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A Link between Interannual Heat Transport Variability and Surface Temperature Predictability in the North Atlantic

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We examine how meridional ocean heat transport (OHT)-anomalies influence the predictive skill of North Atlantic surface temperatures in the years following the anomaly. We use an ensemble of initialized coupled model simulations from the MPI-ESM-LR covering the period 1901-2010 (Müller, W. et al., 2014, GRL). We find that 0-6 years after strong OHT anomalies at 50N, a characteristic pattern of sea surface temperatures emerges. This pattern is characterized by warm SST anomalies in the North-East Atlantic and cold SST anomalies in the Gulf Stream region 3-6 years. SST anomalies of opposite sign emerge 0-2 years after weak OHT anomalies. The different lengths of the emergence of these SST anomalies can be related to the different durations of heat convergence in the subpolar gyre following strong and weak OHT anomalies.
Analyzing predictive skill of yearly initialized hindcasts against the assimilation experiment and HadISST observations shows that SST hindcast skill in the North Atlantic region is dominated by the OHT-related SST anomaly pattern. SSTs in the North Atlantic show predictive skill higher than the overall average on time scales of 1-2 years after weak OHT anomalies, and predictive skill higher than the overall average 3-5 years after strong OHT anomalies. We find ocean-atmosphere heat fluxes to be predictable in the North Atlantic on a similar time scale. This suggests that the Predictability of North Atlantic SSTs and associated surface air temperatures depends crucially on the strength of North Atlantic OHT at the beginning of the prediction.