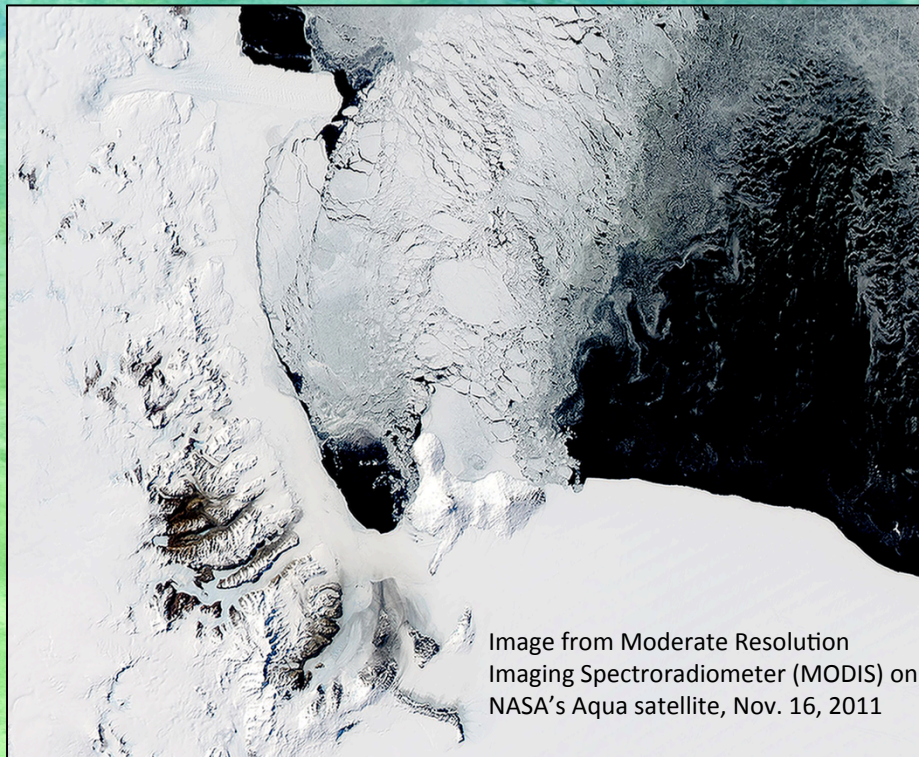


Daniel Kaufman

Marjorie Friedrichs, Walker Smith, Eileen Hofmann, Michael Dinniman, John Hemmings

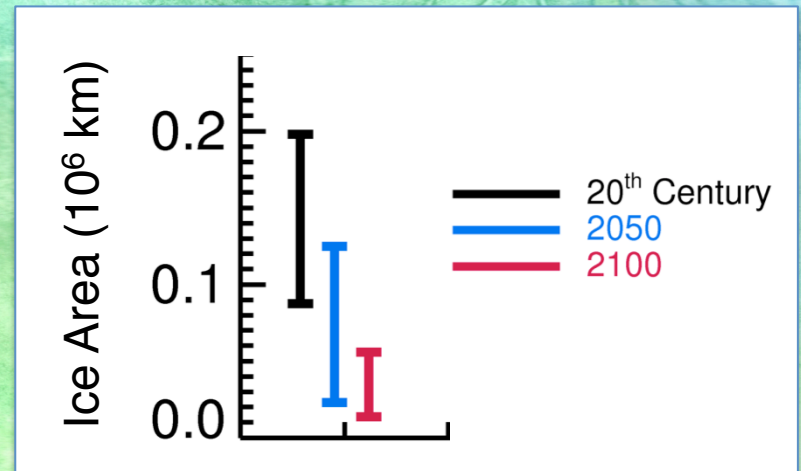
The Ross Sea, Antarctica

- Annual phytoplankton bloom
- High primary productivity



Objective

To determine how phytoplankton productivity and carbon export in the Ross Sea, Antarctica, may be affected by future climate-induced changes in temperature, mixing, and sea ice

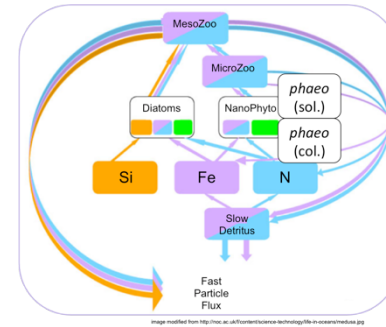


Glider observations



- CTD, bio-optic sensors
- 78 days, 571 dives

Data Assimilative Model



Productivity
Increases



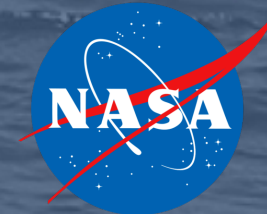
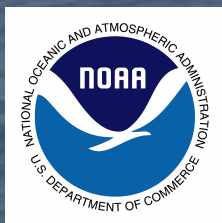
- What about export?
- Which physical factors drove the simulated increase?
- Different phytoplankton groups?

Plenary Session 5. Our autonomous future

Combining bio-optical glider observations and biogeochemical modeling to examine potential Ross Sea phytoplankton changes in the 21st century

Daniel Kaufman

Marjorie Friedrichs, Walker Smith, Eileen Hofmann, Michael Dinniman, John Hemmings



College of Earth, Ocean,
and Atmospheric Sciences

Observing the carbon cycle in the Southern Ocean using biogeochemical Argo floats equipped with pH

(poster this afternoon)

Nancy Williams

Laurie Juranek, Richard Feely, Ken Johnson, Jorge Sarmiento,
Lynne Talley, Andrew Dickson, Alison Gray, Rik Wanninkhof,
Joellen Russell, Steve Riser, and Yui Takeshita (*Global
Biogeochemical Cycles*, 2017)



SOCCOM
Unlocking the mysteries of the Southern Ocean

Southern Ocean Carbon and Climate Observations and Modeling

The Southern Ocean plays a major role in the ocean's uptake of heat and carbon yet it is relatively undersampled and not well-represented in models

The plan:

- 200 biogeochemical Argo floats over 5 years in the Southern Ocean
- floats equipped with pH, nitrate, oxygen, chlorophyll, backscatter, CDOM
- ice-enabled floats = under ice data!

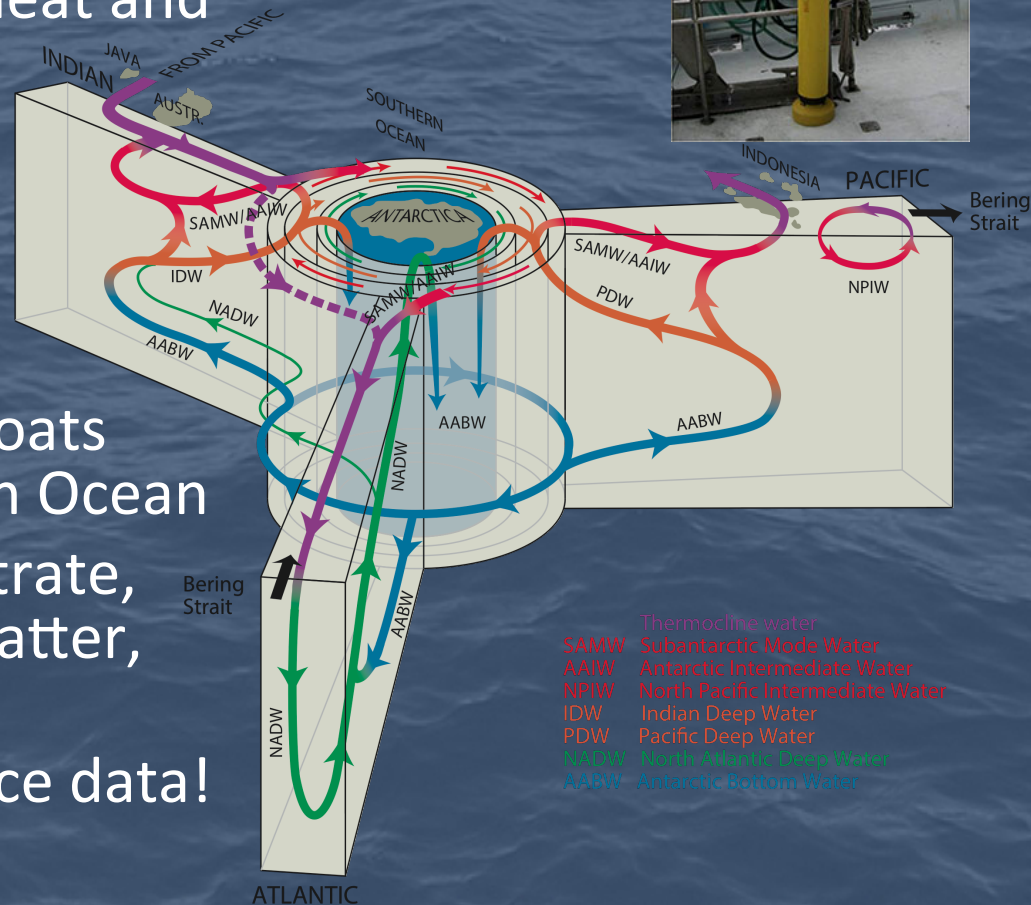


figure from Talley (*Oceanography*, 2013)



SOCCOM

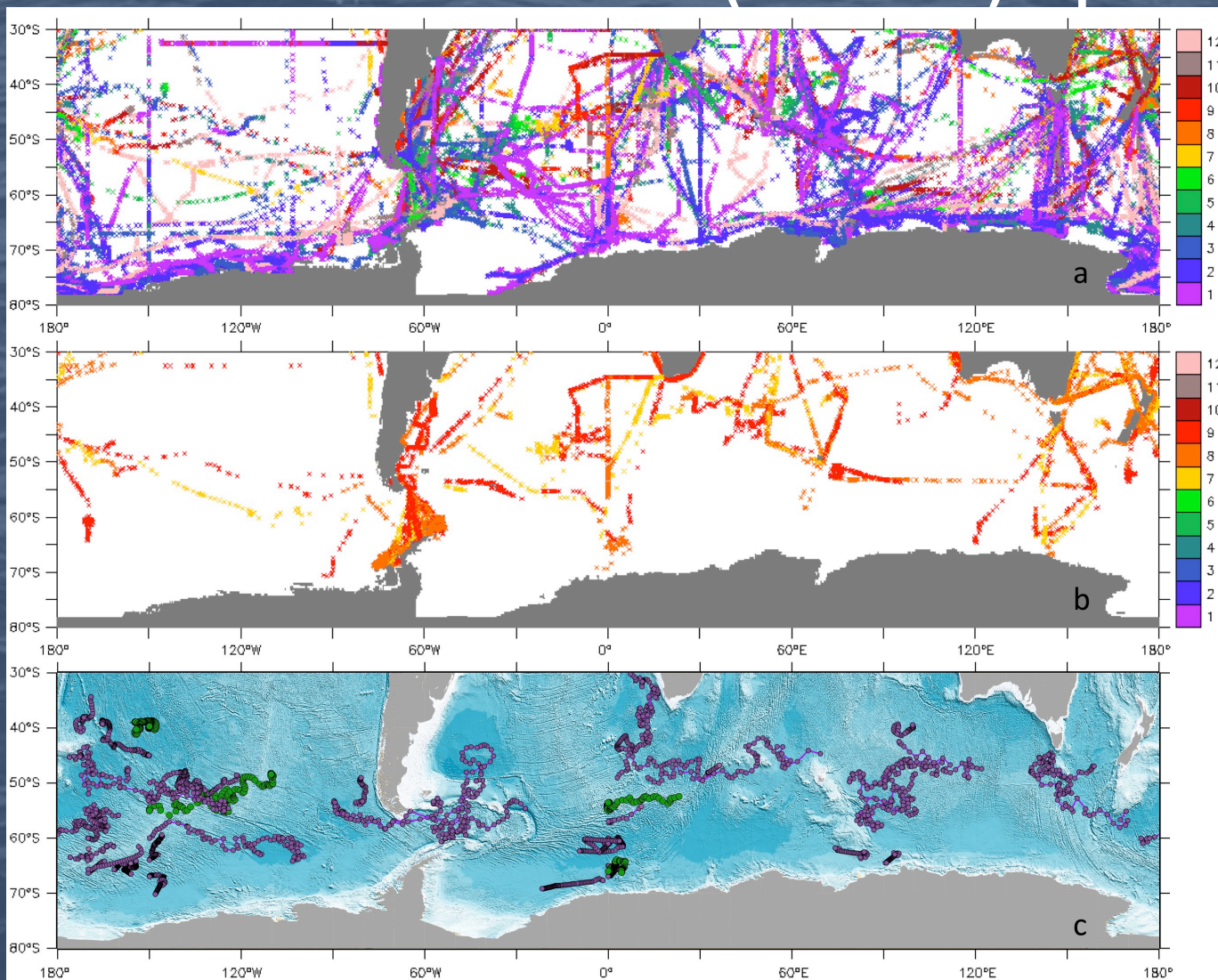
Unlocking the mysteries of the Southern Ocean

Wintertime data are (were?) sparse

All SOCAT data
EVER

Austral winter
(July, August,
September)

SOCCOM floats



A microscopic view of marine particles, showing various small, brownish, and fibrous structures against a dark blue background. The particles are scattered across the frame, with some appearing as small clumps and others as thin, hair-like fibers.

