Geophysical Research Abstracts, Vol. 8, 10184, 2006
SRef-ID: 1607-7962/gra/EGU06-A-10184

Carbon fluxes within a natural plankton assemblage during the PeECE III CO_2 enrichment study

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The predicted doubling of current atmospheric carbon dioxide (CO_2) around the year 2100 will lead to a redistribution of oceanic dissolved inorganic carbon (DIC), increasing CO_2 and bicarbonate (HCO_3^-) at the expense of carbonate ion (CO_3^{2-}) concentrations. In laboratory studies it has been shown that mechanisms and efficiencies of inorganic carbon acquisition by marine phytoplankton are sensitive to changes in carbonate system chemistry. However, the consequences of the future DIC redistribution on marine ecosystems as a whole, and hence marine carbon cycling are virtually unknown. During the PeECE III CO_2 enrichment study the bloom development of a natural plankton assemblage was investigated at today's, predicted year 2100 and year 2150 CO_2 concentrations. To follow the carbon fluxes within these ecosystems, the water was enriched with the stable carbon isotope ^{13}C. In surface waters and sediment traps, samples were taken for analysis of the carbon isotopic composition of group specific biomarkers (polar-lipid-derived fatty acids), representative for marine phytoplankton and bacteria. Additionally, also zooplankton was collected for carbon isotopic analysis. This unique dataset allows evaluation of the carbon fluxes between the DIC, phytoplankton, zooplankton, bacteria and detritus pools during the course of bloom development in response to changing CO_2.