What's missing in the ocean that the land already has?

Corinne Le Quéré, I. Colin Prentice, Erik T. Buitenhuis

Max Planck Institute for Biogeochemistry, PO box 100164, D 07745 Jena, Germany, fax +49-3641-686710, tel. +49-3641-686722, lequere@bgc-jena.mpg.de

In recent years, a variety of climate models have been used to assess the impact of climate change on the oceanic CO_2 sink. These models systematically suggest that the oceanic CO_2 sink will be reduced by 5-25% in 2050, mostly due to the thermodynamic effect of warming and to ocean stratification. Similar models of the land biosphere show a much less predictable behavior, mostly due to the poorly understood response of the soils. While the ocean and the land CO_2 reservoirs are fundamentally different, some processes included in land models are also important in the ocean, but are nearly absent from ocean models. These processes are 1) the consideration of plant functional types, 2) variable stoichiometry, 3) variable nutrient content and 4) remineralization of refractory organic carbon. In addition, 5) the alkalinity cycle and 6) fluxes in the coastal ocean are only simply represented. On time scales from 50 y to thousands of years, these processes have the potential to lead to variations in atmospheric CO_2 concentrations of some tens of ppm. The fact that no global model can reproduce the observed glacial-interglacial variations in atmospheric CO_2 is a strong incentive to explore these avenues. Here we present recent advances and ideas in relation to each of these processes, and discuss if and how they can be included in ocean biogeochemical models.