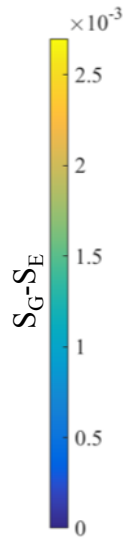
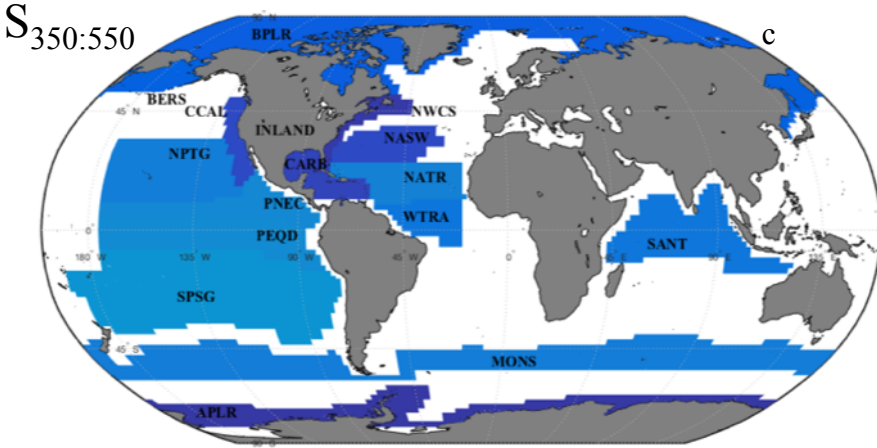
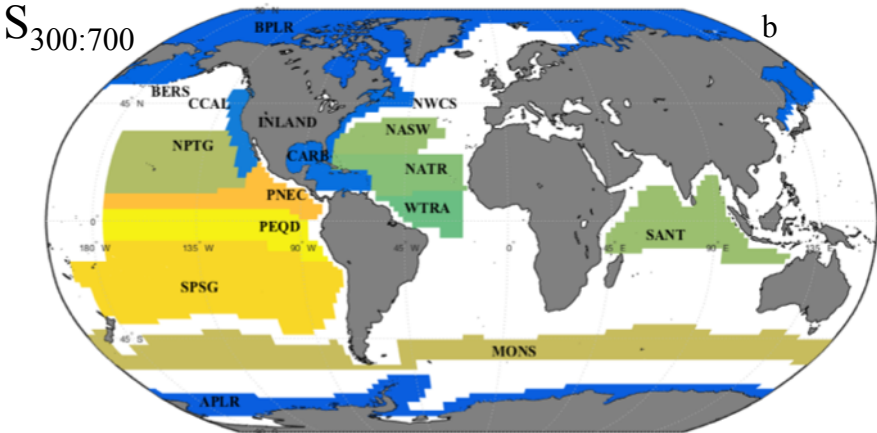
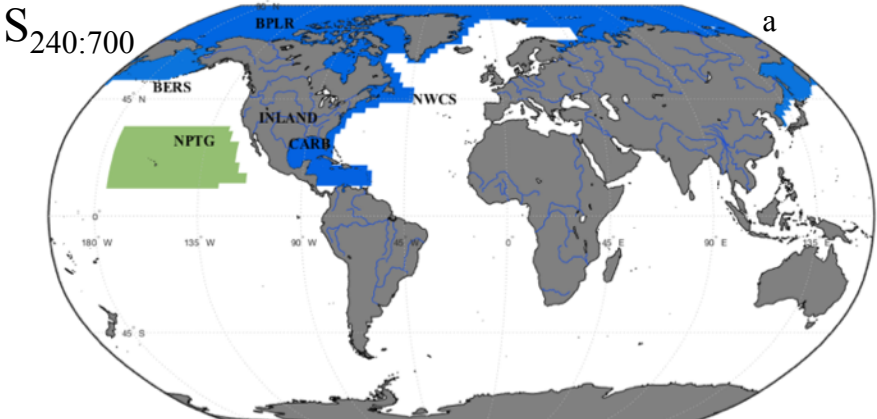
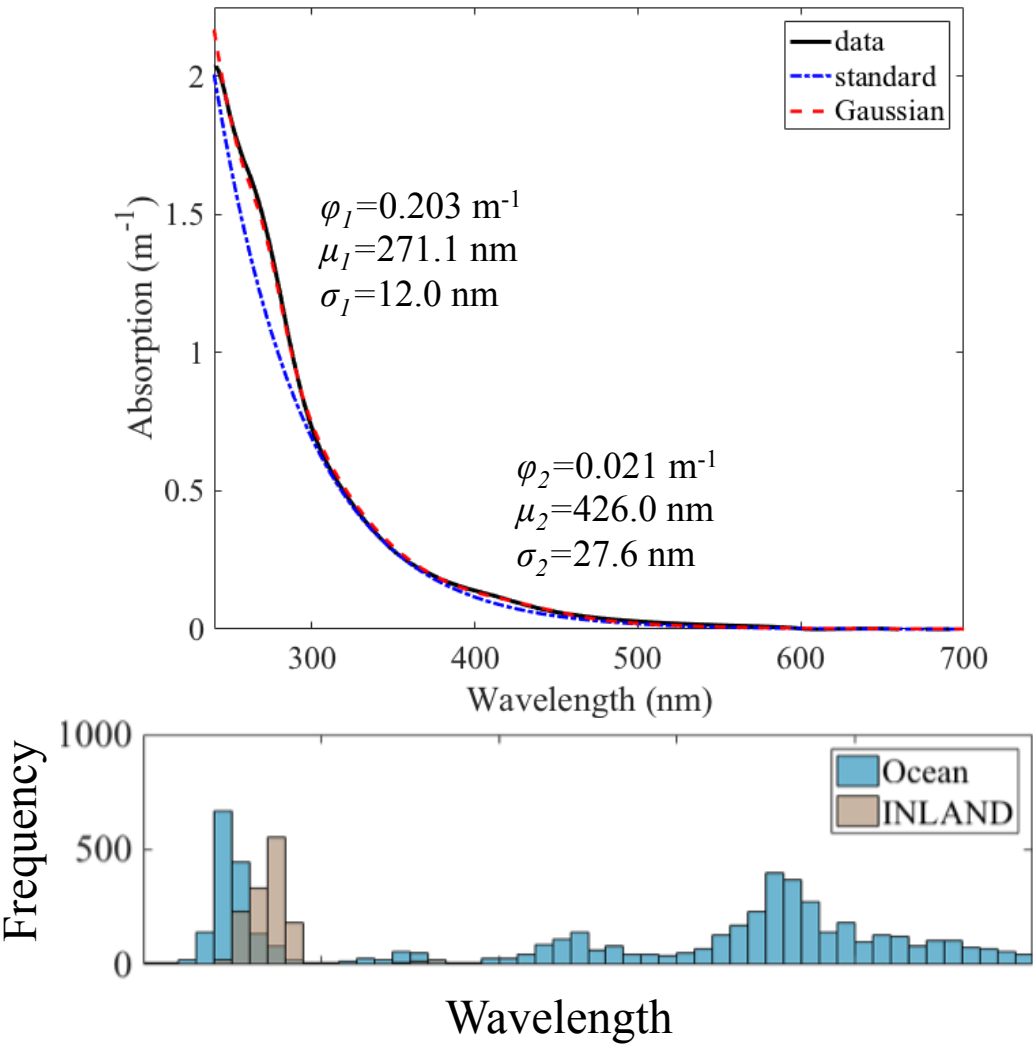
Marine Particles through Virtual Reality

**Assessment of holographic microscopy for
quantifying marine particles**

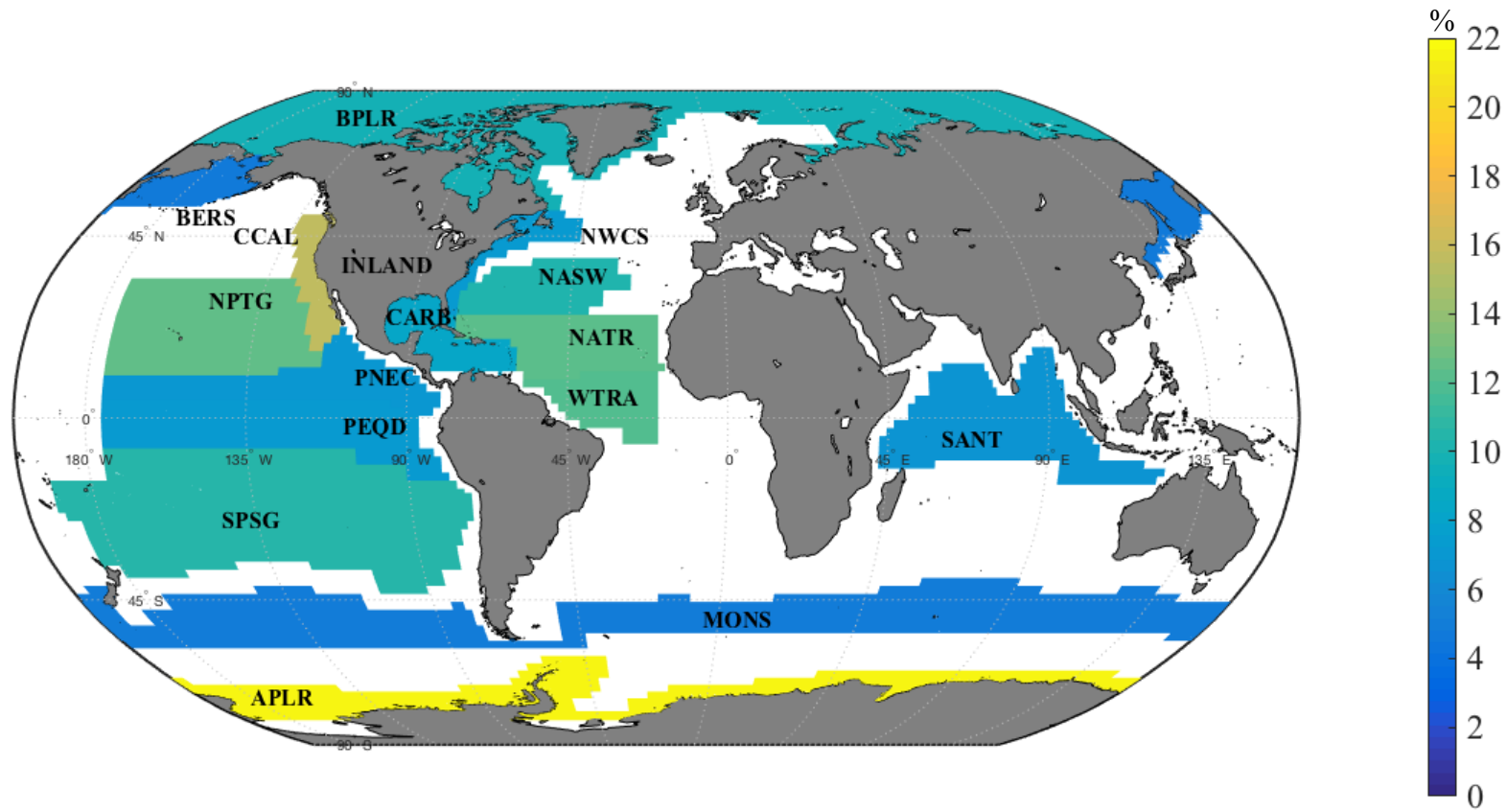
Noah Walcutt (URI)

