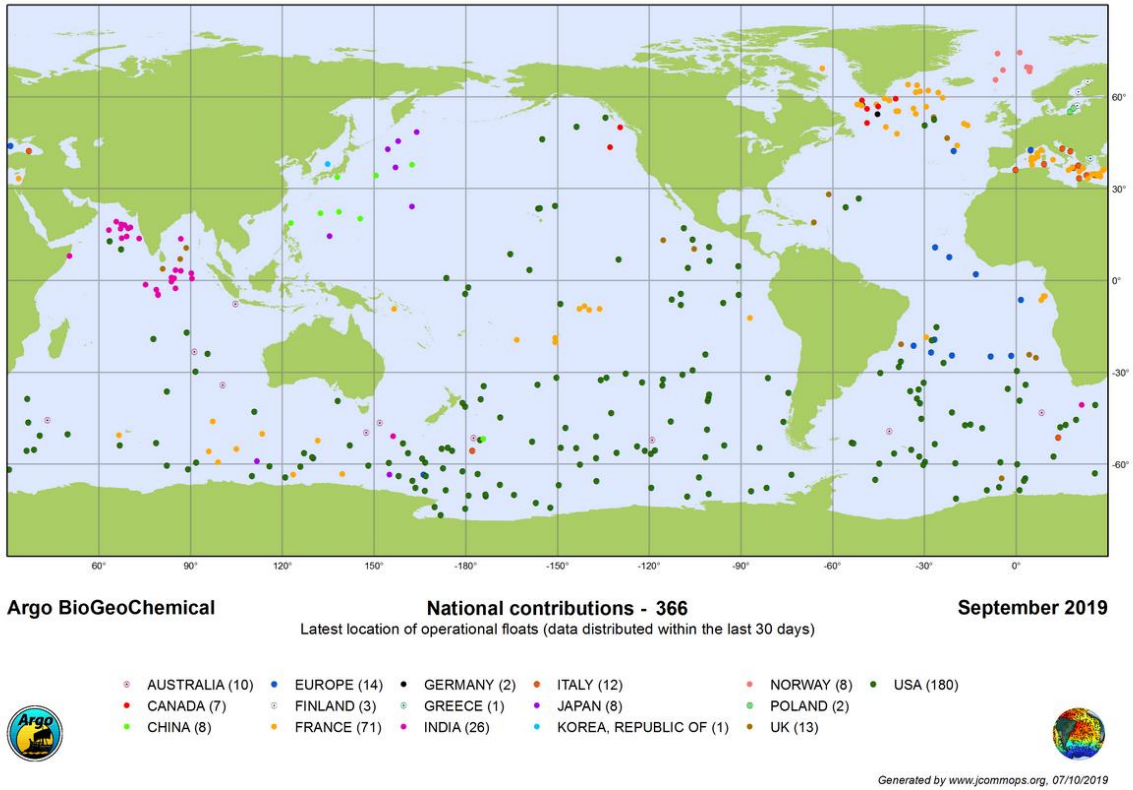
biogeochemical Argo

The future of BGC-Argo

Ken Johnson
Monterey Bay Aquarium Research Institute



biogeochemical Argo

Monterey Bay Aquarium Research Institute

5th Euro-Argo Science Meeting & AST, Brest, France 2015

Carbon cycling during the spring bloom in the Southern Ocean observed by the SOCCOM profiling float array

Kenneth S. Johnson[1], Stephen C. Riser[2], Lynne D. Talley[3], Emmanuel Boss[4], Joellen Russell[5], Jorge L Sarmiento[5]

[1]Monterey Bay Aquarium Research Institute
[2]University of Washington
[3]Scripps Institution of Oceanography
[4]Univ. of Maine, [5]Univ. of Arizona, [6]Princeton Univ.

Dean Roemmich and Susan Wjiffels (Argo Steering Team Co-Chairs) in comments to Herve Claustre and Ken Johnson at the 2015 Argo Steering Committee meeting:

“Regional studies are great, but if you want to be part of Argo, you need to be global!”

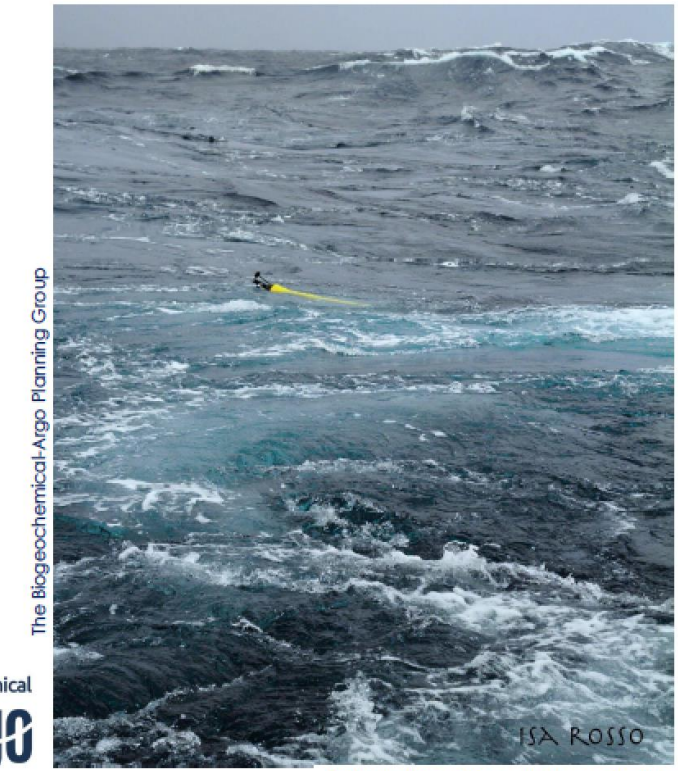
biogeochemical Argo

The Biogeochemical-Argo Implementation Plan (2016)

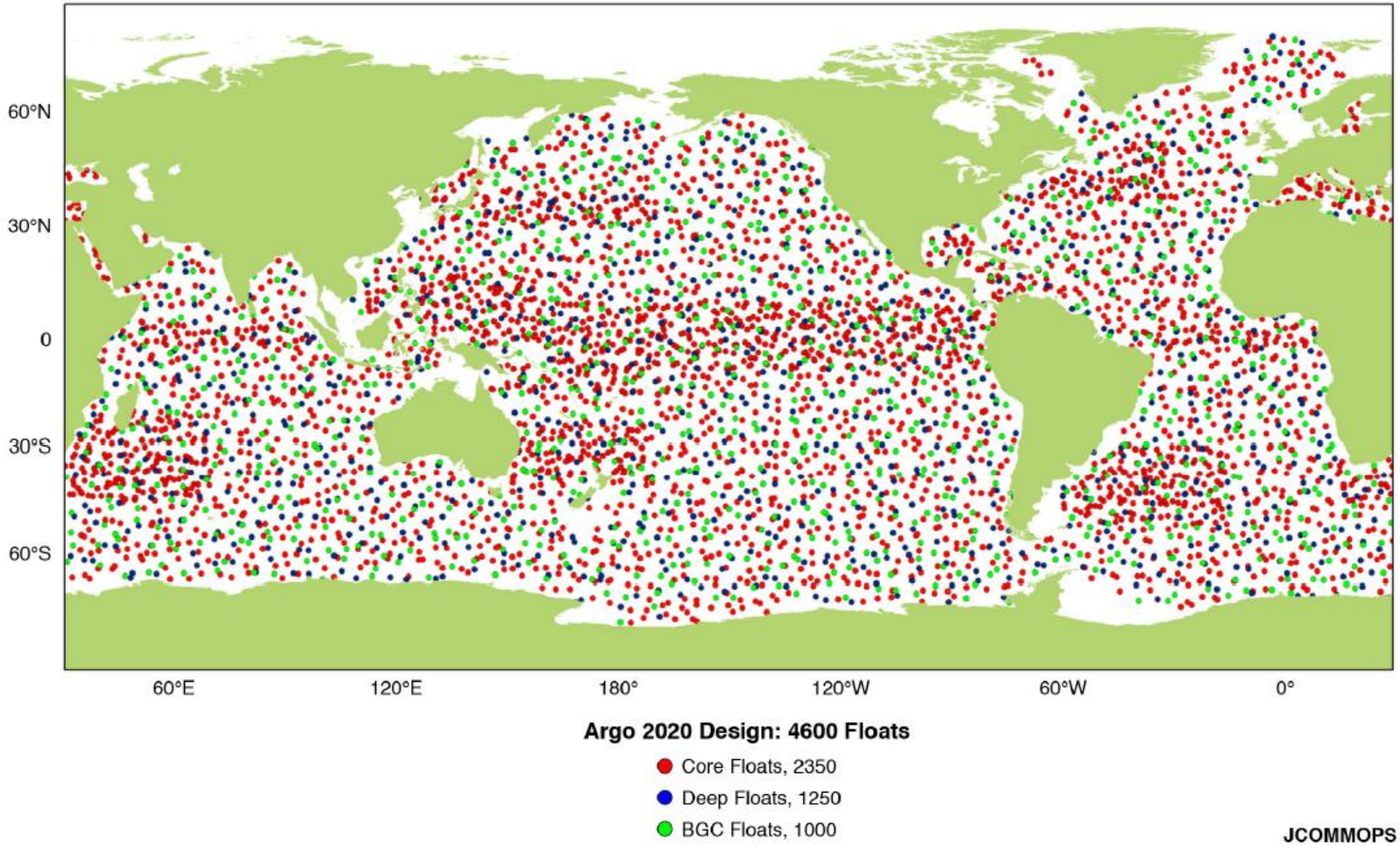
- An international plan
- 1000 profiling floats with O_2, pH, NO_3^-, bio-optics
- US would deploy half (500 floats)
- Observe seasonal and interannual change in carbon cycling, OMZ's, nutrient flux, acidification, biological carbon pump, phytoplankton phenology
- Ocean management of living marine resources & carbon budget verification

