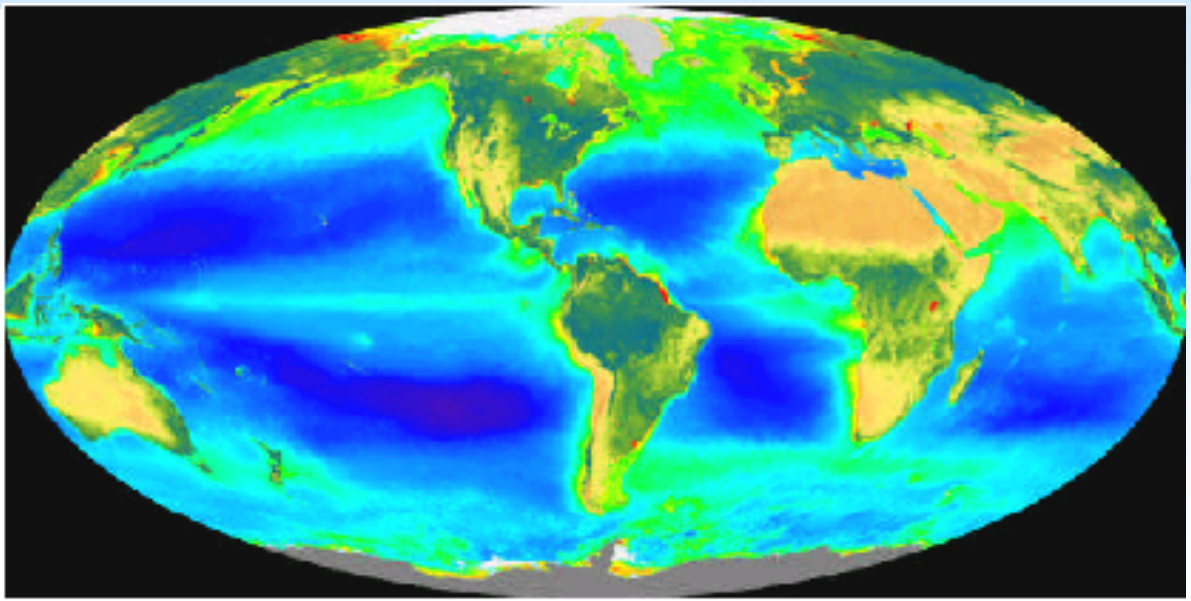
Ocean Carbon & Biogeochemistry (OCB): Overarching Science Questions

Scott Doney
Woods Hole Oceanographic Institution

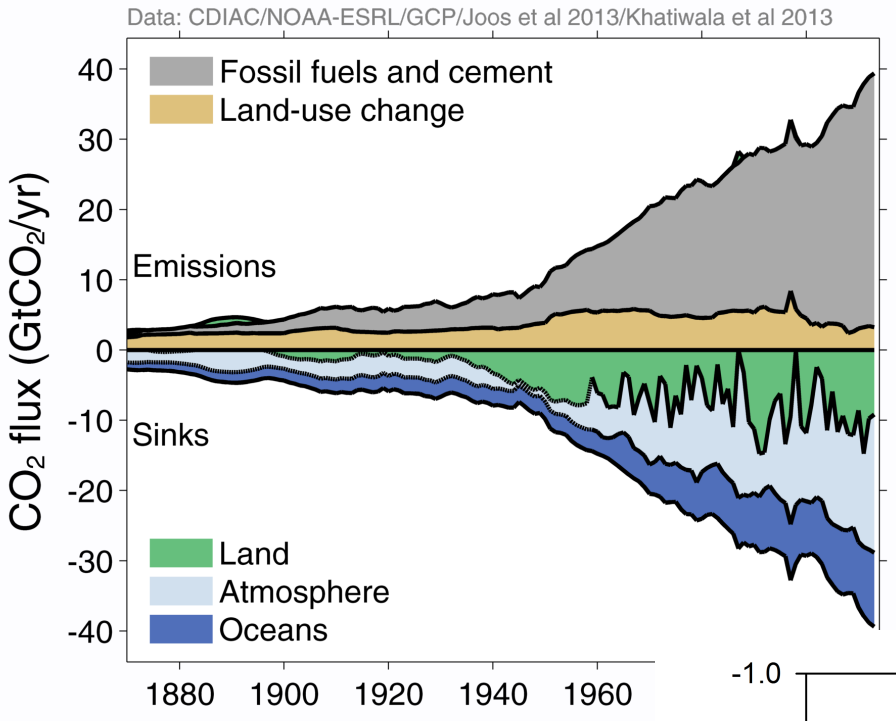
OBB Pre-Decadal Survey/
Advance Plan Workshop
Woods Hole, July 2015

