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Modelling the response of cyanobacteria to pH-variability on seasonal to decadal time scales

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Cyanobacteria blooms regularly occurred in the Baltic Sea during the last decades. The possible effects of increasing temperatures and eutrophication on cyanobacteria have been already investigated. This model study concentrates on the combined effect of expected temperature increase and ocean acidification on cyanobacteria blooms in the Baltic Sea.
We make use of an established model system that comprises the life cycle model of cyanobacteria (CLC) and a biogeochemical model (ERGOM), a carbon chemistry model, and the water column model GOTM. These models are modularly coupled through the framework for aquatic biogeochemical models (FABM). In the CLC model, the cyanobacteria growth is dependent on the sea water pH following the results of experimental studies. The numerical experiments are forced by the output of a regional climate model (RCAO) for the period 1960-2100. A number of simulations are performed for different configurations of the coupled ecosystem, in order to estimate the effect of acidification and the effect of seasonally varying pH on the cyanobacteria bloom.
Our simulation experiments show that cyanobacteria growth is stimulated by the increase of temperature in the future, while the blooms' strength decreases in the second half of the 21th century due to ocean acidification. The magnitude and trend of cyanobacteria concentrations are also affected by the seasonal variations of pH.
Overall, the results show that the combined effect of the climate stressors, warming and acidification, on the cyanobacteria bloom is weak.