Predicting lake anoxia using a coupled water column-sediment diagenesis model

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We updated the 1D model for lake physics and plankton dynamics MyLake [1] and coupled it to a vertically resolved sediment diagenesis module. The new module, written in Matlab, includes a biogeochemical reaction network seamlessly coupling water column and sediment processes, as well as sediment transport processes such as bio-mixing and sediment advection. Modelled concentrations of dissolved species in the lower layer of the water column are used as boundary conditions for the sediment model. The advective flux of solid species, arriving at the sediment-water interface, is proportional to its concentration in the water column and its settling velocity. The return flux of the aqueous species is modelled via molecular diffusion at the sediment-water interface, enhanced by bioirrigation.

The application of the model to a boreal lake shows the capacity to simulate daily water quality and sediment-water exchange fluxes dynamically over a period of 40 years [2]. During this period, climate warming and increase in dissolved organic carbon loads to the lake enhanced lake respiration processes, resulting in longer periods of bottom-water anoxia.

[1] Saloranta and Andersen (2007) Ecol. Model. **207**, 45-60. [2] Couture *et al*. (2015). *J. Geophys. Res: Biogeosci*. ***120***,2441–2456.