Ocean Carbon & Biogeochemistry

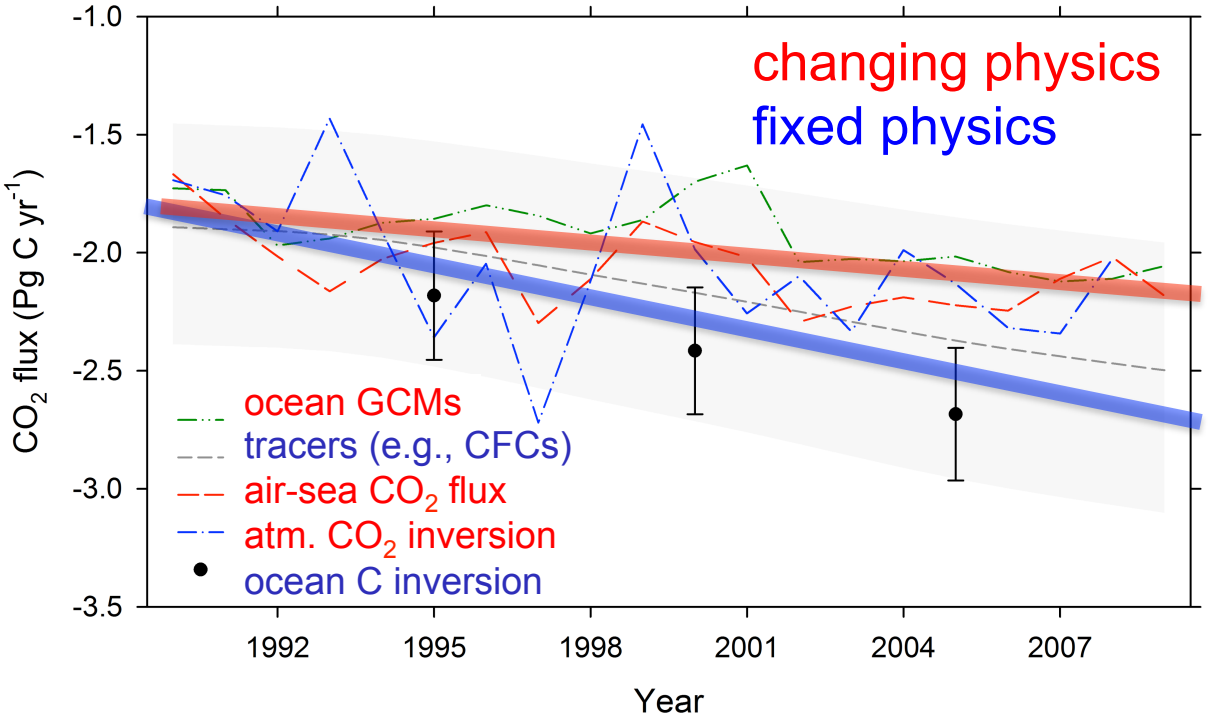


Current OCB Research Priorities

Ocean carbon uptake and storage

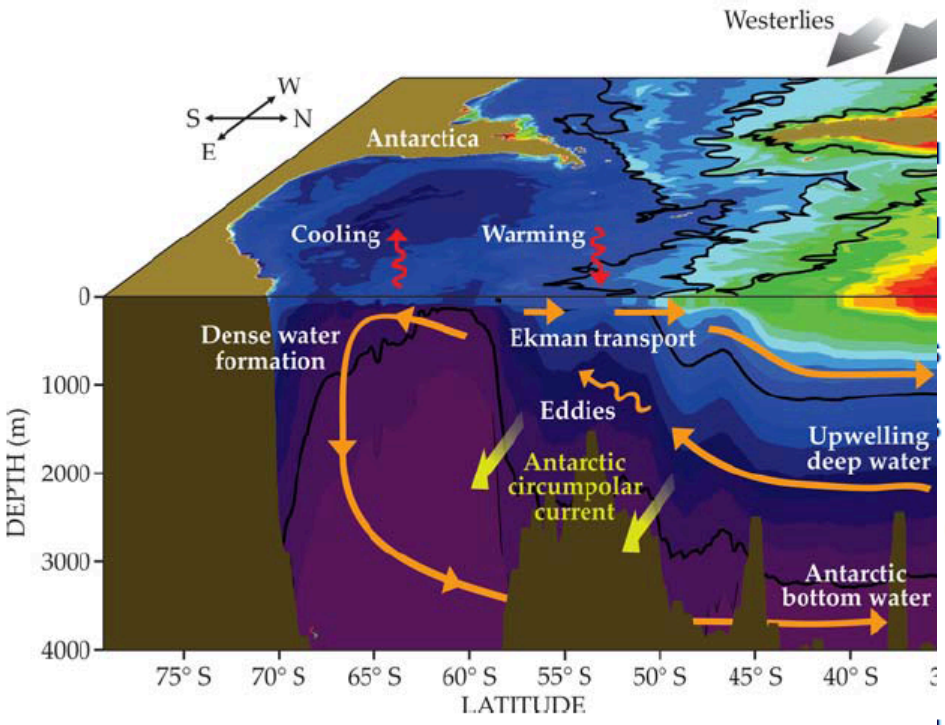


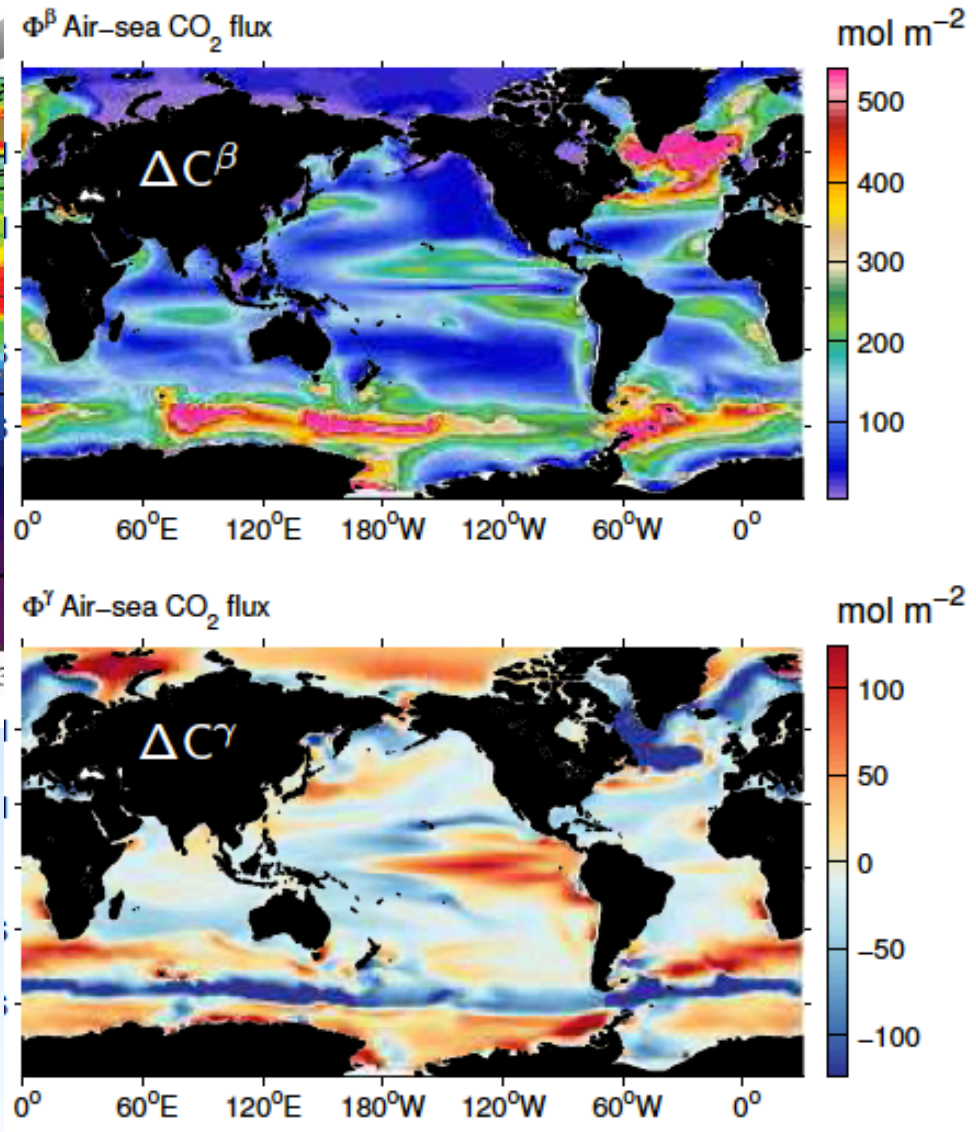
Global Carbon Project 2015



Wanninkhof et al. Biogeosciences 2013

Role of the Southern Ocean



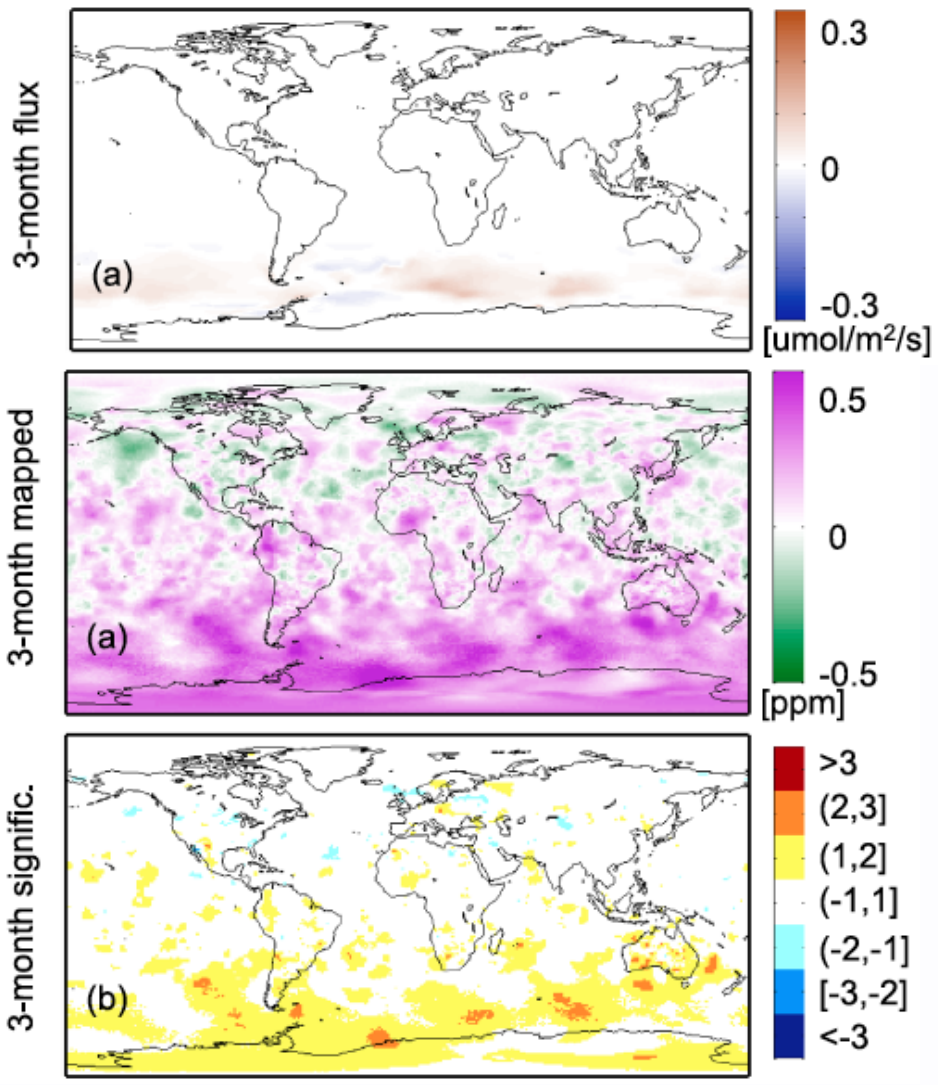


Morrison et al. Physics Today 2015

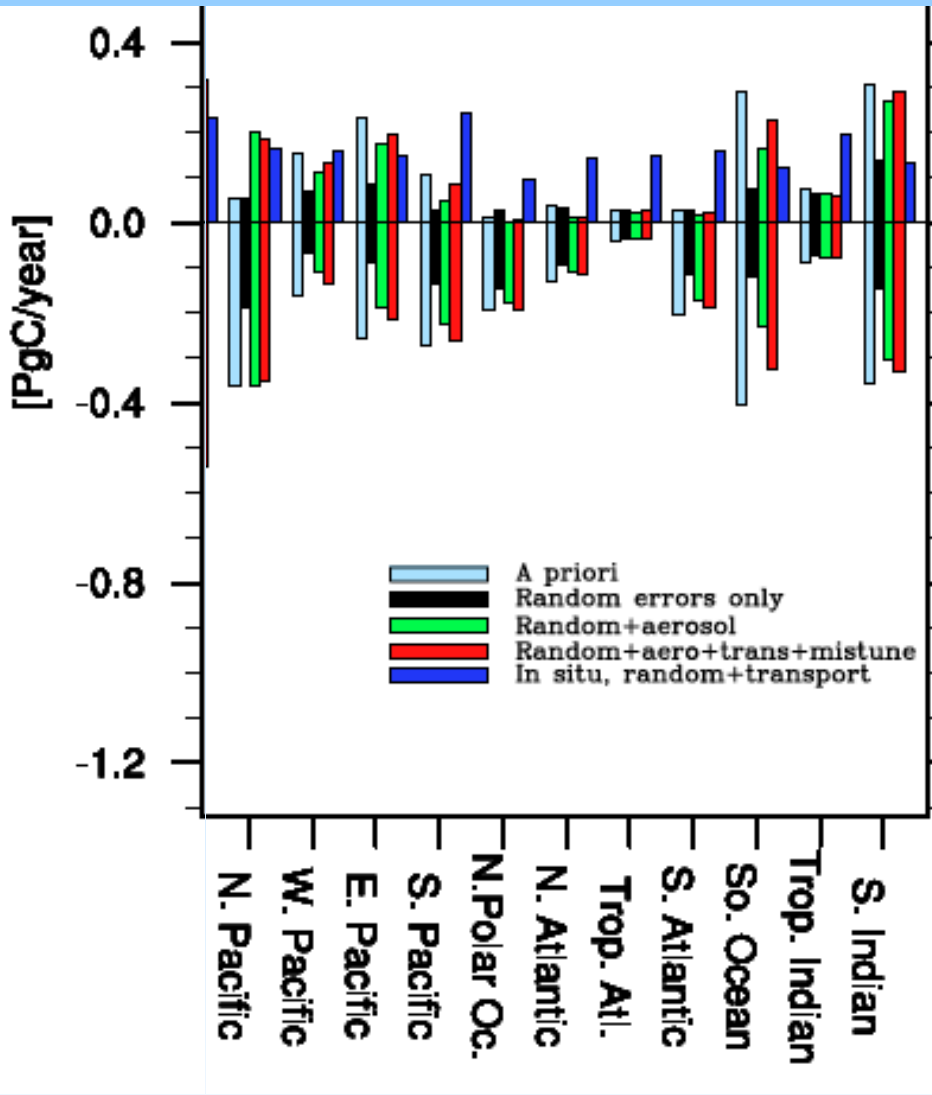
M. Long et al. (CESM) in prep.