Optically estimating CDOM composition across diverse spectral ranges

Brice Grunert



Percent Error $a_{\text{CDOM}}(412)$



$$a_{\text{CDOM}}(412) = a_{\text{CDOM}}(443) e^{-0.0154(412 - 443)}$$

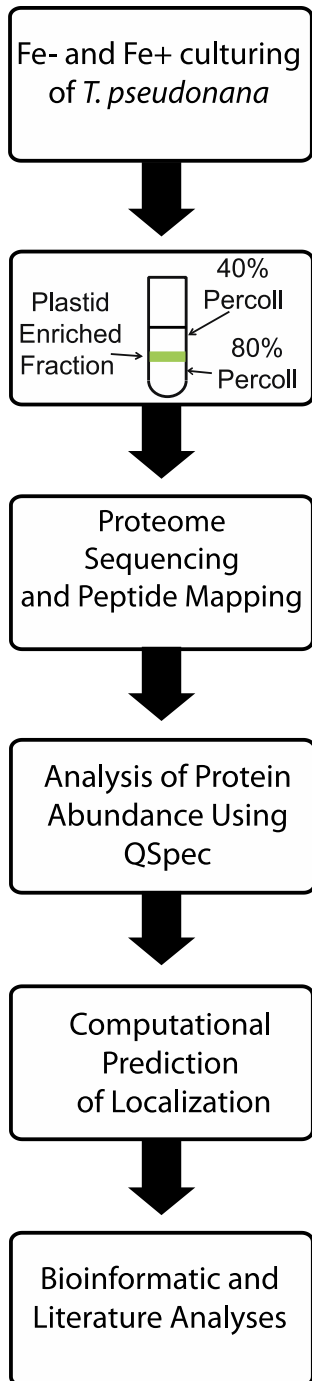
$$\frac{a_{\text{CDOM}}(412_{\text{observed}}) - a_{\text{CDOM}}(412_{\text{estimated}})}{a_{\text{CDOM}}(412_{\text{observed}})} \cdot 100$$

Subcellular proteomics for determining iron limited remodeling of plastids in diatoms

Kristofer Gomes

Jenkins lab

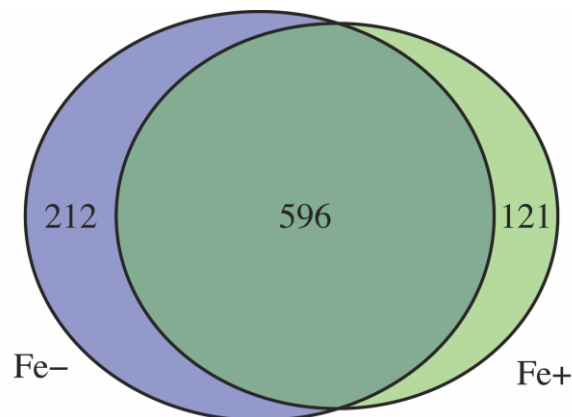
University of Rhode Island



- Investigating plastid (chloroplast) protein content using enriched organelle fractions from the diatom species *Thalassiosira pseudonana*
- Culturing under iron (Fe) limited and replete conditions has allowed for the determination of how the diatom chloroplast responds to Fe limitation

Subcellular proteomics for determining iron limited remodeling of plastids in diatoms

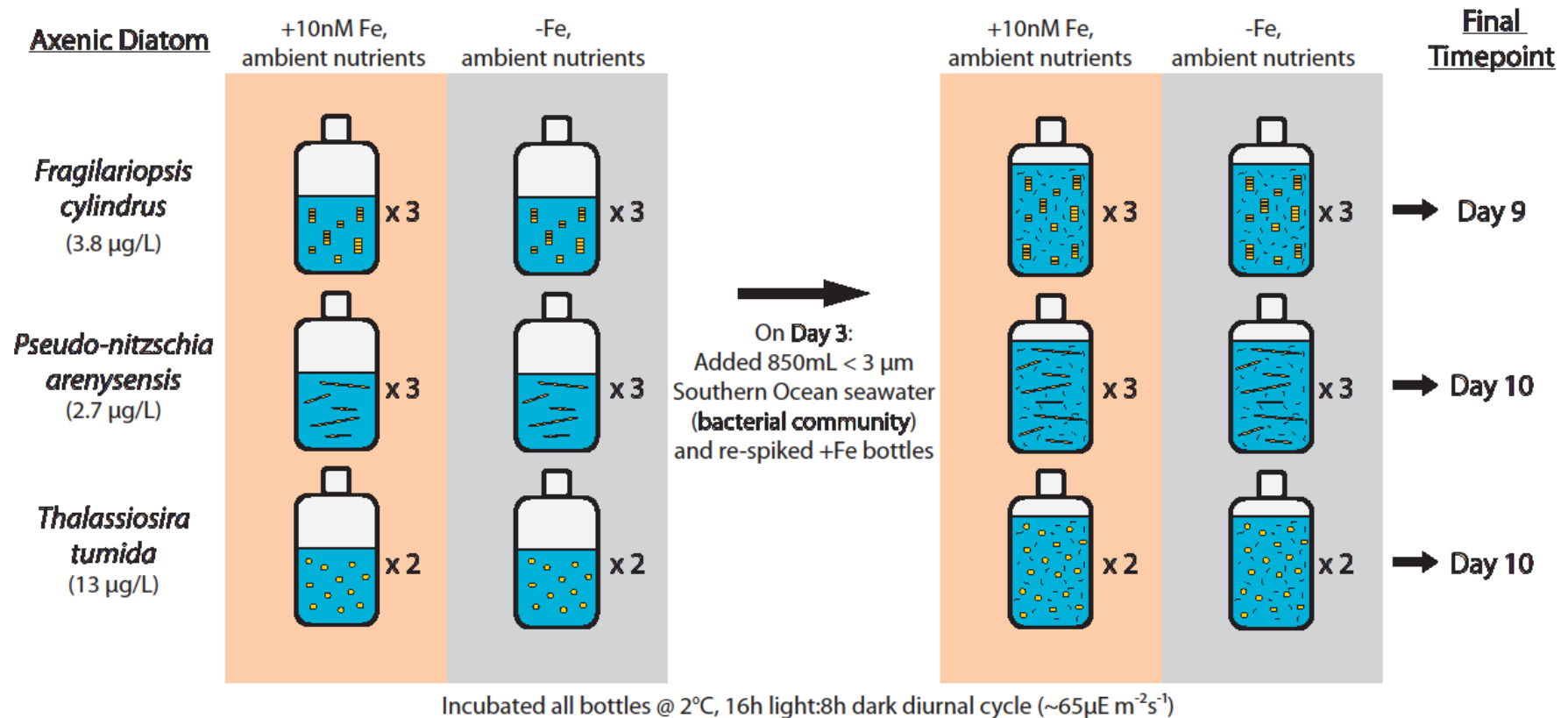
- Chloroplast protein content contains 929 proteins between both Fe limited and replete conditions.
- 596 proteins are shared within both Fe limited and replete conditions, representing the potential core diatom chloroplast protein content.
- Diatom chloroplast proteins exhibit changes in expression under Fe limitation
 - Alteration in rates of photosystem protein recycling
 - Regulation of light harvesting complex proteins and non-photochemical quenching



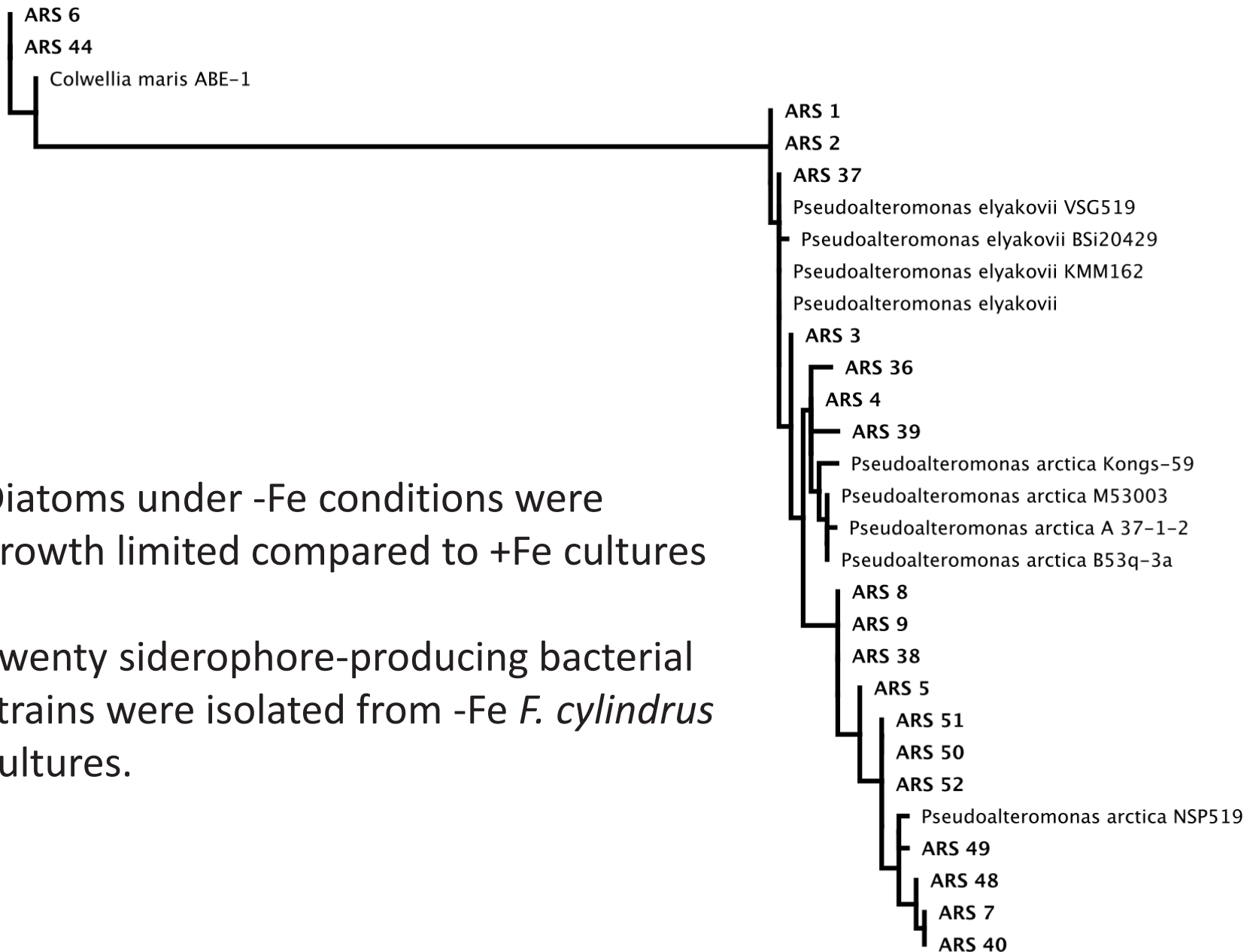
Comparison of bacteria recruited by axenic Southern Ocean diatoms under Fe stress

Laura Filliger (Jenkins Lab, University of Rhode Island)

SO diatoms may uptake bacterially-produced organic ligands (siderophores) bound to Fe.



- Do Fe-stressed diatom recruit distinct bacterial communities?
- Are the recruited bacteria producing siderophores?



