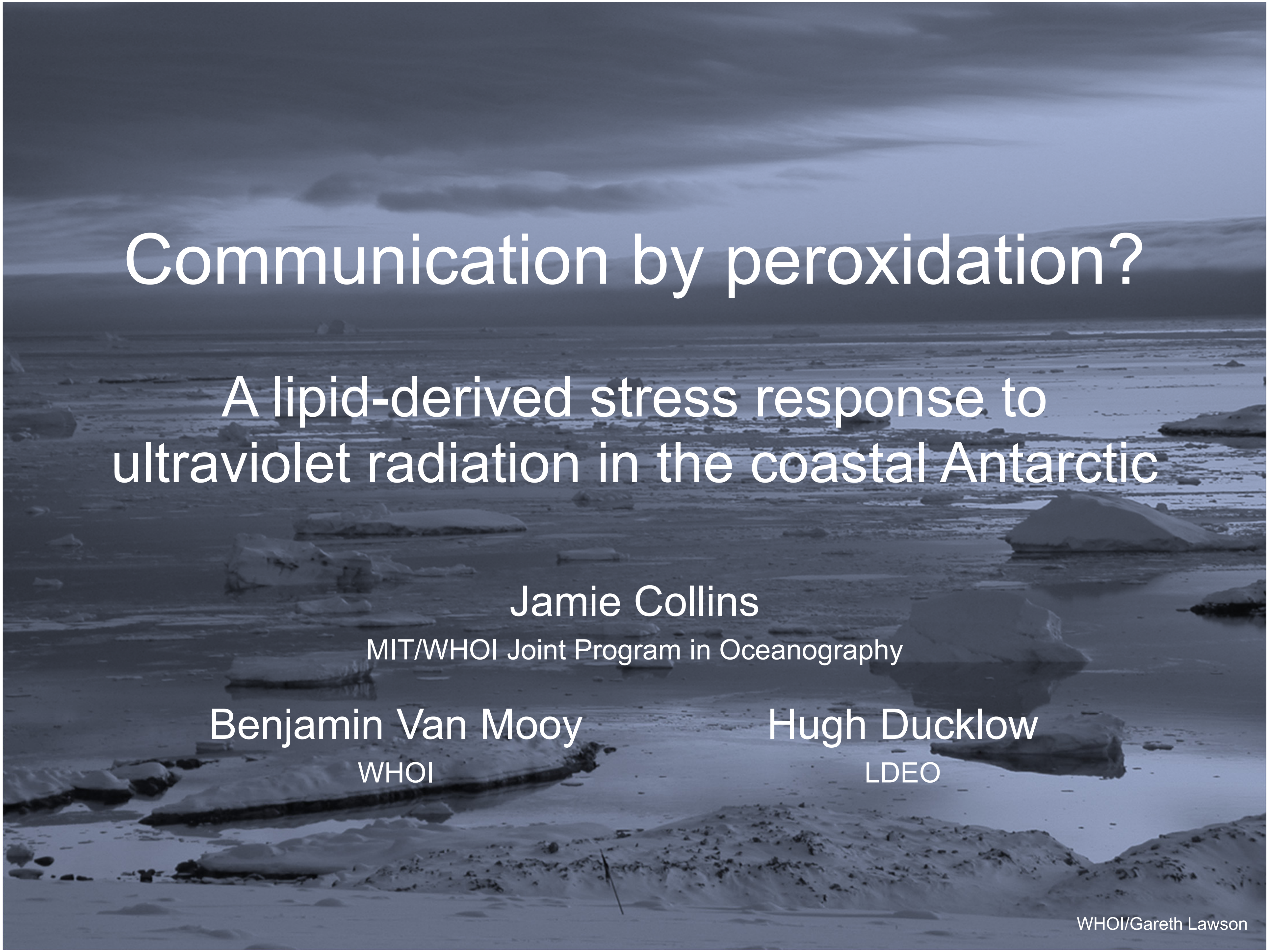
- Surface %CHL in difference physical features of +/- vorticity ?
- Resolution matters?
- Seasonality?

On going research:

Subtropical Mode Water nutrient characters + Upwelling Forcing

↓

Diatom Bloom?

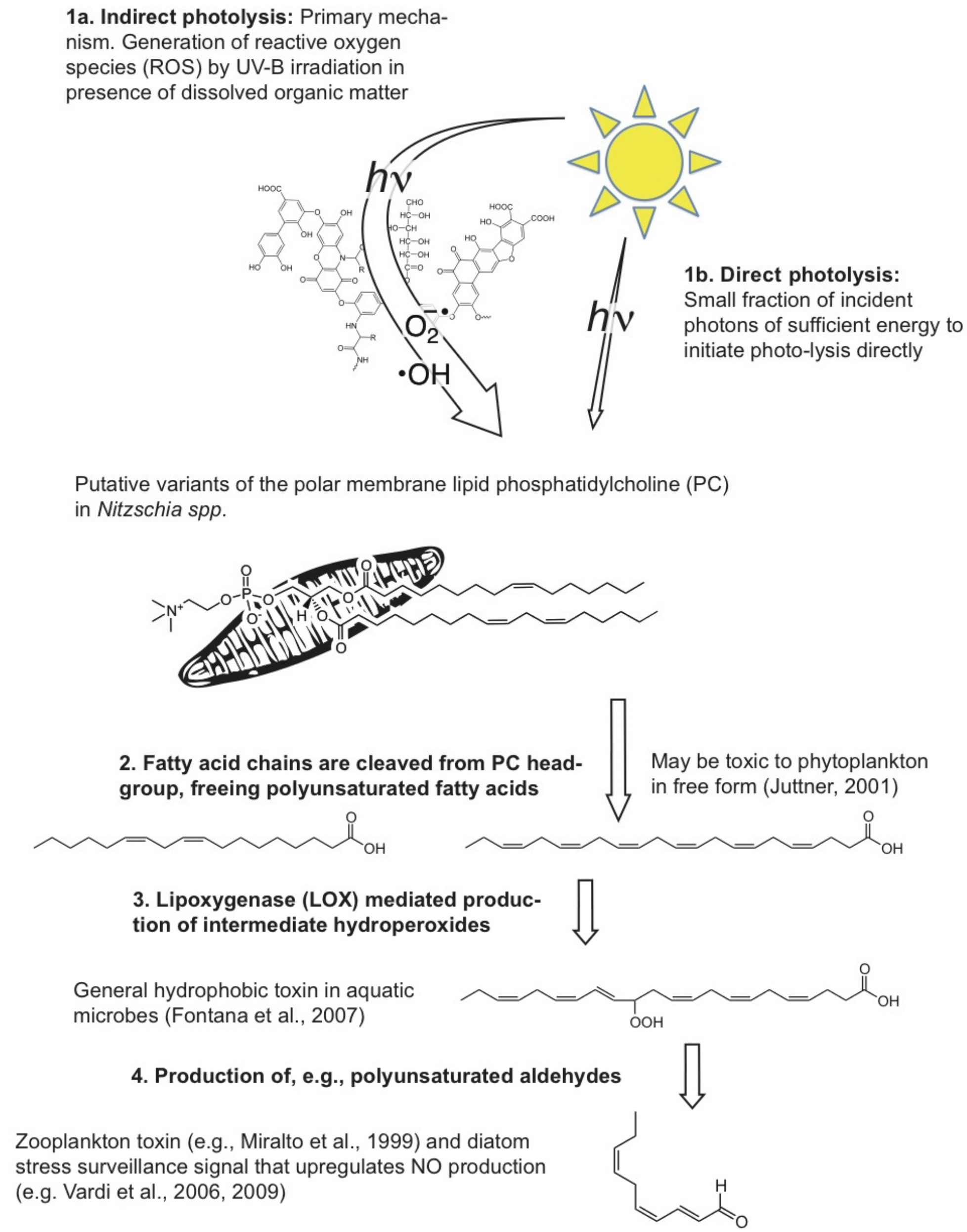

Communication by peroxidation?
A lipid-derived stress response to ultraviolet radiation in the coastal Antarctic
Jamie Collins
MIT/WHOI Joint Program in Oceanography
Benjamin Van Mooy
WHOI
Hugh Ducklow
LDEO
WHOI/Gareth Lawson

UV-B a significant environmental stressor at high latitudes

For algae in upper euphotic zone, cell and plastid membrane lipids represent “first line of defense”

DOC-catalyzed peroxidation of these lipids produces suite of oxidized daughter fatty acid products

Hypothesis: These labile, highly reactive oxylipins are an “infochemical” mechanism by which patterns of primary productivity (and export?) are modulated



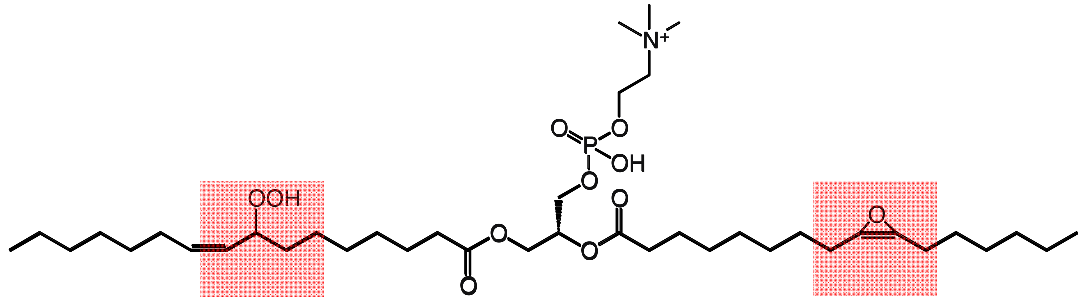
Approach: Laboratory experiments with (1) cultures of model species (*P. antarctica, N. frigidia*) and (2) liposomes

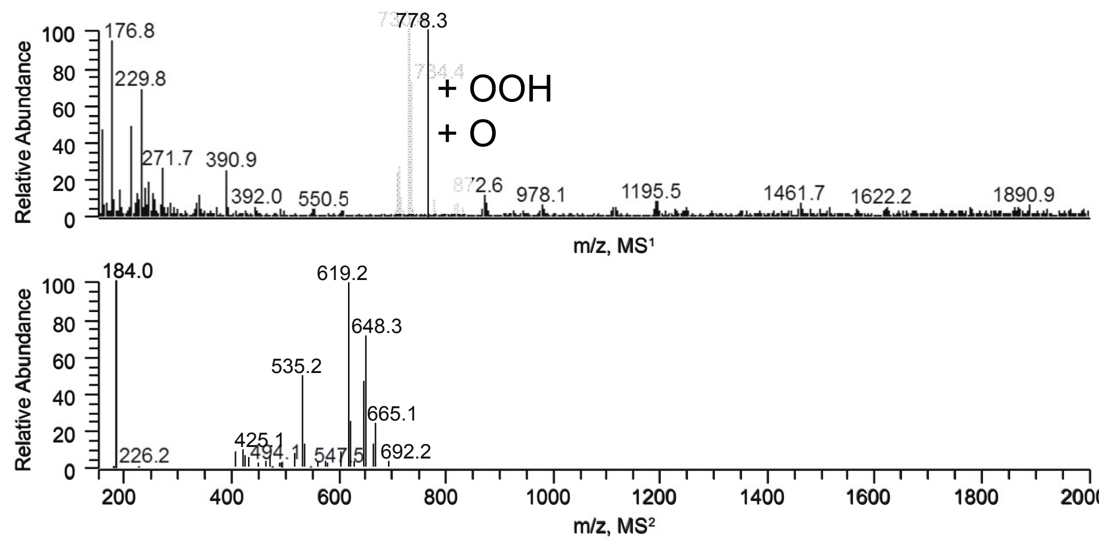
Environmental sampling: In conjunction with Palmer LTER study Oct 2013 - Feb 2014

Preliminary results with on-deck liposome incubations: Can identify oxylipins produced only in presence of natural UV-B

