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Skillful decadal predictions of North Atlantic blocking

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State-of-the-art decadal predictions are known to exhibit significant skill for sea surface temperature (SST) anomalies beyond the warming trend, even with small ensembles. A well-established result is the high predictive skill in the North Atlantic basin, associated with the observed Atlantic Multidecadal Variability signal. However, for societal applications it is rather the weather patterns and the associated atmospheric circulation anomalies that are of interest. For successful decadal predictions of the mid-latitude atmosphere, large ensembles are needed to allow the signal from the oceanic forcing to emerge among the dominating, inherently unpredictable atmospheric variability.

Having chosen blocking frequency as an aspect particularly relevant to the perceived weather in the Euro-Atlantic sector, here we evaluate the skill of the Community Earth System Model (CESM) Decadal Prediction Large Ensemble (DPLE) simulations in predicting the observed decadal variations of wintertime blocking frequency. Interestingly, significant skill is found over large areas of high climatological blocking activity and for various lead time ranges up to 10 years with anomaly correlation coefficients reaching and even exceeding 0.6. This predictive skill for blocking indicates similar predictability for the decadal variations of the North Atlantic stormtrack, the associated eddy-driven jet and dominant teleconnections, such as the North Atlantic Oscillation (NAO). The latter has been verified, i.e. the skill for the NAO is comparable to that for Greenland blocking.

The above-mentioned predictability of the mid-latitude atmospheric circulation arguably originates from the SST forcing, in line with indications from previous observational and modeling studies. On the seasonal range, certain patterns of SST anomalies in autumn have been identified in relation to blocking variability in the following winter. The physical mechanisms via which the ocean drives the atmosphere are still under investigation, yet the documented predictability for the NAO and blocking in the North Atlantic represents a breakthrough in the field of decadal predictions, also pointing to the need for even larger ensembles and multi-system assessments.