Reanalyzed Oceanic Variability from GFDL Ensemble Coupled Data Assimilation

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The Ensemble Coupled Data Assimilation (ECDA) system at GFDL (Geophysical Fluid Dynamics Laboratory) has integrated the 20-century climate observations into its fully coupled climate model, CM2.1, providing reanalyzed coupled initial conditions that are resulted from the balance between the climate prediction model and atmospheric and oceanic observations. Here we focus on a comprehensive evaluation of the oceanic variability during the second half of the 20th century where the NCEP/NCAR atmospheric reanalysis is used as the atmospheric ``observations.'' Meridional oceanic heat transport, net ocean surface heat flux, wind stress, sea surface height, top 300 m heat content (HC300), tropical temperature, salinity and currents are compared with various *in situ* observations and the other existing oceanic reanalysis product. Results show that the ECDA agrees well with observations in both climatology and variability in this period. While systematic model biases are mostly corrected by the coupled data assimilation, some model biases (e.g., strong trade winds, weak westerly winds and warm SST in the southern oceans, T-S biases along the equatorial western Pacific boundary, overestimating the mixed layer depth around the subpolar Atlantic and southern oceans in the winter seasons) still exist although smaller than the existing reanalysis. For the simulation of the tropical Atlantic Ocean and global salinity variability, the ECDA shows a good performance compared to the other reanalysis. The ECDA also shows no significant drift in the deep ocean temperature and salinity. In terms of climate variability, the ECDA provides good simulations of the dominant oceanic signals associated with El Nino and Southern Oscillation (ENSO), Indian Ocean Dipole (IOD), Pacific Decadal Oscillation (PDO), and Atlantic Meridional Overturning Circulation (AMOC).

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