http://biogeochemical-argo.org

Biogeochemical-Argo
Science & Implementation Plan



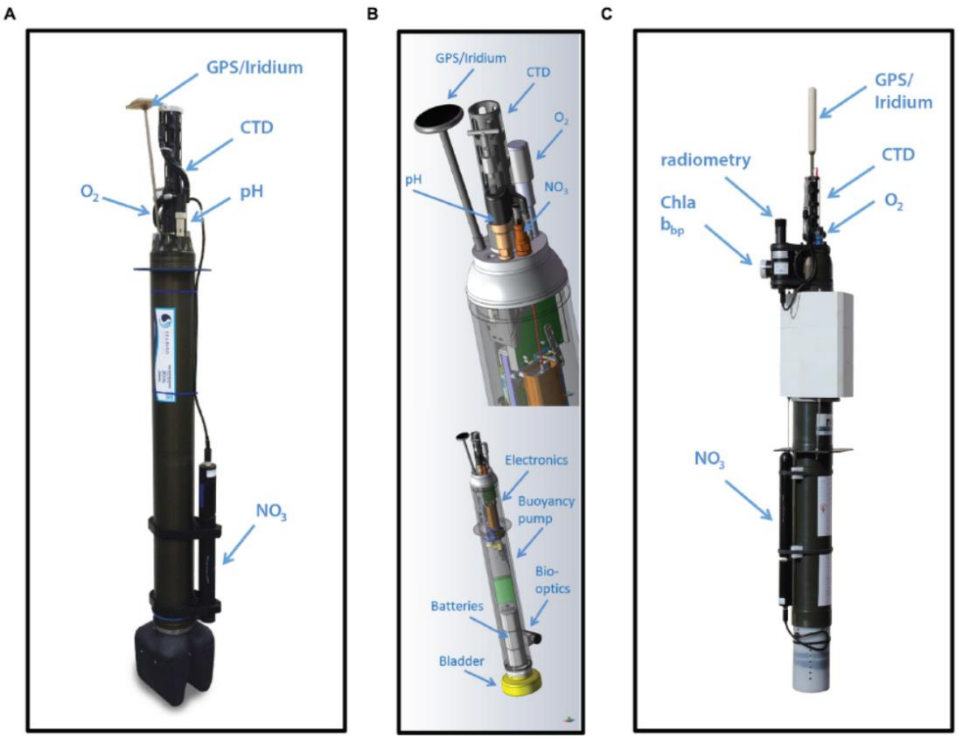
Argo Beyond 2020
An integrated array of Core, Deep, and Biogeochemical Floats



biogeochemical Argo

- BGC-Argo data is of high quality when fully processed (not all DACs have complete processing)
- Argo is now the dominant source of BGC data for the global ocean
- Community moving from analyses of 1 or a few floats to basin/global scale
- Float deployments moving to sustained efforts at basin/global scale
- Linking floats to models is key

Navis APEX Provor



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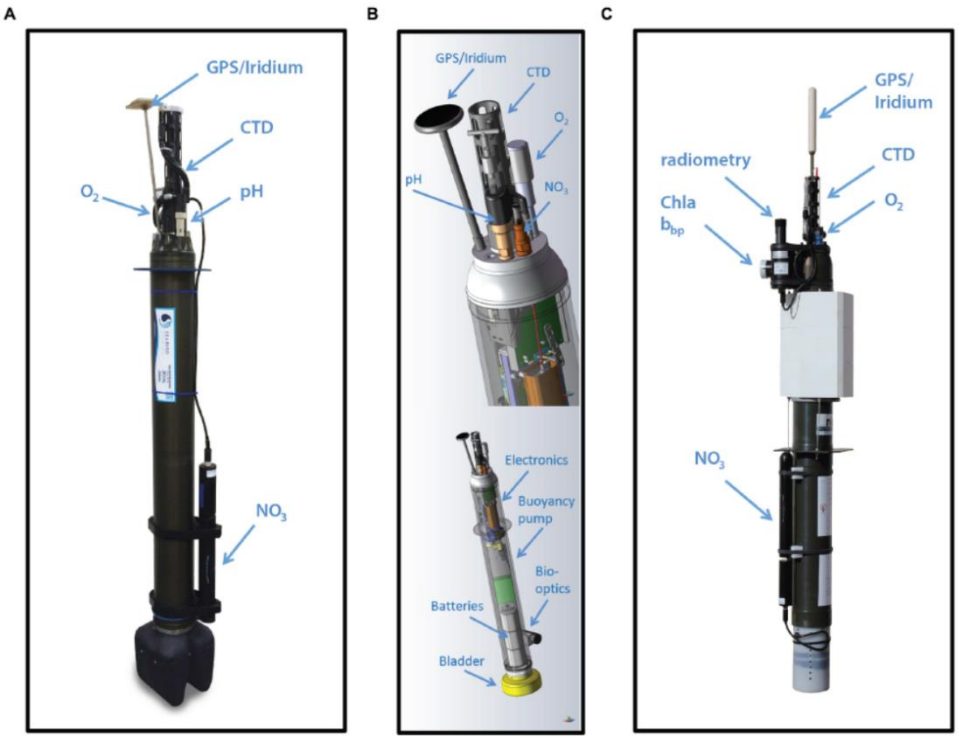
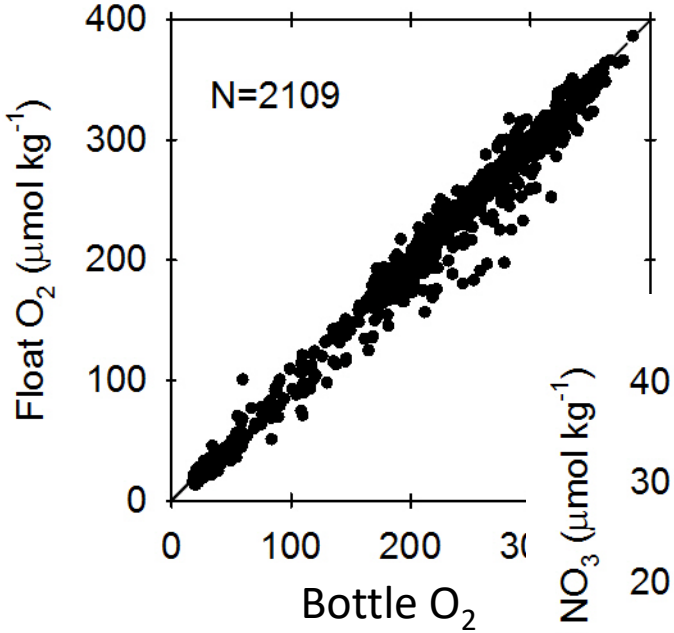
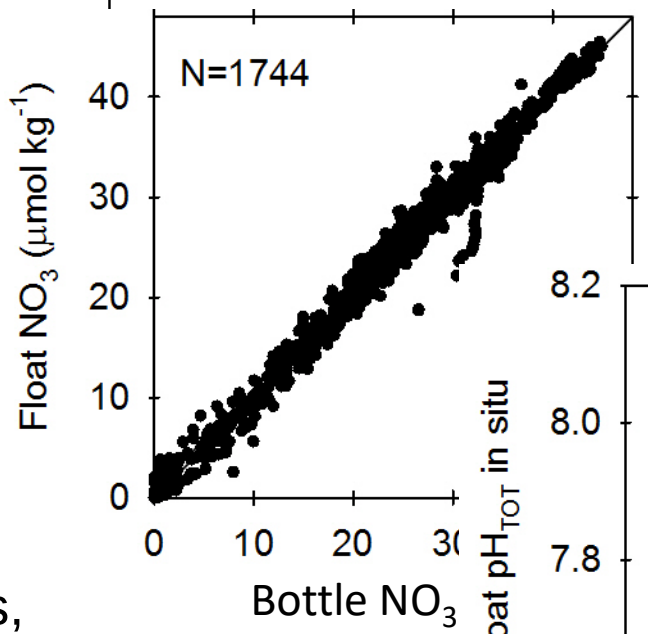
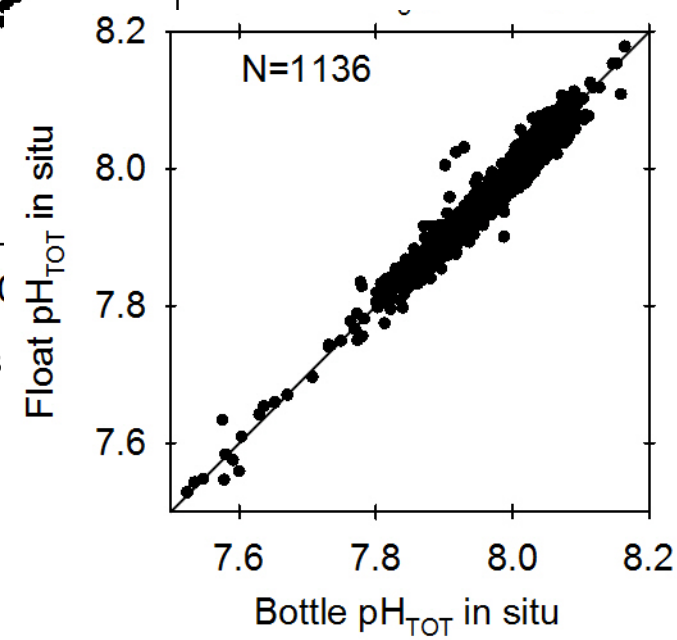


