Geophysical Research Abstracts
Vol. 13, EGU2011-4675-1, 2011
EGU General Assembly 2011

Mechanisms of carbon absorption on shelfs - a model case study for the NW European shelf.

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Although shallow shelf areas comprise only 7 – 8 % of the world ocean, there is growing evidence that they may be responsible for 15 – 30 % of the total marine primary production. They also may absorb more than 1 Pg carbon per year (continental shelf pump).
In this study a global state of the art OGCM coupled to a marine biogeochemistry model is used to estimate the carbon absorption by the global ocean and shelf areas. For this, river loads for 71 major river systems all over the world have been implemented for riverhine contributions of P, O2 N2, DIC, Fe, and Si.
We find that the global carbon uptake increases by about 1.5 PgC when integrating the model with riverhine nutrients. The carbon absorption on the global shelfs increases by 10 %. Special investigations are carried out for the NW European shelf seas, especially the North Sea/Baltic Sea. Here, the yearly carbon absorption is strongly linked to the North Atlantic Oscillation (NAO) and varies between 8 – 10 million tons of carbon. Maxima in carbon uptake are associated with increased nutrient imports from the adjacent Atlantic during periods when the NAO is in its positve phase. In the southern North Sea riverhine nutrient inputs increase the biological productivity which lowers nearly everywhere the local CO2 partial pressure and, in turn stimulates the CO2 flux from the atmosphere to the ocean. At the northern shelf edge a highly variable export of carbon in the near bottom layers is simulated, which in the longterm mean amounts to $\sim$180 million tons per year. This is balanced by a corresponding import through the English channel and by the flux from the atmosphere.