- Diatoms under -Fe conditions were growth limited compared to +Fe cultures
- Twenty siderophore-producing bacterial strains were isolated from -Fe *F. cylindrus* cultures.

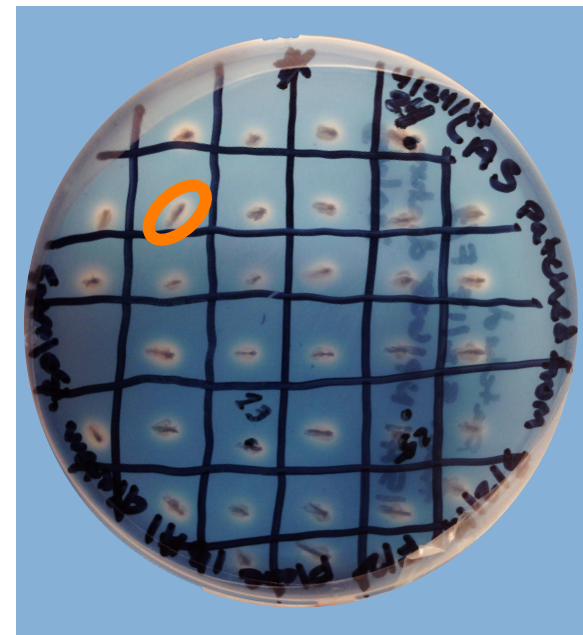
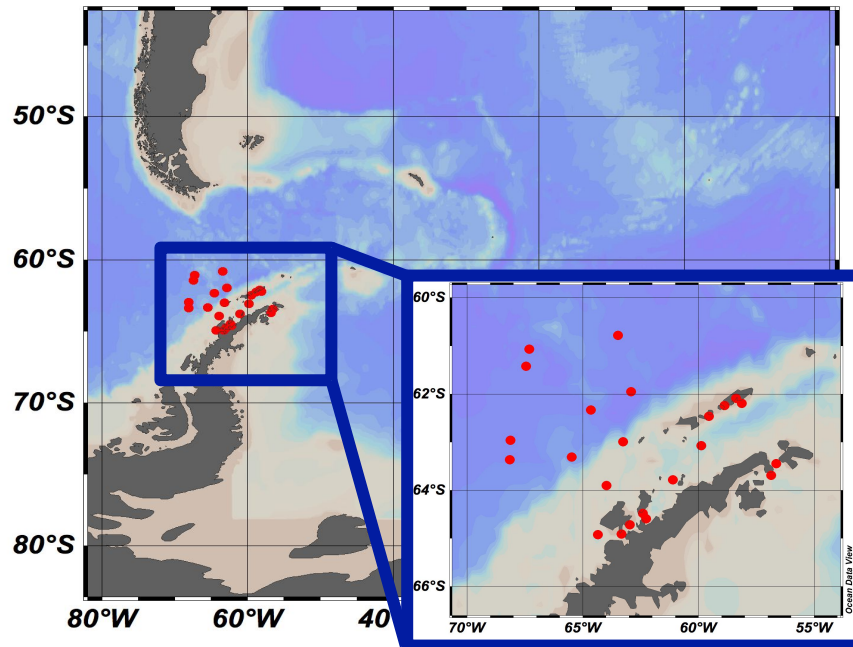
0.02

Assessing bacteria as potential enhancers of iron availability for Southern Ocean diatoms

Alexa Sterling

University of Rhode Island, Jenkins lab

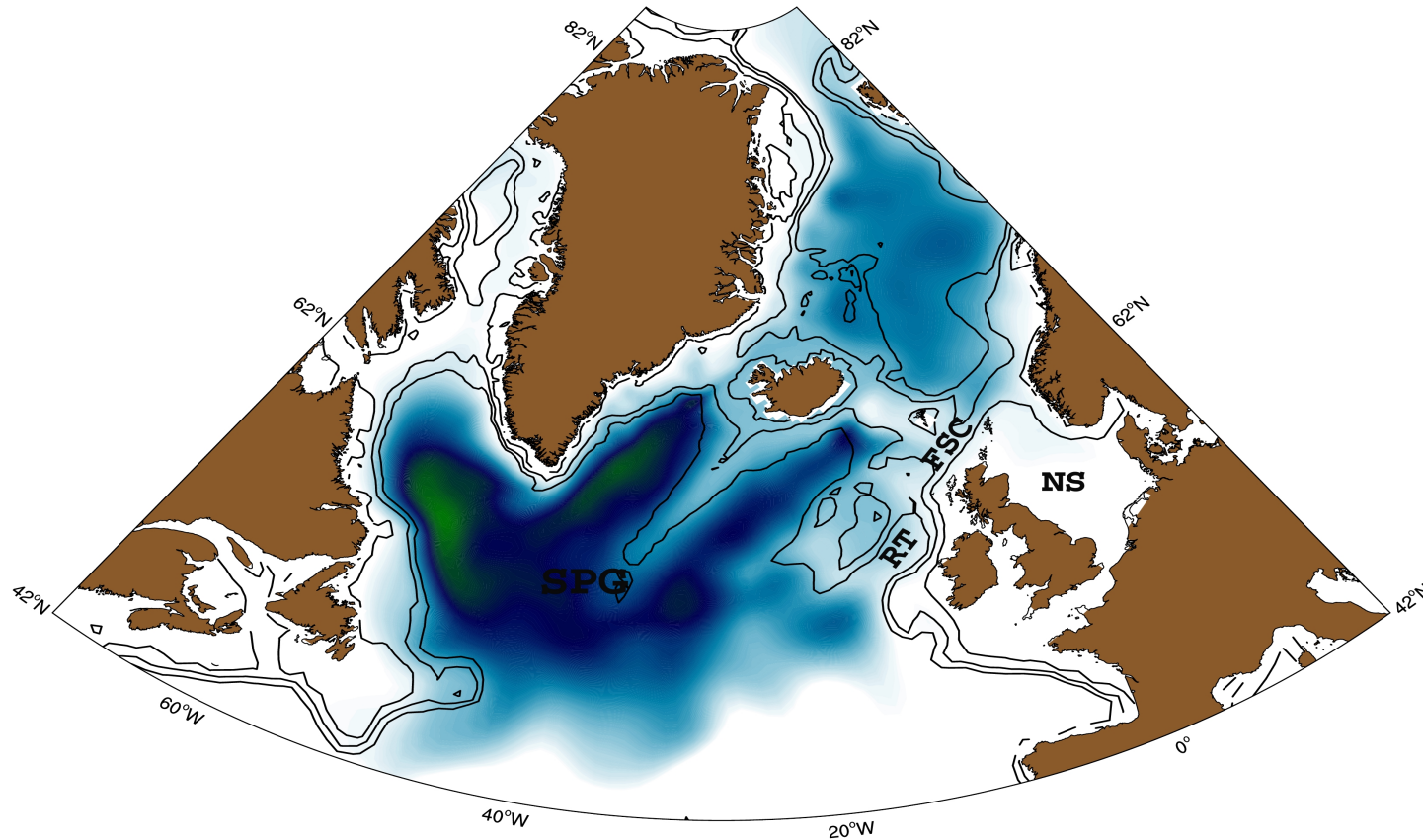
asterling@uri.edu



- Diatom-associated and free-living bacteria isolated
- Chrome Azul S (CAS) plates to screen bacteria for siderophore production
- Diverse Gammaproteobacteria identified

Atlantic Inflow to the North Sea Modulated by the Subpolar Gyre: A Potential Oceanic Influence on North Sea Marine Ecosystems?

Vimal Koul (Universität Hamburg and IMPRS-ESM, Germany)



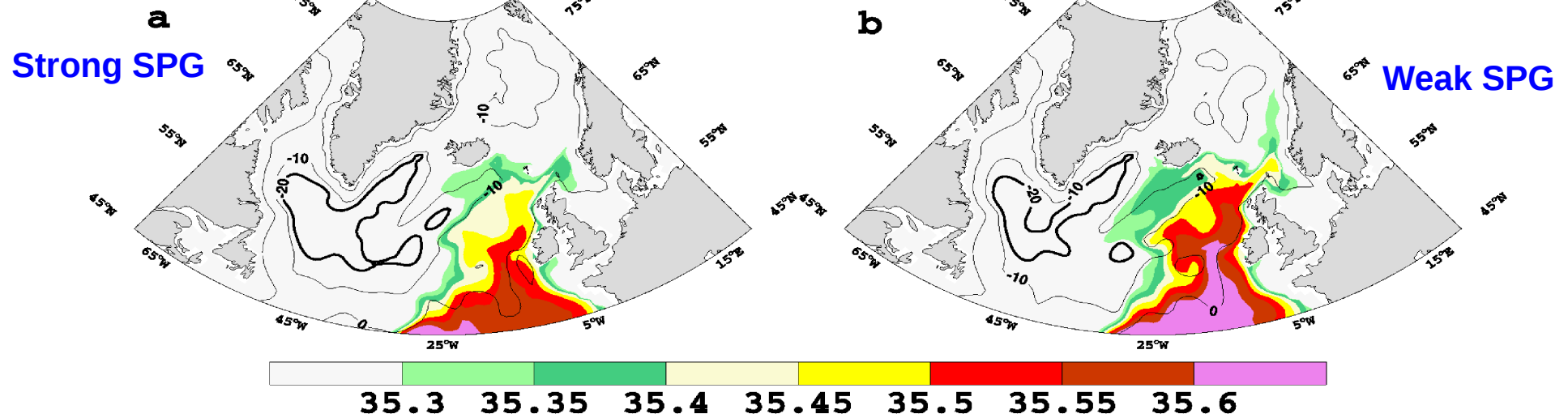
Reid et al 2003: Periodic changes in the zooplankton of the north sea during the twentieth century linked to oceanic inflow.

Holliday et al 2001: Is there a connection between high transport of water through the rockall trough and ecological changes in the north sea?

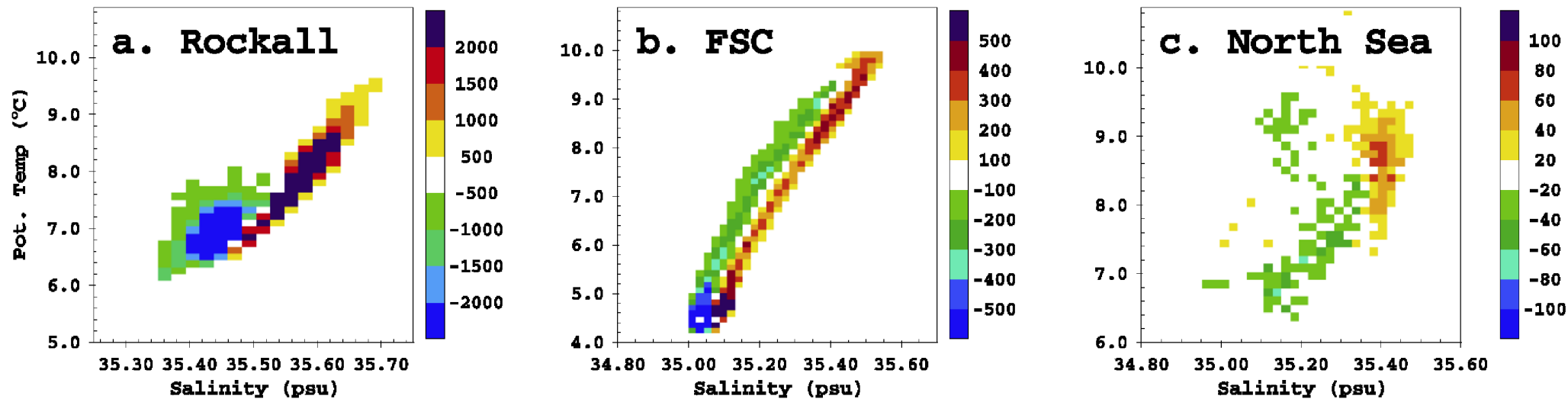
Holt et al 2014 : Oceanic controls on the primary production of the northwest european continental shelf: model experiments under recent past conditions and a potential future scenario.

