Interannual Heat Transport Variability and its Links to Surface Temperature Predictability in the North Atlantic

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We examine how meridional ocean heat transport (OHT)-anomalies influences 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 1900-2010 (Müller, W. et al. (2014), GRL). We find that 0-6 years after a strong AMOC-/OHT-anomaly at 50N, a characteristic pattern of sea surface temperatures emerges. This pattern is characterized by positive anomalies in the North-East Atlantic subpolar gyre and negative anomalies in the Gulf Stream region, showing warm SST anomalies in the North-East Atlantic and cold SST anomalies in the Gulf Stream region 3-6 years after an above average OHT anomaly. SST anomalies of opposite sign emerge 0-2 years after a below average OHT anomaly. 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 phases.

Analyzing predictive skill of yearly initialized hindcasts against the assimilation experiment and HadISST observations shows that SST-predictability in the North Atlantic region is dominated by the 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 phases, and predictive skill higher than the overall average 3-5 years after strong OHT phases. We also investigate potential implications of this enhanced interannual predictability of North-East Atlantic SSTs for the predictability of central European surface air temperatures.