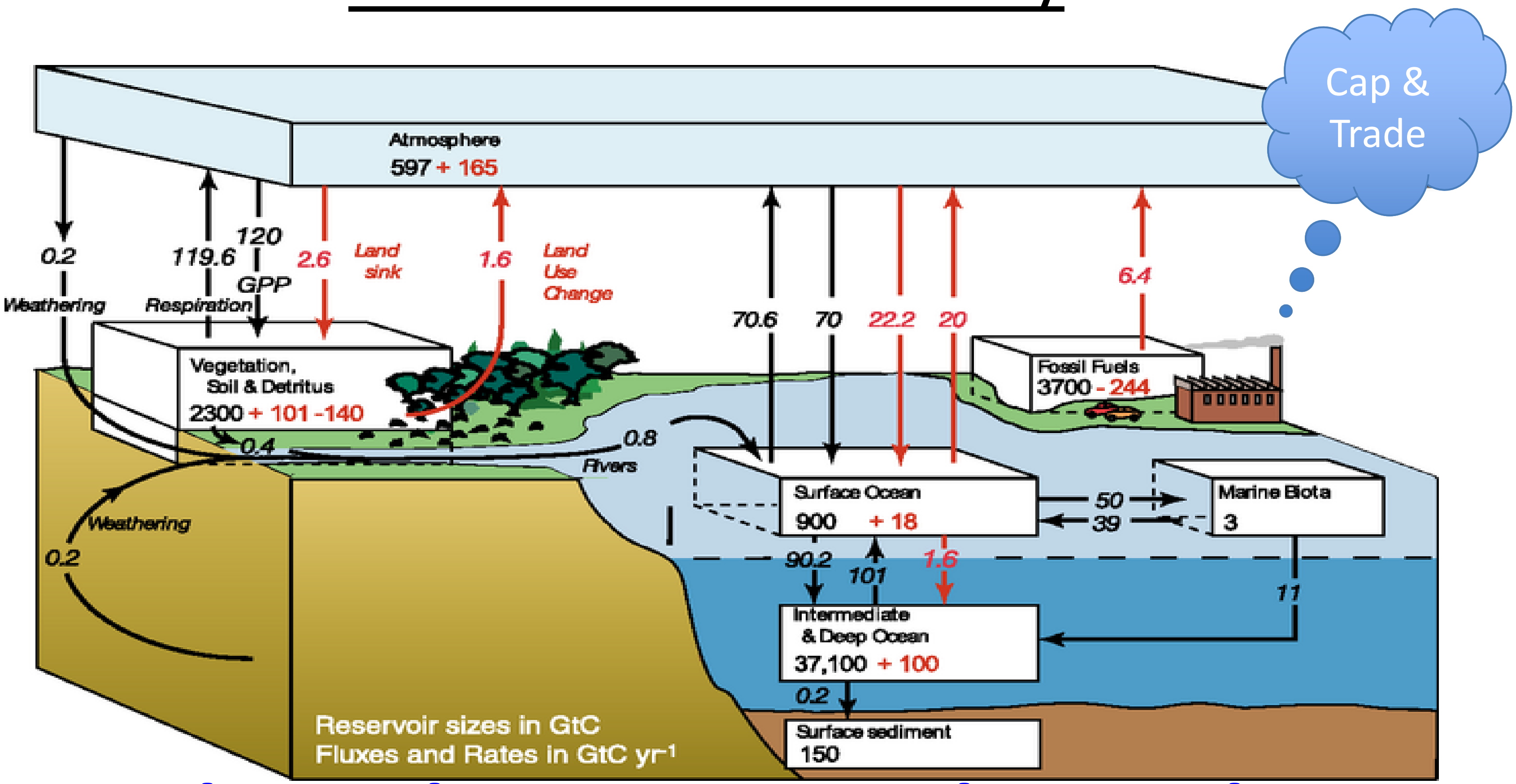
Questions:
jrcollins@whoi.edu

Lamont-Doherty Earth Observatory
Columbia University | Earth Institute



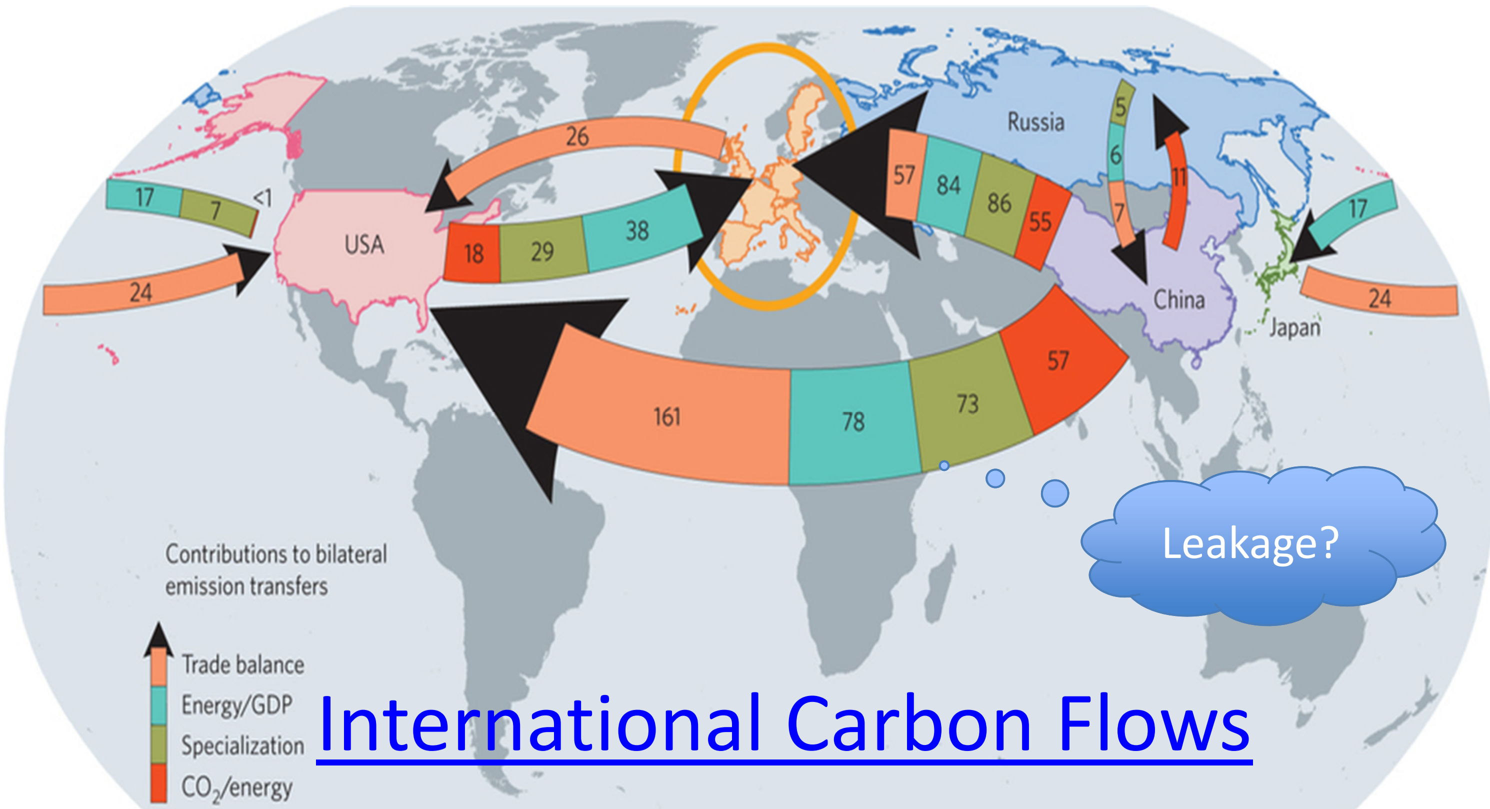


Carbon Management in the Post-Cap-and-Trade Carbon Economy



[The anthropogenic carbon cycle as described in IPCC AR4 WG1]

Carbon Management in the Post-Cap-and-Trade Carbon Economy



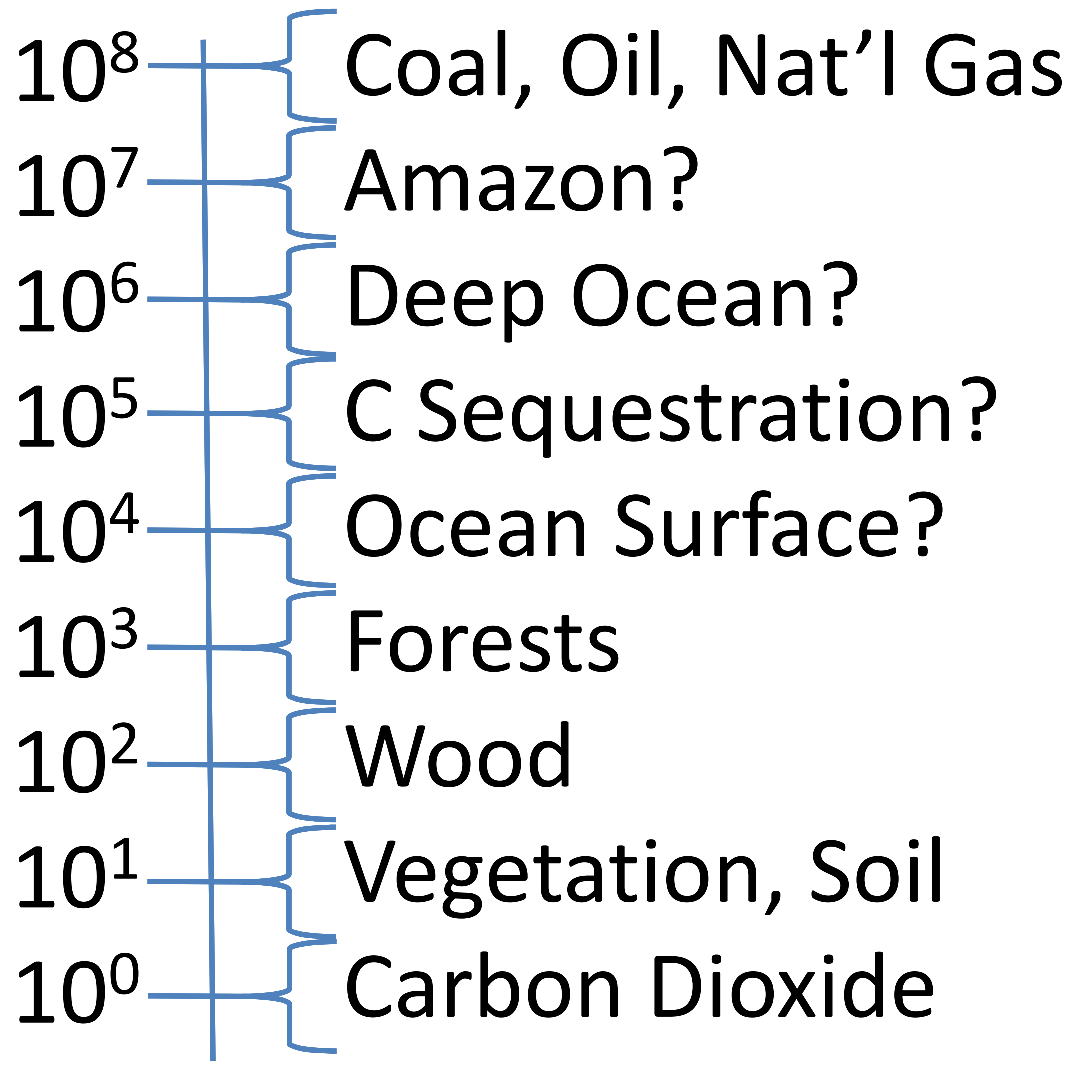
Jakob, Michael, and Robert Marschinski. "Interpreting Trade-related CO_2 Emission Transfers." *Nature Climate Change*. Nature Publishing Group, a Division of Macmillan Publishers Limited. All Rights Reserved., 23 Sept. 2012. Web. 12 May 2013. <http://dx.doi.org/10.1038/nclimate1630>.

Carbon Management in the Post-Cap-and-Trade Carbon Economy

Carbon metric
CQ = f (log(mean carbon residence time))

CQ(wood) = $\log_{10}(10^2) = 2$

$CQ(CO_2) = 0$
(by definition)



Carbon Management in the Post-Cap-and-Trade Carbon Economy

- Define carbon metric to value carbon in all forms
- Apply carbon metric to assess carbon toll for anthropogenic changes
- Apply carbon metric for anthropogenic movement of embodied carbon into jurisdictions with different metric

Kimberly deLong

University of New Hampshire

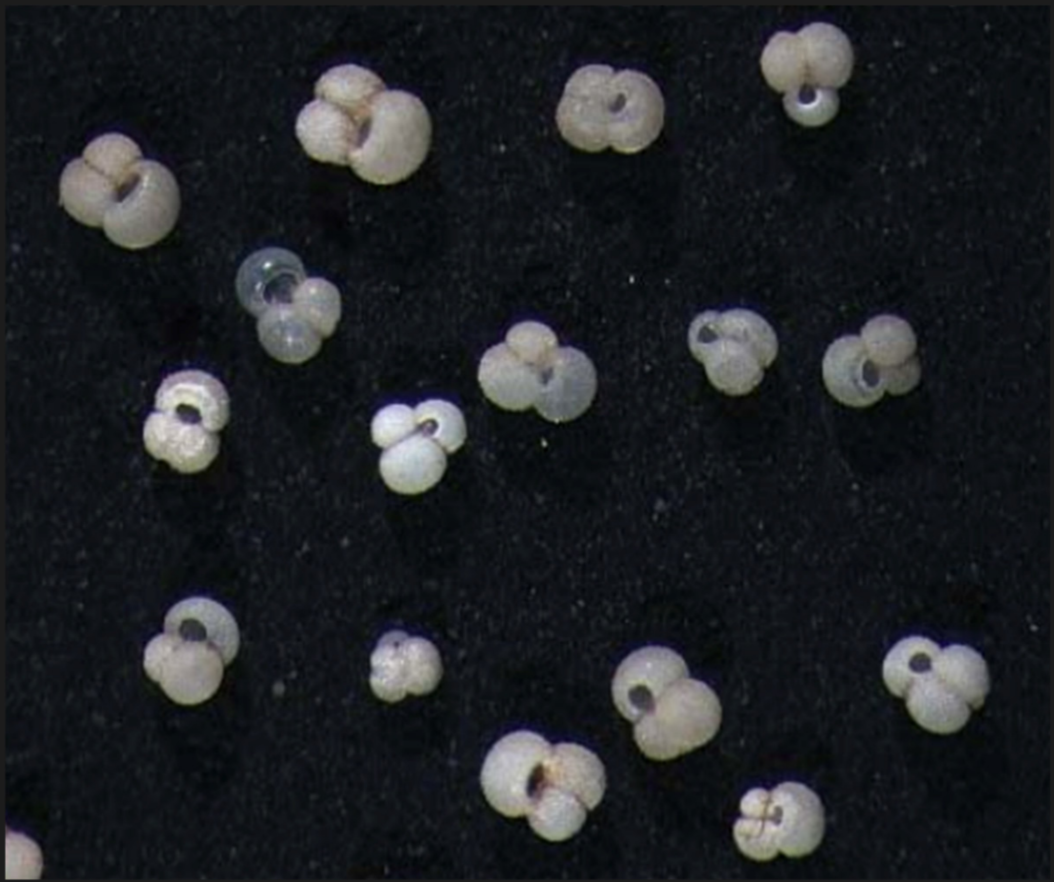


Image: Sarah Schulenburg

Current Project:

$\delta^{18}O_{sw}$ and Cd/Ca in the Bay of Bengal

Sub-orbital scale variability in the Asian Monsoon

Research Interests

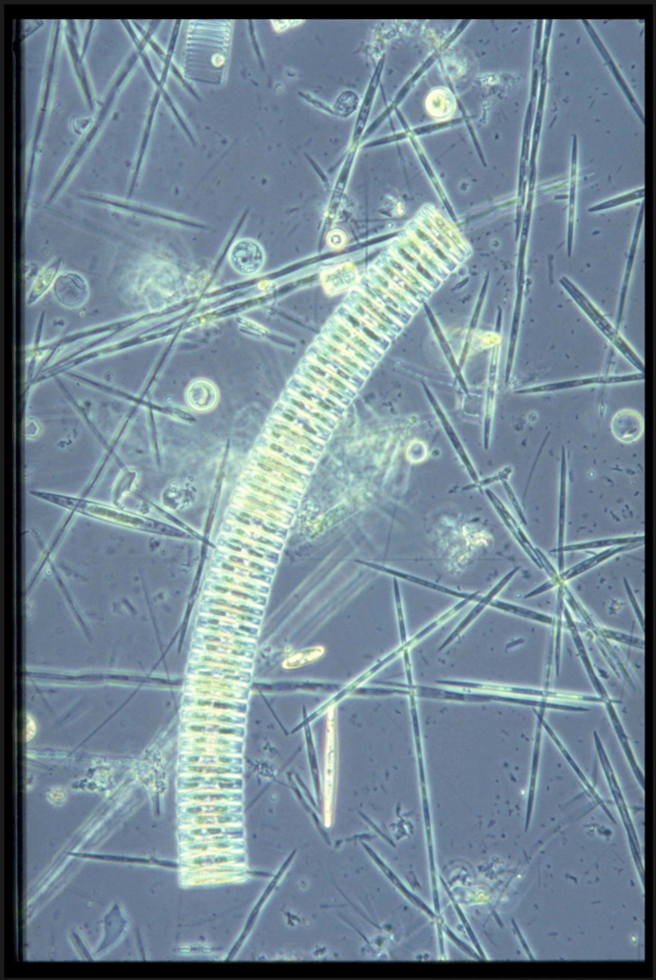


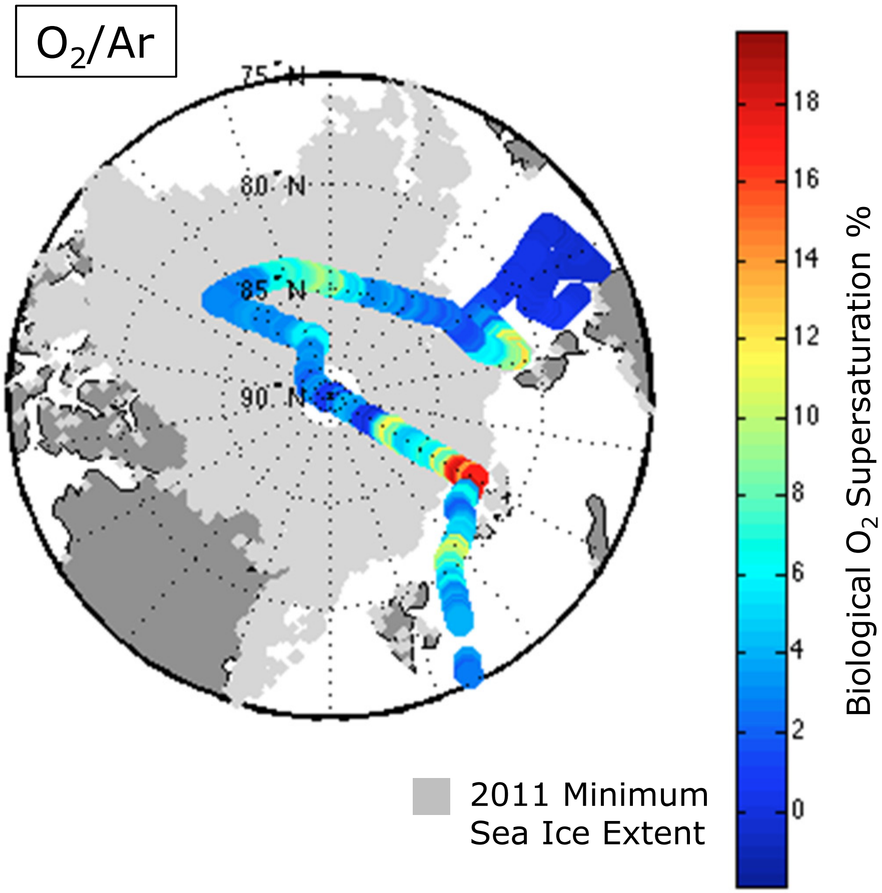
Image: http://www.awi.de

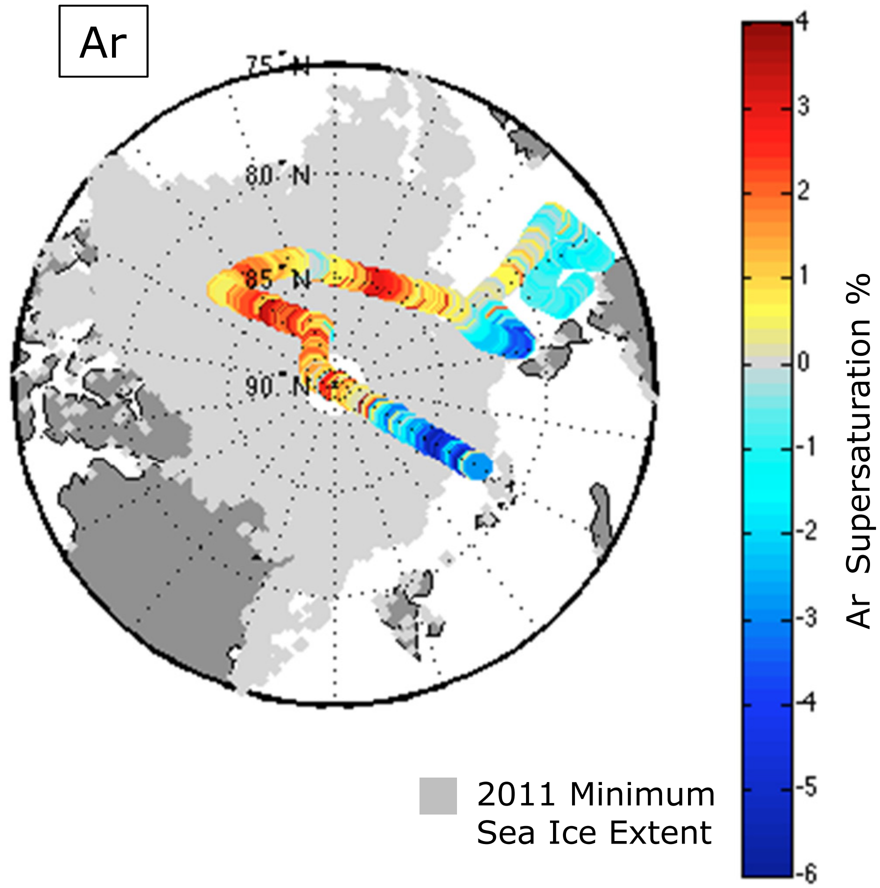
- How plankton communities affect the composition of seawater
- And how trace element compositions of sea water affect global nutrient cycling
- Geochemical approach to study past oceans