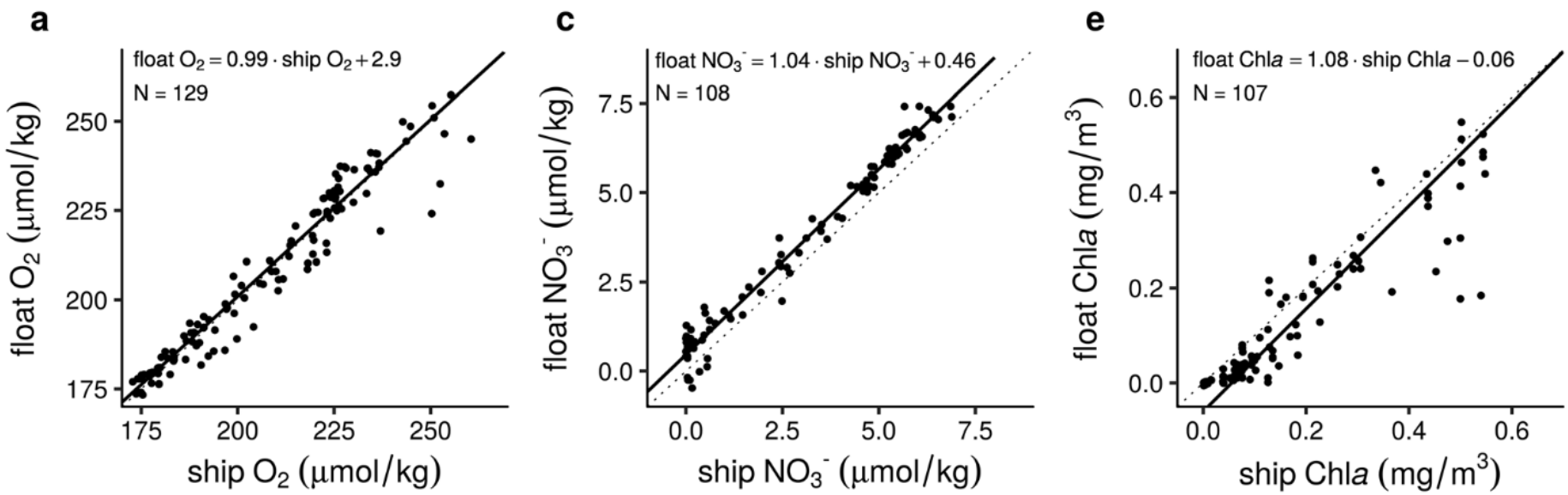
First float profile data after qc compared to bottle samples collected when float deployed (updated from Johnson et al., JGR Oceans 2017).







Bottle samples are not used to calibrate sensors, they are an independent assessment of accuracy.



Geophysical Research Letters

RESEARCH LETTER
10.1029/2018GL080541

Key Points:
- The triple collocation analysis is

Quantifying Observational Errors in Biogeochemical-Argo Oxygen, Nitrate, and Chlorophyll *a* Concentrations

A. Mignot[1,2], F. D'Ortenzio[1], V. Taillandier[1], G. Cossarini[3], and S. Salon[3]

SOCCOM assessment (Johnson et al., 2017), probably true in general for qc'd BGC-Argo data

	Fleet average bias	Fleet average precision (SD)
O_2	1 µmol/kg	2 µmol/kg
NO_3	0.1 µmol/kg	0.5 µmol/kg
pH	0.005	0.008