OCB/CLIVAR Working Groups
Caltech Linde Center Workshop

Ocean CO_2 Fluxes & Atmospheric Imprint

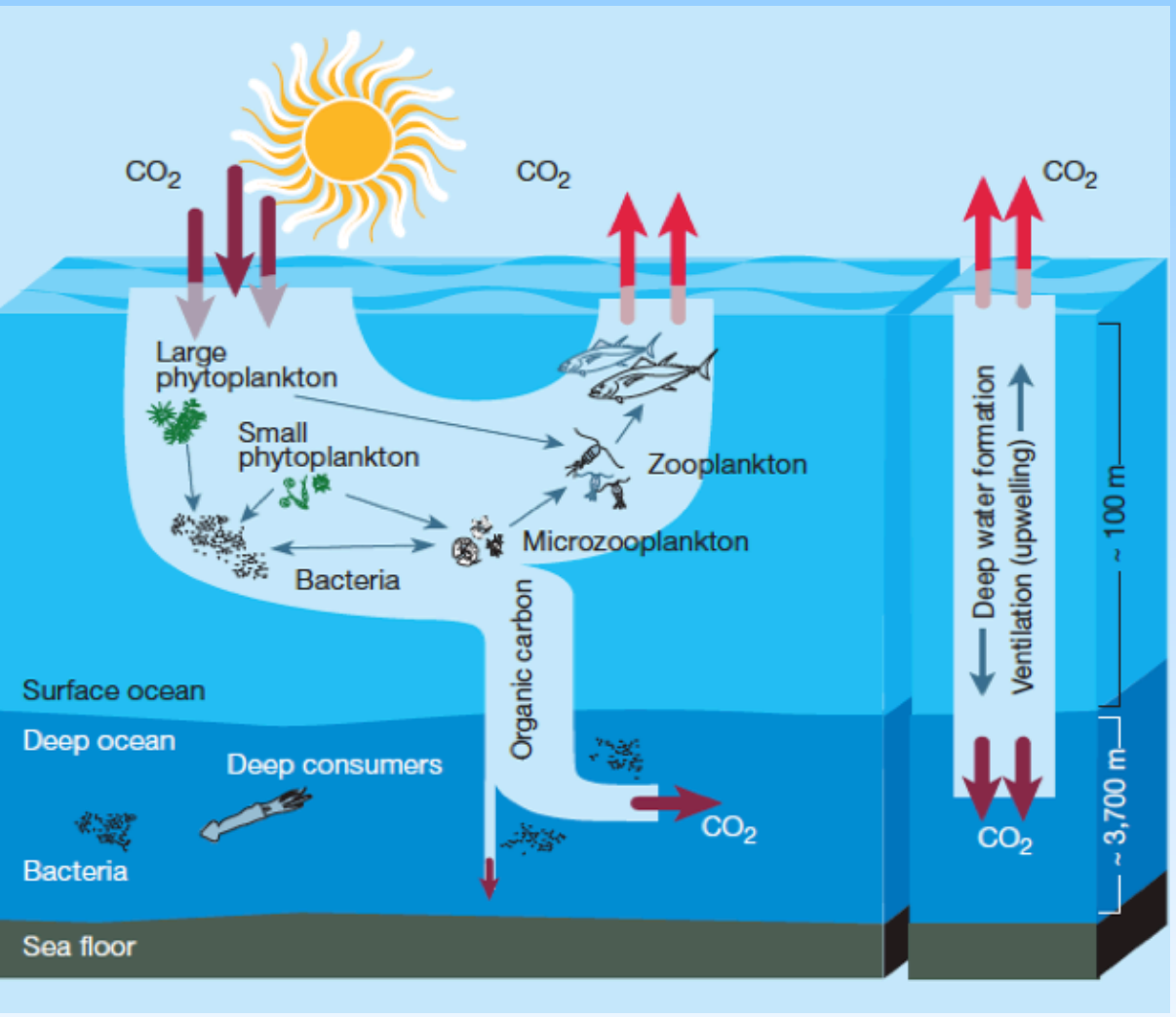


Hammerling et al.
J Geophys. Res. Atmos. 2015



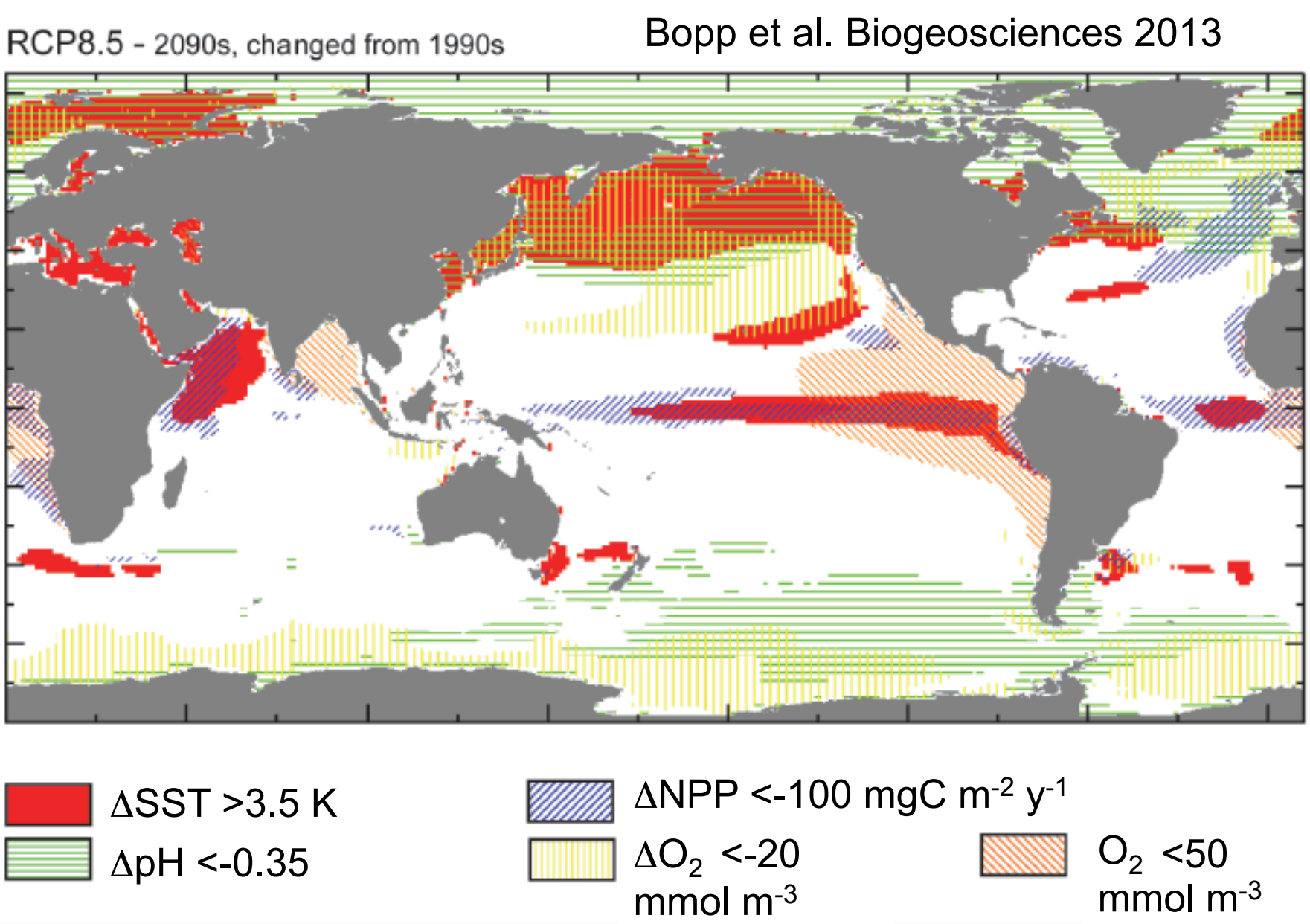
Baker et al.
Atmos. Phys. Chem. 2010

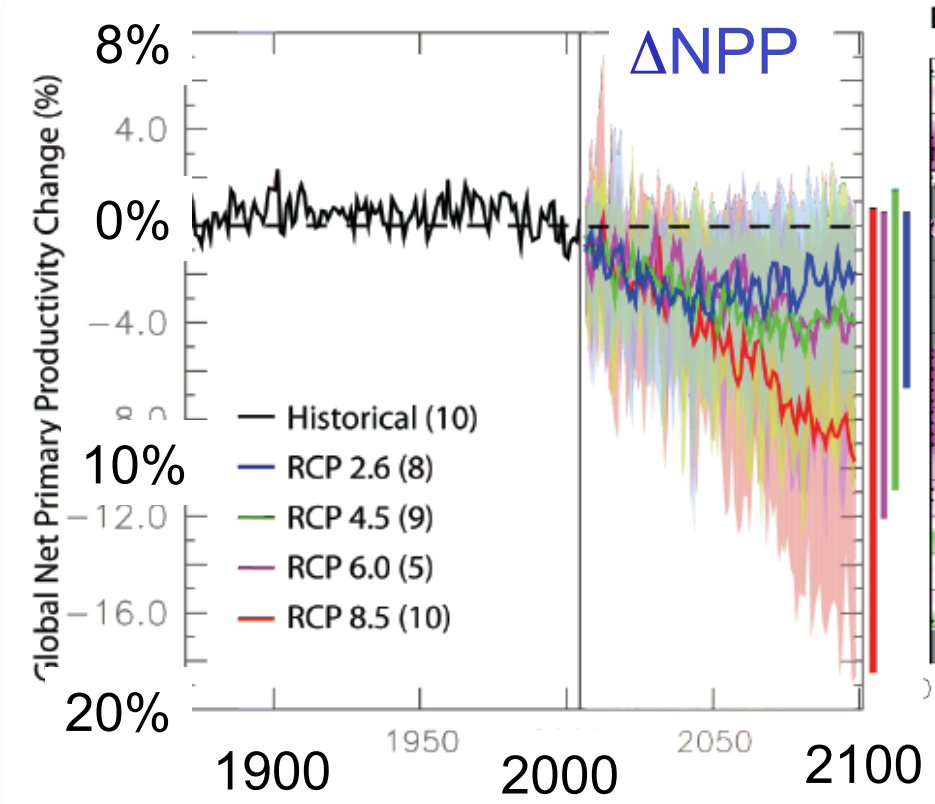