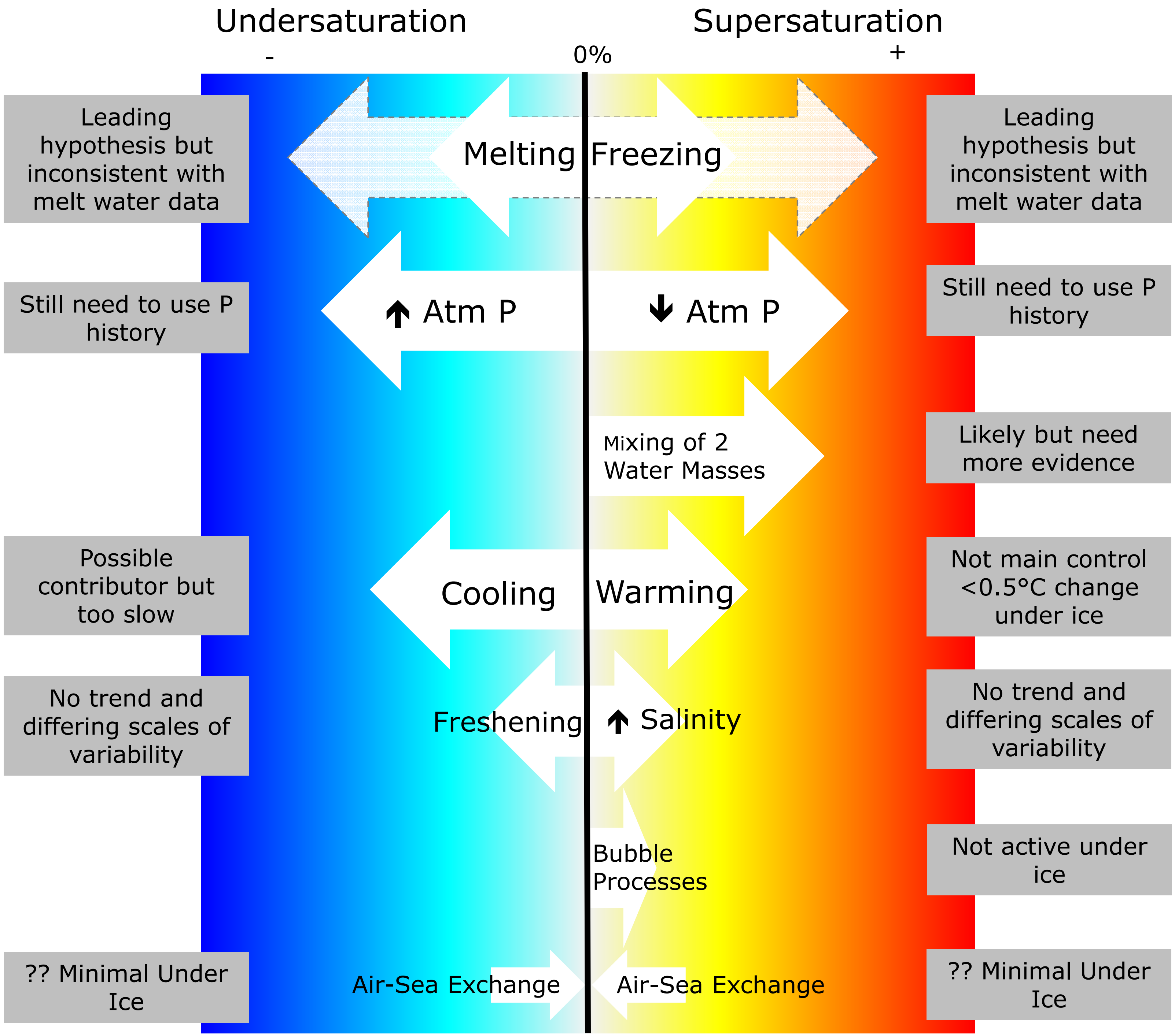
Physical and biological controls on gas saturation variability in the Central Arctic

Rachel K Eveleth[1*], Mary-Louise Timmermans[2], Nicolas Cassar[1]
*rachel.eveleth@duke.edu

[1] Department of Earth and Ocean Sciences, Duke University, Durham, NC, 27708
[2] Department of Geology and Geophysics, Yale University, New Haven, CT, 06511







Undersaturation
-
0%
Supersaturation
+
Leading hypothesis but inconsistent with melt water data
Melting
Freezing
Leading hypothesis but inconsistent with melt water data
Still need to use P history
Atm P
Atm P
Still need to use P history
Mixing of 2 Water Masses
Likely but need more evidence
Possible contributor but too slow
Cooling
Warming
Not main control <0.5°C change under ice
No trend and differing scales of variability
Freshening
Salinity
No trend and differing scales of variability
Bubble Processes
Not active under ice
?? Minimal Under Ice
Air-Sea Exchange
Air-Sea Exchange
?? Minimal Under Ice

Primary production in salt marsh tidal creeks using gas tracers and oxygen mass balance

Evan Howard and Rachel Stanley, WHOI

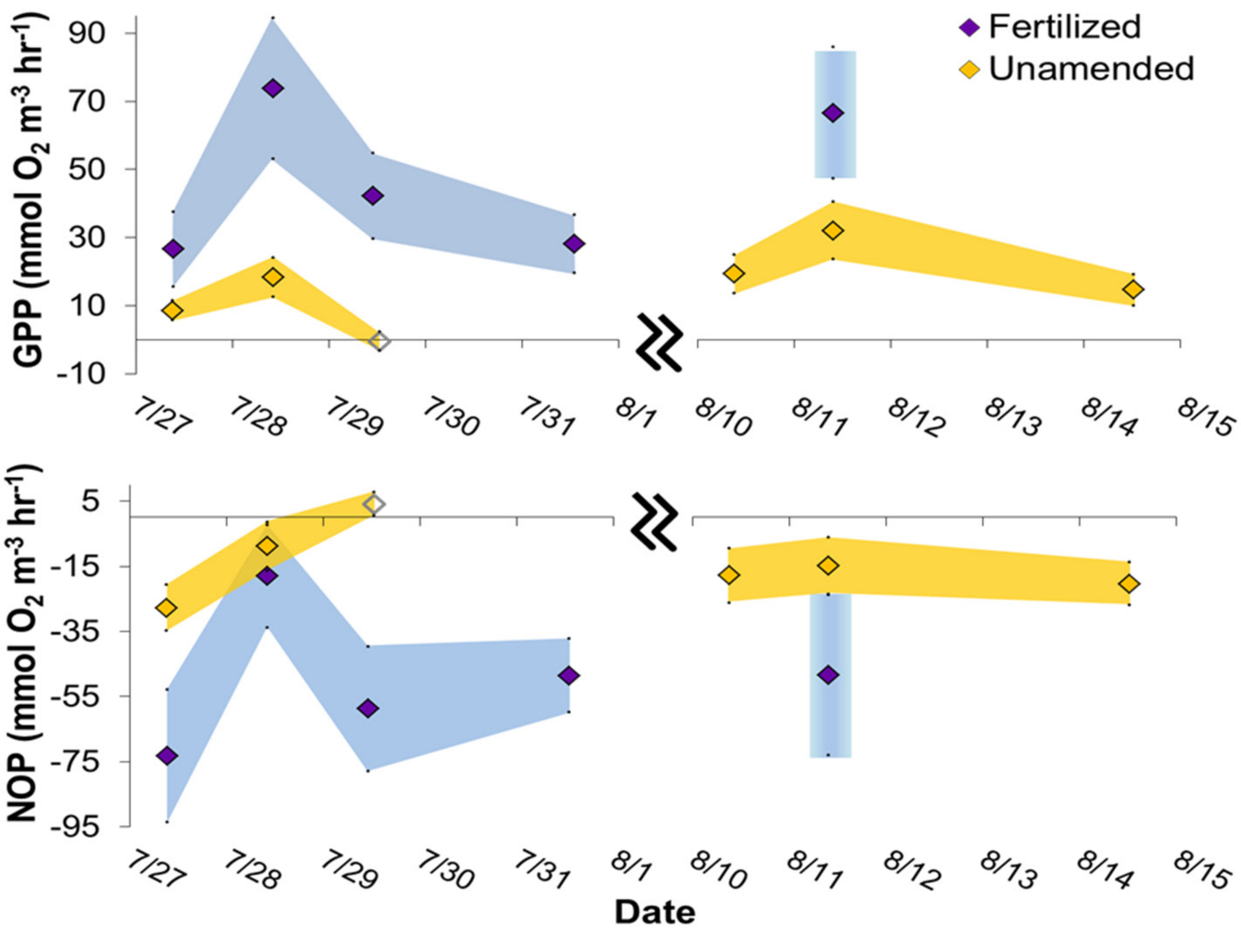
Murray *et al.* 2001

salt marshes

- Mediate elemental cycling between terrestrial and marine environment
- Productive and widespread
- Economic and ecological value

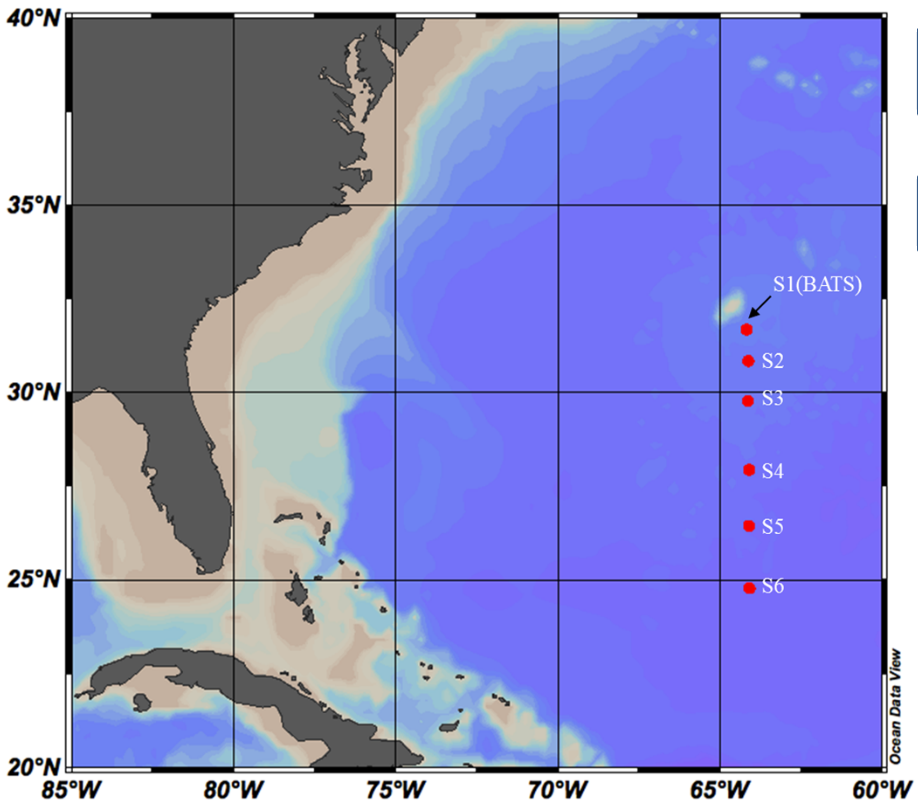
Plum Island Estuary LTER:
Fertilized and unamended tidal creeks

- Fertilized creek has higher gross primary productivity, but also greater net oxygen consumption
- Most of the production difference at high or mid-tide



Nitrogen Fixation Rates at BATS and along the North Atlantic Subtropical Front

Haibei Hu
07/22/2013
SMAST
UMass Dartmouth



Map of Bermuda sampling station in August 2012 plotted using Ocean Data View

Fill up 4L polycarbonate bottles(no headspace)

↓

Add ^{15}N labeled N_2 gas, shake for 10 min

↓

Subsample for initial enrichment

↓

Add ^{13}C-$NaHCO_3$

↓

Top up the seawater leaving no headspace

↓

Incubation

↓

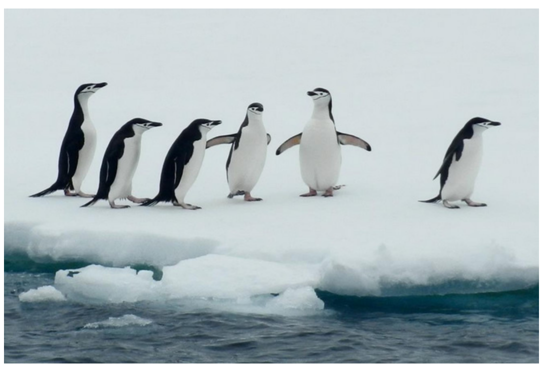
Sample termination

↓

Pre-filter with 20 micro Nitex mesh
Filter through GF/F to collect PON
Collect filtrate for DON and NH_4 isotope

Ocean uptake of carbon dioxide from the atmosphere

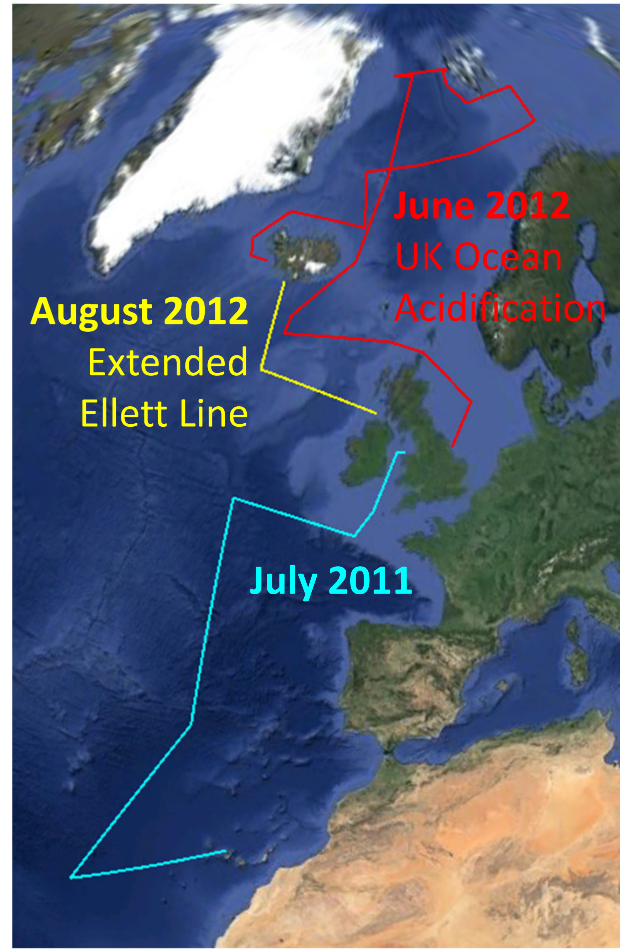
- Remote sensing & parameterisation to improve spatial/temporal resolution of data
- Measuring changes in marine carbonate chemistry in the eastern North Atlantic
- Biological impacts of ocean acidification in the surface ocean at high latitudes
- Measurement–model output comparisons
- Monitoring of the Suess effect