SOCCOM

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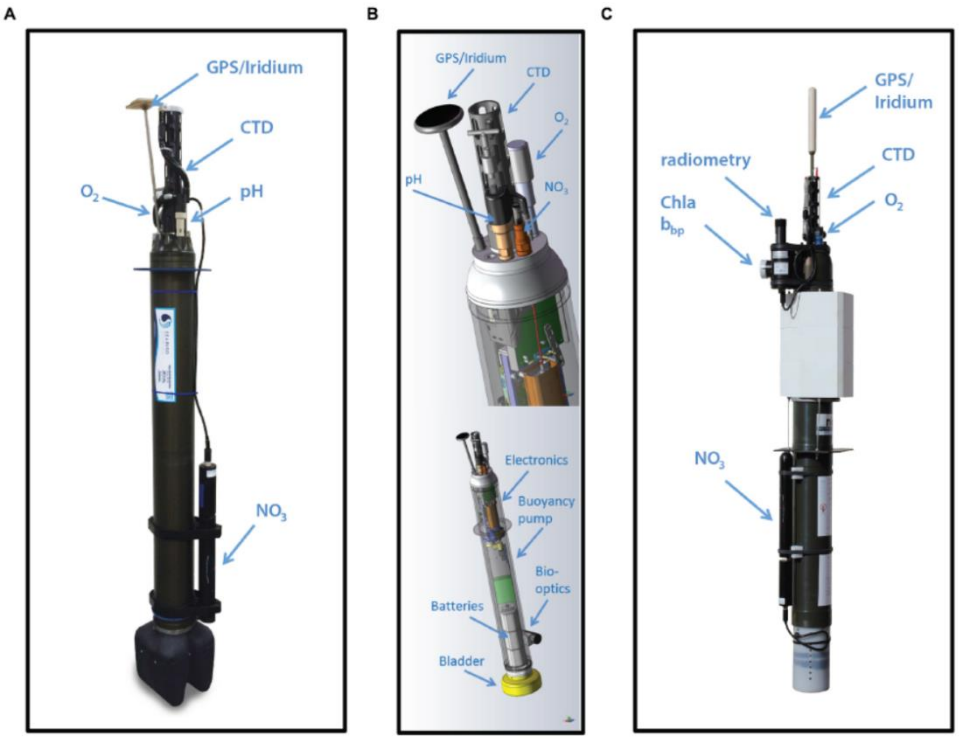
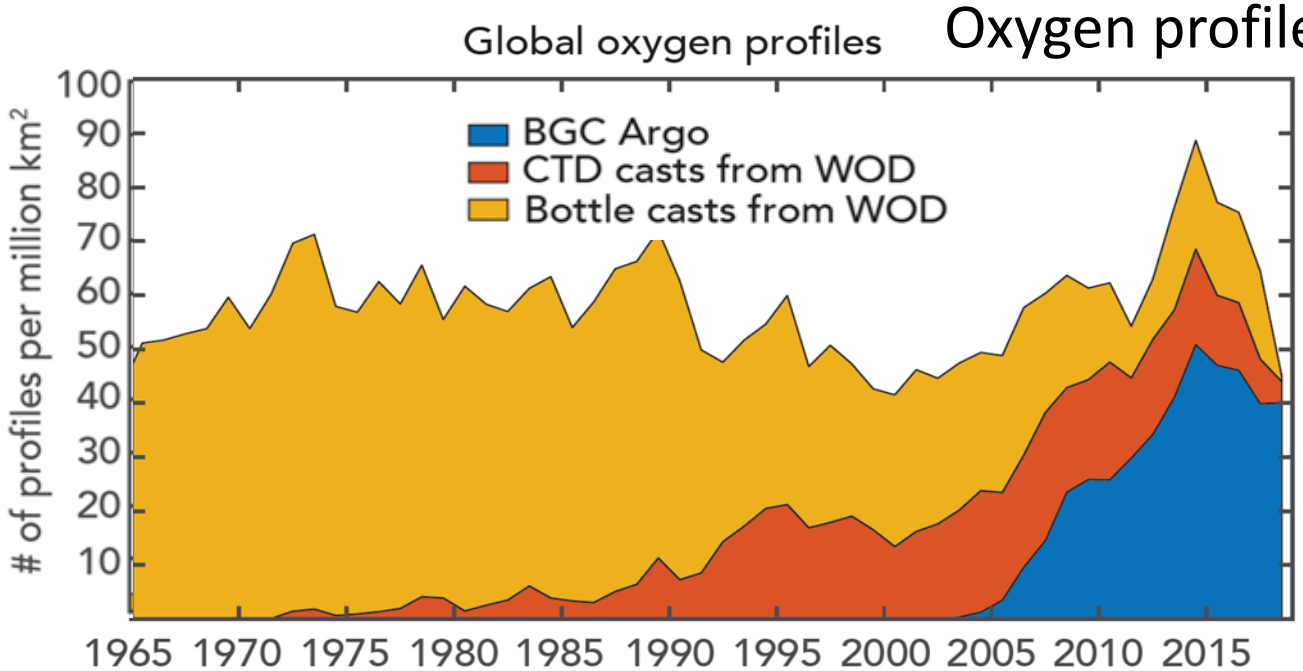
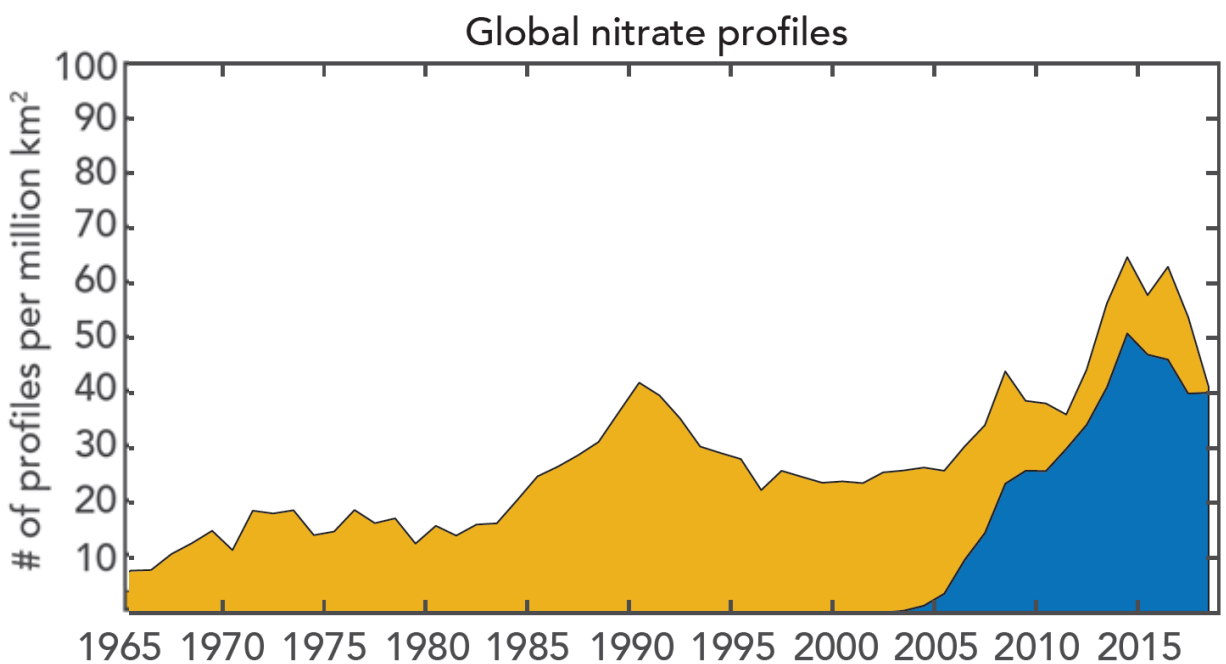


Oxygen profiles



For depths > 900 m

Nitrate profiles



Graphics courtesy of Katja Fennel

WOD = NOAA World Ocean Database

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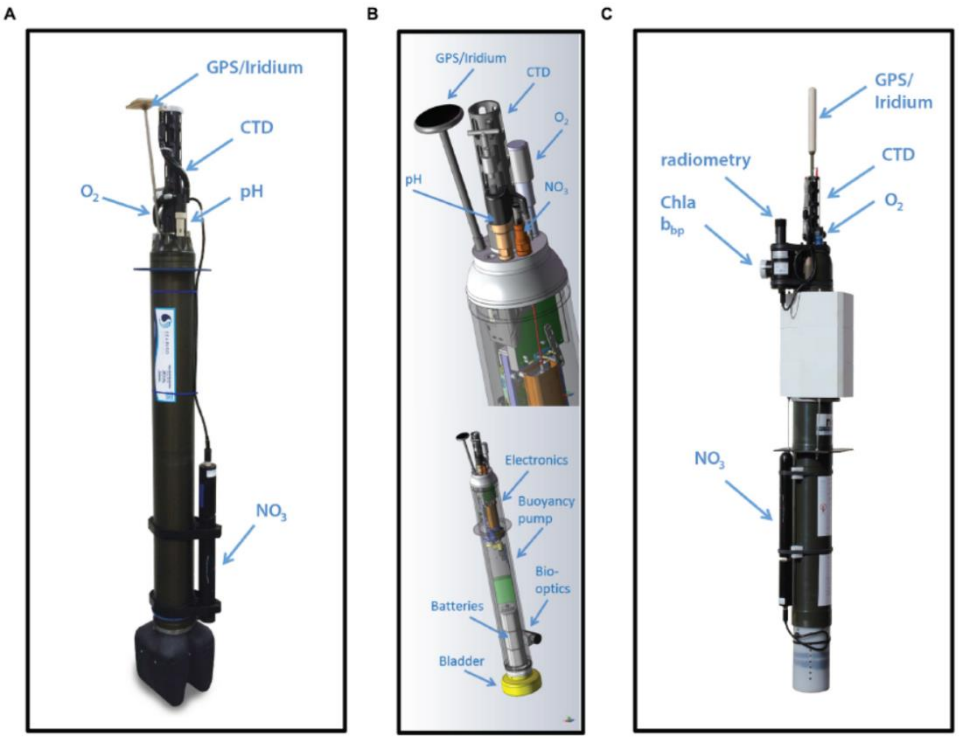


