



A reversal of climatic trends in the North Atlantic since 2005

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In the mid-1990s the North Atlantic subpolar gyre warmed rapidly, which had important climate impacts, such as increased hurricane numbers, and changes to rainfall over Africa, Europe and North America. Evidence suggests that the warming was largely due to a strengthening of the ocean circulation, particularly the Atlantic Meridional Overturning Circulation (AMOC). However, since the mid-1990s direct and indirect measurements have suggested a decline in the strength of the ocean circulation, which is expected to lead to a reduction in northward heat transport.

Here we show that since 2005 a large volume of the upper North Atlantic Ocean has cooled significantly by approximately -0.45C or $-1.5 \times 10^{22} \text{ J}$, reversing the previous warming trend. By analysing observations and a state-of-the-art climate model, we show that this cooling is consistent with a reduction in the strength of the ocean circulation and heat transport, linked to record low densities in the deep Labrador Sea. The low density in the deep Labrador Sea is primarily due to Deep Ocean warming since 1995, but a long-term freshening also played a role. Finally, the observed upper ocean cooling since 2005 is not consistent with the hypothesis that anthropogenic aerosols directly drive multi-decadal variability in Atlantic temperatures.