Current OCB Research Priorities

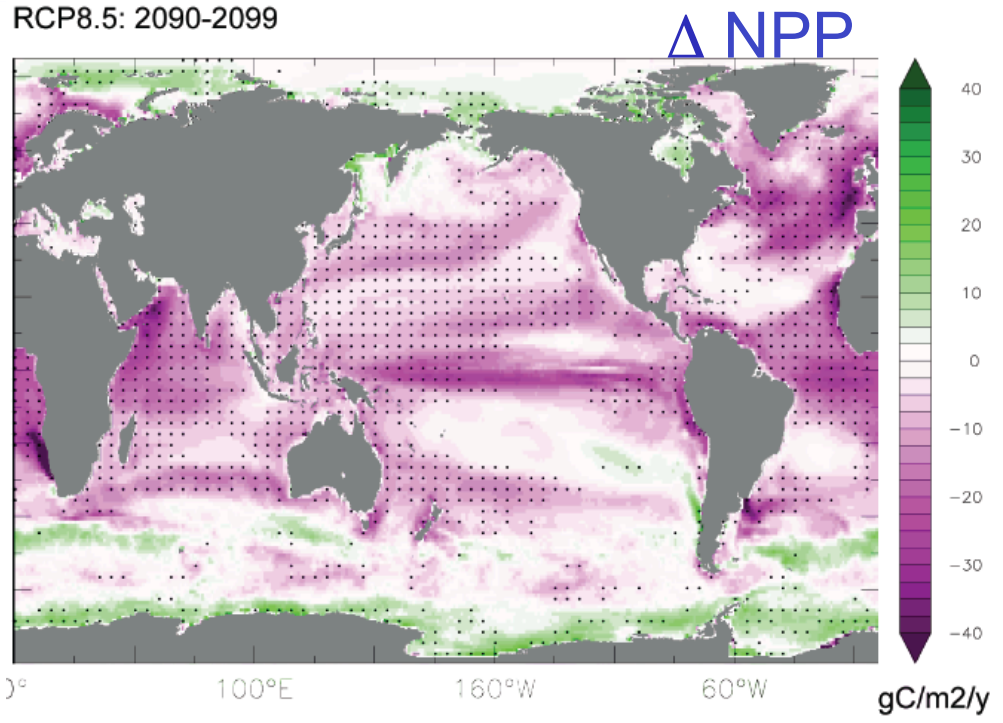


Climate- and human-driven changes in ocean chemistry and associated impacts on biogeochemical cycles and marine ecosystems

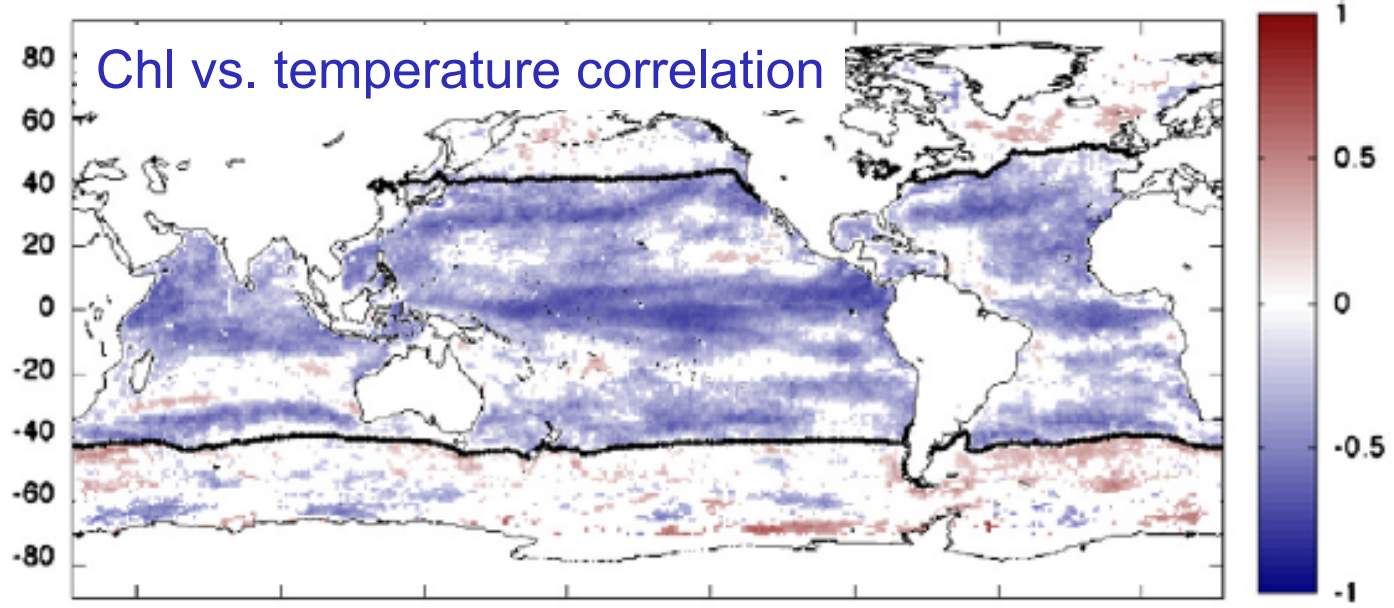
Regional Variation in Multiple Stressors





