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Can upper ocean vertical mixing be determined from ocean surface chlorophyll-a concentrations using data-assimilation?

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While an essential upper-ocean process like the vertical mixing still needs to be determined by complicated in-situ measurements, a wide range of physical and biological surface data of the ocean are provided by remote sensing. Remotely sensed surface chlorophyll-a concentration show for example a strong variation in the seasonal and the latitudinal distribution of phytoplankton growth. Such differences in the growth behaviour are known to be strongly affected by the vertical mixing in the upper ocean. This motivated us to assimilate ocean surface chlorophyll-a concentrations in a turbulence-phytoplankton model to estimate properties of vertical mixing. The Global Ocean Turbulence Model (GOTM) is thereto coupled to an one-dimensional biological model. The parameters of the biological model are calibrated to different locations in the North Atlantic. First we show that the modelled surface chlorophyll-a concentration are sensitive to the vertical mixing coefficient; this sensitivity is a key factor for successful data assimilation. Next, with fixed biological model parameters, we assimilate surface chlorophyll-a concentrations into the model to estimate parameters in the turbulence model using a particle filtering technique.

The presentation will focus on the issue how accurately the profile of the vertical mixing coefficient can be determined by assimilating ocean surface chlorophyll-a data into the turbulence-phytoplankton model.