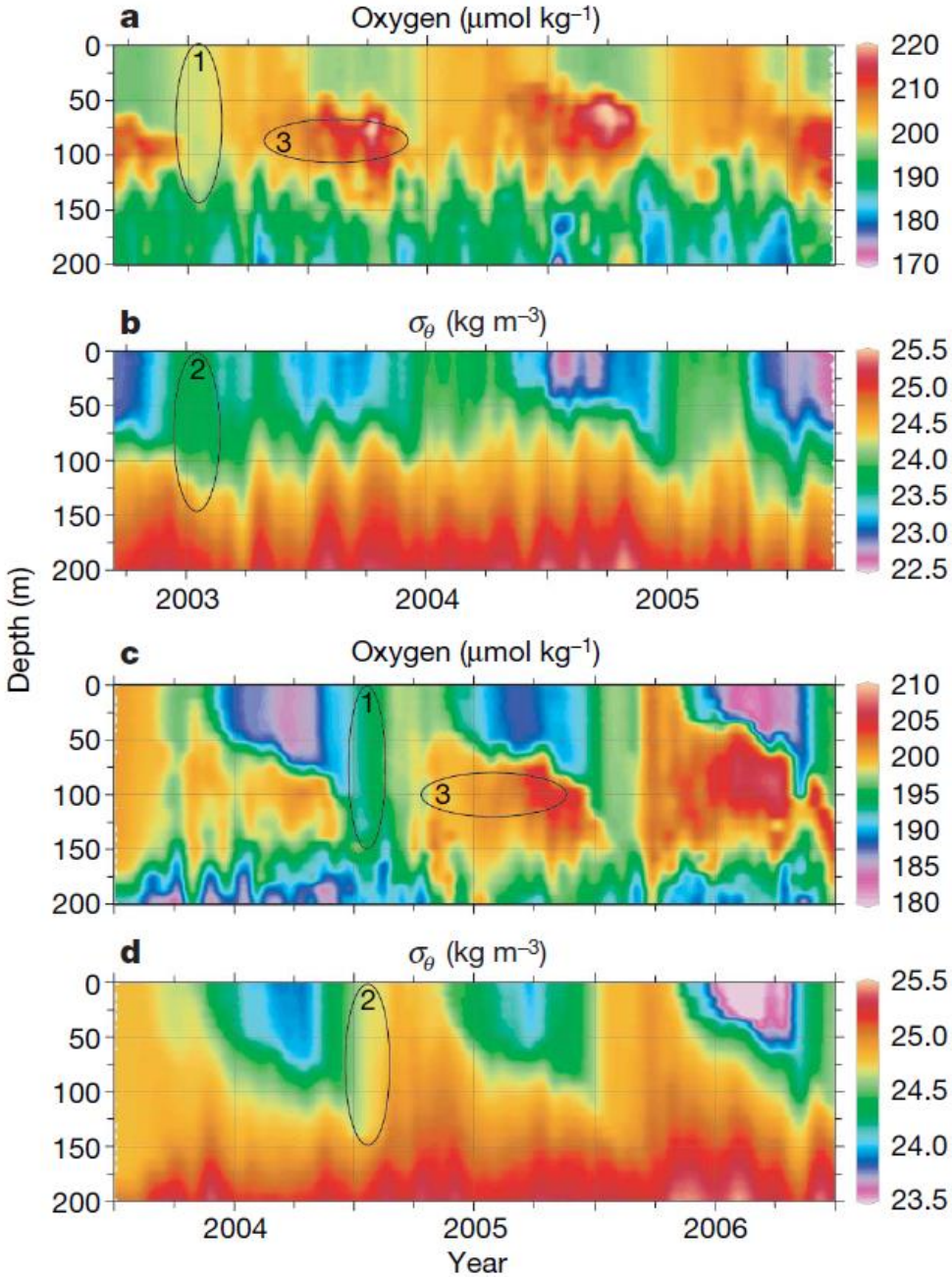
Net production of oxygen in the subtropical ocean

Stephen C. Riser[1] & Kenneth S. Johnson[2]

Nature, 2008

1 float, North Pacific

1 float, South Pacific



Geophysical Research Letters

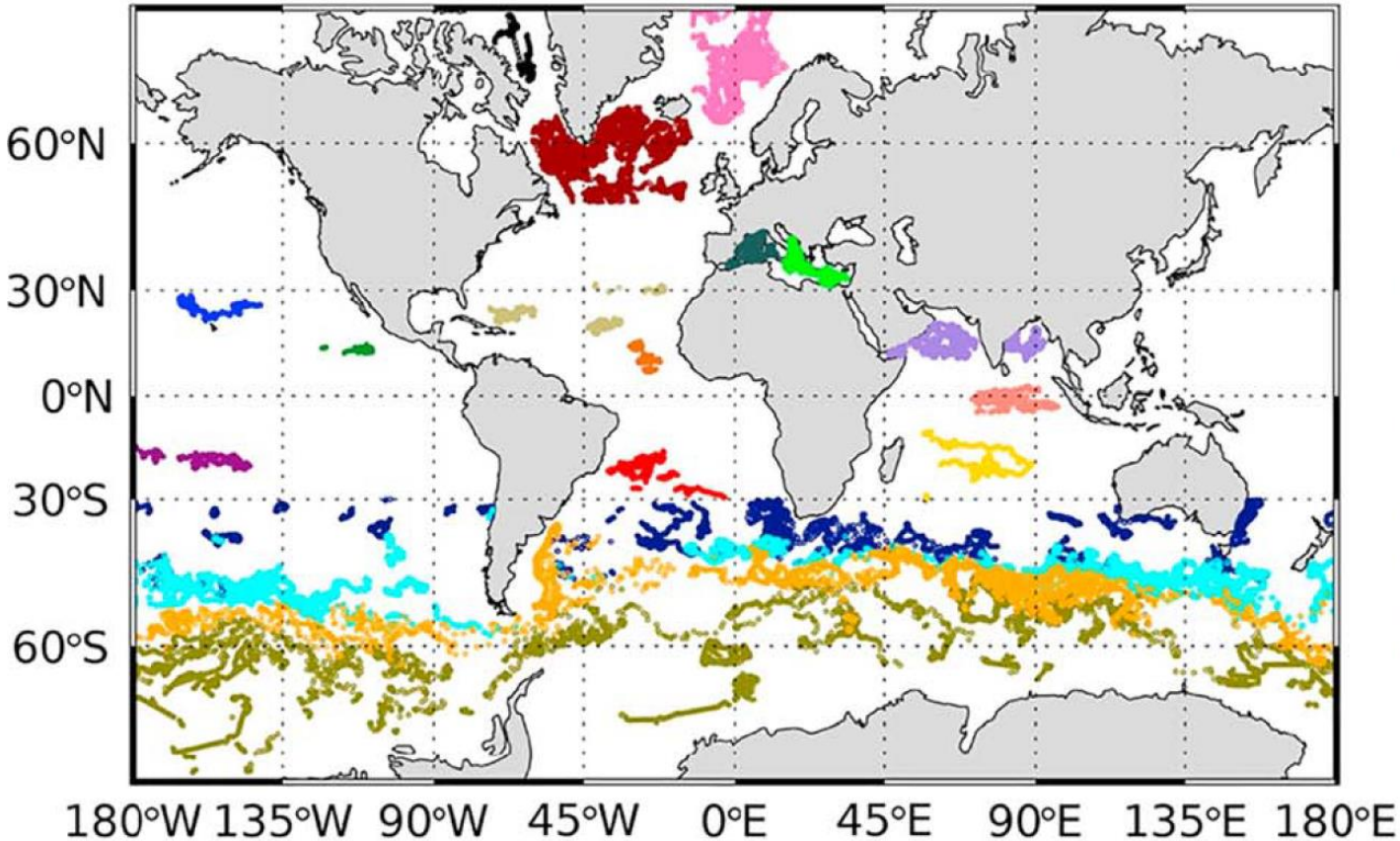
RESEARCH LETTER
10.1029/2019GL084078

Global Variability of Optical Backscattering by Non-algal particles From a Biogeochemical-Argo Data Set

M. Bellacicco[1,2], M. Cornec[2], E. Organelli[2], R. J. W. Brewin[3,4], G. Neukermans[2], G. Volpe[5], M. Barbieux[2], A. Poteau[2], C. Schmechtig[2], F. D'Ortenzio[2], S. Marullo[1], H. Claustre[2], and J. Pitarch[6]

Key Points:

- The background backscattering of non-algal particles decrease from Northern to Southern Hemispheres at the surface and in the euphotic



