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The ECCO Consortium: Comparison of measures of AMOC variability as expressed through adjoint sensitivities.

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A dual (adjoint) model is used to explore elements of the oceanic state influencing the meridional volume and heat transports (MVT and MHT) in the subtropical and the sub-polar North Atlantic so as to understand their variability and to provide the elements of useful observational program design. Focus is on the effect of temperature (and salinity) perturbations. On short time-scales (months), as expected, the greatest sensitivities are to local disturbances, but as the time scales extend back to a decade and longer, the region of influence expands to occupy much of the Atlantic basin and significant areas of the global ocean, although the influence of any specific point or small area tends to be quite weak. The propagation of information in the dual solution is a clear manifestation of oceanic teleconnections. It takes place through identifiable dual Kelvin, Rossby, and continental shelf-waves with an interpretable physics, in particular in terms of dual expressions of barotropic and baroclinic adjustment processes. Difference between 26N and 48N sensitivities will be analyzed, providing a dynamical background for the discussion of meridional coherence (or lack thereof) of the AMOC. Regional, as well as time-dependent differences, between MVT and MHT sensitivities highlight the lack of a simple correspondence between their variability. Some implications for observing systems for the purpose of climate science are discussed.