Atlantic Inflow to the North Sea Modulated by the Subpolar Gyre

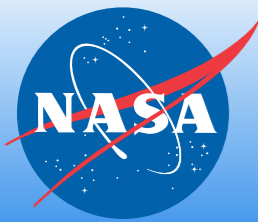
Contours → Barotropic Streamfn. [Sv]
Color → Salinity [psu]



Weak minus Strong SPG



Color → Volume [Km³]



Freshening and stratification in the subpolar North Atlantic: Possible effects on Chlorophyll-a concentrations and NPP

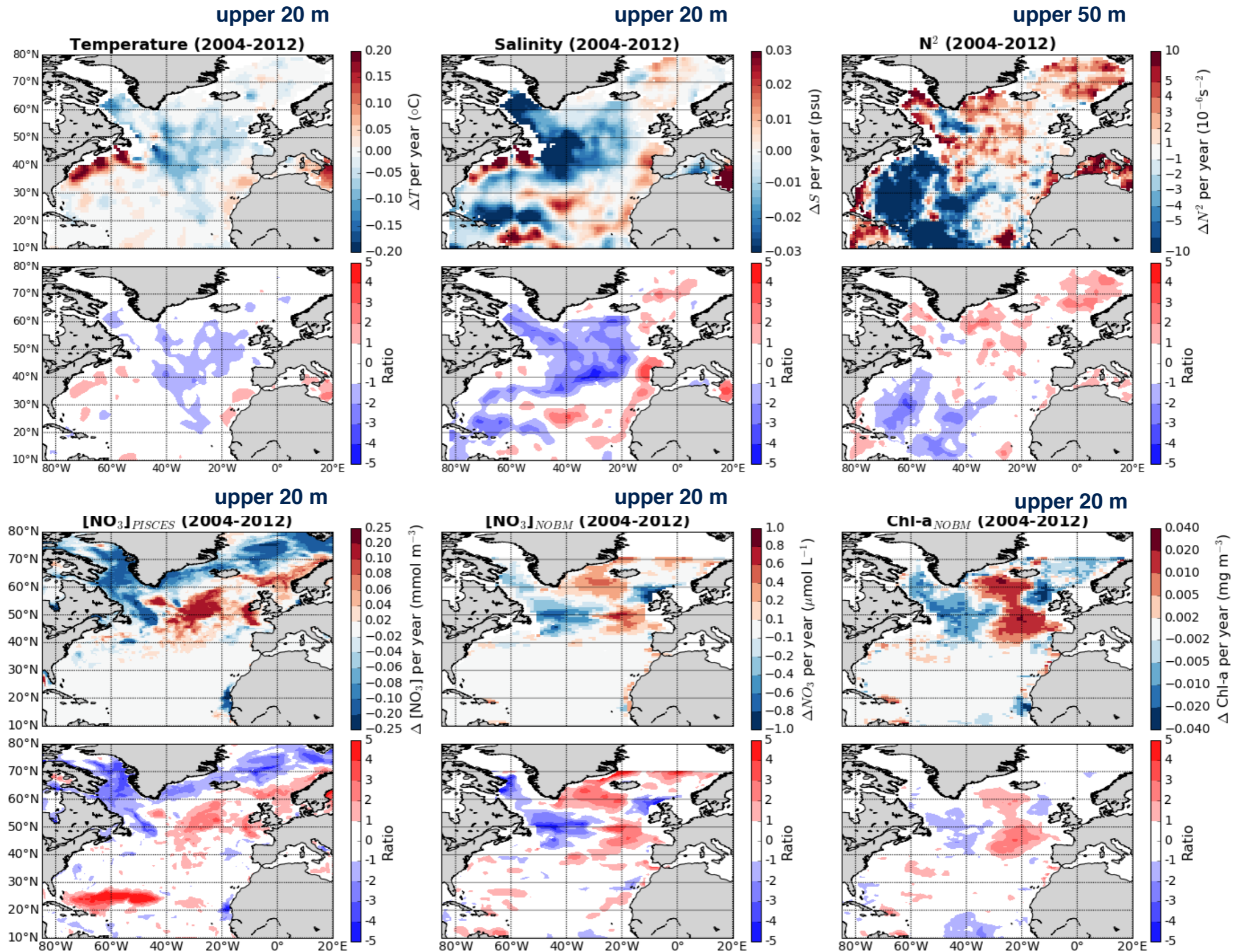
Lamont-Doherty Earth Observatory
COLUMBIA UNIVERSITY | EARTH INSTITUTE

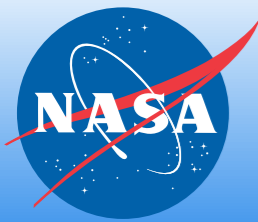
Jan-Erik Tesdal^{1,2,*}, J. I. Goes^{1,2}

¹Department of Earth and Environmental Sciences, Columbia University, New York, New York, USA

²Lamont-Doherty Earth Observatory, Columbia University, Palisades, New York, USA

General Interest
Tuesday





Freshening and stratification in the subpolar North Atlantic: Possible effects on Chlorophyll-a concentrations and NPP

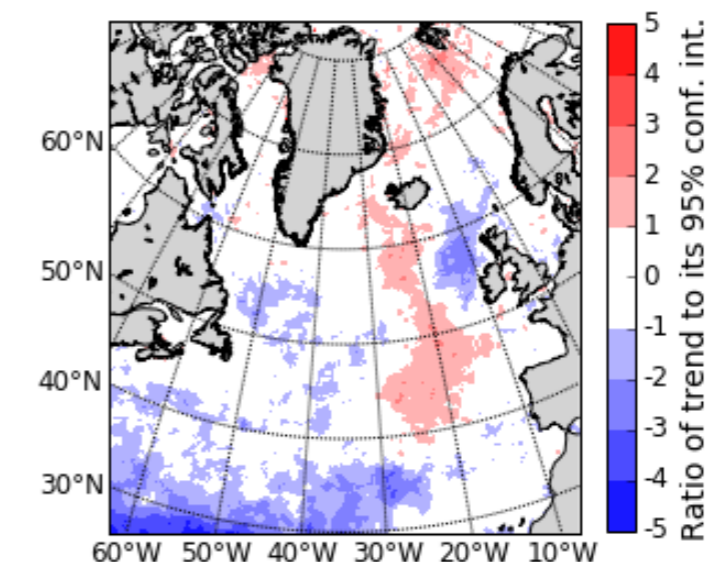
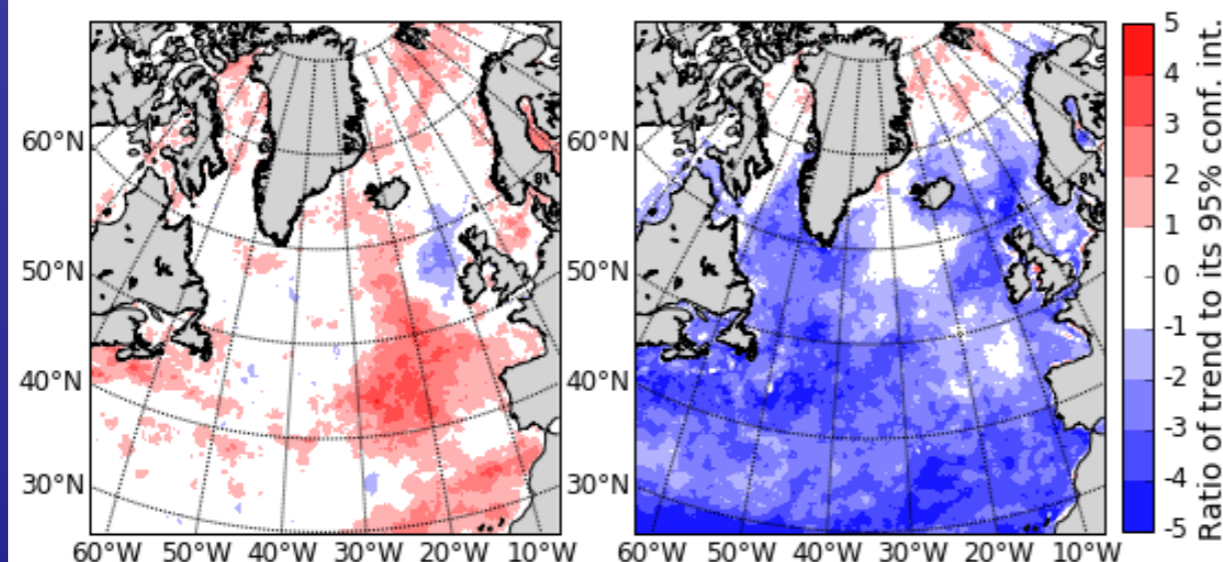
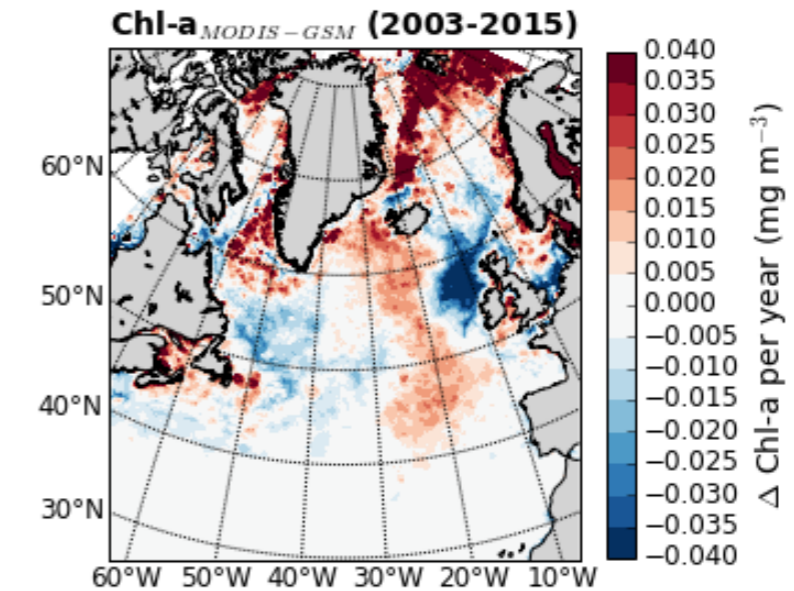
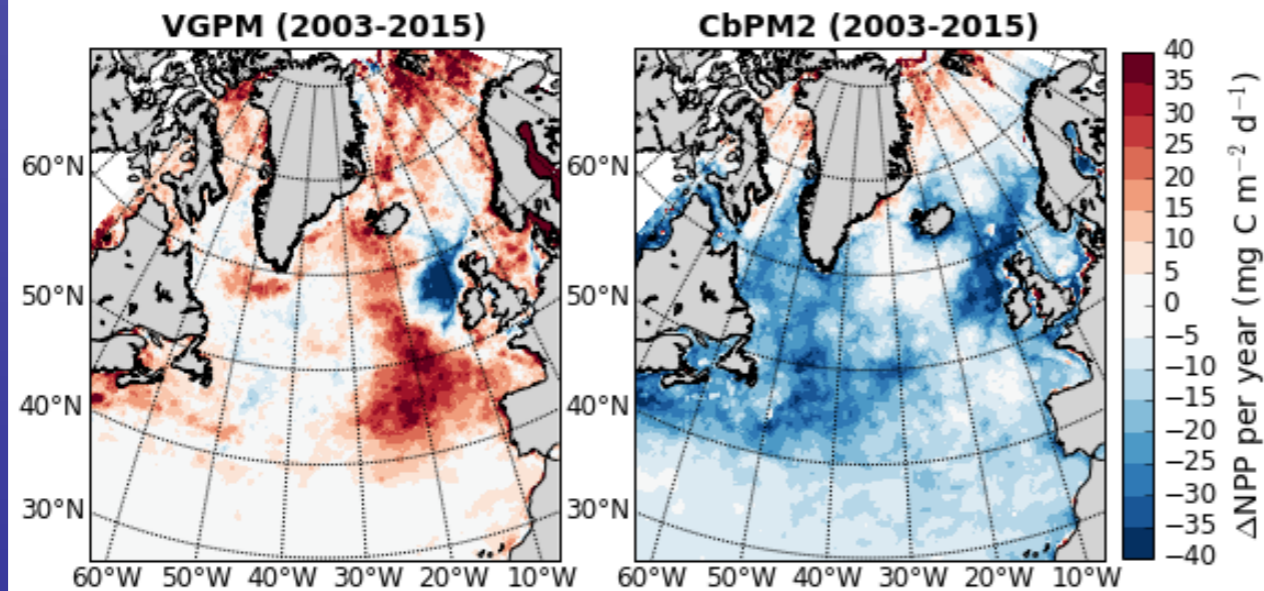
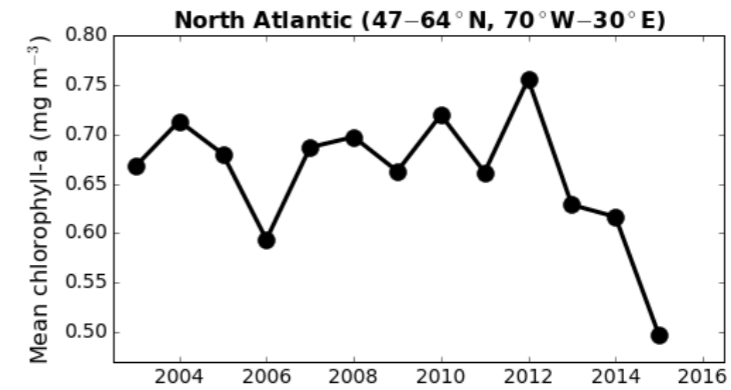
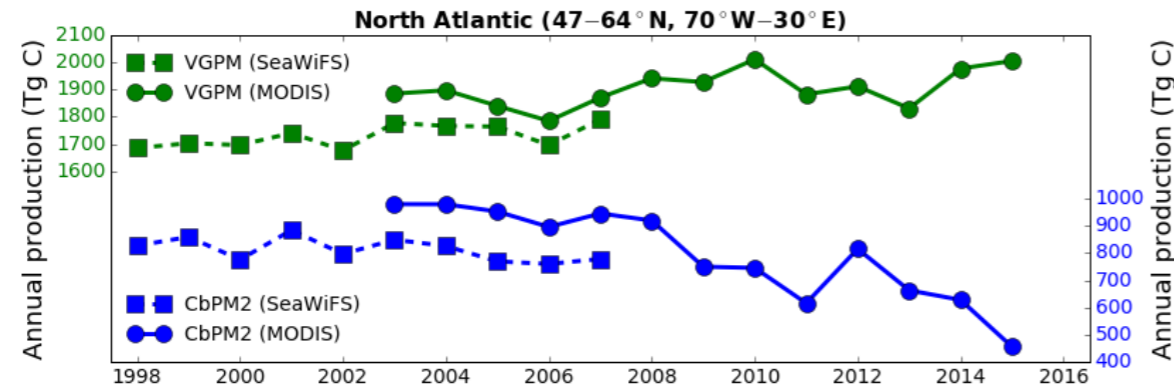
Lamont-Doherty Earth Observatory
COLUMBIA UNIVERSITY | EARTH INSTITUTE

