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Fidelity of the Ocean Solution in a High Resolution 0.1° Global Coupled Ocean-Ice Simulation

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The fidelity of a global 0.1°coupled ocean-ice simulation part of Lawrence Livermore National Laboratory (LLNL) computing Grand Challenge project "Ultra-high resolution coupled climate simulations" is assessed using observational in-situ data and climatologies. The realism of the ocean solution is further evaluated in comparison with lower resolution 1° version of the model and same resolution but stand-alone ocean only simulation. The model consists from the latest versions of the Los Alamos National Laboratory (LANL) Parallel Ocean Program (POP2.0) and sea ice model (CICE 4.0). It is configured on a tripole grid with horizontal resolution 3600x2400 and 42 vertical levels, incorporating partial bottom cell topography. The simulation is forced with Coordinate Ocean-ice Reference Experiments (CORE) data set specifically designed to be used among the modeling community in such coupled ocean-ice experiments (Griffies et al, 2009). The mean state of the ocean solution is examined in terms of mean sea surface height (SSH), sea surface temperature (SST), salinity (SSS) and velocity compared to their observational analogs from the Mean Dynamic Ocean Topography (MDOT, Niiler et al., 2003) and Polar Hydrographic Climatology (PHC3.0, Steele et al, 2001) and Drifter (Pazan and Niiler, 2000) data sets. The variability of the ocean circulation is validated via comparison of the model RMS SSH and mean and eddy kinetic energy with corresponding quantities derived from a satellite and drifter observations. Finally, the meridional overturning circulation is evaluated using RAPID observations. The main goal of the study is to evaluate the improvements of the ocean model performance due to the increased model resolution and coupling to a realistic sea-ice model.