Nutrient supply and carbon uptake in a warm ocean

Atlantic nutrient, carbon and oxygen supply in the Pliocene warm world; consequences for primary productivity and carbon sink efficiency

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Background and motivation

One large unknown in future climate predictions is how changes in ocean structure, circulation and primary productivity may reorganize the global nutrient, oxygen and carbon distribution. A future concern is that Atlantic meridional overturning circulation (AMOC) will slow and less nutrients and oxygen will be transported from the Southern Ocean to the global ocean, which will have large consequences for marine ecosystems and ability to capturing and storing of CO_2.

Project Description

The Pliocene (5.3–2.6 Ma) is the most recent geologic time interval with sustained global warmth (1.8–3.6°C warmer than preindustrial) and levels of greenhouse gases comparable to today (330–495 ppmv) and can thus serve as an analogue for future climate change. I will analyse microfossil remains in Pliocene marine sediment deposits to reconstruct how ocean circulation and primary productivity operated under warm temperatures, to give a better understanding of what we can expect in the future.

How paleoceanographers collect data of past climate change through marine sediment drilling
Credit: IODP, Kevin Kurtz and Alice Feagan

Main Questions

- The Pliocene Atlantic structure, nutrient, carbon and oxygen transport.
- Area and amount of marine carbon absorption and outgassing in a warmer world.

Aims

- Microfossil assemblages, stable isotopes, multiproxy and model comparisons
- International collaborations
- Southern Ocean research expedition

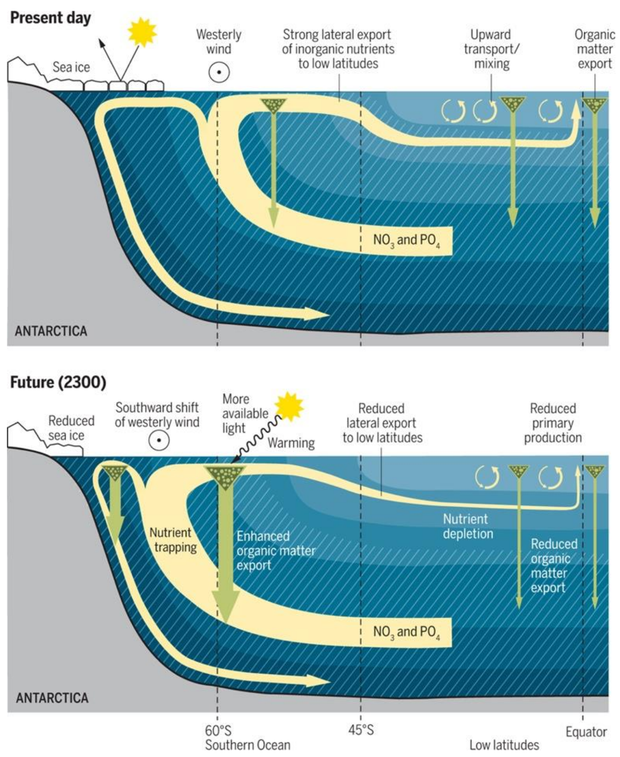
Expected outcomes

I aim to improve our understanding of the oceans role in the climate system and primary productivity/carbon pump. Reconstructions of marine conditions in the warm past (eg. Pliocene) could give us a glimpse into the future.

Marine sustainability

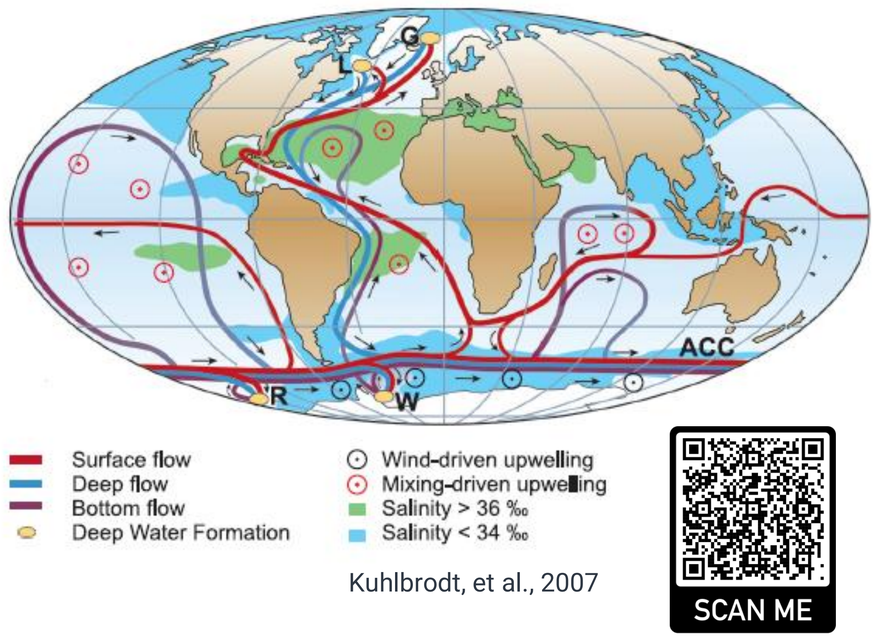
By communicating my scientific findings, I aim to inspire action, and mobilize diverse policymakers, stakeholders and the public to work collectively towards a more sustainable future.
Our paleoceanographic records can improve predictive models of future ocean structure, nutrient availability and marine ecosystem health.

Nutrient cycling



Laufkötter and Gruber, 2018

Global thermohaline circulation



Kuhlbrodt, et al., 2007

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