An Assessment of Atlantic Meridional Overturning Circulation (AMOC) in Coordinated Ocean-ice Reference Experiments (CORE-II)

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Ocean hindcast simulations forced with inter-annually varying atmospheric data sets provide a framework to evaluate mean and variability of AMOC during the recent past. Such hindcasts can also be used to investigate AMOC variability mechanisms, complementing fully-coupled climate simulations. Furthermore, solutions from ocean hindcast simulations can serve as ocean initial conditions for climate (e.g., decadal) prediction experiments, and they provide case study opportunities for mechanism-oriented validation of such prediction experiments. In this study, we present an assessment of ocean mean states and variability from eighteen global ocean – sea-ice hindcast experiments with a focus on AMOC. These experiments use inter-annually varying atmospheric forcing data sets for the 60-year period from 1948 to 2007 and are performed as contributions to the second phase of the Coordinated Ocean-ice Reference Experiments (CORE-II). Despite using the same atmospheric forcing data sets, the solutions show significant differences from each other. Differences in upper-ocean temperature and salinity distributions and mixed layer depths in the Labrador Sea region are identified as contributors to substantially different representations of AMOC among the models. These differences are attributed to use of diverse subgrid scale parameterizations and parameter values in the ocean models as well as use of a wide variety of sea-ice models. Our findings have significant implications for initialization of climate prediction experiments.