Jan-Erik Tesdal^{1,2,*}, J. I. Goes^{1,2}

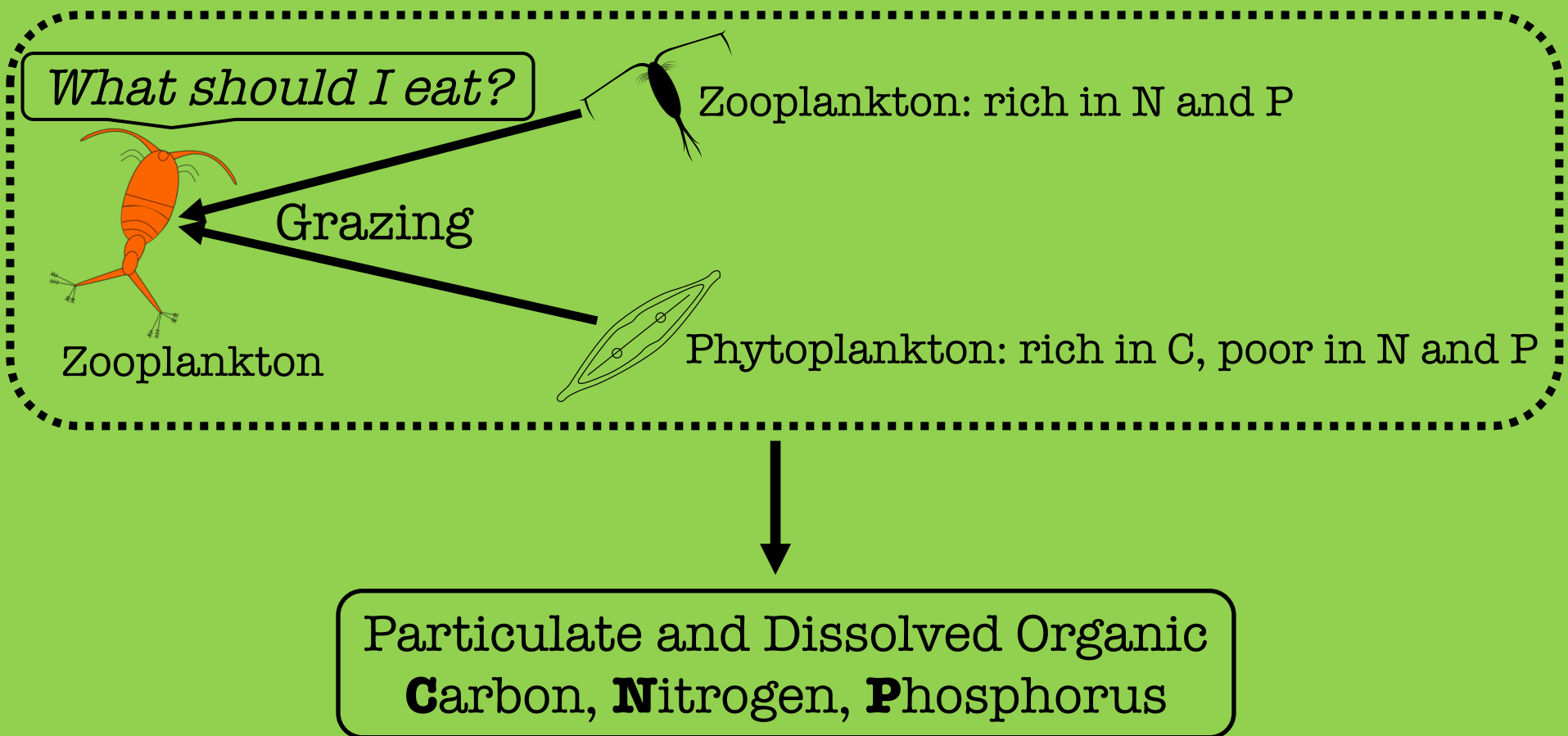
¹Department of Earth and Environmental Sciences, Columbia University, New York, New York, USA

²Lamont-Doherty Earth Observatory, Columbia University, Palisades, New York, USA

General Interest
Tuesday

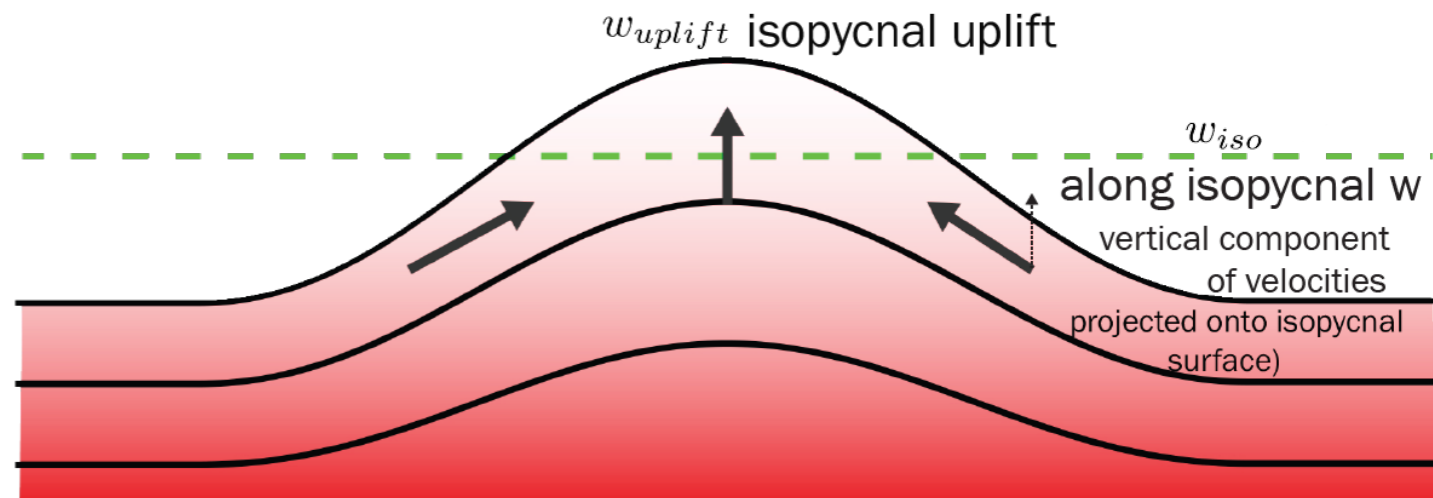
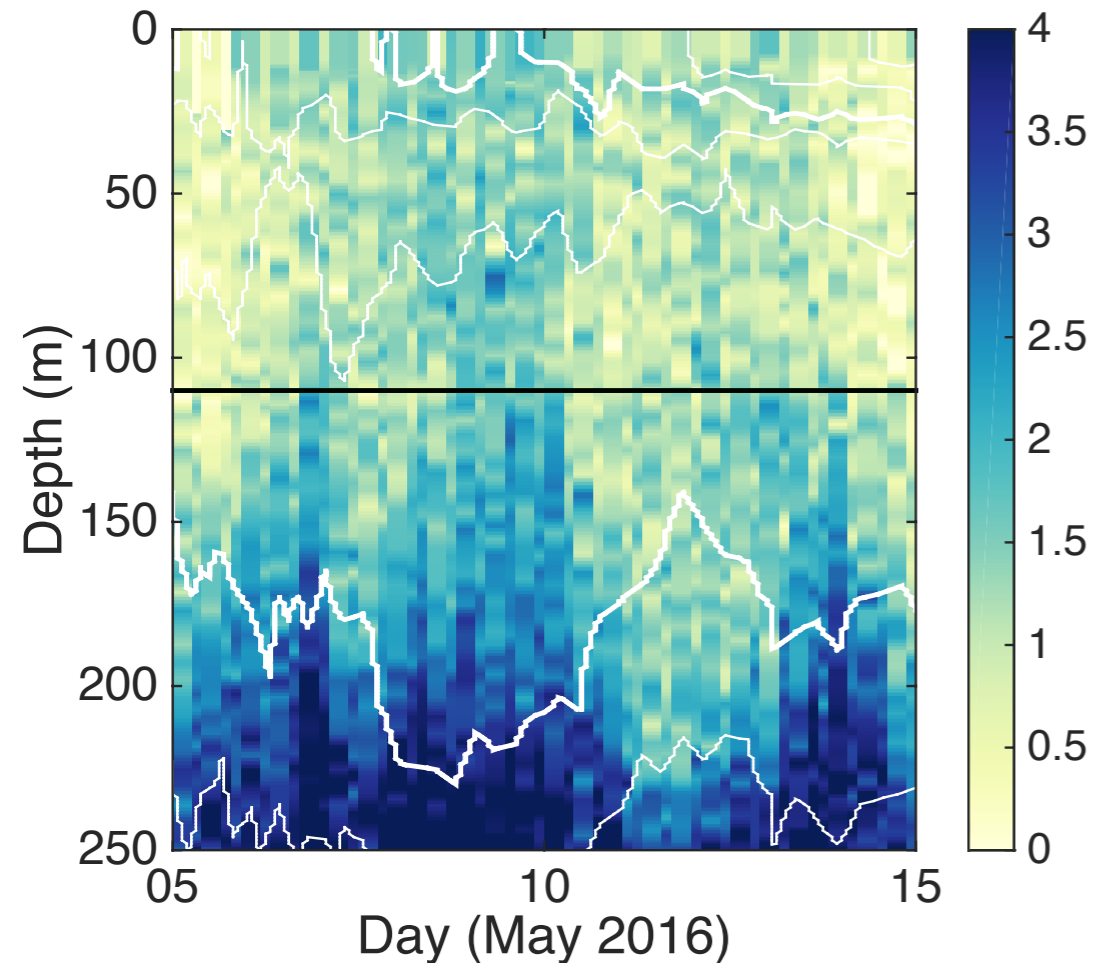


How does Zooplankton's Grazing Preference Affect C:N:P Ratios of Marine Ecosystem?



