International workshop on seasonal to decadal prediction
Toulouse, France, 13-16 May, 2013

An Assessment of Hindcast-Based Ocean Initial Conditions for Climate Prediction Experiments

Gokhan DANABASOGLU

National Center for Atmospheric Research (NCAR), USA, gokhan@ucar.edu
Steve Yeager (NCAR)
Presenter : Gokhan Danabasoglu

Because the memory of the ocean vastly exceeds that of the atmosphere, variations in the climate system on seasonal to decadal and longer time scales are thought to be driven primarily by oceanic processes, thus making accurate initialization of past ocean states a key aspect of climate prediction efforts on these time scales. In addition to ocean analysis products from ocean data assimilation, solutions from ocean hindcast experiments can be used to initialize climate prediction experiments. Such hindcast experiments also provide a framework to evaluate ocean model performance and study mechanisms of time-dependent ocean phenomena and their variability from seasonal to decadal time scales for the recent past, thus providing a mechanism-oriented verification approach for decadal 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 the Atlantic Meridional Overturning Circulation (AMOC) and other related fields in the North Atlantic. 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 inter-model differences. As most models also differ from available observations, biases in sea-ice cover, upper-ocean potential temperature and salinity distributions, and mixed layer depths in the Labrador Sea region are identified as contributors to inter-model differences in AMOC. These differences and biases from observations are attributed to use of a wide variety of sea-ice models as well as to use of different subgrid scale parameterizations and parameter values in the ocean models. Our findings have significant implications for initialization of climate prediction experiments.