Geophysical Research Abstracts
Vol. 21, EGU2019-3412, 2019
EGU General Assembly 2019

The North Atlantic “Cold Blob”: an Alternate Explanation

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A well-known exception to rising sea surface temperatures (SST) across the globe is the subpolar North Atlantic, where SST is declining at a rate of 0.62K/century. This “cold blob” has been interpreted as evidence of an Atlantic Meridional Overturning Circulation (AMOC) slowdown, an interpretation supported by climate models, yet not conclusively validated with observations. Motivated by atmospheric observations that show a northward shift in the mid-latitude jet stream over the North Atlantic, we explore whether local processes can instead account for the cooling trend in the subpolar North Atlantic.

We apply a 1-d idealized ocean model that consists of a mixed layer and subsurface thermocline, with heat exchanged across the air-sea interface and between the two layers. We force the model with observed air-sea heat fluxes to simulate SSTs and subsurface ocean temperatures over the past 100 years. We find that direct heat loss from the ocean mixed layer (3.5 W/m2 per decade) can explain 48% of the observed SST cooling trend. Furthermore, cooling is also achieved due to enhanced convection and entrainment of cold water from the subsurface. With the addition of these two cooling mechanisms, and the resultant adjustment of ocean stratification, the model yields a trend of -0.06K SST/decade, equivalent to 97% of the observed SST trend over the past century. Thus, these idealized model simulations suggest that an increase in storm-induced heat loss and deep convection, induced by the northward shift of the jet stream over the past century, can explain the observed cooling in the subpolar North Atlantic.