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# Wintertime atmospheric response to Atlantic multi-decadal variability and the role of the stratosphere

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The winter North Atlantic Oscillation (NAO) changes drive a significant portion of Atlantic Multi-decadal Variability (AMV). However, whether the ocean-atmosphere interaction or other processes internal or external to the atmosphere force the NAO changes is still controversial.
By using observational analysis and atmospheric model experiments we show that the AMV-warming drives precursory stratospheric vortex weakening and warming. These anomalies propagate downward, and cause a negative NAO in late winter. The wave-induced stratosphere/troposphere dynamical coupling is important for the NAO response to the AMV and can only be simulated with a stratosphere-resolving model. The stratospheric changes result primarily from the extra-tropical SST. Further long-term experiments using the latest version of the MPI stratosphere resolving Atmosphere/ocean coupled model confirm our results. The standalone atmospheric component of the MPI model can also reproduce the vertical structure of the atmospheric AMV signature. Our results show that the stratosphere is a crucial element of extra-tropical atmosphere/ocean interaction and climate variability. The forcing of NAO by the AMV, which is believed to be the delayed NAO response, support a self-maintaining delayed oscillatory behaviour between atmosphere and ocean in multidecadal timescales.