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Origin of Quasi-decadal North Atlantic Oscillation Variability

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The North Atlantic Oscillation (NAO) is the leading mode of internal atmospheric variability in the North Atlantic sector. It depicts significant quasi-decadal variability that is well documented, but the underlying mechanism is still under discussion. Other quantities in the North Atlantic sector such as sea surface temperature (SST) exhibit variability on a similar timescale. Here we present results from a global climate model which simulates the quasi-decadal NAO and North Atlantic SST variability consistent with observations. The quasi-decadal NAO variability is suggested to originate from large-scale air-sea interactions, where the Atlantic Meridional Overturning Circulation (AMOC) basically sets the timescale. Wind-driven ocean circulation changes provide a fast positive feedback on North Atlantic SST through anomalous Ekman currents and the establishment of an "intergyre" gyre. A delayed negative feedback on SST is accomplished through surface heat flux-driven changes of the AMOC and associated heat transport. The results stress the importance of both wind-induced and thermohaline-induced changes in the ocean circulation for quasi-decadal climate variability in the North Atlantic sector.