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

Multiyear predictions of the North Atlantic variability - the impact of increased ocean model resolution

Daniela MATEI

Max Planck Institute for Meteorology, Germany, daniela.matei@zmaw.de
Johann Jungclaus, Wolfgang Müller, Holger Pohlmann, Ketan Kulkarni, Helmuth Haak, Jochem Marotzke
Presenter : Daniela Matei

The latest sets of the MPI-M Earth System Model (MPI-ESM) decadal predictions provided for the 5th coupled model intercomparison project (CMIP5) and MiKlip project (see presentation by Pohlmann et al.) are examined here with a focus on exploring the potential benefits of increased ocean resolution on the multiyear predictability of the North Atlantic climate and oceanic fluctuations. Both sets of near-term climate predictions include suites of decadal hindcast experiments performed with two different set-ups of the MPI-ESM coupled model (MPI-ESM-LR and MPI-ESM-MR). While the horizontal resolution of the atmospheric component is similar in the two model configurations, the MPI-ESM-MR setup employs an eddy-permitting ocean model. The ocean initializations assimilate three-dimensional temperature and salinity anomalies from MPIOM ocean experiments forced with the NCEP-NCAR atmospheric reanalysis for the CMIP5 system and from ORA-S4 ocean reanalysis for the MiKl ip system.

The skill of the initialized decadal hindcast experiments is assessed against the benchmark prediction skill of the non-initialized hindcast simulations and statistical forecasts. We show that in both model configurations, the variations in sea surface temperature and upper-ocean-heat content in the North Atlantic region can be skilfully predicted up to a decade ahead with greater skill than by both uninitialized simulations and persistence forecasts. Multiyear potential predictability of a number of ocean dynamical quantities, such as North Atlantic Ocean volume and meridional heat transport variations, is also presented, together with a discussion on the potential impact of AMOC on North Atlantic climate predictability. Moreover, we use the ocean observational estimates provided by the RAPID-MOCHA array and THOR&NACLIM projects to investigate the seasonal-to-interannual predictability of the thermohaline circulation at selected key sections in the North Atlantic.