The importance of the ecosystem in marine Hg modelling

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Since ratification of the Minimate Convention on Hg, modeling marine Hg speciation is receiving increasing attention. To assess the risk of Hg contamination in seafood it is necessary to improve our understanding of the complex processes of marine Hg cycling. Chemical speciation models can be designed with a varying degree of complexity. In this study, we show the importance of Hg ecosystem interactions on marine Hg cycling. For this, we compare results of model runs with and without bioaccumulation and evaluate its impact on the fate of Hg in the marine environment. For Hg speciation, the MECOSMO model is used and run using the Generalised Ocean Turbulence Model (GOTM) as a host. The ecosystem interactions are modelled using the ECOSMO model and the models are coupled using the Framework for Aquatic Biochemical Modelling (FABM). The results show that including bioaccumulation has a significant impact by reducing the amount of available Hg in surface water in summer which reduces the formation of MeHg. Additionally, the production of oxygen in surface water and following consumption in deeper water decreases surface water methylation rates while boosting methylation in deep water. Moreover, sedimentation of organic matter is a strong vector of Hg transport to deep water and biologically induced anoxic conditions can drive the formation of HgS. Based on these results we conclude that there is significant feedback from Hg-ecosystem interactions to Hg cycling and as such the importance of the ecosystem should be considered in marine Hg modelling, even if it is not the focus of the particular research.