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Air-sea Interactions over the North Atlantic at Decadal Timescales and Implications for Prediction of North Atlantic SST

Mojib Latif, Milan Klöwer, Hui Ding, Richard Greatbatch, and Wonsun Park
GEOMAR Helmholtz-Zentrum für Ozeanforschung Kiel, Kiel, Germany (mlatif@geomar.de, +49 431 600 4052)

Recent research suggests that North Atlantic sea surface temperature (SST) during the instrumental period is driven by ocean dynamics at decadal timescales. Further, the Atlantic Meridional Overturning Circulation (AMOC) is thought to be an important driver of North Atlantic SST and also Northern Hemisphere climate at these timescales. This conjecture is supported by many climate models. However, the mechanisms for AMOC variability widely differ between models. Direct measurements of the AMOC strength have only been available since 2004, which is too short to investigate its link to long-term climate variability from observations alone. Here a hybrid approach is presented to understand the origin of and predict decadal variability in North Atlantic SST. The AMOC during 1900-2010 is first reconstructed from the history of the North Atlantic Oscillation using a climate model. The simulated variations in the AMOC are found to be highly correlated at lags of 1-2 decades with the observed variations in basin-wide North Atlantic SST, known as the Atlantic Multidecadal Oscillation/Variability (AMO/V). This implies a relatively large decadal predictability potential of North Atlantic SST, which solely arises from past variations of the NAO. The future evolution of the AMO/V is then statistically forecast using the reconstructed AMOC up to 2010 as predictor. The present warm phase of the AMO/V is predicted to continue until the end of this decade, but with a strong negative tendency after 2015. Slightly negative AMO/V conditions are forecast toward the end of the 2020s.