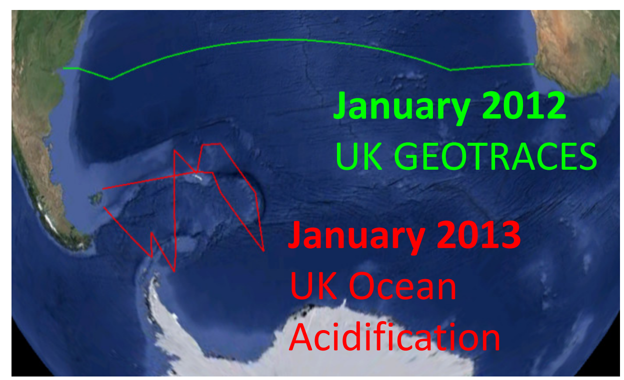


Matthew P. Humphreys

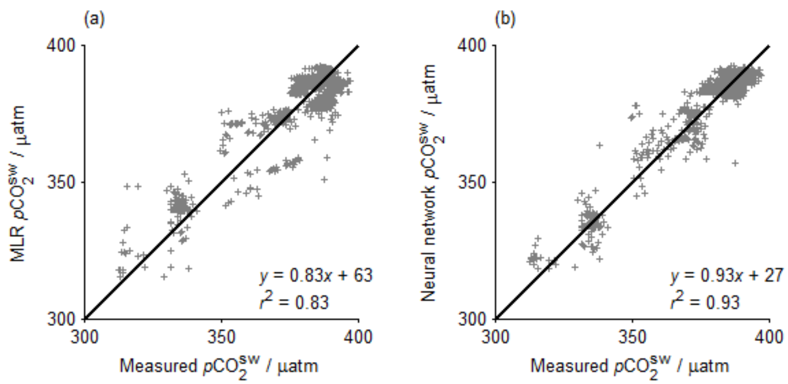
Ocean & Earth Science, University of Southampton, UK

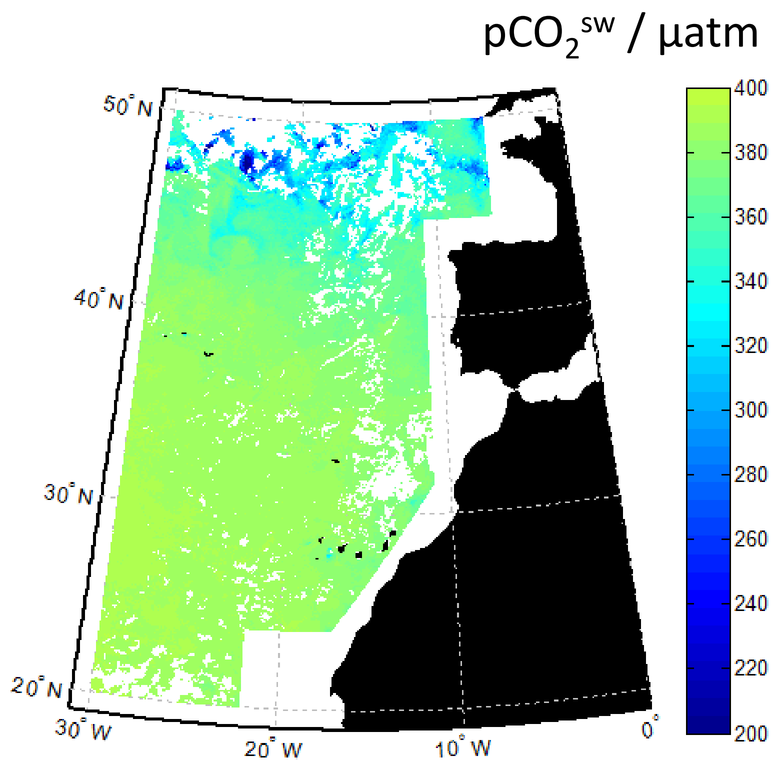
PhD Supervisors: Eric Achterberg, Toby Tyrrell, Kevin Oliver



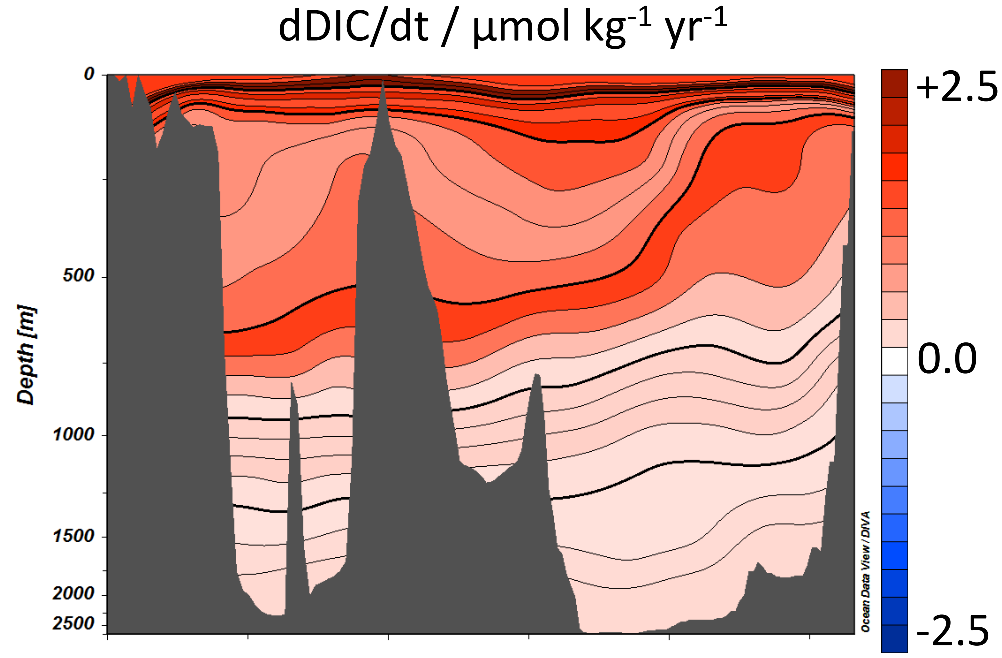


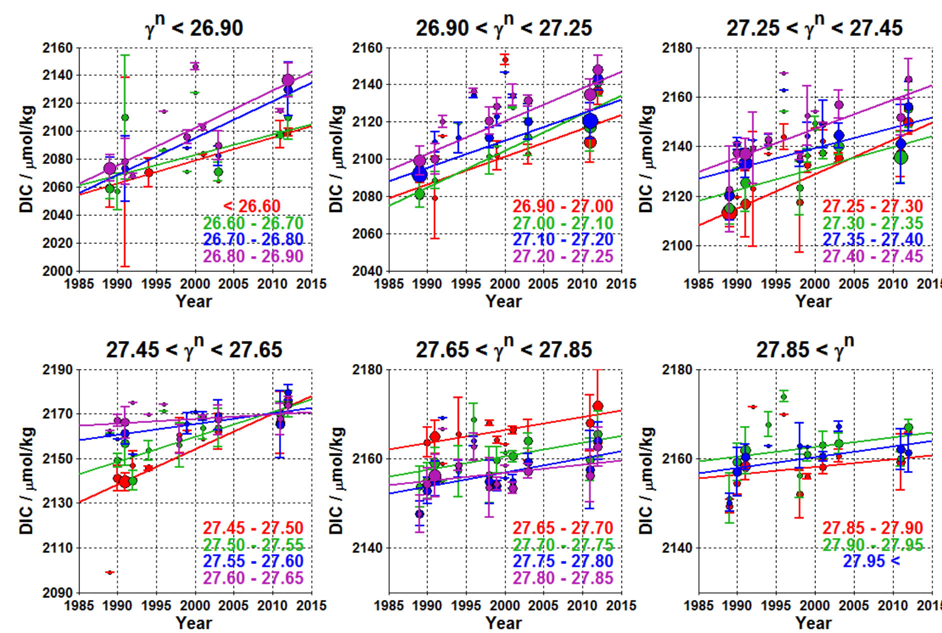
Remote sensing & parameterisation of marine carbonate chemistry system





Extended Ellett Line DIC increases (poster)





E. Brooke Jones
PhD Student

Physical-Biological Oceanography

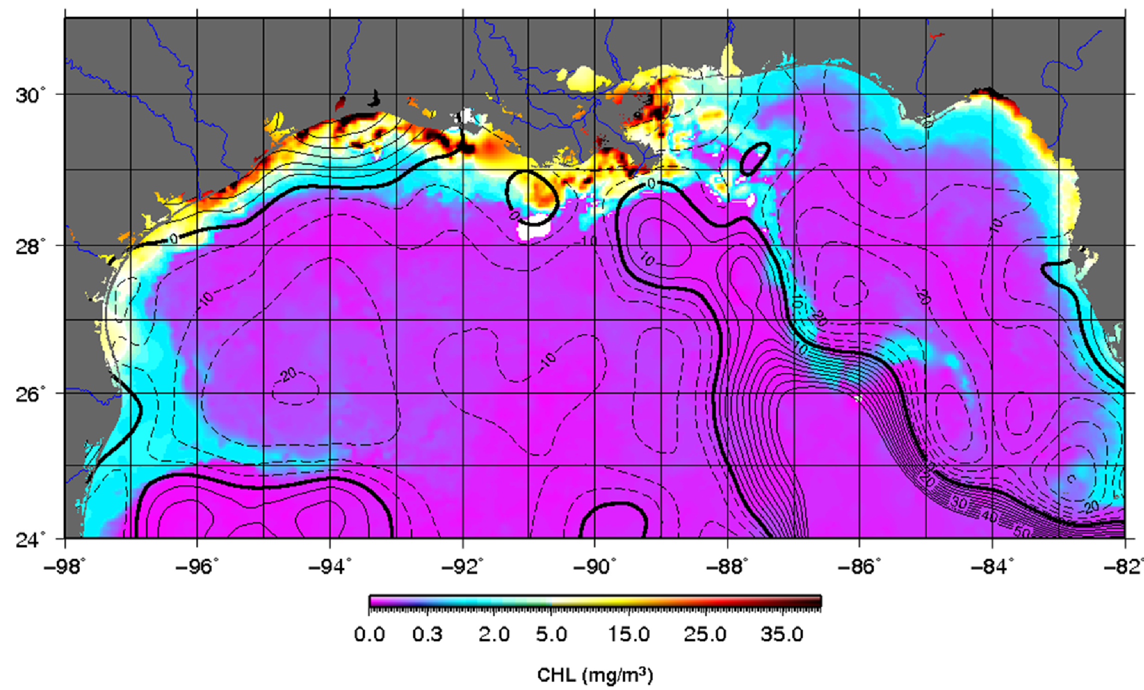
University of Southern MS
Department of Marine Science
Stennis Spacecenter, MS

BS in Biological Sciences
University of Southern Miss
Hattiesburg, MS

My research:

Interdisciplinary approach to understand bio-physical marine systems/processes

Integrate the broad spatial and temporal data range of satellite observations with the detailed output of physical/biogeochemical models to describe biophysical interactions



Biophysical case study

Cross-shelf transport of MS River plume

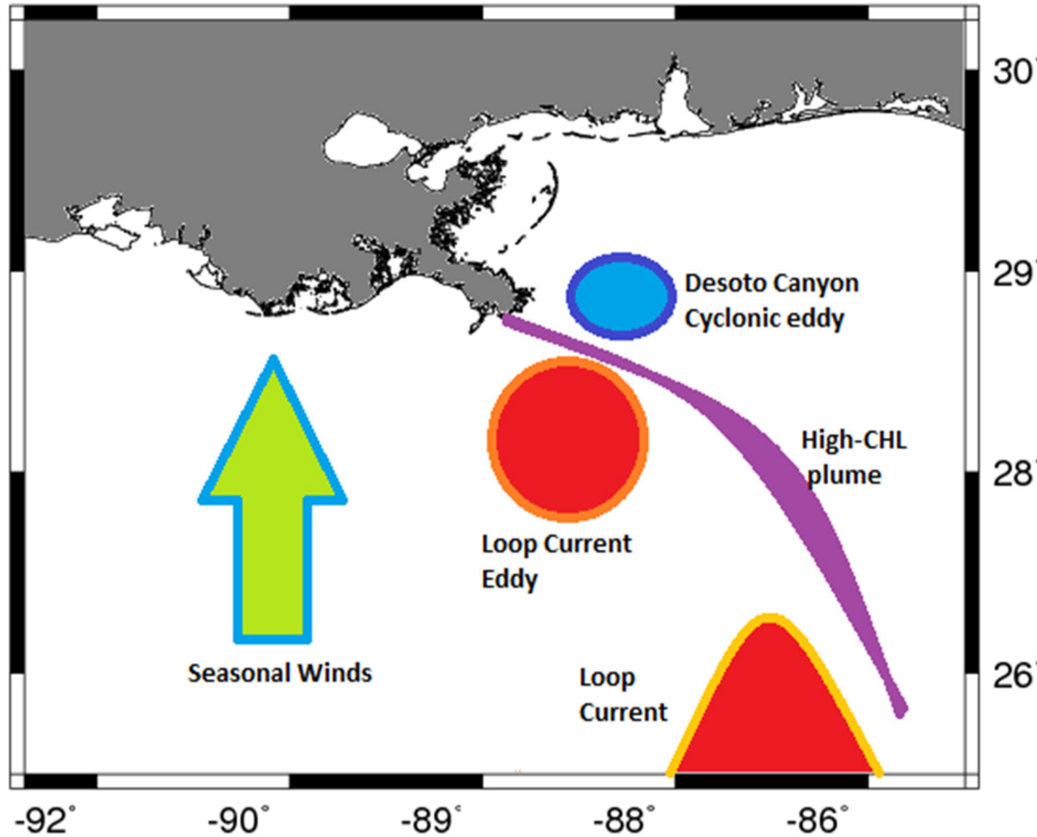
Seasonal (summer) winds can drive mass transport shelf waters eastward in the Northern Gulf of Mexico

This allows the MS River plume to spread near the Desoto Canyon

High cyclonic energy in this region can interact with the loop current/eddies to form a cross-shelf flow

MS River plume waters entrained by this system can result in a high-chlorophyll plume extending to the Central Gulf

This plume has effects on phytoplankton growth, primary productivity and potentially export



VIMS | WILLIAM & MARY
VIRGINIA INSTITUTE OF MARINE SCIENCE

University of East Anglia

NSF

Daniel Kaufman

Committee: Marjorie Friedrichs, Walker Smith, Eileen Hofmann, Elizabeth Canuel

Biogeochemical Variability in the Ross Sea: Results from a Glider Deployment

Objective is to resolve abrupt changes in Ross Sea phytoplankton biomass and highlight potential mechanisms responsible for this variability using high-resolution glider data

