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The importance of ecosystem in marine mercury speciation

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The bioaccumulation of mercury (Hg) and methylmercury (MeHg) can lead to the concentration of methylmercury in seafood that is dangerous to humans. Because of this, the bioaccumulation of Hg and MeHg is often studied in the context of understanding and managing the toxicity levels in seafood. Less attention is given to how the seasonal removal of large quantities of Hg and MeHg from the epipelagic zone due to bioaccumulation has an impact on marine mercury cycling. In this modelling study, the effect of bioaccumulation on marine cycling is analysed by combining the ECOSMO II ecosystem model and the MERCY mercury speciation model with and without a bioaccumulation model in a 1D water column model in the Baltic Proper. Here we show by comparing the difference between our setup with bioaccumulation to the setup without that the removal of dissolved Hg and MeHg during the spring and autumn bloom reduces the evaporation of mercury by 26% and the dissolved Hg in the oxic and dissolved MeHg concentration in the anoxic zone can be up to 50% higher if there is bioaccumulation. These results demonstrate that there are important interactions between bioaccumulation and marine Hg cycling that should not be carelessly overlooked. This has important consequences for marine mercury modelling efforts, as chemical speciations models often rely on less regional specific input data and could easier be made to function on a larger scale. The importance of the ecosystem complicates this as it means that in order to fully model marine mercury speciation biologically relevant regionally specific factors such as plankton species composition, fishing rates and nutrient levels play important roles.