Geophysical Research Abstracts
Vol. 12, EGU2010-12400-1, 2010
EGU General Assembly 2010

Seasonal and inter-annual variability of air-sea CO2 fluxes and seawater carbonate chemistry in the Southern Bight of the North Sea

Nathalie Gypens (1), Geneviève Lacroix (2), Christiane Lancelot (1), and Alberto V. Borges (3)

(1) Ecologie des Systemes Aquatiques, Université Libre de Bruxelles, Bruxelles, Belgium, (2) Unité de Gestion du Modèle Mathématique de la mer du Nord, Institut Royal des Sciences Naturelles de Belgique, Bruxelles, Belgium, (3) Chemical Oceanography Unit, University of Liège, Liège, Belgium

A 3D coupled biogeochemical-hydrodynamical model (MIRO-CO_2&CO) has been implemented in the English Channel (ECH) and the Southern Bight of the North Sea (SBNS) to estimate the present-day spatio-temporal distribution of air-sea CO_2 fluxes, surface water partial pressure of CO_2 (pCO_2) and other components of the carbonate system (pH, saturation state of calcite (Ω_{ca}) and of aragonite (Ω_{ar})) and the main drivers of their variability. Model simulations performed from 1994 to 2004 show higher seasonal variability and horizontal gradients of air-sea CO_2 fluxes and seawater carbonate chemistry variables in near-shore waters than in off-shore waters. This results from important river inputs of nutrients and carbon. Nutrients, by stimulating primary production, drive a sink of atmospheric CO_2 and an increase of pH, of Ω_{ca} and of Ω_{ar}, while the input of organic and inorganic carbon, drive a source of CO_2 to the atmosphere and an decrease of pH, of Ω_{ca} and of Ω_{ar}. For the 1994-2004 period, air-sea CO_2 fluxes show significant inter-annual variability, with oscillations between annual CO_2 sink and source. The inter-annual variability of air-sea CO_2 fluxes simulated in the SBNS is controlled primarily by river loads and changes of primary production (net autotrophy in spring and early summer, and net heterotrophy in winter and autumn), while in areas not influenced by rivers as the ECH, the inter-annual variations of air-sea CO_2 fluxes are mainly due to changes in sea surface temperature and in near-surface wind strength and direction.