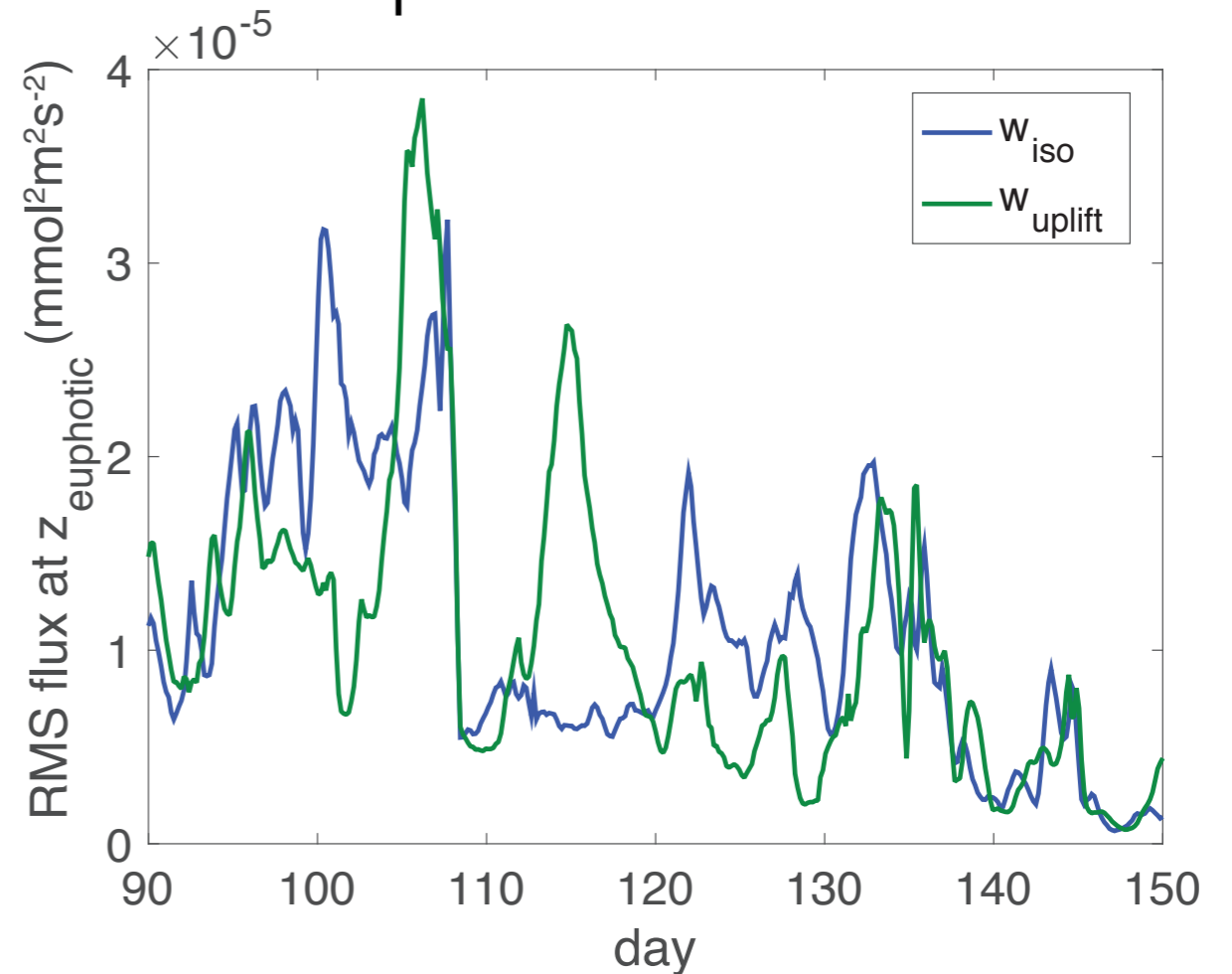
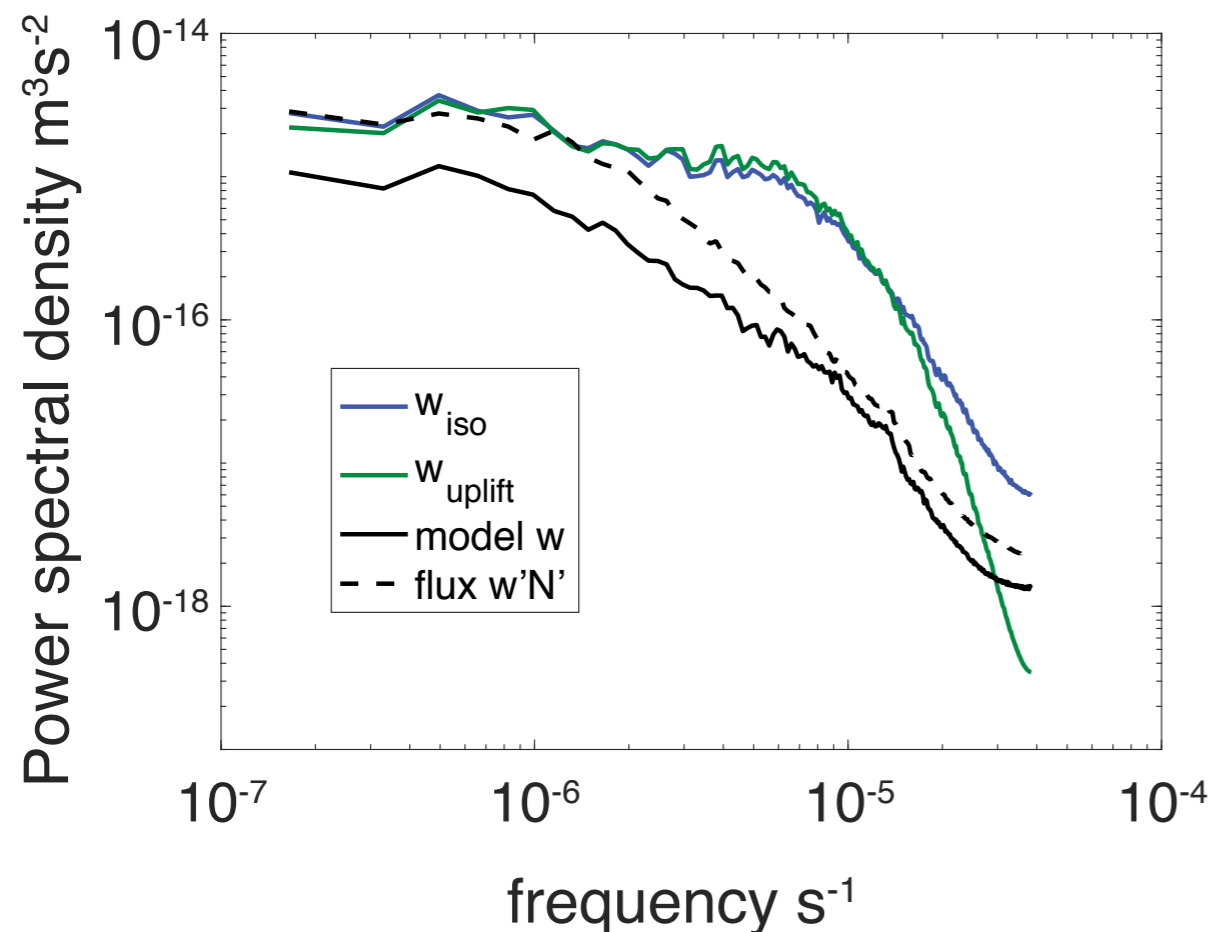
Mara Freilich: Nutrient flux processes

Nitrate mmol/m³



Mara Freilich: Nutrient flux processes

- Flux of nutrients along density surfaces is as important as isopycnal uplift at local scales

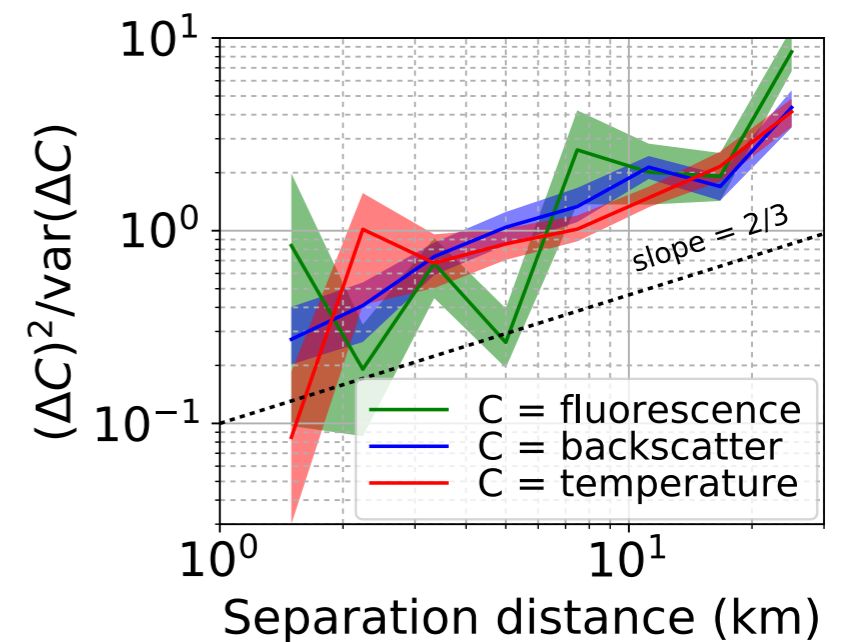
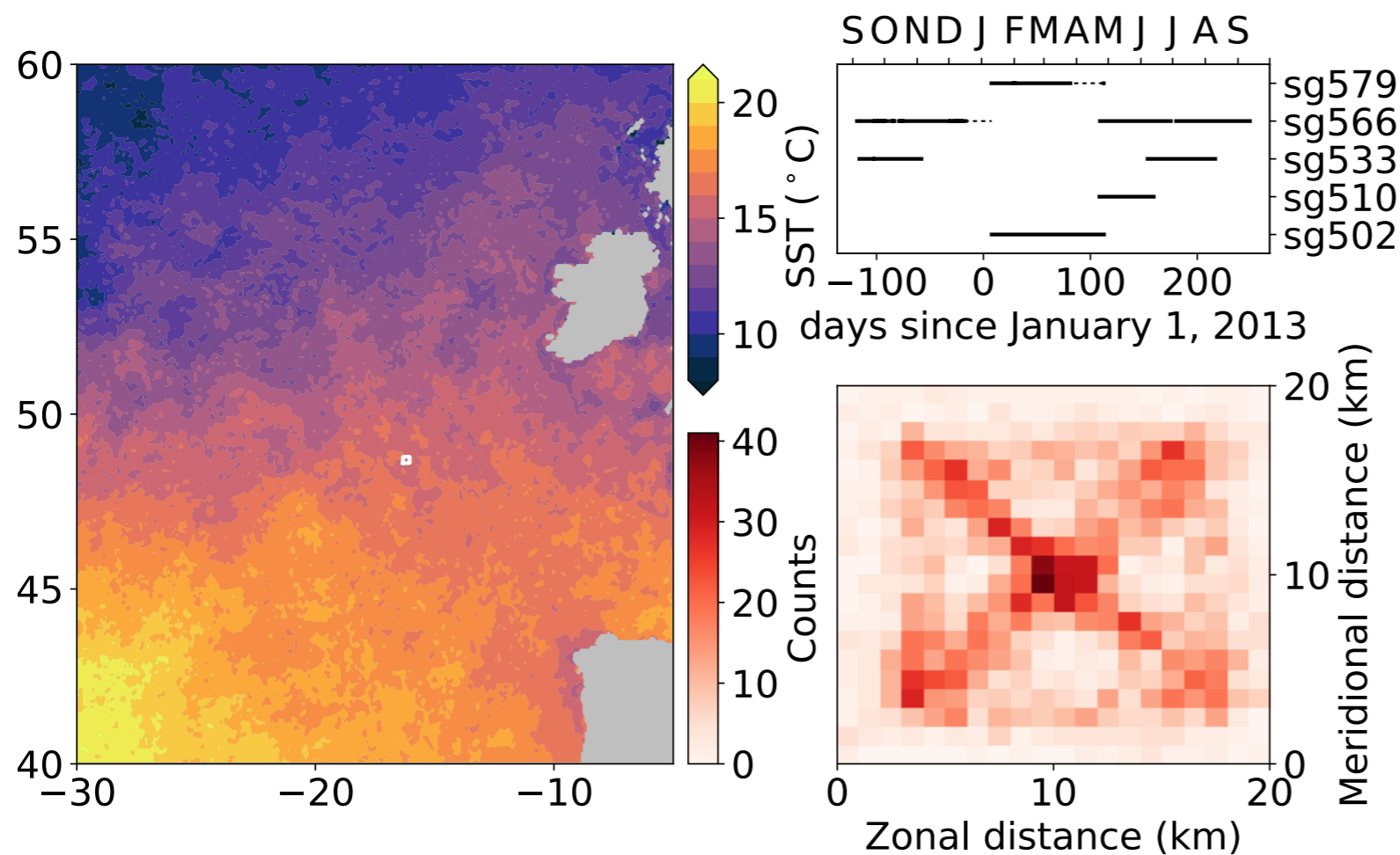