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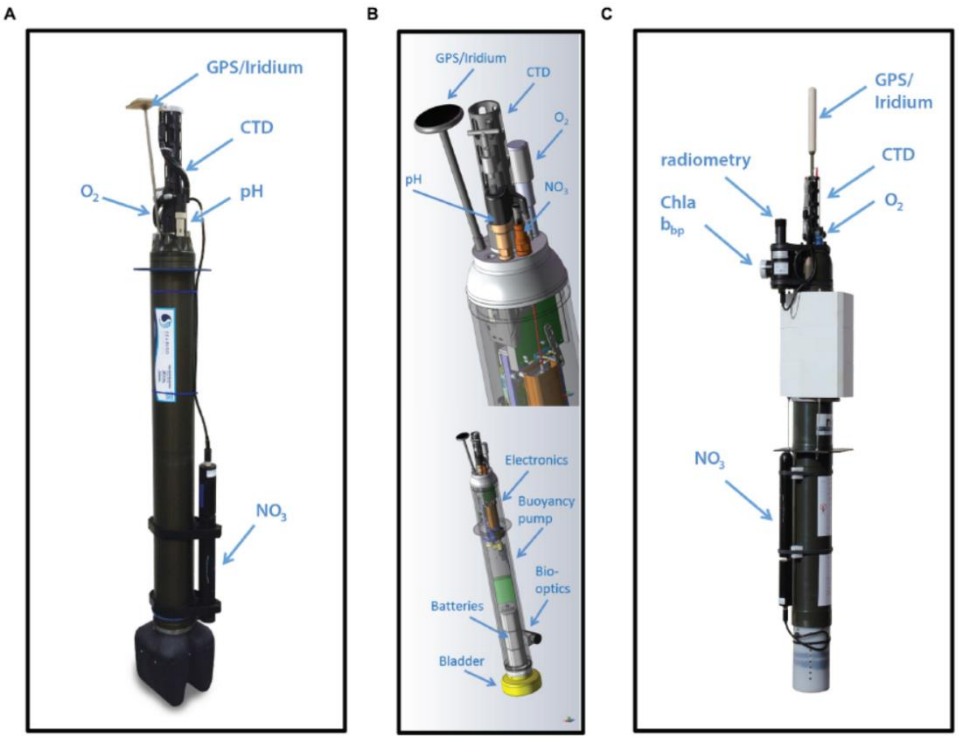
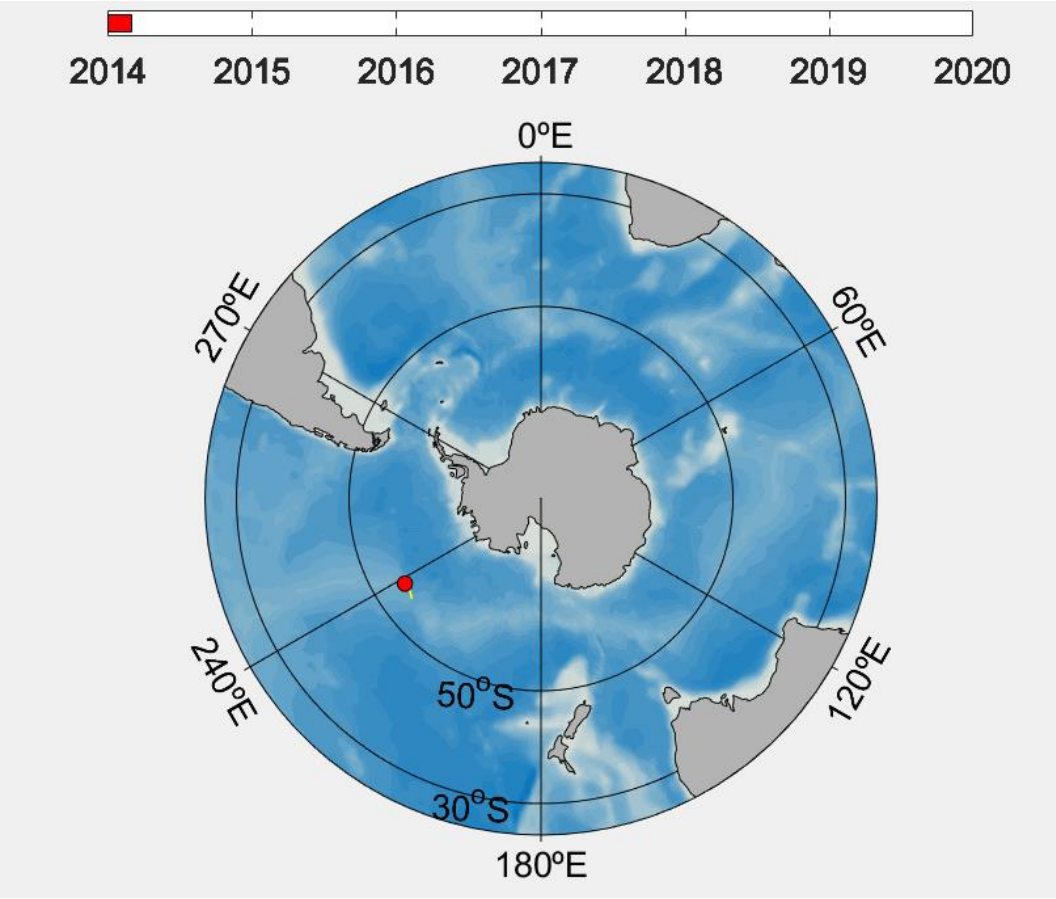


Southern Ocean Carbon & Climate Observations & Modeling

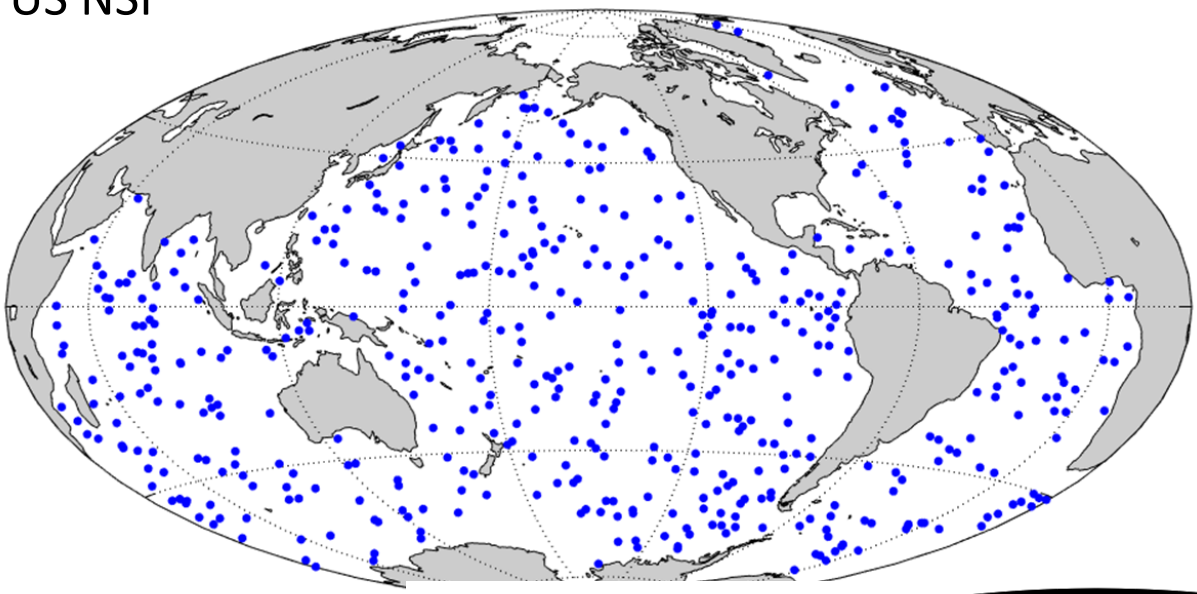
SOCCOM

- >150 floats deployed since 2014
- 137 operating
- Data fully processed and qc'd
- Will continue for 5 more years with 30 floats/y.

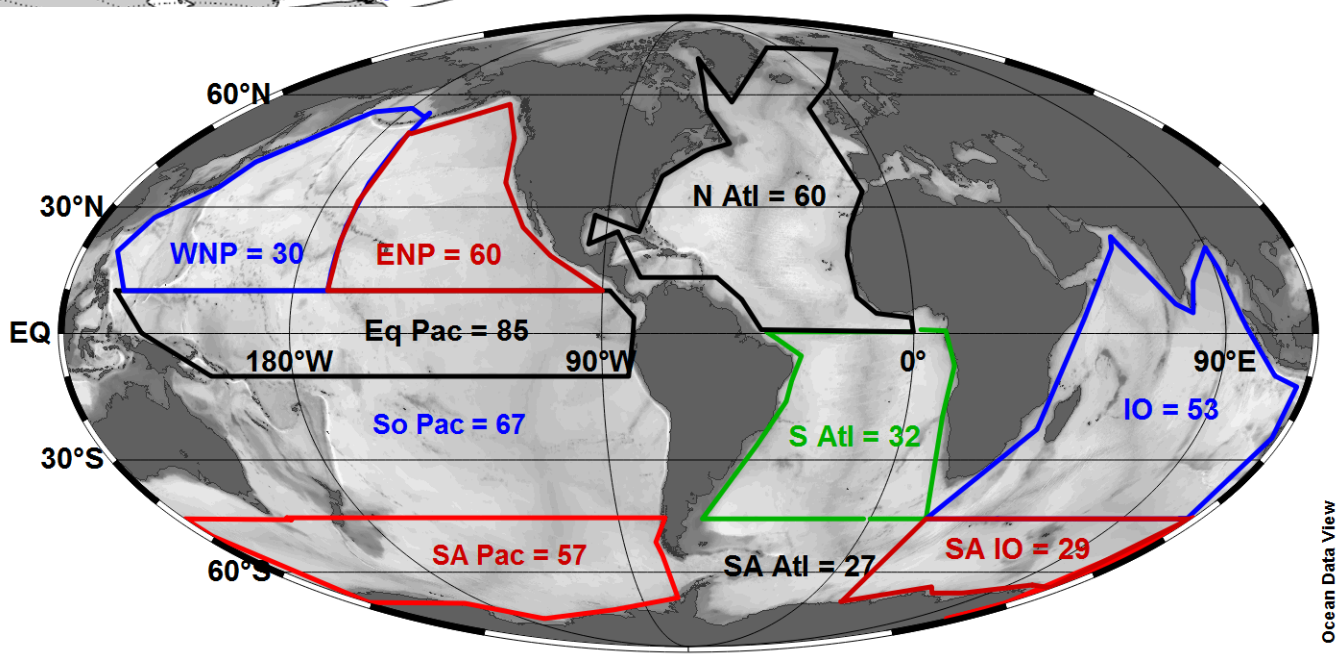


biogeochemical Argo

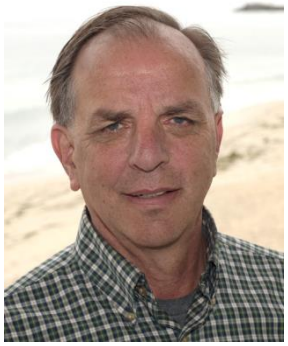
Mid-scale RI-2 Consortium: Biogeochemical-Argo: A global robotic network to observe changing ocean chemistry and biology. A $52.9 million proposal to the US NSF



