OC17 - Modelling nutrient and primary producers´ dynamics in a kettle hole in an agricultural landscape

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Kettle holes are shallow and small (< 1 ha) ponds that originated in depressions formed during the retreat of the ice at the end of the last glaciation. They are very abundant in the moraine regions in North-East Germany, where intensive agriculture currently threatens the ecosystem services they provide. In order to effectively plan the conservation and management of kettle holes, comprehensive knowledge on their ecological functioning should be attained. To this aim, we developed a novel process-based biogeochemical model that targets the reproduction of the seasonal dynamics of biological and chemical components in semi-permanent kettle holes located in the Uckermak region, in North-East Germany. The model considers four elemental cycles (C, N, P, and O), and two primary producers' growth forms: phytoplankton and free-floating macrophytes (duckweeds). The capacity of the model to reproduce the patterns observed in an extensively studied kettle hole was evaluated. A sensitivity analysis identified the most influential parameters on the simulated components. The predicted mass fluxes associated to the ecological interactions were also quantified. The model reasonably simulated the seasonal patterns of phytoplankton and duckweeds in the pond, as well as that of most components of P and C cycle. The sensitivity analysis indicated that the parameters controlling phytoplankton growth and losses as well as duckweeds mortality exert the strongest influence on the model outputs. The model results suggest that differential efficiency in nutrient and light utilization enabled the coexistence of phytoplankton and duckweeds in the pond. Finally, our results indicate that internal loading constitutes a fundamental nutrient source for the primary producers considered by the model.