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Skillful North Atlantic predictability extends beyond decadal time scale

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The recently emerged field of near-term climate prediction aims at skillfully predicting the regional climate variations for a time horizon of up to 30 years. However, all dynamical decadal prediction systems employed to date focus on a much shorter forecast horizon, even if there are indications that skilful predictions may be achieved for lead times beyond a decade. In this study we try to push the current decadal prediction boundary by extending the forecast window from the classical length (standard CMIP5 decadal prediction setup) of 10 years to 20 years. For this purpose we employ the MPI-ESM-LR CMIP5 decadal prediction system that makes use of an oceanic initialization from a MPI-OM NCEP/NCAR forced ocean simulation over the period 1948-2012. Estimates of 3-D temperature and salinity anomalies from this simulation are used to initialize a 6-member ensemble of 20-yr-long hindcasts starting on every 1st Jan between 1960 and 2012. 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 focus in the presentation on the North Atlantic, a region robustly identified as exhibiting the highest predictive skill beyond the global warming trend and an important driver of climate variability over Europe and North America. Our results show that indeed, in accordance to several potential predictability studies, the predictive skill and the added-value from the ocean initialization remains statistically significant during the whole 20yr of the forecast time over the North Atlantic Subpolar Gyre, eastern subtropical North Atlantic and Western Mediterranean basin. The skilful extended range predictability is achieved not only for surface quantities such as sea surface temperature and sea level height, but also for upper ocean heat and salt content variations. Therefore, our results support recent observational analyses suggesting that the integrated effect of the North Atlantic Oscillation onto the ocean leads to useful predictions of the AMV 15-to-20 years later. In addition, the recent NAO weakening might also explain the consistent cooling tendency of the North Atlantic Subpolar Gyre SSTs of our forecast ensemble over the next 5 years.