



Atmospheric controls on North Atlantic Ocean heat content: an adjoint sensitivity study

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The North Atlantic Ocean has been changing rapidly in recent years, with a cooling trend in the surface subpolar region and warming trends in the surface and intermediate depths of the subtropics. The mechanisms enforcing these changes have not yet been identified or observed. Here we address the North Atlantic's complex regional pattern of heat content variations using a set of adjoint sensitivity experiments at various depths on annual to decadal timescales. We employ the ECCOv4 global ocean configuration of MITgcm, which is a data-constrained state estimate covering the period 1992-2011. On timescales longer than one year, we find that the annual mean surface heat content in the upper 500 m of the central subtropics is most sensitive to the atmospheric state/fluxes over the Gulf Stream, with most sensitivities peaking in autumn/winter. We also compare local (i.e. in a selected region of interest) and non-local sensitivity patterns to understand the relative impacts and timescales of local and remote atmospheric forcing on ocean heat content.