Geophysical Research Abstracts
Vol. 13, EGU2011-13601, 2011
EGU General Assembly 2011

Modeling the recent changes of CO_2 sink in the Arctic Ocean

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The Arctic Ocean has been showing clear signs of response to anthropogenic climate change because of the area of its sea-ice cover (SIC) rapidly declining with two spectacular events of reduction in 2005 and 2007. Large variations in SIC would potentially impact the rate of uptake of carbon dioxide (CO_2) because SIC is the main factor controlling both the biological production of in pelagic ecosystem and the amount of ocean area available for air-sea gas exchange. The paucity of observational data in the Arctic Ocean makes highly uncertain the estimates of CO_2 uptake that varies between 20 and 200 TgC yr^{-1}. In order to fill this gap, we use an ocean physical-biogeochemical model configured for the Arctic region that we force with re-analyzed atmospheric state (NCEP) for the period 1992-2007. The ocean physical model is also coupled to a dynamic/thermodynamical sea-ice model. The biogeochemical model is based on five oceanic tracers : total alkalinity, dissolved inorganic carbon, dissolved organic phosphorus, dissolved oxygen and dissolved inorganic phosphorus. The model also implements an additional sixth tracer, the dissolved organic carbon of terrestrial origin linked to the river discharge explicitly represented in this model given the importance of the riverine carbon for the ocean carbon fluxes in this region. By using this model, we aim to quantify the interannual changes in CO_2 uptake responding not only to SIC variability but also to all the processes associated with climate warming of this polar region. Special emphasis will be given to the changes of shelf seas where most of the Arctic Ocean CO_2 sink occurs.