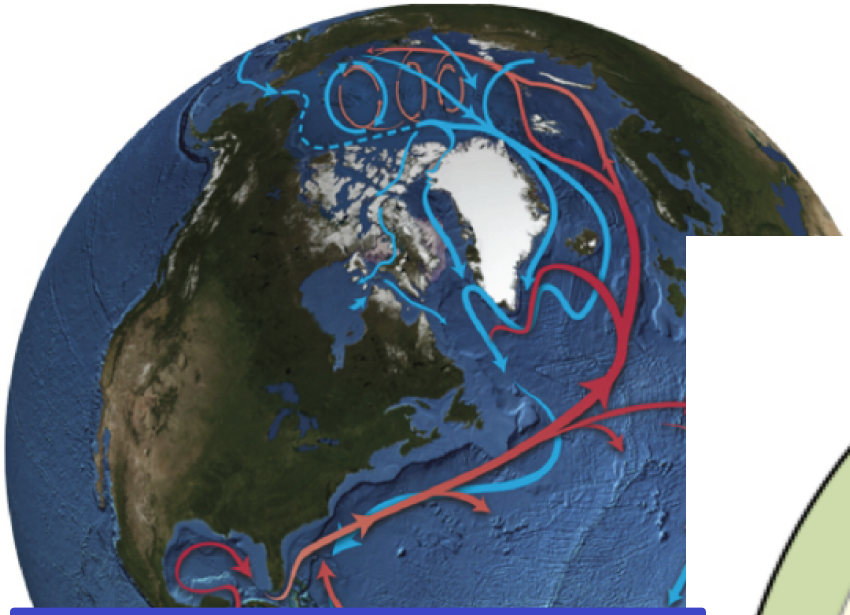


Bopp et al. Biogeosciences 2013



Siegel et al. Remote Sensing Env. 2013

North Atlantic-Arctic Science Plan

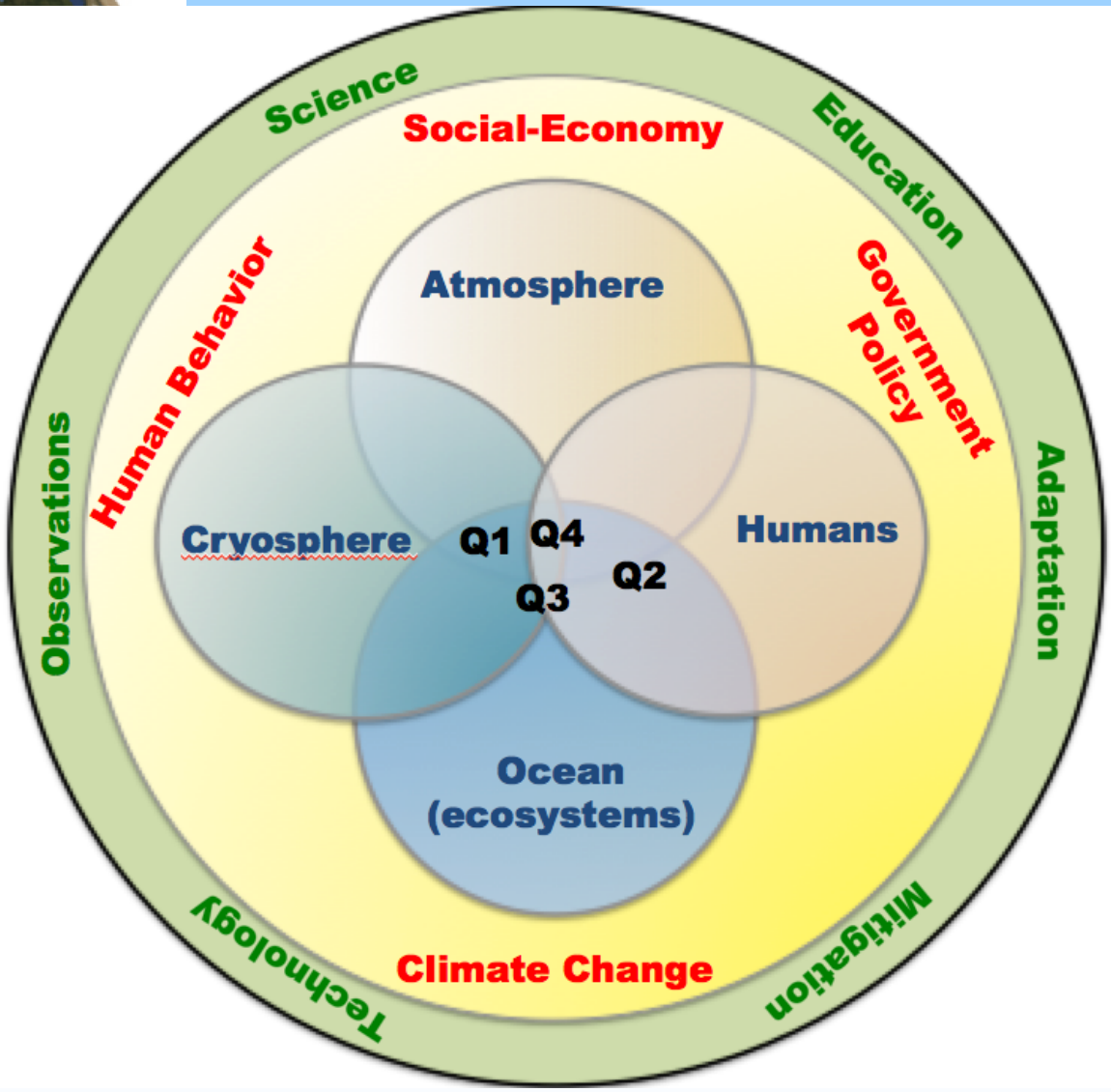


-Physical Circulation & Climate

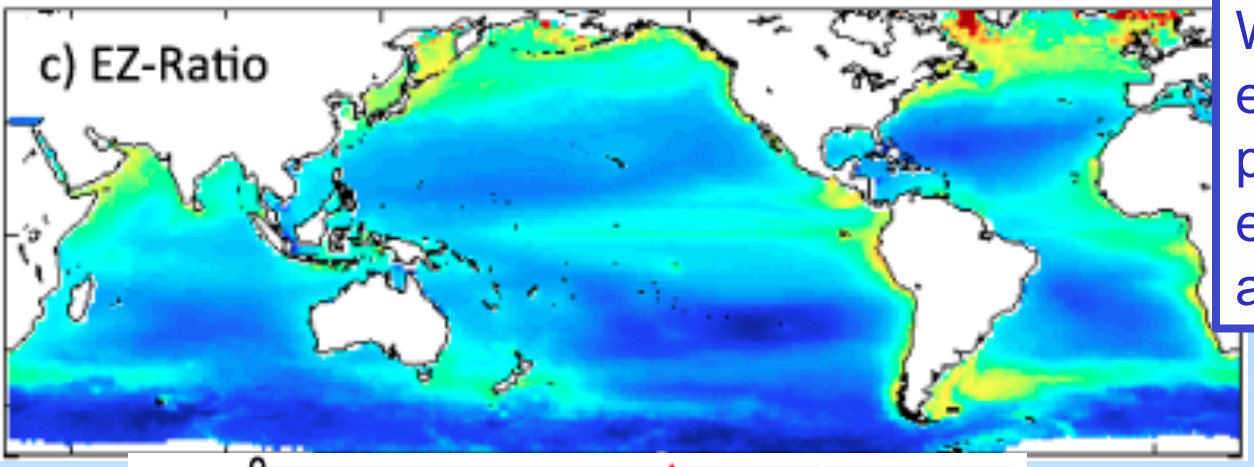
-Biogeochemistry of Shelf & Open Waters

-Food Web Dynamics & Community Structure

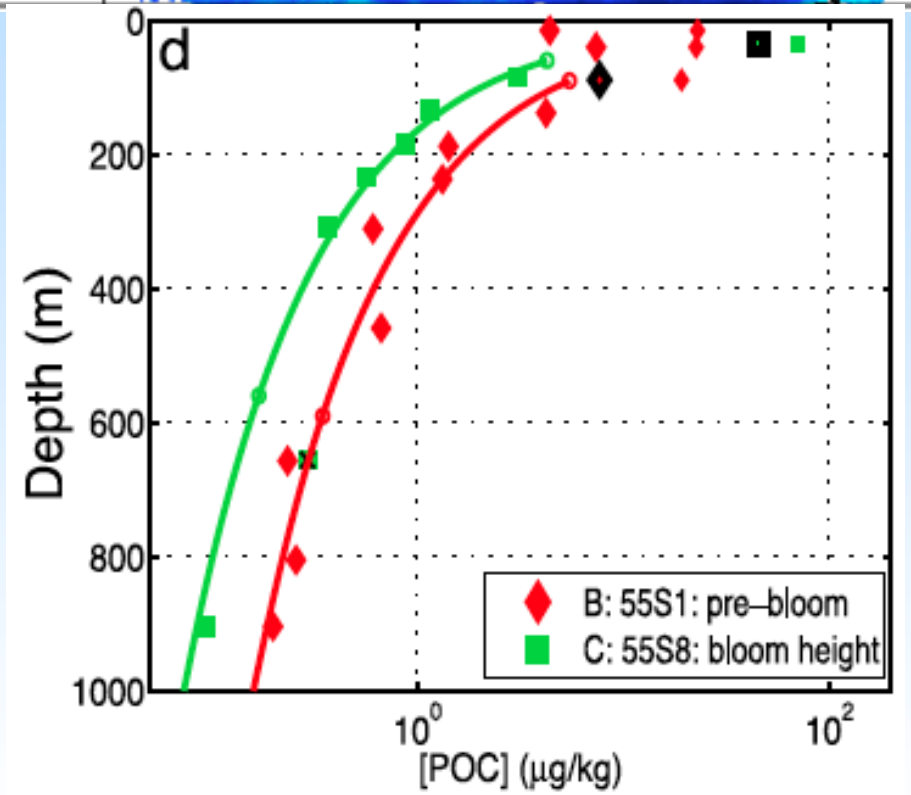
-Linking of Social & Natural Science



Current OCB Research Priorities



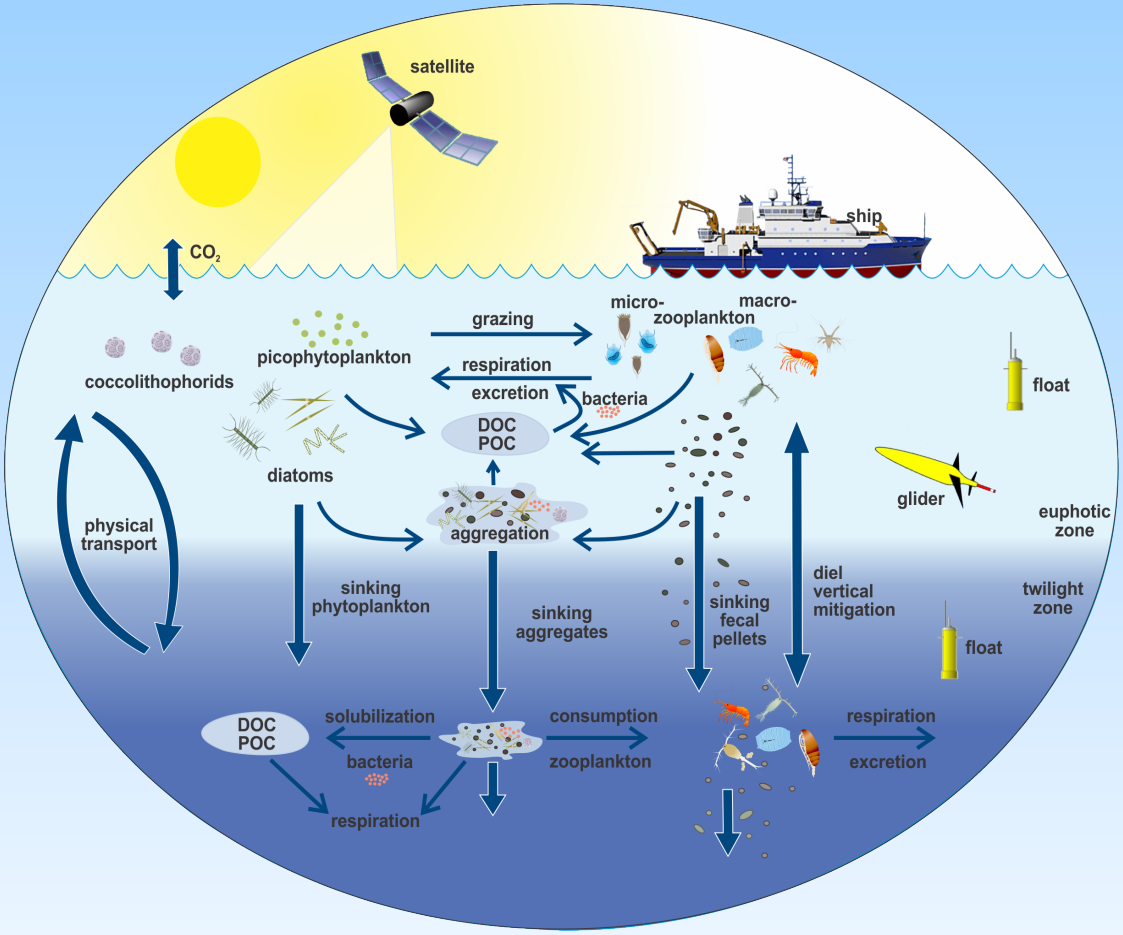
Water column and seafloor ecological-biogeochemical processes and associated effects on carbon export and the biological pump