2010 – 2011

370 dives, 28 days

CTD, oxygen, bio-optics

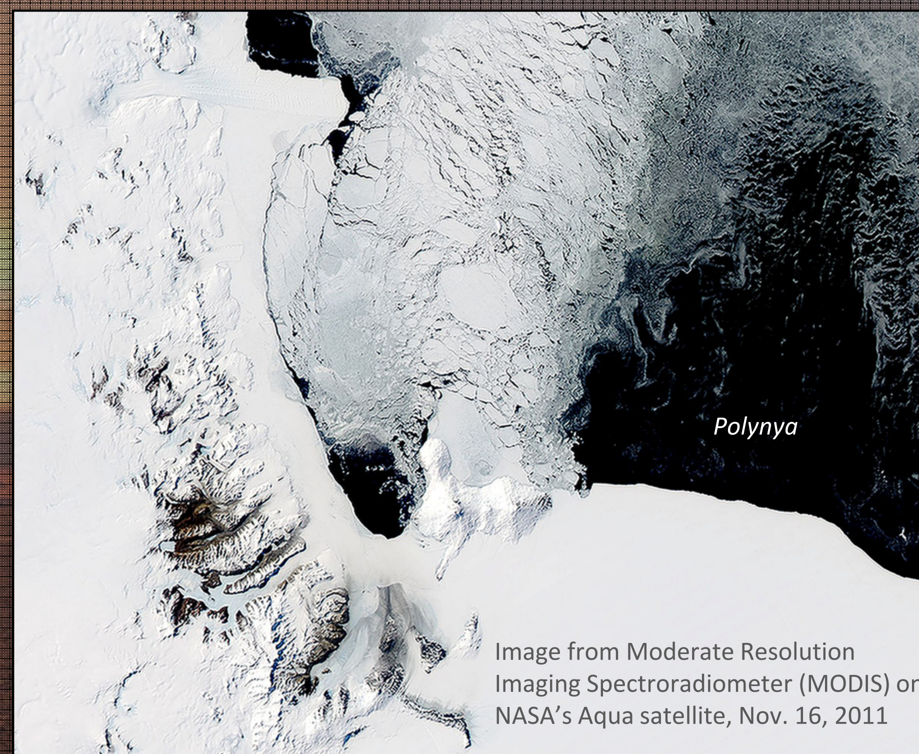
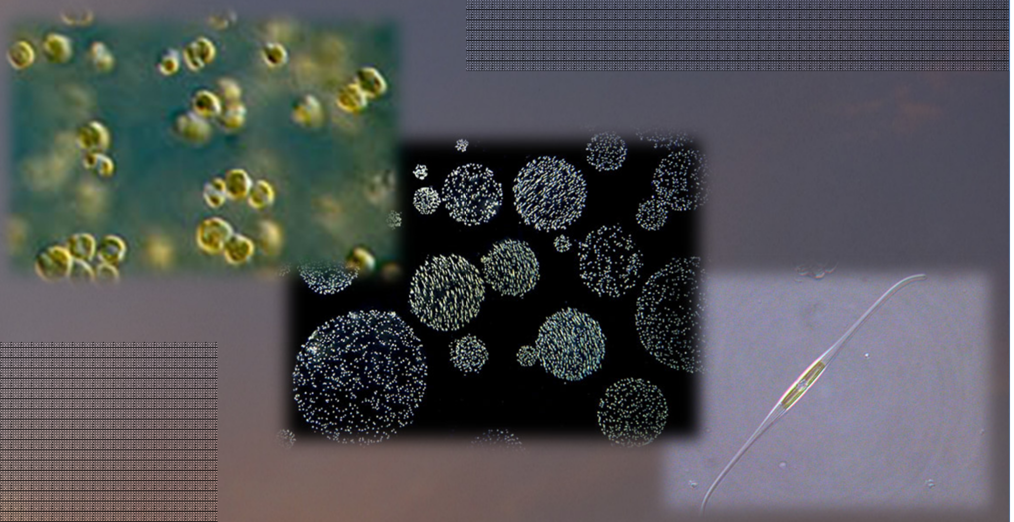
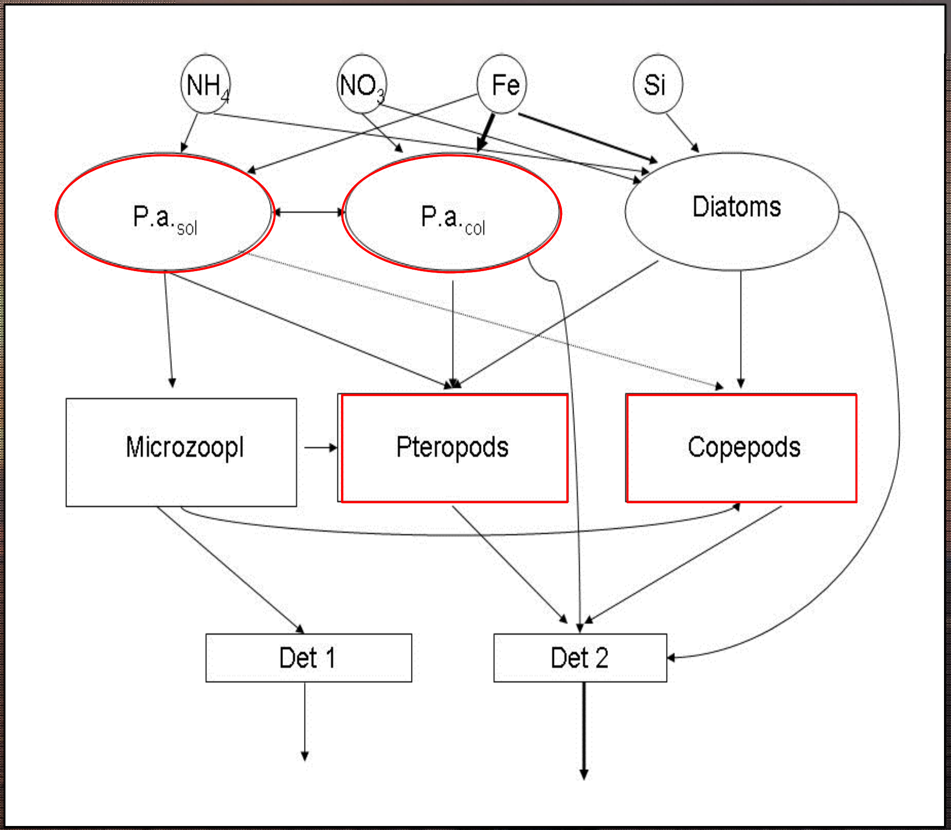


Image from Moderate Resolution Imaging Spectroradiometer (MODIS) on NASA's Aqua satellite, Nov. 16, 2011

An analysis of glider sections

- Observed an abrupt change in POC and chlorophyll
  - Suggestive of transition from *Phaeocystis antarctica* to diatoms.
- Was most strongly correlated with temperature





Next steps

- Develop 1D biogeochemical NPZD model, forced by ROMS
- Assimilate glider data using variational adjoint method for parameter optimization
- Idealized scenario tests

Catherine Lamb

HUMBOLDT STATE UNIVERSITY, CALIFORNIA

MARINE BIOLOGY MAJOR

Currently…

- Humboldt State University Marine Laboratory Volunteer

  -Bryozoan feeding

  - Algae and diatom culturing

- S.C.U.B.A. certified

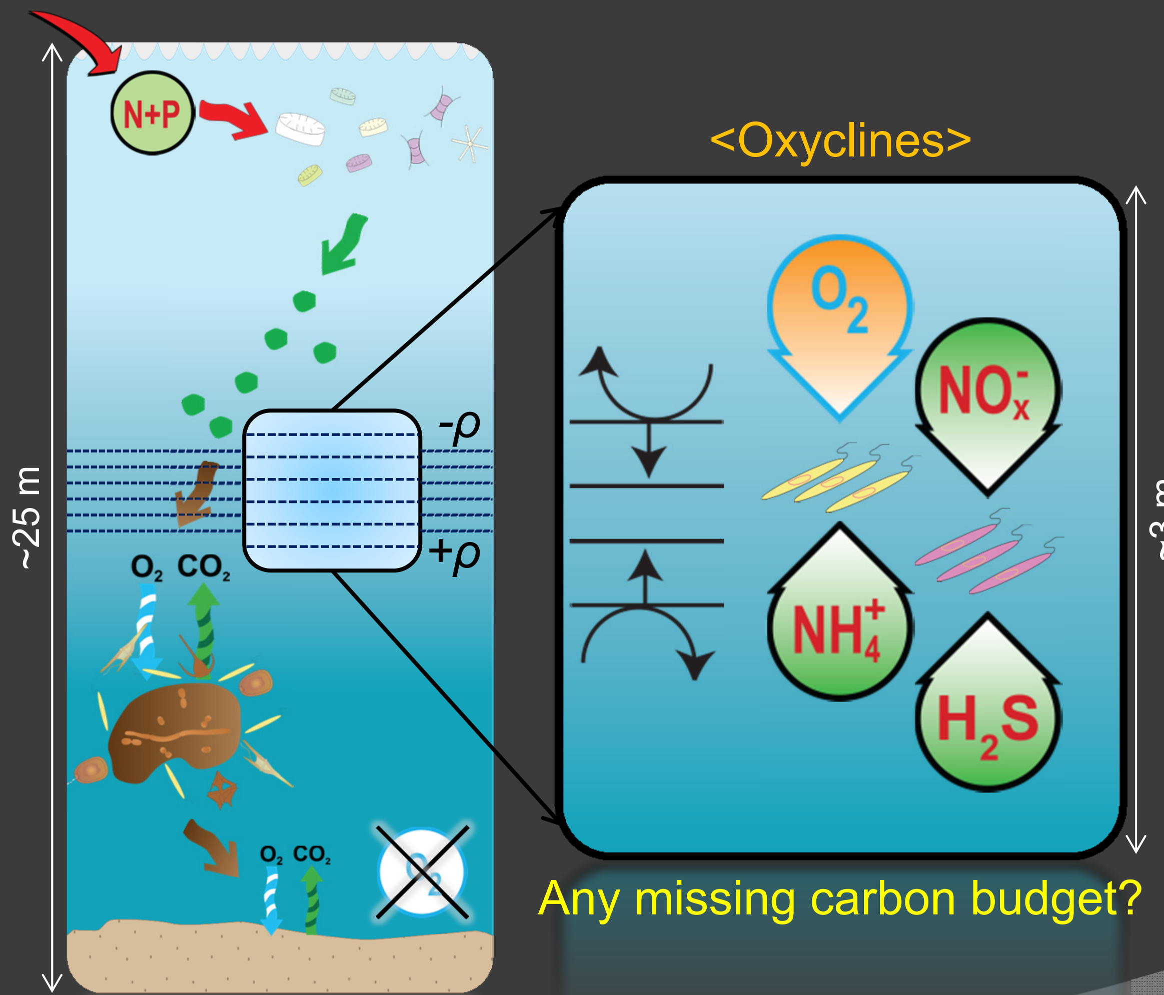
Research Interests

- Behavior and ecology of marine animals

- The effects of pollution on the Marine environment and marine mammals

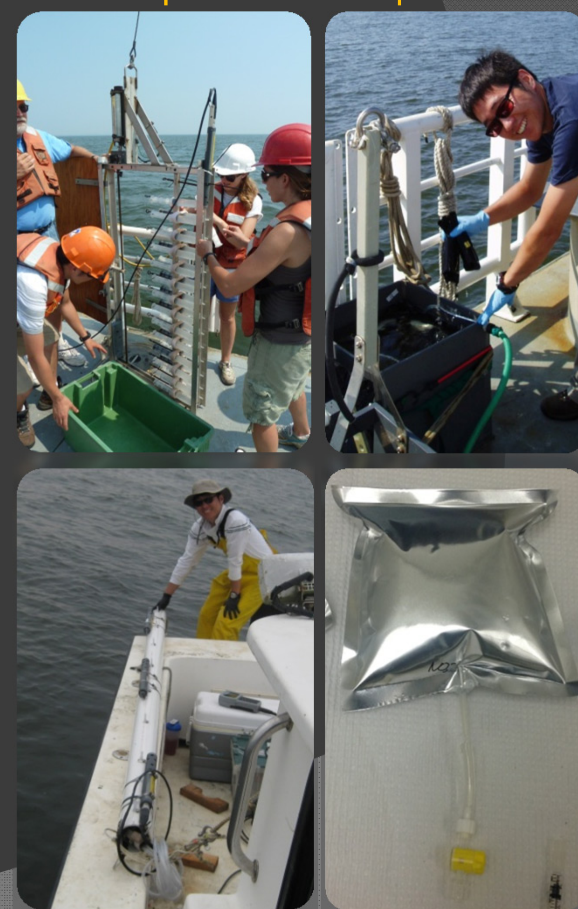
Carbon cycles within oxyclines during seasonal anoxic event in the Chesapeake Bay

(Lee, D.Y. *et al.*)



Any missing carbon budget?

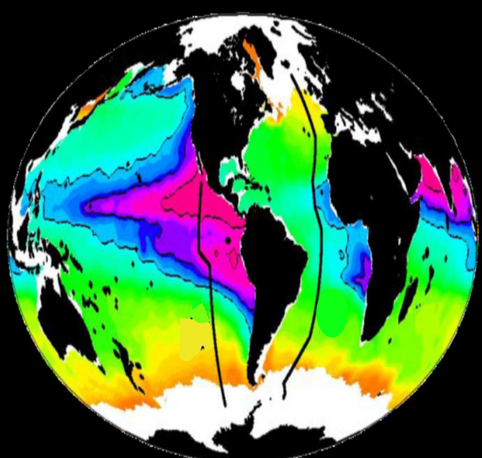
<Samplers> <Experiments>



Climate-Biogeochemistry Interactions in the Tropical Ocean

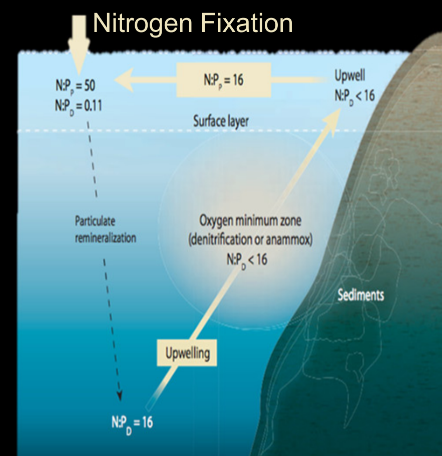
SFB 754

"Photoautotrophic responses to changes in nutrient stoichiometry"



(after Karstensen et al. 2008)

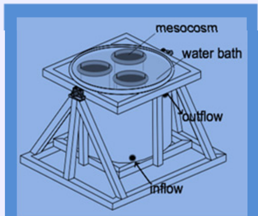
Prof. Oschlies, Andreas
Dr. Pahlow, Markus
Prof. Riebesell, Ulf
PhD. Student Marki, Alexandra



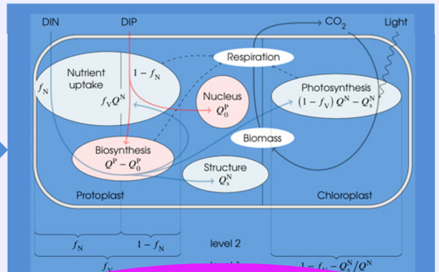
(from Capone and Knapp, 2007)

22. July 2013
OCB 2013 Summer Science Workshop, WHOI

Modelling responses in mesocosm food web succession to changes in nutrient stoichiometry



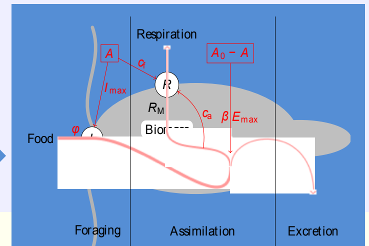
(Hauss et al., 2012, Franz et al., 2012)



(Pahlow et al., 2013)

Phytoplankton: Optimality based chain model

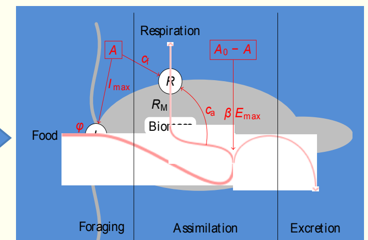
1) Nutrients (N) — Phytoplankton (P)



(Pahlow et al., 2010)

Zooplankton: Optimal current-feeding model

2) Nutrients (N) — Phytoplankton (P) — Herbivorous Zooplankton (Z)



(Pahlow et al., 2010)

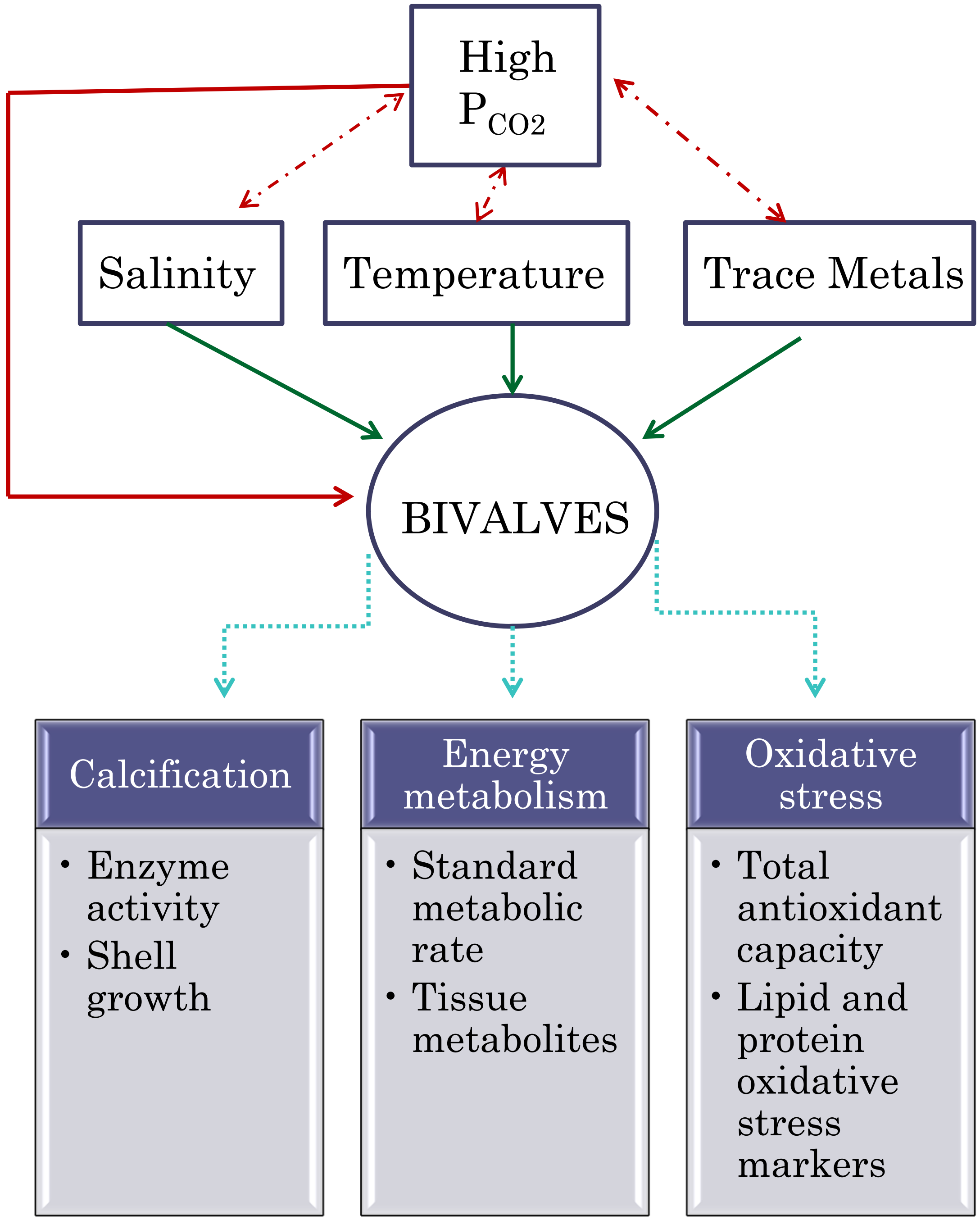
3) Nutrients (N) — Phytoplankton (P) — Herbivorous Zooplankton (Z) — Carnivorous Zooplankton (C)

Thank you!

