Geophysical Research Abstracts
Vol. 18, EGU2016-4010-2, 2016
EGU General Assembly 2016

Interannual sedimentary effluxes of alkalinity in the southern North Sea: Model results compared with summer observations.

Johannes Paetsch (1), Wilfried Kuehn (1), and Katharina Six (2)

(1) Institute of Oceanography, University of Hamburg, Bundesstraße 53, D-20146 Hamburg, Germany (johannes.paetsch@zmaw.de), (2) Max Planck Institute for Meteorology, Bundesstraße 53, D-20146 Hamburg, Germany (katharina.six@mpimet.mpg.de)

Alkalinity generation in the sediment of the southern North Sea is the focus of several recent studies. One motivation for these efforts is the potentially enhanced buffering capacity of anthropogenic CO_2 invasion into the corresponding pelagic system.

An adaptation of a global multilayer sediment model (Heinze et al., 1999) in combination with a pelagic ecosystem model for shelf sea dynamics was used to study the benthic reactions on very different annual cycles (2001 – 2009) including the River Elbe summer flooding in 2002. The focus of this study is the efflux of alkalinity, their different contributors (aerobic respiration, denitrification, net sulfate reduction, calcite dissolution, nitrification) and their seasonal and interannual cycles.

Similar to the observations covering the southern North Sea (Brenner et al., 2015) the model results show large horizontal gradients from the near-shore high productive areas with benthic remineralization up to R_{min} = 10.6 mol C m^{-2} yr^{-1} and TA generation R_{TA} = 2 mol C m^{-2} yr^{-1} to off-shore moderate productive areas with mean R_{min} = 2.5 mol C m^{-2} yr^{-1} and mean TA generation R_{TA} = 0.4 mol C m^{-2} yr^{-1}.

Beside calcite dissolution, aerobic respiration (producing ammonium) and denitrification are the largest contributors to alkalinity generation. Nitrification is reducing alkalinity in the sediment.

Due to low regenerated primary production in summer, the year 2001 exhibits the lowest input of particulate organic matter into the sediment (POC_{exp}=2.3 mol C m^{-2} yr^{-1}), while the year 2003 exhibits the highest export production (POC_{exp}=2.6 mol C m^{-2} yr^{-1}). The biogeochemical reactions and the effluxes from the sediment follow these pelagic amplitudes with a time lag of about one year with damped amplitudes.

References

Brenner, H., Braeckman, U., Le Guitton, M., Meysman, F.J.R., 2015. The impact of sedimentary alkalinity release on the water column CO_2 system in the North Sea. Biogeosiences Discussion, 12(15): 12395-12453.

Heinze, C., Maier-Reimer, E., Winguth, A.M.E, Archer, D., 1999: A global oceanic sediment model for long-term climate studies. Glob. Biogeochem. Cycles, 13(1): 221-250.