Siegel et al.
Global Biogeochemical Cycles 2014

Lam et al.
Global Biogeochemical Cycles 2011

EXPORTS: EXport Processes in the Ocean from RemoTe Sensing

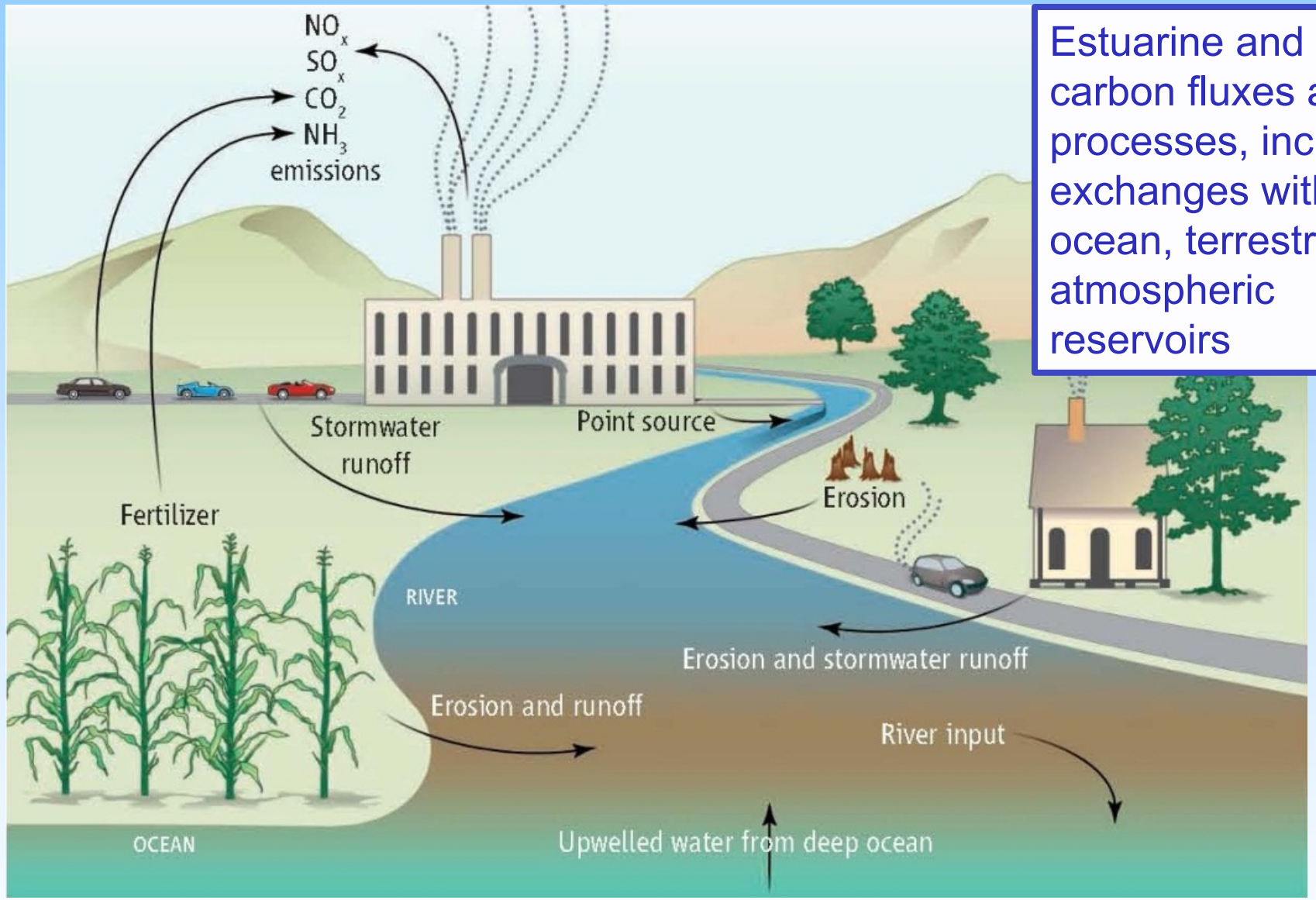


How do upper ocean ecosystem characteristics determine the vertical transfer of organic matter from the well-lit surface ocean?

What controls the efficiency of vertical transfer of organic matter below the well-lit surface ocean?

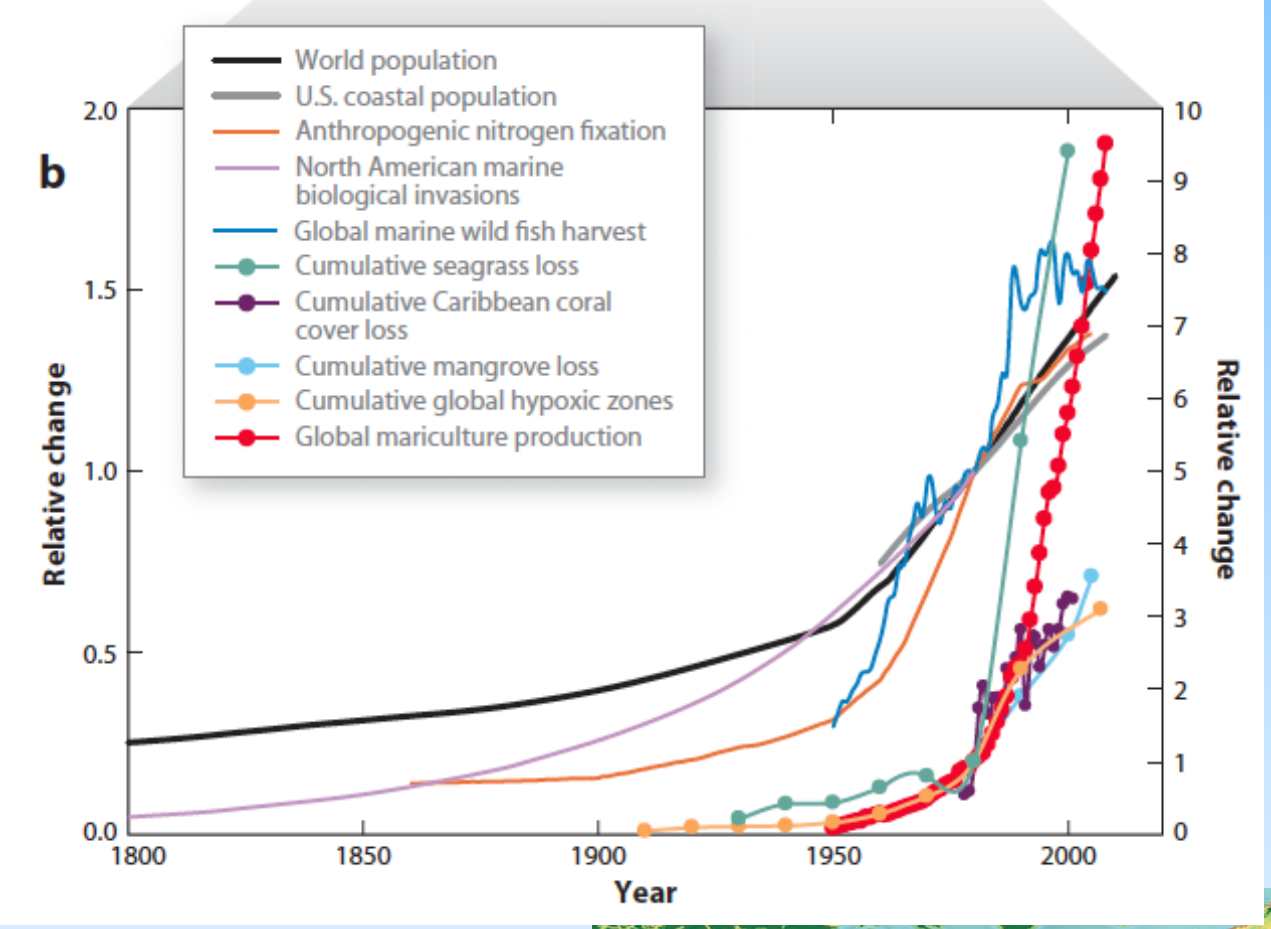
How can the knowledge gained be used to reduce uncertainties in contemporary & future estimates of the export and fates of NPP?