Research Interests

INTERACTIVE EFFECTS OF OCEAN ACIDIFICATION AND MULTIPLE STRESSORS ON THE PHYSIOLOGY OF MARINE BIVALVES

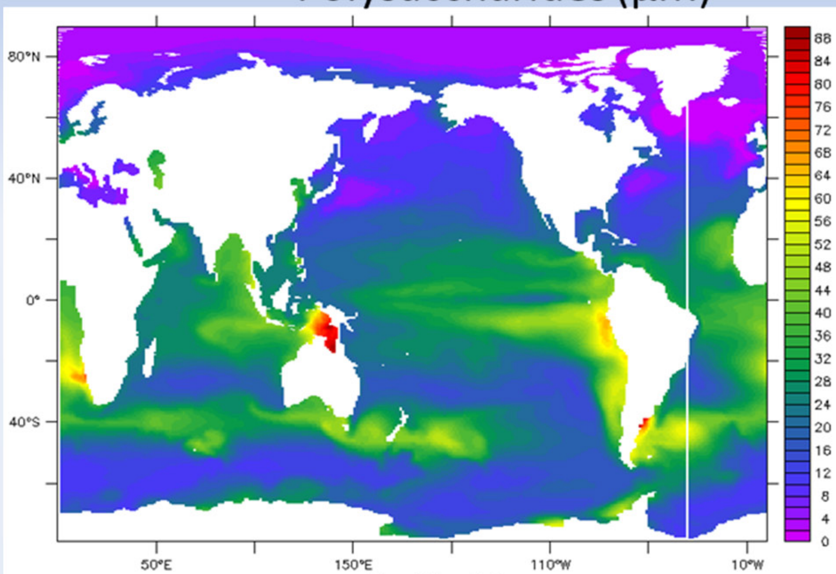
Omera Matoo
PhD candidate
Sokolova lab, Dept. of Biology
UNC, Charlotte


High
P_{CO2}
Salinity
Temperature
Trace Metals
BIVALVES
Calcification
• Enzyme activity
• Shell growth
Energy metabolism
• Standard metabolic rate
• Tissue metabolites
Oxidative stress
• Total antioxidant capacity
• Lipid and protein oxidative stress markers

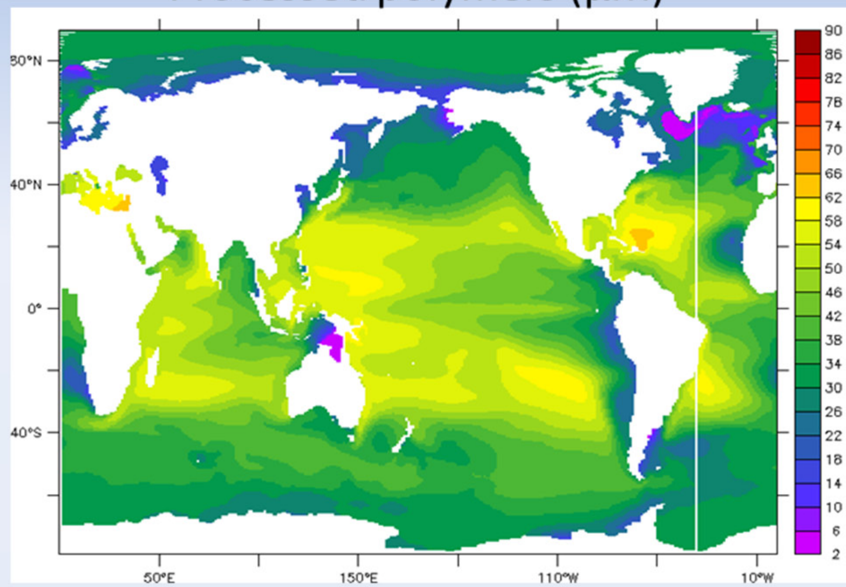
SIMULATION OF MARINE ORGANIC MACROMOLECULES - FEBRUARY

O. Ogunro, O. Wingenter, S. Burrows and S. Elliott

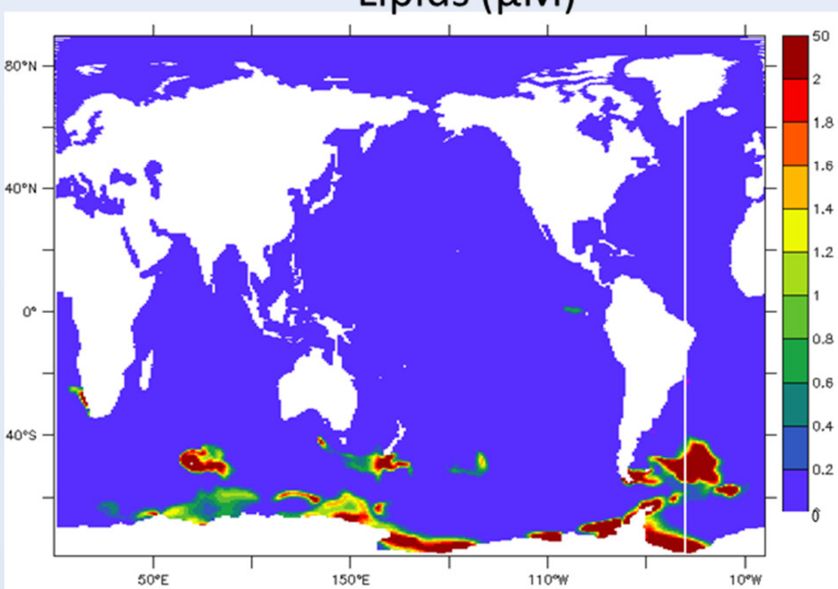
Polysaccharides (μM)



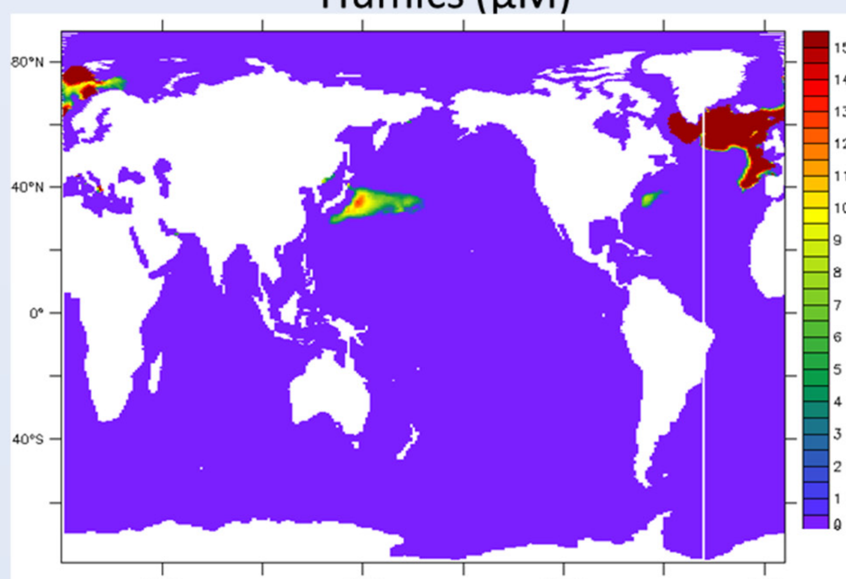
Processed polymers (μM)



Lipids (μM)

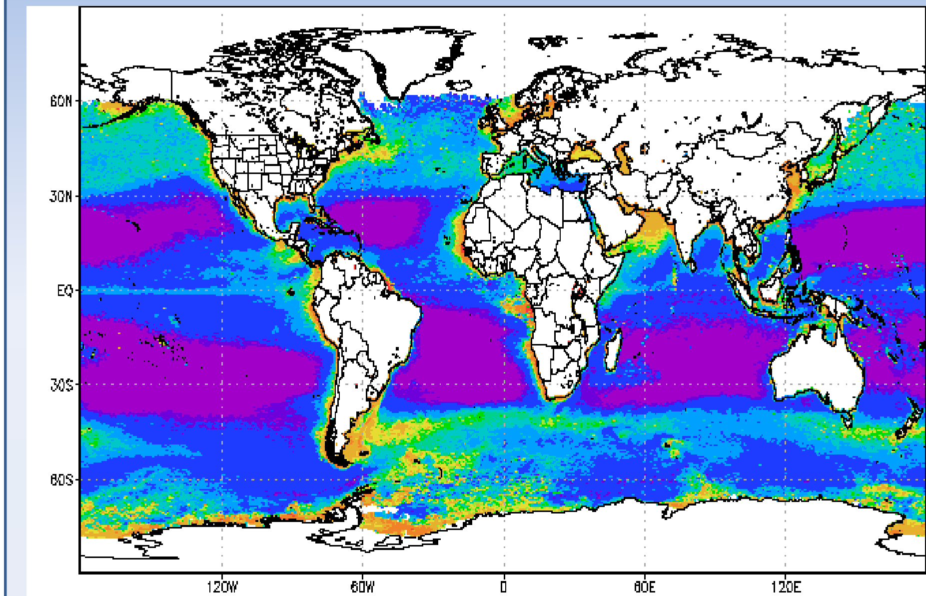


Humics (μM)

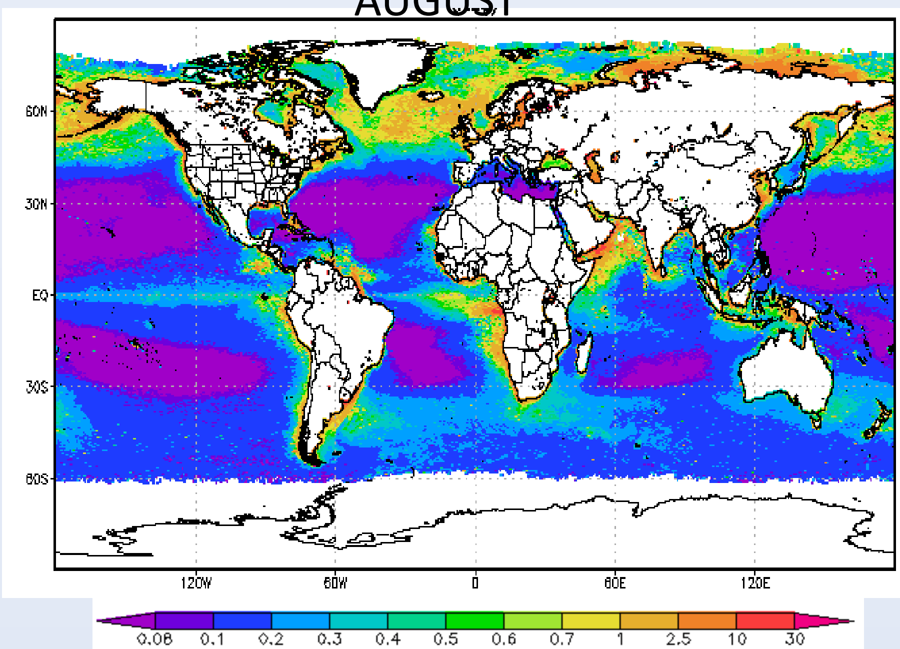


SeaWiFS Chlorophyll a concentration climatology (mg m^{-3})

FEBRUARY

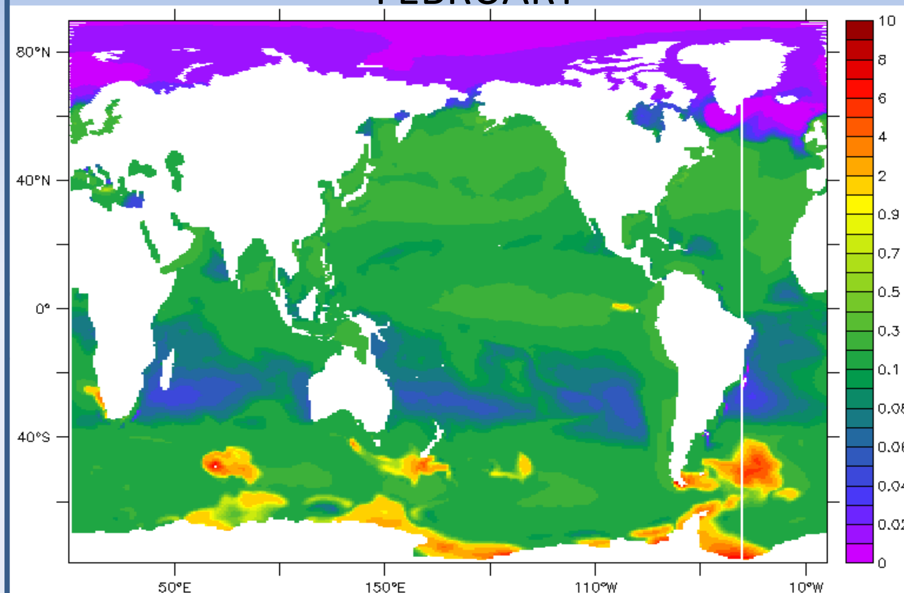


AUGUST

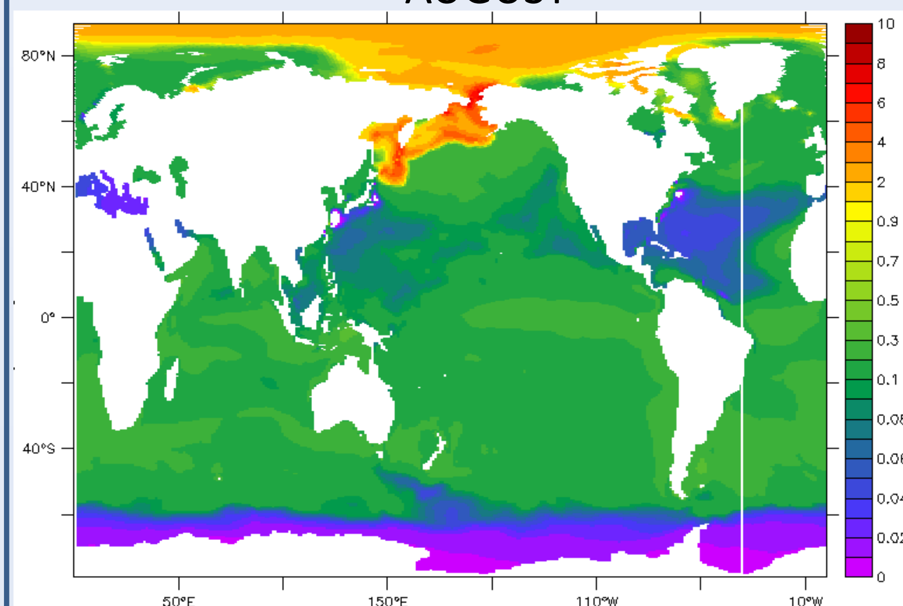


Chlorophyll Concentration from POP model (mg m^{-3})

