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Decadal hindcasts with MPI-ESM initialized from coupled assimilation of oceanic observations and atmospheric re-analysis data

Sebastian Brune (1), Holger Pohlmann (2), Lars Nerger (3), Wolfgang Müller (2), and Johanna Baehr (1)

(1) Institute of Oceanography, Center for Earth System Research and Sustainability (CEN), Universität Hamburg, Germany, (2) Max Planck Institute for Meteorology, Hamburg, Germany, (3) Alfred Wegener Institute, Helmholtz Center for Polar and Marine Research, Bremerhaven, Germany

We present a set of decadal hindcast simulations initialized from a coupled assimilation of oceanic sub-surface observations and atmospheric re-analysis data within the same model. In the global coupled Max Planck Institute for Meteorology Earth System Model (MPI-ESM), we assimilate ocean observations using the singular evolutive ensemble Kalman filter (SEIK) and atmospheric re-analysis data using simple nudging. Our set of hindcast simulations consists of yearly initializations between 1960 to 2014, with 8 ensemble members each. This set of hindcast simulations from the SEIK-nudged assimilation is compared against a set of hindcasts simulations where both ocean an atmosphere are nudged to re-analysis data. In the assimilation experiments, we find for surface temperature, the nudged assimilation experiment in closer agreement with observations than the SEIK-nudged assimilation experiment. In contrast, the hindcasts initialized from the SEIK-nudged assimilation experiment improve over the hindcasts initialized from the nudged assimilation experiment for global mean surface temperature, and in particular for the Northeast Atlantic and for the lead years 1 to 3. In terms of the Atlantic meridional overturning circulation (AMOC), which has not been assimilated directly, we find that the SEIK-nudged assimilation experiment is closer to observations (26°N, 2004 to 2013) than the nudged assimilation experiment. We also investigate the hindcast skill for the AMOC in both experiments. Our initial results suggest that the subtle changes from the SEIK assimilation compared to the nudged assimilation in the ocean component of the coupled MPI-ESM do not necessarily degrade but even regionally improve hindcast skill.