Earth Science / Geosciences / Environment
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CO_2 and Climate Change: Past – Present – Future

Speaker:

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The sensitivity of the biological pump to changing CO_2 in the ocean: What can we learn from present day experiments?

There is now global awareness that human activities are responsible for increasing atmospheric CO_2 concentrations to a level higher than it's ever been in the last 20 million years. This awareness raises the need for a better understanding of the complex feedback mechanisms between global climate and biogeochemical processes. Although tiny in size, marine phytoplankton play a large role in the global carbon cycle, because each year they remove about 45 Gt of inorganic carbon from the upper ocean during growth and redirect a significant fraction to the ocean's interior. This biological sequestration of carbon promotes net uptake of the greenhouse gas CO_2 from the atmosphere and is referred to as the 'biological pump'. Because CO_2 and carbonate ions are substrates in metabolic processes, such as photosynthesis and calcification, changes in their availability affect the physiology of cells and the stoichiometry of metabolic products. The degree to which phytoplankton species can tolerate changes of the carbonate system, and the extent to which the biological response may affect the efficiency of the biological pump is still unknown. Therewith future atmospheric CO_2 concentration is difficult to predict. One approach for examining the response of marine phytoplankton to changing CO_2 concentrations is the use of perturbation experiments with contemporary species. This lecture will present recent studies on CO_2 effects on biological processes from the organism to ecosystem level and will discuss the prospects and limits of present day experiments for understanding the variability of the biological pump of the past, present, and future.

Further readings:

Barker, S., J. A. Higgins, and H. Elderfield. 2003. The future of the carbon cycle: review, calcification response, ballast and feedback on athmospheric CO_2. Philosophical Transactions of the Royal Society of London Series A361. 1810: 197-1999.

Hays, G. C., A. J. Richardson and C. Robinson. 2005 Climate change and marine plankton. Trends in Ecology and Evolution 20 (6): 337-344.

Riebesell, U. 2004. Effects of CO_2 enrichment on Marine Phytoplankton. Journal of Oceanography 60:719-729.

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