Title: Causes of interannual-to-decadal meridional heat transport variability in the North Atlantic Ocean

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Interest in the meridional overturning circulation (MOC) derives from its supposed role in climate, owing to its influence on ocean meridional heat transport (MHT). Recent studies elucidate the nature of interannual-to-decadal changes in the North Atlantic MOC, for example, revealing dominant forcing mechanisms and spatial scales of variability. But since factors other than the MOC can have an influence on MHT (e.g., gyre circulations, temperature changes), it is not clear to what extent these new insights apply to interannual-to-decadal MHT variability in the North Atlantic. Utilizing numerical experiments and kinematic decompositions, performed using a data-constrained ocean general circulation model, we explore the nature of interannual-to-decadal MHT changes in the North Atlantic. Over relatively short periods (<3 yrs), the dominant MHT variability (RMS values of 0.04-0.09 PW) occurs at latitudes south of 40°N and is mainly the result of wind-driven changes in the overturning circulation. In contrast, over longer periods (>3 yrs), considerable MHT changes (0.04-0.06 PW) occur at all latitudes, with multiple mechanisms (e.g., winds, buoyancy fluxes, nonlinear coupling of the ocean's response to atmospheric variability) contributing. Further, north of 40°N, gyre circulations and temperature changes become important; hence, at these latitudes, the MOC and MHT cannot be regarded as equivalent quantities.