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The decadal climate prediction skill with focus on the North Atlantic region

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The skill of the decadal climate prediction is analyzed based on recent ensemble experiments from the CMIP5 and CMIP6 decadal climate prediction projects (DCPP) and the Community Earth System Model (CESM) Large Ensemble (LENS) Project. The experiments are initialized every year at November 1 for the period of 1960-2005 in the CMIP5 DCPP experiments and 1960-2016 for the CMIP6 DCPP models as well as the CESM LENS decadal prediction. The CMIP5/6 ensemble has 10 members for each model and the CESM ensemble has 40 members. For the considered models un-initialized (historical) ensembles with the same forcings exist. The advantage of initialization is analyzed by comparing these two sets of experiments.

We find that the models agree that for lead-times between 4-10 years little effect of initialization is found except in the North Atlantic sub-polar gyre region (NASPG). This well-known result is found for all the models and is robust to temporal and spatial smoothing. In the sub-polar gyre region the ensemble mean of the forecast explains 30-40 % more of the observed variance than the ensemble mean of the historical non-initialized experiments even for lead-times of 10 years.

However, the skill in the NASPG seems to a large degree to be related to the shift towards warmer temperatures around 1996. Weak or no skill is found when the sub-periods before and after 1996 are considered. We further analyze the characteristics of other climate indicators than surface temperature as well as the NAO to understand the cause and implication of the prediction skill.

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