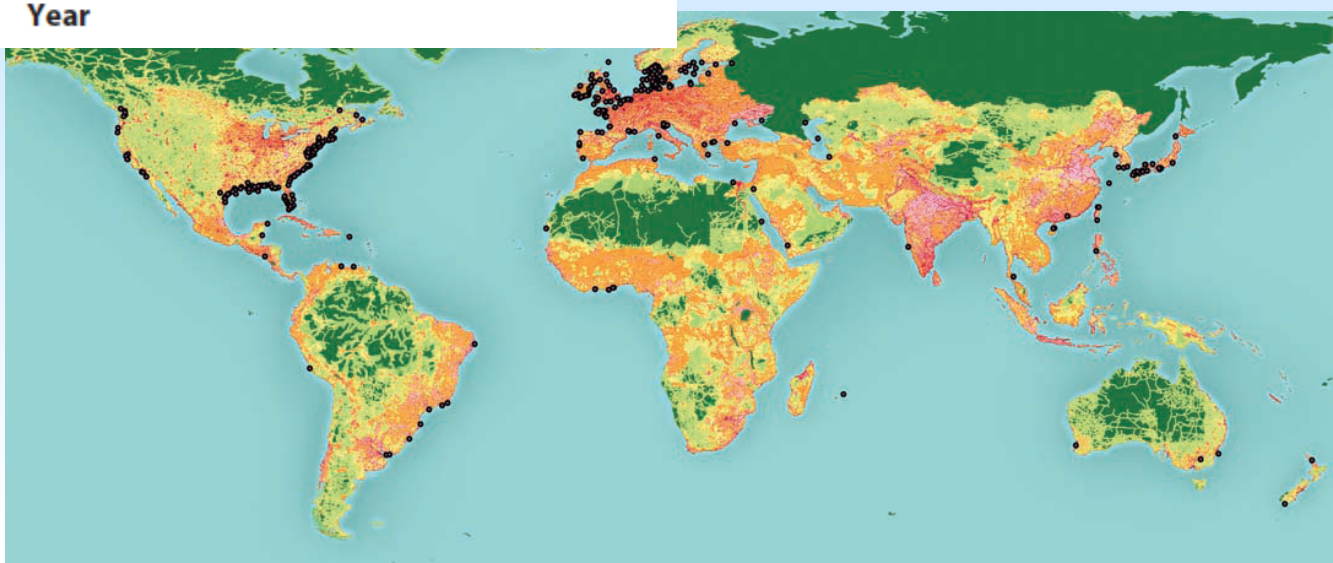
Current OCB Research Priorities



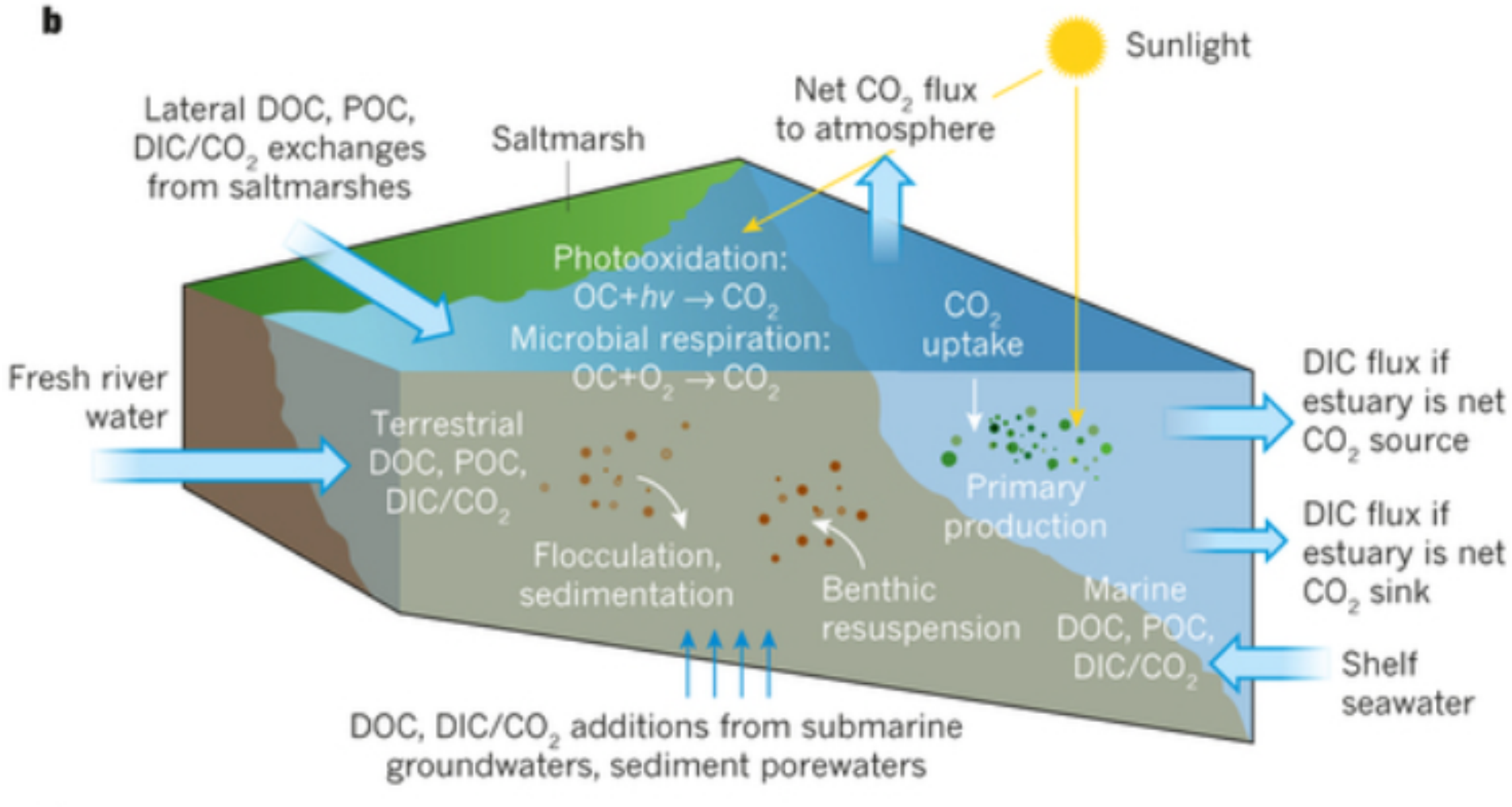
Estuarine and coastal carbon fluxes and processes, including exchanges with open ocean, terrestrial, and atmospheric reservoirs

Coastal Eutrophication, Hypoxia & Land-use Change

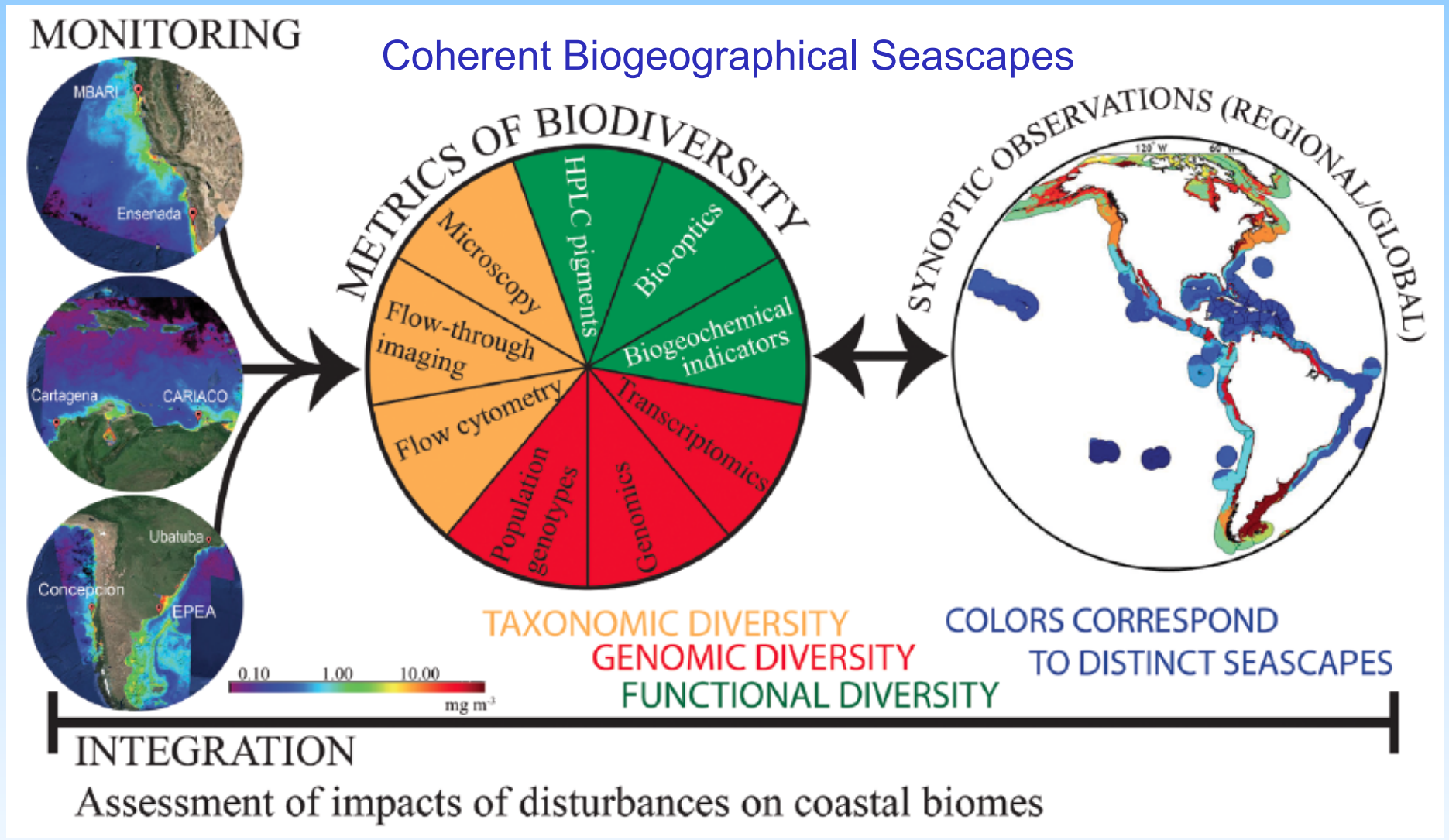




NACP/OCB Coastal CArbon Synthesis (CCARS)

