

On the origins of low-frequency variations in large-scale North
Atlantic circulation in the 20th Century

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Forced hindcast simulations of historical Atlantic ocean variability in the 20th century are characterized by large, decadal variations in the strength of the AMOC which are coherent with variations in the strength of the subpolar gyre (SPG) circulation. The fidelity of this low-frequency variability cannot be assessed by direct comparison with observation, but a set of CMIP5 decadal prediction experiments using CCSM4 reveals that there is significant predictive power associated with the slow spinup of the overturning and gyre circulations between about 1970 and 2000 diagnosed from CORE-forced hindcast experiments. The low-frequency Atlantic circulation changes in the latter 20th century in such simulations have been linked to slow changes in buoyancy forcing associated with the upward trend in NAO. We analyze a set of sensitivity hindcasts in which interannual forcing variability is withheld from particular flux components and regions in order to identify the origins of the AMOC and SPG changes of the late 20th century. The analysis sheds light on the coupling between Atlantic gyre and overturning circulations on long timescales.