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Ocean observations indicate a key role for ocean dynamics in Atlantic Multidecadal Variability

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Multidecadal changes in North Atlantic Ocean heat storage directly affect the climate of the surrounding continents, and it is important to understand how and why the changes are taking place. Here we synthesize a wide range of observational datasets to construct an upper ocean heat budget for the period 1950 to 2020. Lead-lag correlation analysis of time series of ocean heat content, horizontal heat transport, sea surface temperature and air sea fluxes are used to infer the drivers North Atlantic heat content changes. We find systematic and interconnected migration of heat content anomalies around both subtropical and subpolar gyres and between the near surface and deep ocean on multidecadal timescales. We find a significant driving/active role for ocean circulation in these migrations throughout the North Atlantic. In contrast, air sea interaction mainly plays an active/driving role in the western subpolar Atlantic. Our use of multiple independent observational estimates of the variables allows us to provide robust error/uncertainty estimates for the evolution of the North Atlantic heat budget terms.