

SESSION: (B2) Modelling issues in S2D prediction

(B2-12)

Climate-mode initialization for decadal predictions

Polkova, Iuliia (1), Köhl, Armin (1) and Stammer, Detlef (1)

Institute of Oceanography Universität Hamburg, Germany (1)

Based on the Earth System Model from the Max Planck Institute for Meteorology (MPI-ESM) we designed a climate-mode initialization method for the decadal prediction system MiKlip. The idea of the initialization method is in improving the ESM's prediction skill through the initialization of balanced components of the initial conditions and filtering out components inconsistent with the dynamics of climate model. As the current MiKlip prediction system is using anomaly nudging toward ORAS4 reanalysis in the ocean, the proposed method is expected to eliminate inconsistencies between the prediction system and the non-native ocean reanalysis by synchronizing their oscillation patterns.

To this end, the temperature and salinity anomalies from the ORAS4 reanalysis are projected onto modes of variability derived from an ensemble of historical simulations (15 ensemble members) performed with the MPI-ESM. The climate modes are calculated as statistical modes based on the bivariate empirical orthogonal function (EOF) analysis. The explained standard deviation in the filtered reanalysis amounts to 66%. As this value is somewhat lower than what we expected, we assume that modes of variability of the reanalysis are not exactly compatible with the modes from the prediction system or that they are not yet sufficiently sampled by the available data used to construct the EOFs. The analysis of filtered and original reanalysis anomalies shows that the signal over the whole Pacific basin is well captured and represented, while in the Southern Ocean and the North Atlantic large fraction of the signal is filtered out. The filtered reanalysis' anomalies are then added to the model's climatology and are used as initial states for a set of retrospective decadal predictions. The climate-mode initialization method is compared against the commonly used anomaly initialization method.

A comparison of the climate-modes initialization with the reference initialization indicates an improved surface temperature skill over the tropical Pacific Ocean at seasonal-to-interannual timescales in terms of accuracy and correlation with the observations. This result shows a potential for improving seasonal forecasts of the El-Nino Southern Oscillation. For the 2-5 lead years averages, climate-mode initialization method outperforms the skill of the anomaly initialization for the surface temperature as well as the upper ocean heat content over the central and northern Pacific Ocean. For the North Atlantic subpolar gyre region, the climate-mode initialization experiments rather resemble a trend of the historical simulations than that of ORAS4 or the observations. Also they show smaller amplitudes of variability as compared to the non-filtered initialization. This suggests the need to further improve the design of the climate-mode initialization method attempting to capture better the variability modes in the North Atlantic in an larger EOF-basis.