Modeling fate of Mn and Fe at the sediment/water interface in changing redox conditions

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The bottom redox conditions depend on a combined effect of eutrophication (increase in nutrient load) and climate (intensity of mixing and water renewal). Benthic fluxes of elements can change magnitude and even direction in case of changes of redox conditions from oxic to suboxic and anoxic.

Experimental data show that Mn benthic flux doen't depend on redox conditions and is driven only by the concentration gradient, while the Fe flux is stricktly depend on the bottom water redox conditions (Pakhomova et al., 2007).

The observed changes of concentrations of dissolved Mn and Fe in the bottom water can be connected with (i) transport/diffusion from the sediment and overlying water and (ii) chemical reactions in the bottom water (i.e. reductions of oxides and dissolution/oxidation of sulfides).

An application of a model gives a unique possibility to numerically analize the role of different processes in the observing changes. In this study we use a 1-dimensional C-N-P-Si-O-S-Mn-Fe vertical Bottom RedOx Model (BROM) describing transport in the sediments, bottom boundary layers (BBL) and the water column coupled with biogeochemical block simulating changeable redox conditions, and the carbonate system processes block (Yakushev et al., 2014). The model is capable to reproduce seasonal anoxia and it is possible to analyze the components of Mn and Fe budget in different redox conditions.

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