

Hybrid SORS: Air-Sea Disequilibrium Enhances Glacial Ocean Carbon Storage

Objectives

Abstract: The changes of atmospheric CO₂ concentrations during glacial-interglacial cycles have been attributed to various mechanisms, mostly related to changes in ocean carbon storage. Whereas the direct effect of ocean temperatures has been suggested to be minor, many recent studies imply changes in ocean circulation, sea ice and the biological pump to be major factors. However, the ocean's carbon cycle is complex and quantifying the impacts of different mechanisms on ocean carbon storage, and by extension on atmospheric CO₂ changes, is not straightforward. Here I present results from a novel decomposition of the ocean's carbon pumps applied to a data-constrained model of the Last Glacial Maximum (LGM) to identify the processes responsible for the large decrease in glacial atmospheric CO₂. The model features a weak and shallow glacial Atlantic Meridional Overturning Circulation, expanded sea ice cover and a large increase in soluble iron fluxes in the Southern Ocean. Surprisingly, the large circulation and sea ice changes only have minor effects on atmospheric CO₂ due to their compensating effects on different ocean carbon components. On the other hand, temperature and iron explain most of the simulated atmospheric CO₂ decrease. The decomposition indicates that the biological pump was less efficient during the LGM, contrary to many previous inferences. However, ocean storage was enhanced mainly due to an increase in air-sea disequilibrium, which also explains the larger effects of temperature and iron compared with previous studies.



Short Bio: Samar is an

oceanographer whose research broadly concerns the ocean's role in the global carbon cycle, and in particular the complex interplay between climate, ocean circulation and biogeochemistry. He obtained his Ph.D. in Earth and Environmental Sciences at the Lamont Doherty Earth Observatory of Columbia University, New York, where he worked with Peter Schlosser and Martin Visbeck. This was followed by postdocs at MIT with Carl Wunsch and Lamont with Mark Cane. He remained at Lamont as Research Professor until 2013 when he moved to the UK to take up his current position as Professor of Earth Sciences at the University of Oxford.

Speakers

Speaker: Samar Khatiwala, Professor of Earth Sciences at the University of Oxford.

Host: Raffaele Bernardello, Climate Variability and Change Established Researcher, Earth Sciences

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