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

A comparison of initialization strategies for decadal predictions

Iuliia POLKOVA

Max Planck Institute for Meteorology, Germany, iuliia.polkova@zmaw.de
Armin Koehl, Detlef Stammer
Presenter : Iuliia Polkova

We analyze predictive skill of a coupled ocean-atmosphere UCLA/MITgcm climate model with respect to details of the initialization procedure. For this purpose, the ocean component of the coupled model was initialized using the following three different initialization approaches: full state initialization (FSI), full state initialization employing heat flux and freshwater flux corrections (FC) and anomaly initialization (AI). The ocean initial conditions were provided by the GECCO state (the German contribution to Estimating the Circulation and Climate of the Ocean project), from which ensembles of decadal hindcasts were performed every 5 years over the period 1961-2010. The major focus of this analysis is on assessing which of the three initialization procedures lead to the best predictive skill for the NA sea surface temperature (SST) and the Atlantic meridional overturning circulation (AMOC). We also analyze sea surface height (SSH) hindcasts to learn whether it is possible to improve SSH predictions through initialization procedures. The predictive skill for SST is assessed against the GECCO and the HadISST syntheses, whereas for SSH and AMOC the GECCO data were used. The initialized hindcasts are compared against both an externally forced reference integration and the persistence forecast.

The predictive skill for SST anomalies remains significant for up to a decade over parts of the North Atlantic (NA) and the extratropical Southern Hemisphere in the FC experiment. In contrast, FSI shows less persistent skill and AI does not show high skill in the extratropical Southern Hemisphere, but appears to be more skillful in the tropics. In the North Atlantic (NA) and the extratropical Southern Hemisphere, the improved skill is related to the ability of the FC initialization method to better represent the mixed layer depth, and the skill of all methods shows higher values during wintertime. Areas with high correlation values for SSH appear to be more extended than for SST. For all initialized hindcasts, the correlation skill for the spatially averaged NA SSH hindcasts shows a less steep decline than for the spatially averaged NA SST and remains significant up to a decade for FC. The FC method also shows more persistent (up to nine years) correlation skill for the AMOC at 26.5N. In the band of latitudes from 15N to 55N, all NA MOC initialized hindcasts show high correlation values in the first pentad while correlation remains significant in the following pentad for FSI and FC.