Propagation of Thermohaline Anomalies and their predictive potential

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In this study we assess to what extent the ensemble mean of six different dynamical prediction systems can retrospectively predict the winter sea surface temperature (SST) in the subpolar North Atlantic and the Nordic Seas in the time period 1970-2001. We focus in particular on the region where warm water flows poleward, i.e., the Atlantic water pathway. To better understand why dynamical prediction systems have predictive skill or lack thereof, we confront them with a mechanism identified from observations propagation of oceanic anomalies from low to high latitudes on different forecast times. This observed mechanism shows that warm and cold anomalies propagate along the Atlantic water pathway with a certain time lag, and that this occurred repeatedly over the last 60 years. One of the prediction systems in this study represent this mechanism quite well on forecast time between 3 and 7 years (CESM-DPLE with the ensemble mean based on 40 members), and at the same forecast times the model shows enhanced skill. A key result from this study is, however, that most models have difficulties in representing this mechanism. The lack of representing this mechanism could be one of the reasons for the overall poor skill along the Atlantic water pathway towards the Arctic Ocean (after removing the Atlantic Multidecadal Variability and long-term trends in the time series). The aim with this study is therefore to highlight a challenge in the current state-of-the art dynamical prediction systems that limits their predictive skill in the oceanic gateway to the Arctic.