



Towards the multiyear combined state parameter estimation with ensemble-based Kalman filters: a 2007-2010 hindcast of the North Atlantic and Arctic biology

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For the purpose of the reanalysis of the biological component of the Arctic Ocean over the period 2007-2010, a combined state-parameter estimation experiment is conducted in a North Atlantic and Arctic configuration of the coupled physical-biogeochemical model HYCOM-NORWECOM. Analyses are performed every week with the deterministic ensemble Kalman filter in two steps. In the first step, satellite physical data (Sea Surface Temperature, along-track Sea Level Anomalies and ice concentration) are assimilated in the physical component (HYCOM). A vertical remapping of the biological tracers is introduced to guarantee the conservation of the amount of biological variables at each horizontal grid point. In the second step, surface chlorophyll concentrations data are assimilated in the biological component (NORWECOM) of the coupled model. Log-transformations are introduced to prevent issues arising from the positiveness of the biogeochemical variables, parameters and observations.

Results of the four year hindcast are presented and discussed. The error growth of the surface chlorophyll is relatively well controlled and improvements of the spatial distribution of this variable are observed when the spread of the ensemble allows for corrections on the biogeochemical parameters. However, the large corrections of these parameters betray the limits of the current parameterizations and can lead to local filter divergences during the second year of assimilation. The impact on the estimation of the redrawing of the parameters and the use of optimized parameters is assessed during the last two years of the experiments.