- Proposed US BGC-Argo 500 float array
- Program would start in Aug. 2020 if funded.
- Global extent
- 5 & 6 BGC sensor floats



Proposal Team



Ken Johnson
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Lynne Talley
SIO, Co-PI

Steve Riser UW,
Co-PI

Susan Wijffels
WHOI, Co-PI

Jorge Sarmiento
PU, Co-PI

Gene Massion
MBARI, Sys. Eng.

Roberta Hotinski
PU, Proj. Manager

Proposal Team

Sarah Purkey
SIO

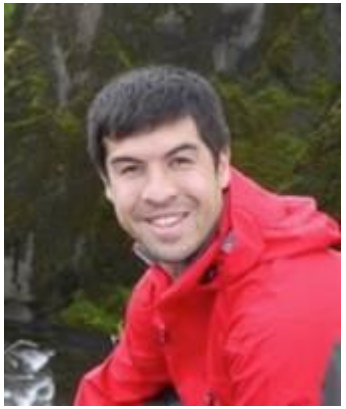
Andrea Fassbender
MBARI

Yui Takeshita
MBARI

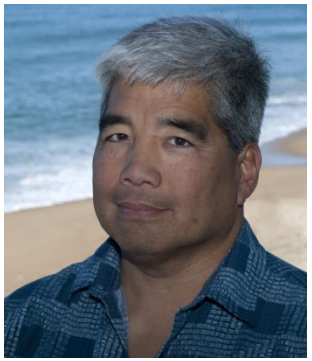
Heidi Cullen
MBARI

Todd Martz
SIO

Alison Gray
UW



David (Roo) Nicholson
WHOI



George Matsumoto
MBARI

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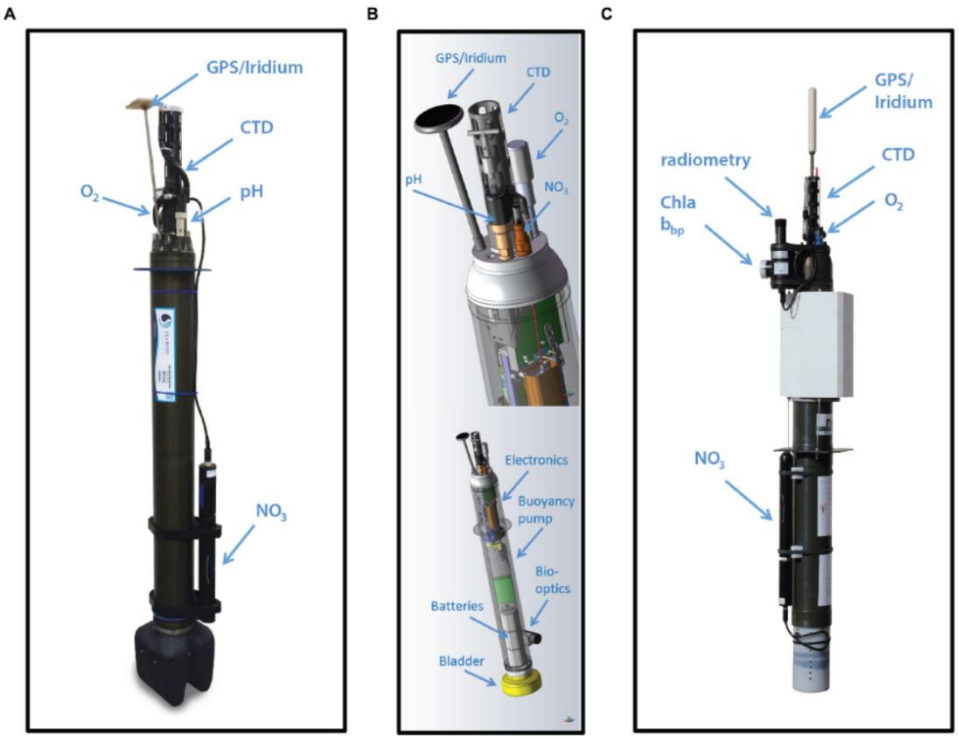


Journal of Geophysical Research: Oceans

RESEARCH ARTICLE
10.1002/2016JC012650

Special Section:
The Southern Ocean Carbon

A data assimilating model for estimating Southern Ocean biogeochemistry

A. Verdy[1] and M. R. Mazloff[1]

Ocean Modelling 133 (2019) 112–128

Contents lists available at ScienceDirect

Ocean Modelling

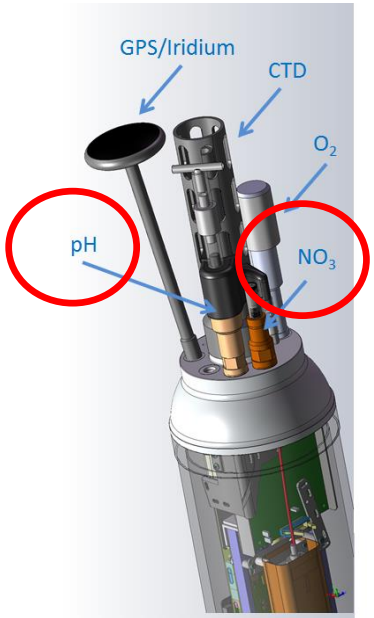
journal homepage: www.elsevier.com/locate/ocemod

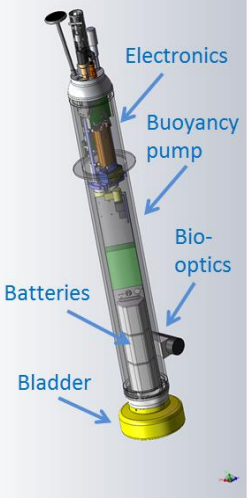
Towards operational 3D-Var assimilation of chlorophyll Biogeochemical-Argo float data into a biogeochemical model of the Mediterranean Sea

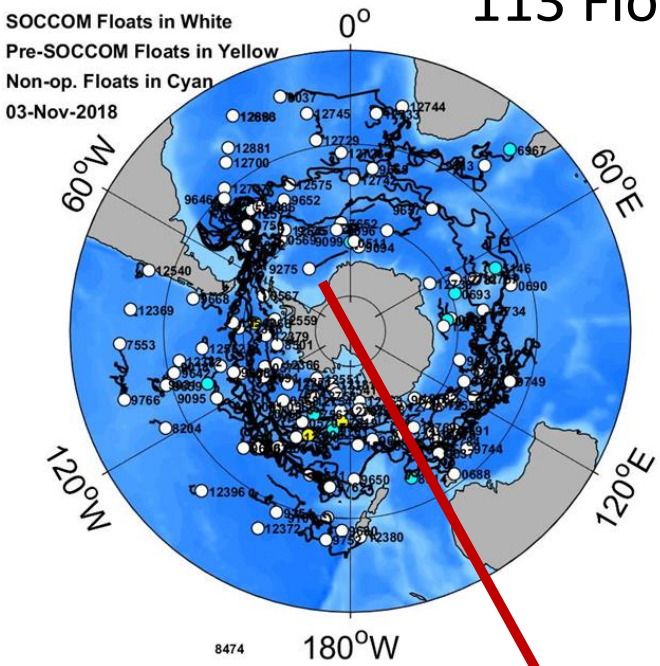
G. Cossarini[a,*], L. Mariotti[a], L. Feudale[a], A. Mignot[b,c], S. Salon[a], V. Taillandier[c], A. Teruzzi[a], F. D'Ortenzio[c]