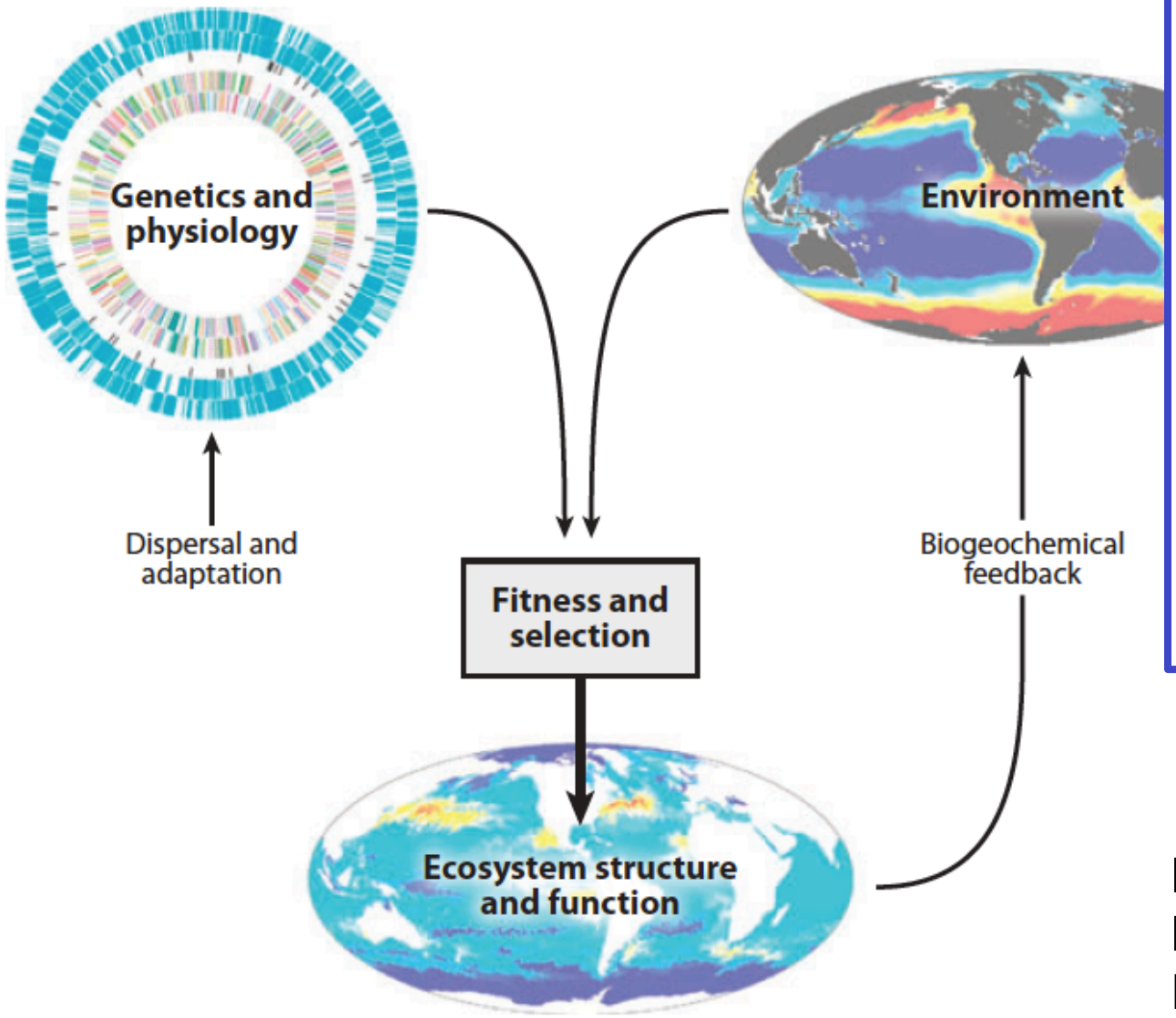


Marine Biodiversity Observation Network (MBON)



Muller-Karger et al. Oceanography 2014

Current OCB Research Priorities

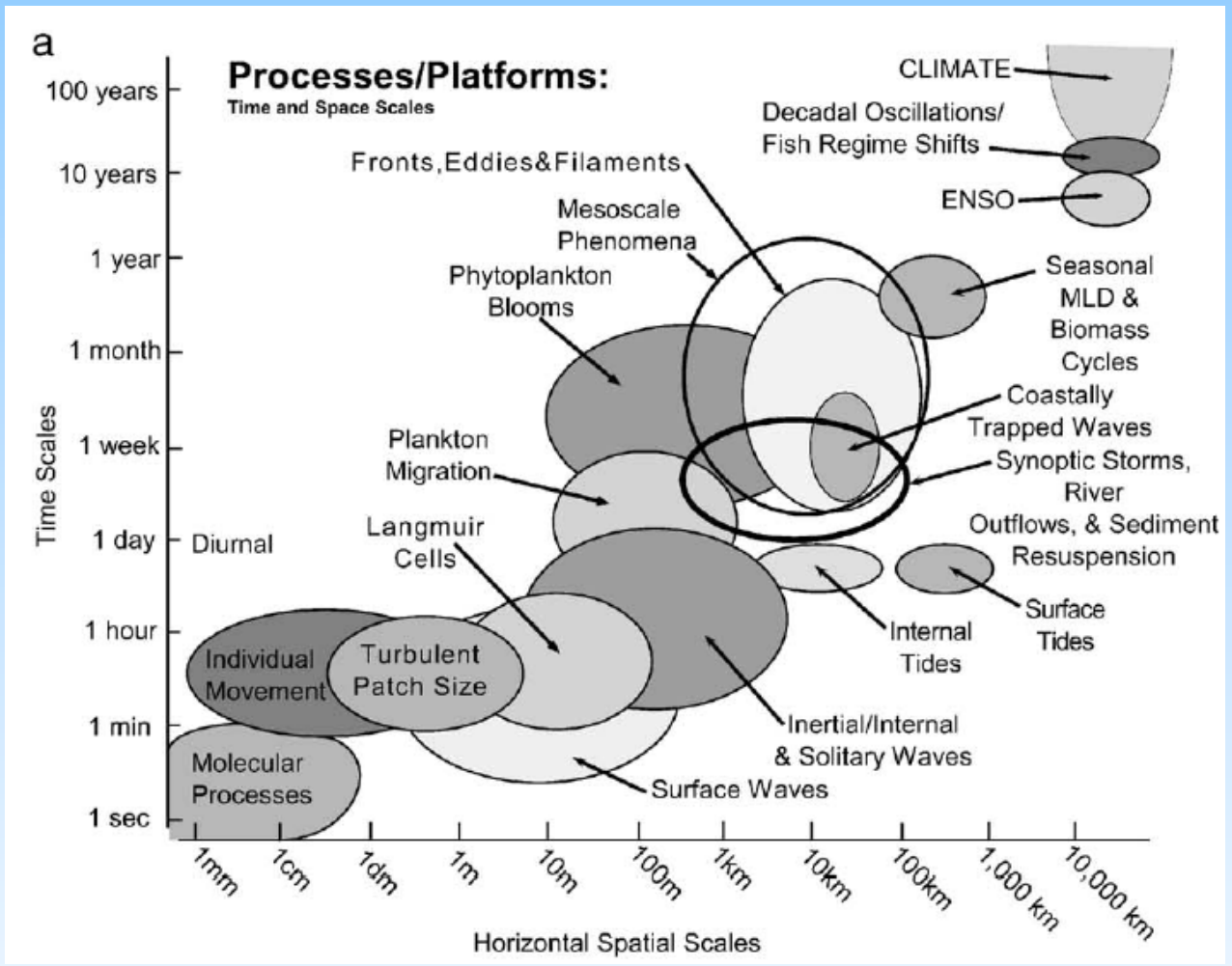


Molecular-level responses of marine organisms to their changing environment

Impacts of evolutionary changes on plankton community structure, function and biogeochemical cycling in the face of global change

Bruggeman & Kooijman
Limnol. Ocean. 2007
Follows et al.
Science 2007

Processes, Scales & Observing Capability



Better integration of suborbital process studies, remote sensing & numerical models to improve:

- Dynamical understanding
- Detection & attribution
- Forecast & prediction

Dickey
J. Marine Science 2003

Current OCB Research Priorities

-Climate- and human-driven changes in ocean chemistry and associated impacts on biogeochemical cycles and marine ecosystems

-Ocean carbon uptake and storage

-Estuarine and coastal carbon fluxes and processes, including exchanges with open ocean, terrestrial, and atmospheric reservoirs

-Water column and seafloor ecological and biogeochemical processes and associated effects on carbon export and the biological pump

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OCB
Ocean Carbon
& Biogeochemistry

North Atlantic Aerosol and Marine Ecosystems Study (NAAMES)