FEBRUARY

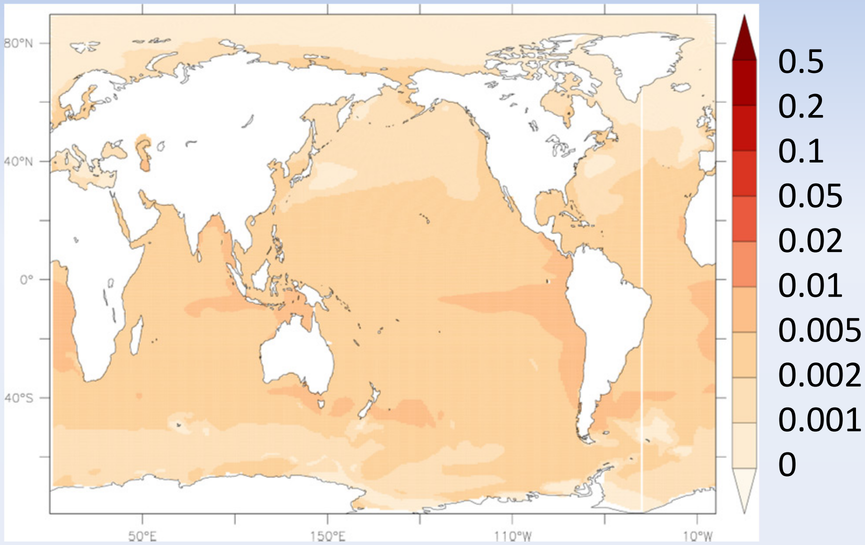


AUGUST

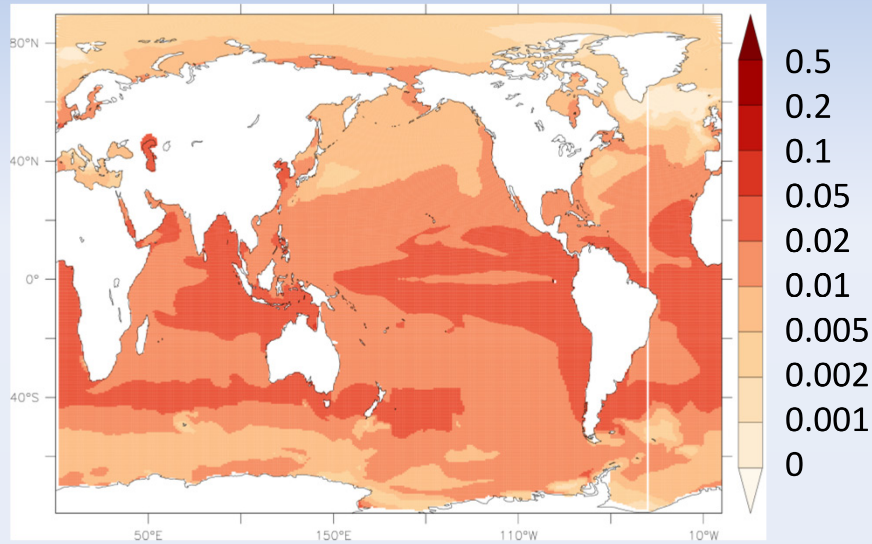


Chemically-resolved submicron sea spray aerosol organic mass fraction – February

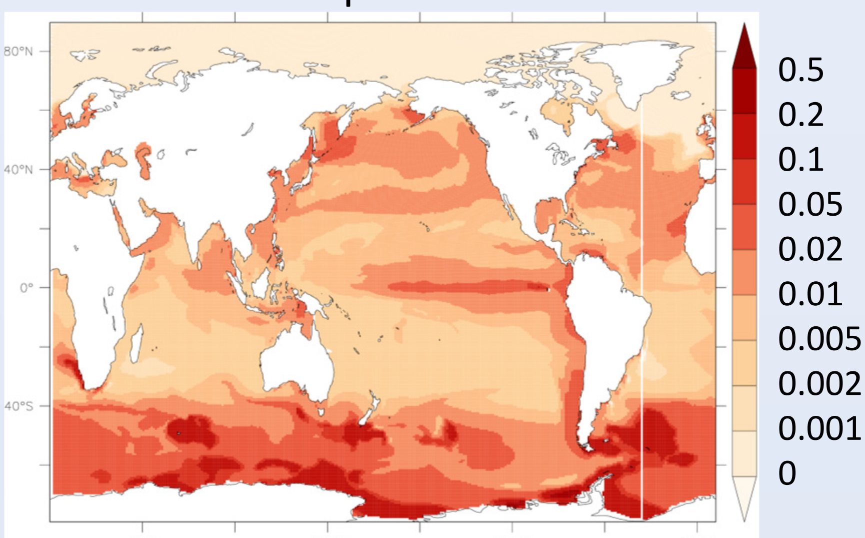
Polysaccharides



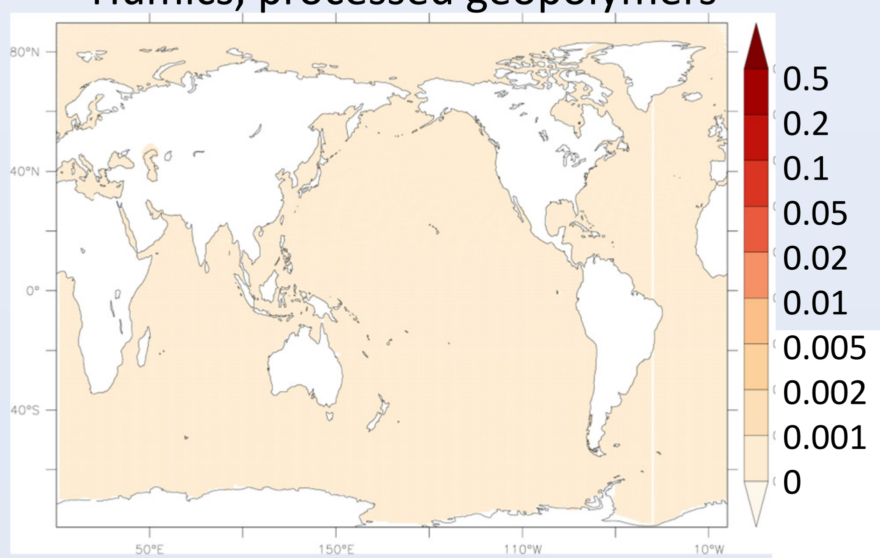
Proteins



Lipids



Humics, processed geopolymers



S. Burrows, et al., 2013, in prep.

Seasonal Nitrate Drawdown, Potential New Production (PNP) and Export Production (EP) for the Waters off the Western Antarctic Peninsula (WAP) Region

Marco Pedulli[1], James J. Bisagni[1], Hugh Ducklow[2], Robert Beardsley[3], Cynthia Pilskaln[4]

[1]School For Marine Science and Technology, UMass Dartmouth, 200 Mill Rd., Suite 325, Fairhaven, MA 02719
[2]Lamont-Doherty Earth Observatory, Columbia University, Palisades, NY 10964
[3]Department of Physical Oceanography, Woods Hole Oceanographic Institution, Woods Hole, MA 02543
[4]School For Marine Science and Technology, UMass Dartmouth, 706 Rodney French Blvd., New Bedford, MA 02744

Corresponding Author Email: mpedulli@umassd.edu

Research Approach:
1-D Analytical Model

$$PNP = \left[\frac{d}{dt}\int_{-Ze}^{0} NO_3 \; dz - Kz\frac{\partial NO_3}{\partial z}\,|_{-Ze}\right] x \; Redfield\ Ratio$$

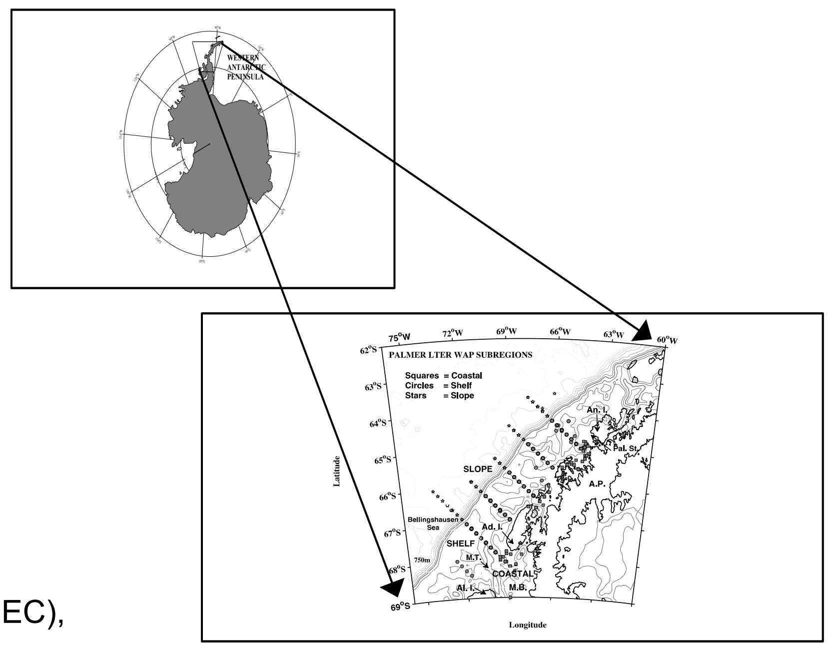
$$\text{Vertical nitrate flux} = Kz\left(\frac{\partial NO3}{\partial z}\right) \qquad \textit{Evaluated at } Z = Ze$$

Where: Ze = is the base of the euphotic layer, Kz = Vertical Eddy diffusivity and Redfield Ratio is the molar ratio between carbon and nitrogen (C:N), i.e. 6.625 (Bisagni 2003; Lance *et al*., 2012; Weston *et al*., 2013; Pedulli *et al*., in prep.).

Data:
NO_3, PAR, Kz, MLD, ^{14}C, Sediment Trap data

Palmer Long Term Ecological Research (LTER) Program,
US Southern Ocean Global Ocean Ecosystem Dynamics (US SO-GLOBEC),
Rothera Time-series (RaTS, BAS); BCO-DMO, Datazoo (UCSD)

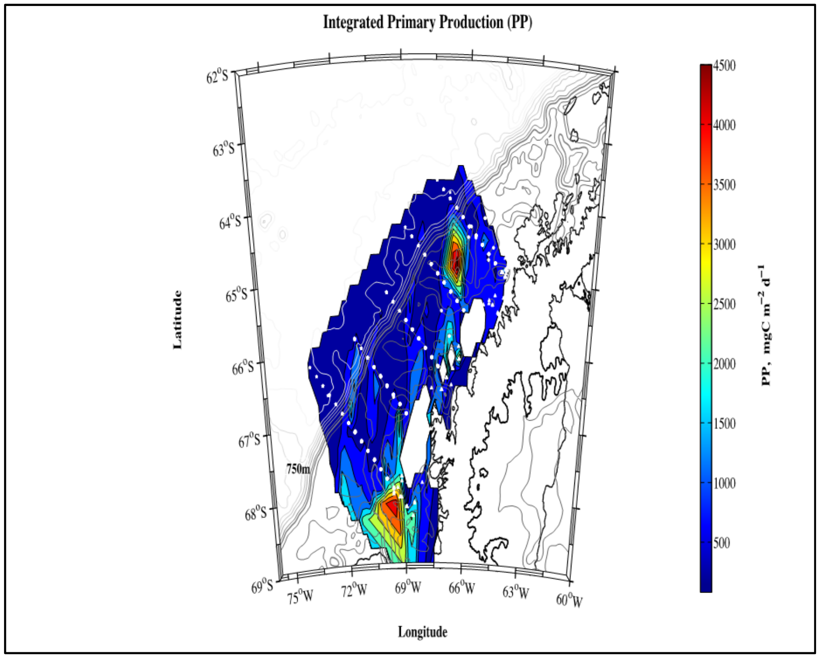
Study Site: Western Antarctic Peninsula (WAP) – Palmer LTER program sampling grid



Results: Pedulli *et al.*, in prep.

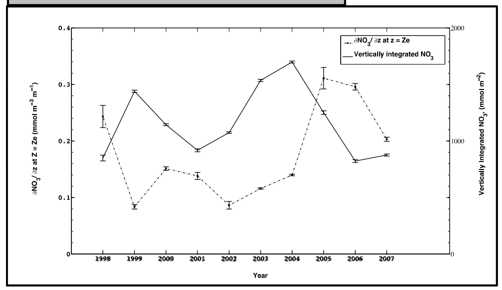
Please stop by our poster under: “Southern Ocean Processes” session

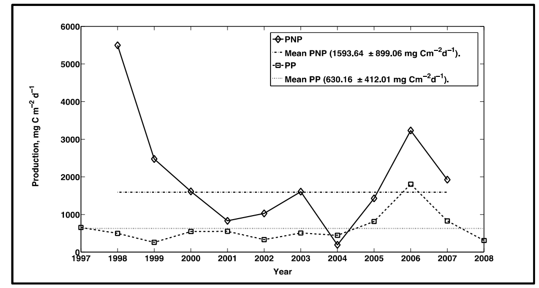
Spatial and Temporal Variability



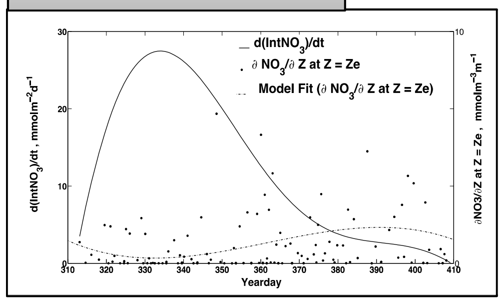
Sub-region	Mean PNP (mg C m^{-2} d^{-1})	Mean PP (mg C m^{-2} d^{-1})	Potential f-ratio
Coastal	2482.6	1080.6	2.3
Shelf	384.5	799.7	0.48
Slope	891.1	359.6	2.5

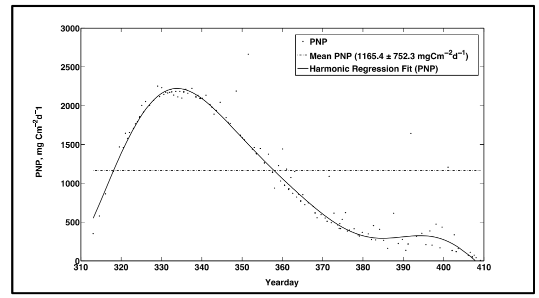
Inter-annual





Seasonal





Acknowledgements: NSF (OCE 0814391), SMAST (UMASS), Massachusetts Space Grant Consortium, Palmer LTER, US SO-GLOBEC, BAS

Special thanks go to Maria Vernet, Oscar Schofield, Walker Smith, Mike Dinniman, Andrea Piñones, Andrew Thomas, Hugh Venables, Mike Meredith and Eileen Hofmann for contributing data and/or discussions and input for this study.

Université du Québec à Rimouski
Institut des sciences de la mer de Rimouski

Université du Québec à Rimouski
Institut des Sciences de la Mer de Rimouski

Photo-oxydation of dissolved organic matter:

Implications for carbon, nitrogen and sulphur cycling in the Arctic Ocean

Abderrahmane TAALBA
Ph.D Student

UQAR ISMER
Université du Québec à Rimouski
Institut des sciences de la mer de Rimouski

TAALBA A.
Ph.D Student

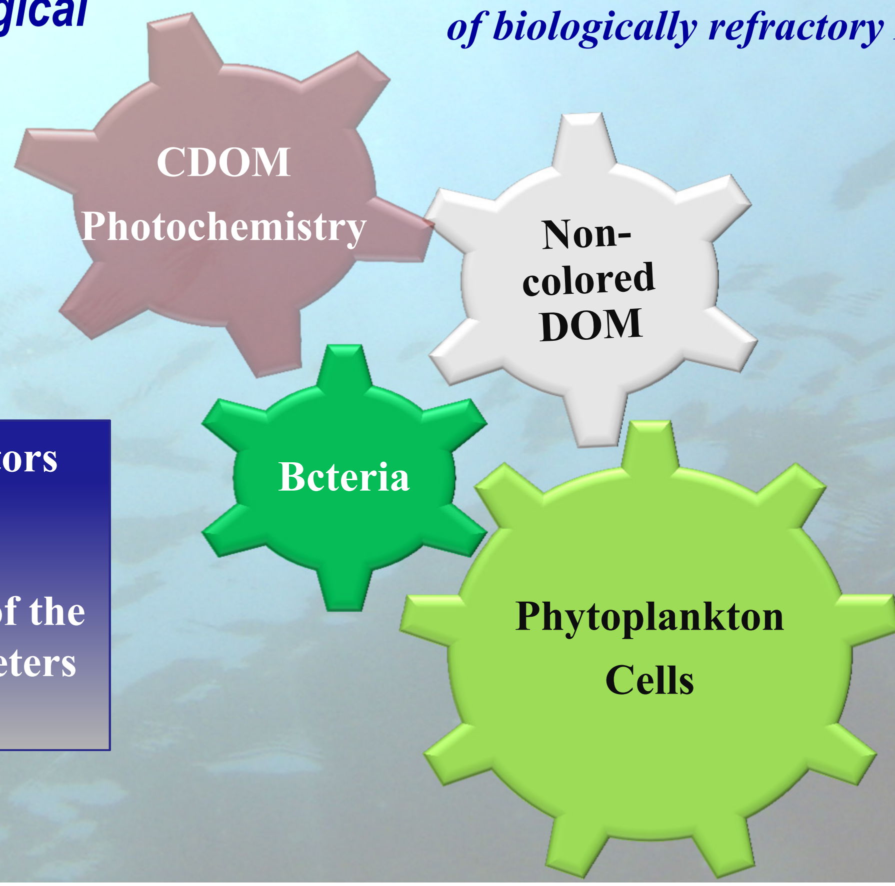
The most relevant light-absorbing substance in surface waters

CDOM

Coastal and estuarine areas:
CDOM essentially of terrestrial origin

Photo-transformation is a major control on the fate of biologically refractory DOM

