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Dynamic response of decomposed barotropic transport in a high-resolution model to the winter North Atlantic Oscillation

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The annual mean barotropic transport from 1960 to 2009 in a high-resolution model of the North Atlantic is decomposed into parts driven by the eddy momentum flux (EMF), mean-flow advection (MFA), a potential energy (PE) forcing whose curl is the JEBAR term, and the wind stress (WS) forcing applied to an ocean of uniform density, based on the vertically-averaged momentum equations. The decomposed barotropic transport preserves the variation in original time series and is hardly distinguishable from the full barotropic transport. The PE term are found to play an important role. The PE driven transport of the Gulf Stream and North Atlantic Current is positively correlated to the winter North Atlantic Oscillation (NAO), and the signal propagates westward across the North Atlantic at a speed comparable to that of first baroclinic mode Rossby waves. The PE driven transports of the sub-polar gyre (SPG) are also positively correlated with the winter NAO and the signal is sustained for up to 6 years in the Labrador Sea, and even longer in the Irminger Sea. The East Atlantic Pattern is suggested to be less important than the NAO in determining the variation of the barotropic transport.