



Impact of initialisation errors on North Atlantic subpolar gyre prediction

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Developing methods to use historical observations to accurately initialise climate predictions is important for assessing skill and building confidence in these predictions. Here we present results from the Norwegian Climate Prediction model on the added benefit of assimilating different ocean observations using the Ensemble Kalman Filter. We focus on decadal retrospective predictions for the North Atlantic subpolar gyre (SPG) region and compare results from two configurations: one anomaly-assimilating only SST observations and another anomaly-assimilating SST as well as temperature and salinity profiles. Prior to 1995, both configurations precondition the SPG in a cold state with a strong circulation. Differences emerge, however, during the hindcast periods: while the first set exhibits a rapid warming once the assimilation is released, the second set maintains the anomalous cold state over a longer period of time and compares favourably with other prediction systems that have demonstrated SPG hindcast capability. The rapid SPG warming in the first set predominantly originates from a too warm Subtropical North Atlantic (STNA) initial state leading to excessive northward heat transport that causes the SPG to prematurely rebound and overshoot. Dynamical effects related to salinity initialization in the SPG region play also a role. The study illustrates that a realistic initial state of the SPG does not alone guarantee decadal forecast skill in that region, irrespective of additional degradation due to model bias. Remote effects, in particular the thermodynamic state of the STNA, also need to be considered to realise the full SPG prediction potential.