Analysis of model drift in a climate forecast system used for decadal predictions

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The climate research community has been facing a new scientific challenge with the evaluation and understanding of the predictability at interannual to decadal (I2D hereinafter) timescales. A considerable international effort has been devoted to the production of near term climate predictions in a set of I2D coordinated experiments within the CMIP5 (Coupled Model Inter-comparison Project Phase 5) framework, where models components are initialized from observations. Preliminary results show that initialized simulations increases the forecast skill comparing with non-initialized experiments for leadtimes ranging from 2-3 years for the Pacific and 6-8 years for the North Atlantic.

In despite of these encouraging results, the science of near-term climate prediction is in its early stages. Due to the imperfect climate simulated by coupled models, when initialized from observations, they are affected by important drifts at the beginning of the forecast experiment that may alter their performance in terms of skill. The climate forecast community has therefore to face with fundamental scientific and technical questions, as to the initialization strategies, the minimization of the drift its understanding and a posteriori correction.

Most of the I2D forecast studies are focused on skill scores on a particular variable on a given region, and the model drift is a posteriori removed by averaging all the forecasts as a function of leadtime. However, the model initial shock has not been carefully analyzed and documented for the most of forecasts systems. In this work we present a detailed analysis of the drift of decadal forecasts performed with the CNRM-CERFACS coupled model (CNRM-CM5) when initialized from NEMOVAR-COMBINE ocean reanalysis. CNRM-CM5 produces a strong and quick initial shock over the Tropical and also the Austral Oceans. We show, based on EOFs analysis, that the model drift projects on the main climate internal modes over the Tropical Pacific and Atlantic during the first 4 years of integration. In particular, over the Tropical Pacific, the model artificially creates a sequence of El Niño/La Niña episodes during the first 4 years of integration, while in the Atlantic; the so-called meridional
mode is excited with a 2 years swing between the two hemispheres. The spurious ENSO teleconnection due to the drift, perturbs the atmosphere over the Northern Hemisphere. At longer timescales, the Atlantic Meridional Variability (AMV) pattern projects onto the model drift.

The present analysis highlights the fact that, to derive to its own climate, the model precisely uses the internal modes of variability that we seek to predict, putting some shade and uncertainties on traditional skill score.