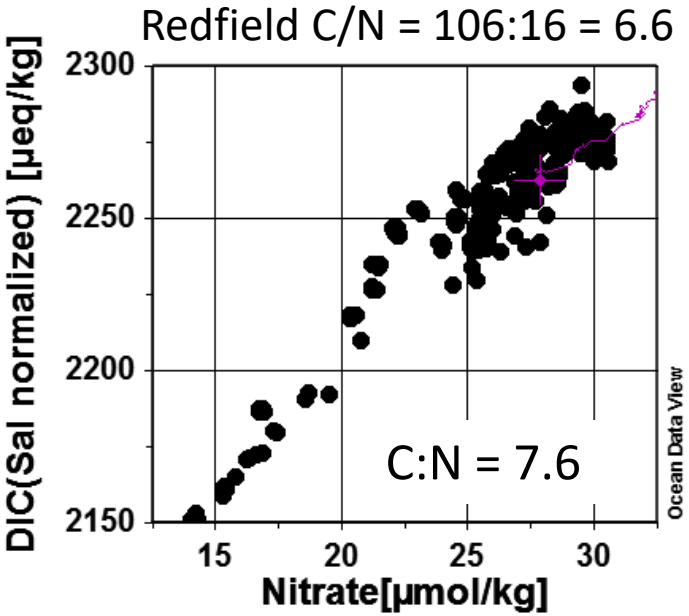
biogeochemical Argo

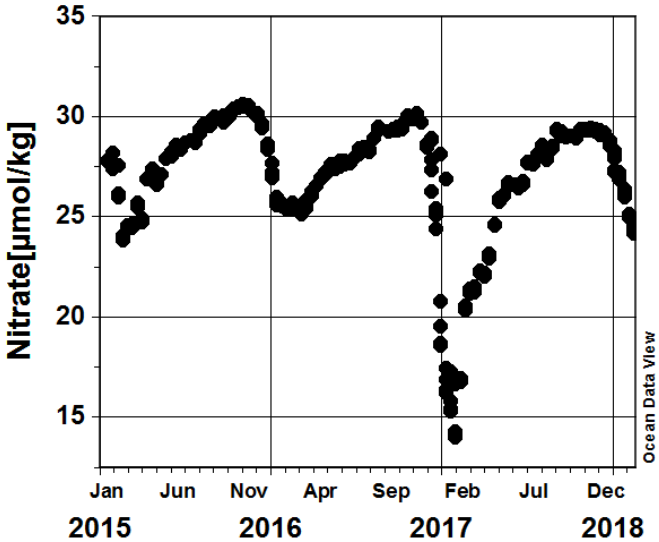
113 Floats/230 Float Years

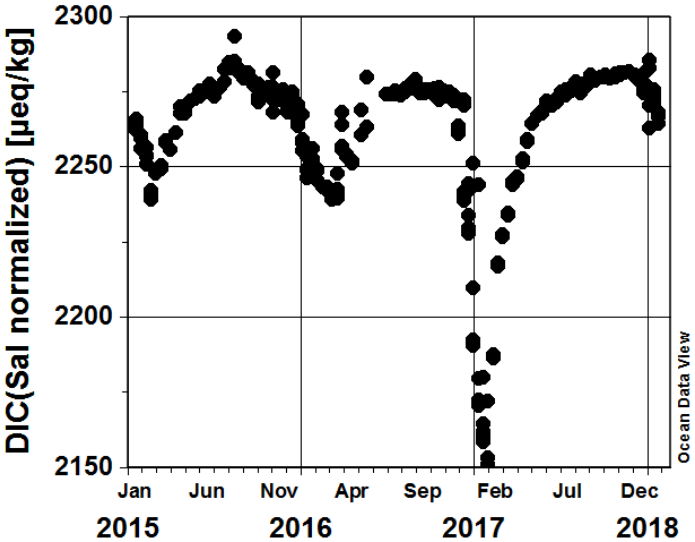




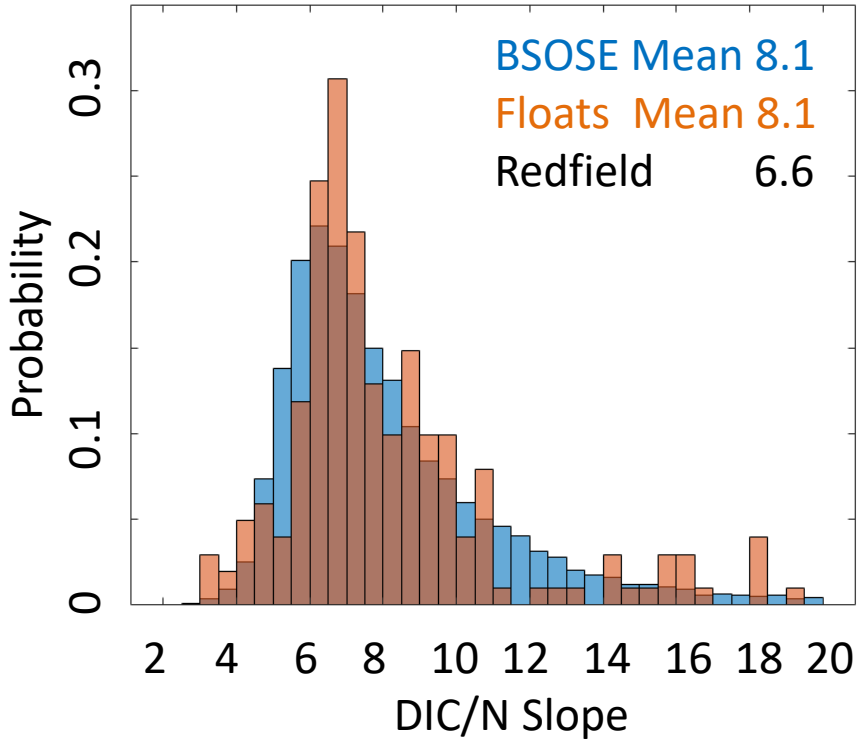




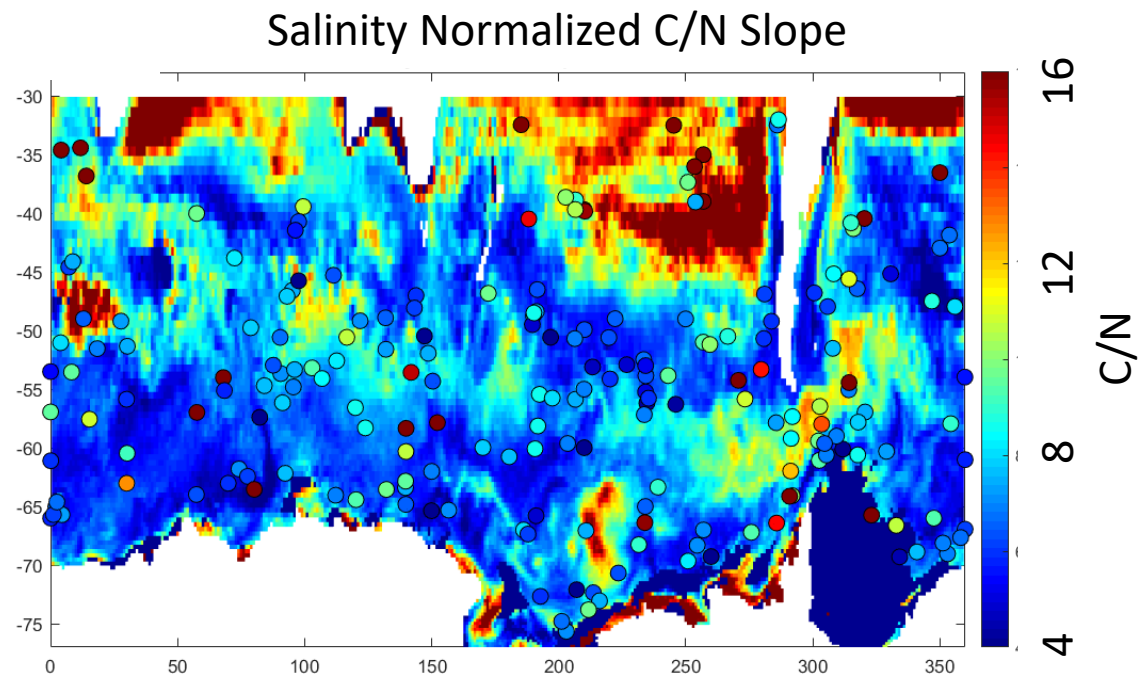




SOCCOM



- C/N slope similar in floats and BSOSE model
- Lots of variability in C/N and ≠ Redfield
- C/N biology in BSOSE fixed at 6.6!!



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