- Vertical motion matched to the temporal scale of biological processes is most important for nutrient flux

Zachary K Erickson and Andrew F Thompson (Caltech)

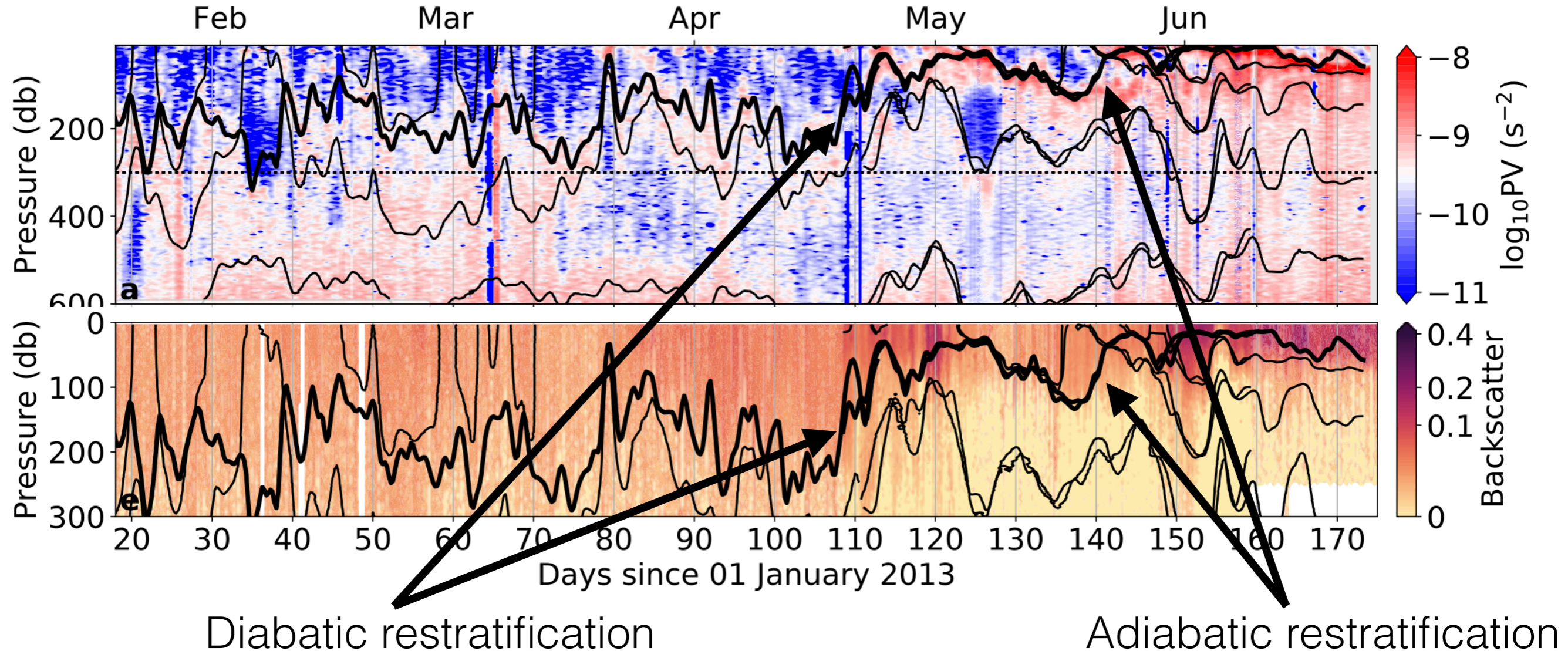
Monday 3:30-5 PM; Session on (Sub)mesoscale bio/geo/chem/physical interactions

A seasonal cycle of surface instabilities and physically-driven export from gliders in the northeast Atlantic Ocean



Zachary K Erickson and Andrew F Thompson (Caltech)

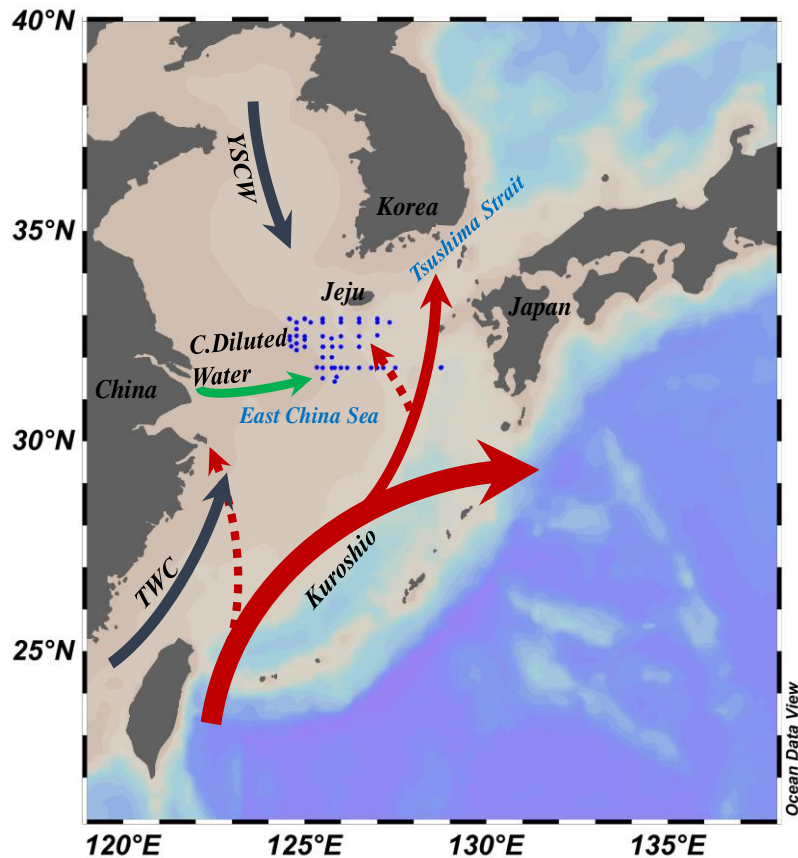
Monday 3:30-5 PM; Session on (Sub)mesoscale bio/geo/chem/physical interactions



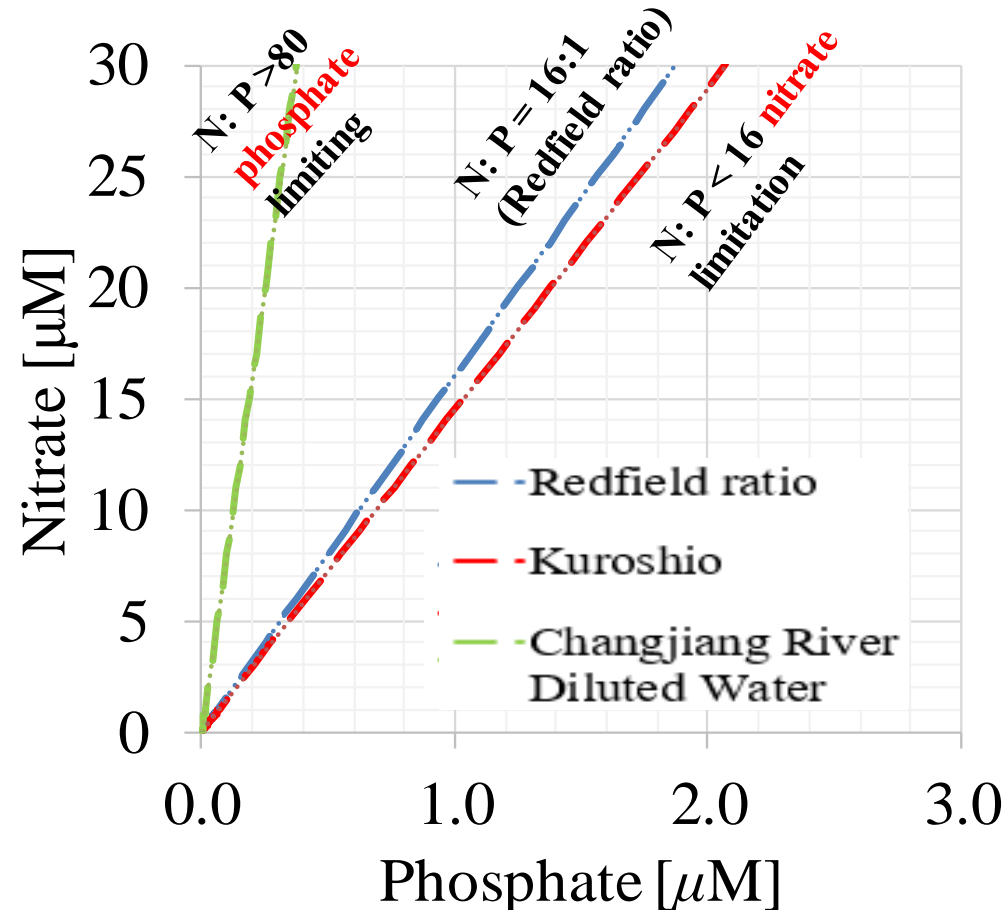
- Low potential vorticity (PV) below mixed layer (ML) is a sign of recent subduction
- Surface **diabatic** instabilities (gravitational, symmetric) can lead to export out of the ML; **adiabatic** instabilities (mixed layer/baroclinic) do not.

Inter-annual changes in summer phytoplankton community with water mass variability in the East China Sea

East China Sea



Nutrient Condition



Phytoplankton: to bloom or not to bloom?



Hypothesis: inter-annual variability in the intrusion of Kuroshio Intermediate Water into shelf region of the East China Sea has a large impact on the distribution of phytoplankton in particular the dominance of diatoms.

Relationship between phytoplankton communities and environmental factors

Tuesday, 5:30-7:00 pm;
Session 3. Mesoscale and
submesoscale physical-biological-
biogeochemical interactions

