



Constraining the evolution of the intensity of the meridional overturning circulation using a particle filter

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Estimating the changes in the intensity of the meridional overturning circulation (MOC) over the last century is a challenge because of the lack of direct observations. As a consequence, the role played by variations in the MOC intensity in past climate changes is still unknown. Combining available data with model results using data assimilation is certainly a good approach to tackle this problem. In order to test this methodology, we have performed twin experiments with the Earth system model of intermediate complexity LOVECLIM. In those experiments, instead of assimilating real observations, we use pseudo-observations created by the model itself. This allows us focusing on the method, as uncertainties in the forcing and model physics have no influence on the results. A simple particle filter method is applied over a relatively large ensemble of simulations: at each step, we resample the members of the ensemble according to their capacity to reproduce the pseudo-observations, computed through a likelihood function. In the present study, we focus on the choice of the variables that need to be assimilated in the model in order to reproduce adequately the evolution of the intensity of the MOC. Different experiments have thus been performed, in which we have assimilated different variables, such as the temperature and salinity (sea surface and in depth) and the geopotential height, i.e., variables that are thought to have a close relation with the MOC, and we identified which set of observations constraints the best the evolution of the MOC in the model simulations.