Geophysical Research Abstracts, Vol. 8, 06416, 2006
SRef-ID: 1607-7962/gra/EGU06-A-06416

Ocean carbon cycling and CO_2 air-sea exchange along the U.S. West Coast

G.-K. Plattner (1), T. Nagai (2), N. Gruber (2), H. Frenzel (2), and J. C. McWilliams (2)

(1) Climate and Environmental Physics, Physics Institute, University of Bern, Switzerland, (2) IGPP & Department of Atmospheric and Oceanic Sciences, UCLA, Los Angeles CA, USA (plattner@climate.unibe.ch / Fax: +41-31-631-8742)

We investigate the coastal ocean carbon budget for the U.S. West Coast on the basis of a coupled physical-biogeochemical model, with a focus on the central upwelling region off California. This region is dominated by intense coastal upwelling, highly turbulent flow, and a high biological production. The ocean model is based on the Regional Oceanic Modeling System (ROMS), coupled to an NPZD-type ecosystem model including a formulation of the ocean carbon cycle, and driven by climatological mean forcing. Our analyses suggest that CO_2 air-sea fluxes constitute only a small component of a very dynamic carbon cycle in the euphotic zone. The central California upwelling region is nearly balanced with regard to CO_2 air-sea exchange, overall constituting a weak source of CO_2 to the atmosphere of roughly 0.2 $\mathrm{mol\,C\,m^{-2}\,yr^{-1}}$. This is the consequence of upwelling-driven CO_2 outgassing nearshore and biologically-driven CO_2 uptake offshore, often associated with filaments originating at capes and other prominent topographical features along the coast. The net CO_2 flux is small compared to e.g. photosynthesis that fixes 8.8 $\mathrm{mol\,C\,m^{-2}\,yr^{-1}}$. New production amounts to 3.3 $\mathrm{mol\,C\,m^{-2}\,yr^{-1}}$ and thus accounts for 37% of total production. Spatially averaged export production nearly equals averaged new production, but locally new and export production are substantially decoupled in this dynamic ocean region. This is due to lateral transport associated with mean horizontal fluxes induced by persistent meso- and submesoscale circulation structures and to lesser degree by the mean lateral offshore transport induced by Ekman transport. We will report on these budgets as well as ongoing efforts to estimate the magnitude of the lateral transport of carbon and nutrients between the coastal and open ocean, which we expect to be substantial.