Arctic-Atlantic Climate Predictability provided by Poleward Ocean Heat Transport

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It is commonly understood that the potential for skillful climate prediction resides in the ocean. The poleward propagation of anomalous heat from the subpolar North Atlantic toward the Arctic Ocean has, in particular, been suggested as a primary source for predictability. It nevertheless remains unresolved how and to what extent variable ocean heat is imprinted on the atmosphere to realize its predictive potential over land. Here we assess from observations whether northwestern European and Arctic climate relates predictably to anomalous ocean heat in the Gulf Stream's northern extension. We show that variations in ocean temperature in the high latitude North Atlantic and Nordic Seas are reflected in the climate of northwestern Europe as well as in the Arctic sea ice extent. Statistical regression models show that climate variability thus can be skillfully predicted up to a decade in advance based on the state of the ocean. Our proposed prognostic framework provides an observationally based benchmark for dynamical prediction and highlights the North Atlantic–Nordic Seas as a key provider of a predictable Arctic-Atlantic climate.