Significant contribution to the ecological and biogeochemical cycling

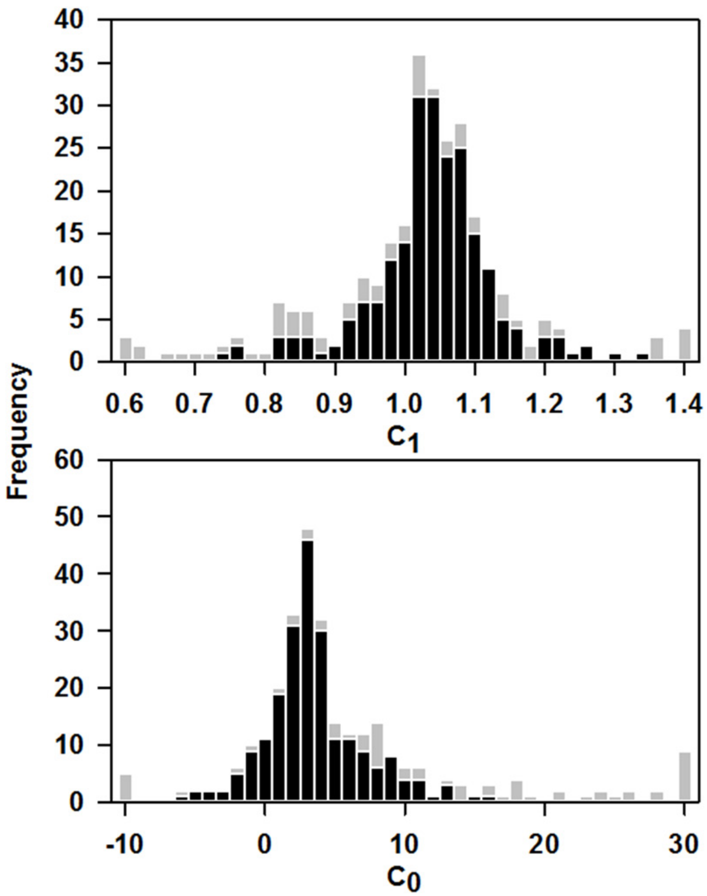


What would be the most important factors controlling photochemical processes:

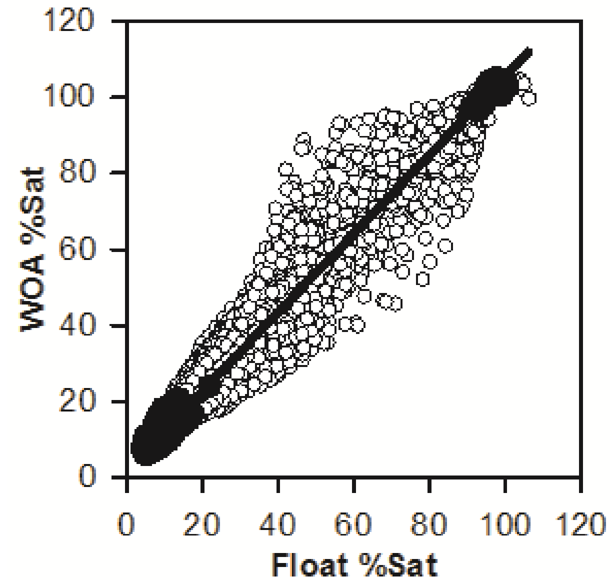
Investigate on the effects of the origin of the DOM *Vs* the physical/chemical parameters of the waters?

A Climatology-Based Quality Control Procedure for Profiling Float Oxygen Data (JGR in Review)

Yuichiro Takeshita, Todd R. Martz, Kenneth S. Johnson, Josh N. Plant, Denis Gilbert, Stephen C. Riser, Craig Neill, and Bronte Tilbrook



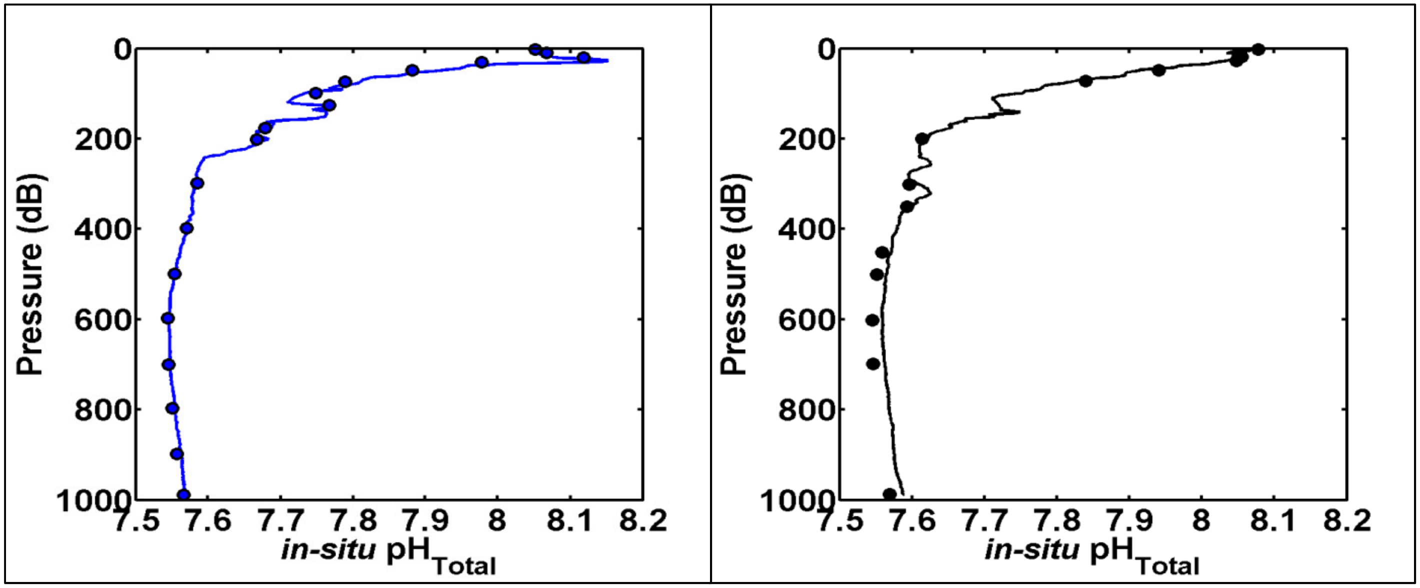
Histogram of the correction coefficients for all of the floats.

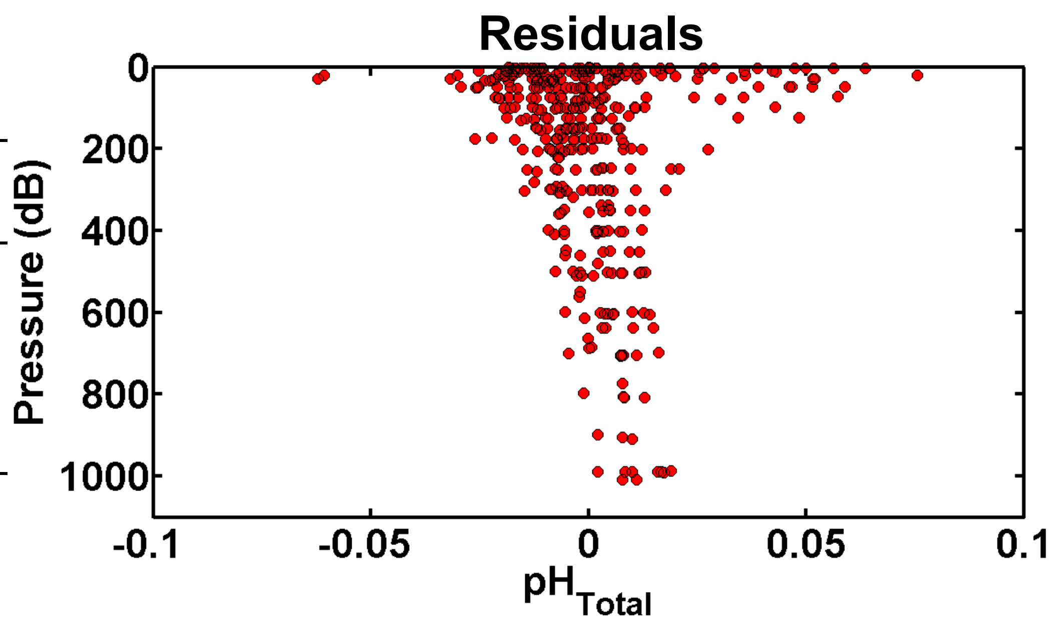


$$O_2' = O_2 \times c_1 + c_0$$

- Method validated using 14 profiling floats with corresponding discrete samples.
- Two methods agree to 2-3%Sat at surface

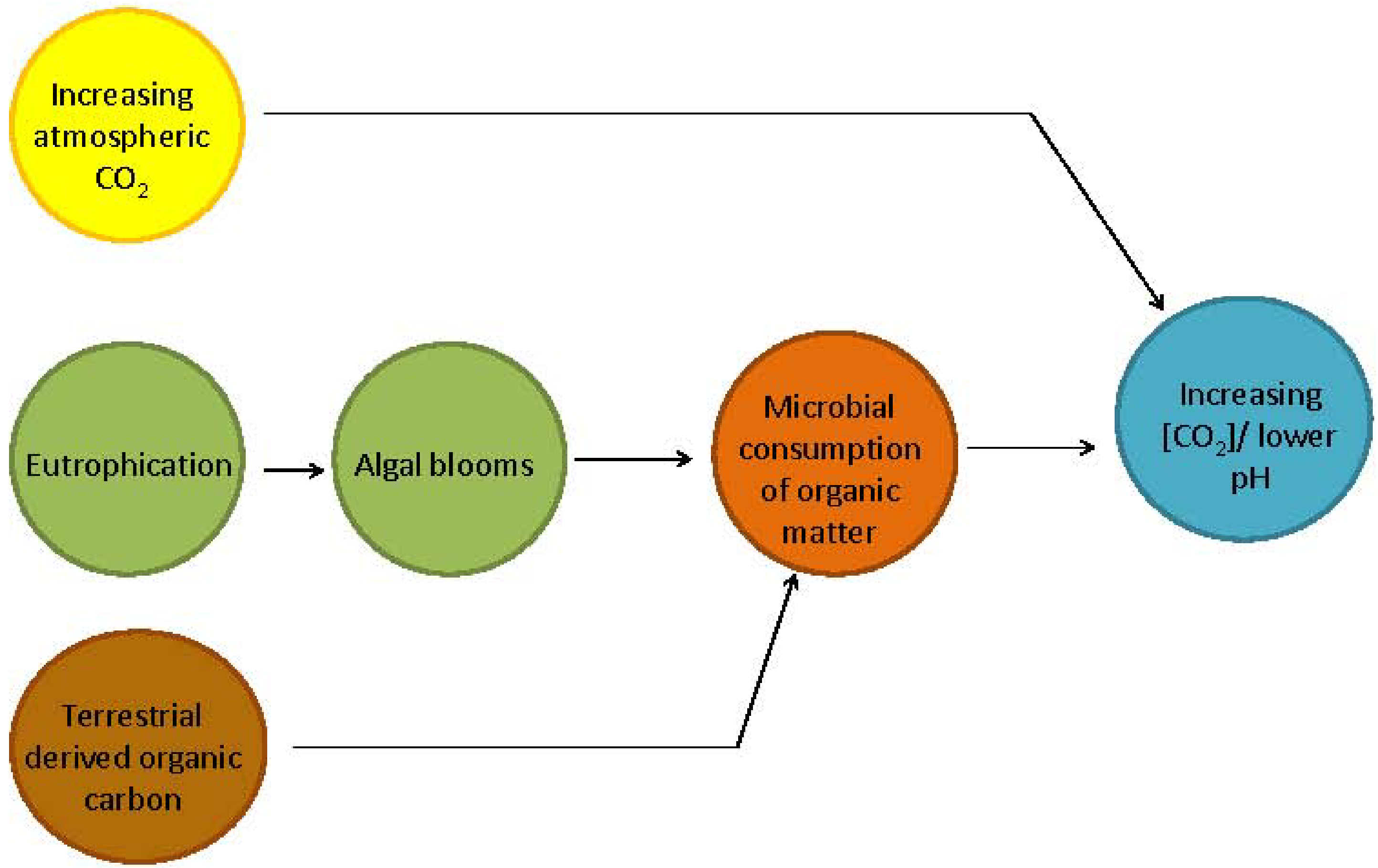
Deep Sea Durafet: At-sea Tests Results





Mean ± s.dev (n)	
All Depths	0.000 ± 0.019 (383)
> 50m	0.000 ± 0.011 (258)
> 100m	0.001 ± 0.009 (206)

- **Inorganic Coastal Carbon Dynamics**: my master thesis research focused on:



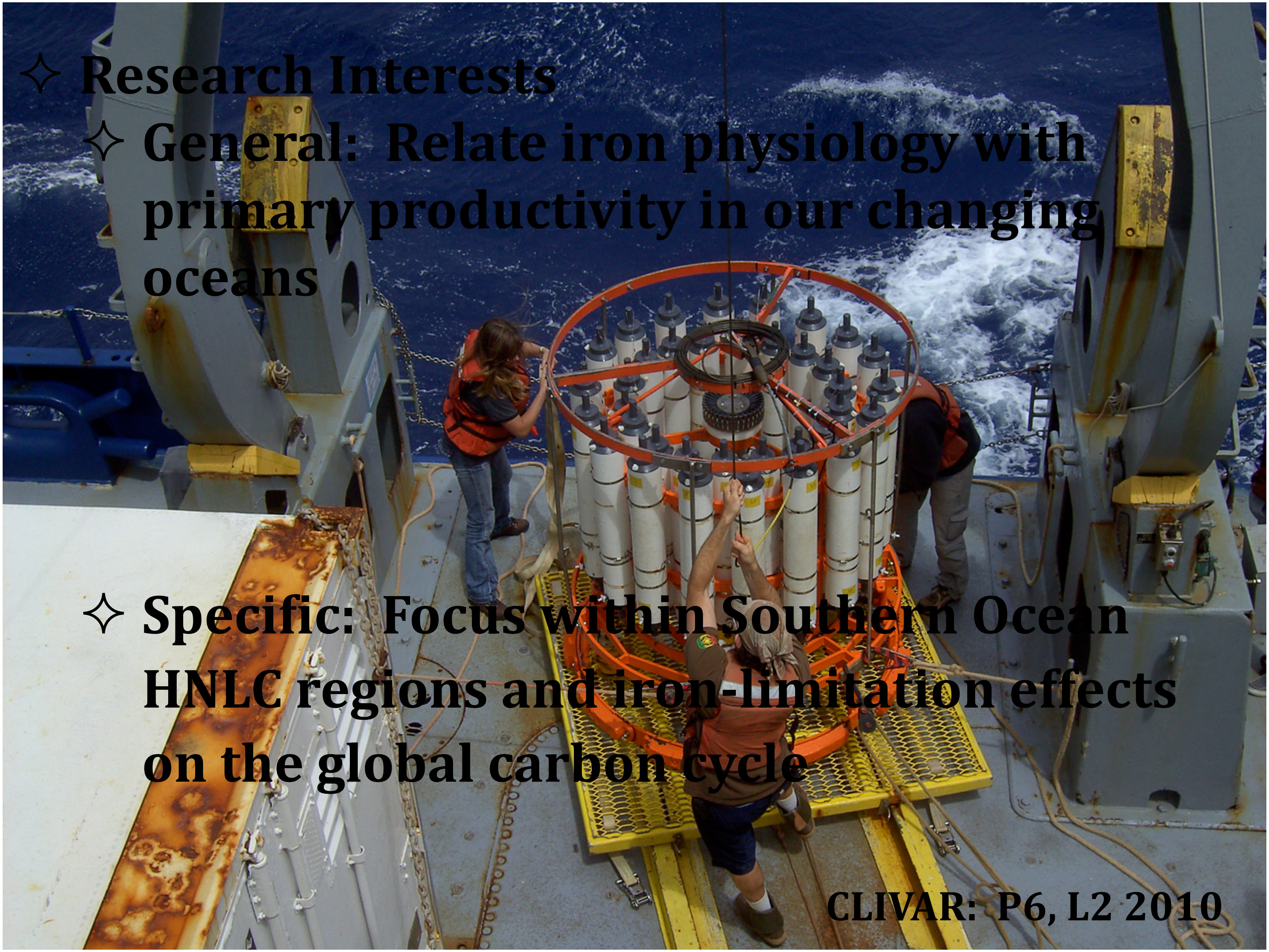
- My current research interests lie on using isotope biogeochemistry to elucidate oceanic methane dynamics.
  - I am interested on understanding the effect of methane gas hydrate dissociation on the oceanic inorganic carbon cycle and its potential for outgassing of greenhouse gases to atmosphere.

Hannah Traggis
University of New Hampshire

Phytoplankton Physiology

Iron limitation of antioxidant systems

- Current research
  - Iron-containing proteins and enzymes involved in photosynthesis and antioxidant defense systems
  - Ascorbate Peroxidase
    - Mehler Reaction
  - FeSOD vs MnSOD
  - Catalase
  - Ferredoxin/flavodoxin



- Research Interests
  - General: Relate iron physiology with primary productivity in our changing oceans
  - Specific: Focus within Southern Ocean HNLC regions and iron-limitation effects on the global carbon cycle

CLIVAR: P6, L2 2010