

Decadal Predictions of the cooling of the North Atlantic in the 1960s

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In the 1960s North Atlantic sea surface temperatures (SST) cooled rapidly. The magnitude of the cooling was largest in the North Atlantic subpolar gyre (SPG), and was coincident with a rapid freshening of the SPG. It has been hypothesised that the cooling was associated with changes in the ocean circulation, in particular a slow down of the Atlantic Meridional Overturning Circulation (AMOC), but conclusive evidence has been lacking, and other hypotheses – for example that the cooling was primarily driven by increases in anthropogenic aerosols – have also been advanced.

Here we analyse hindcasts of the 1960s North Atlantic cooling made with the UK Met Office's Decadal Prediction System (DePreSys), which is initialised using ocean observations. It is shown that DePreSys appears to capture the observed cooling and freshening of the North Atlantic SPG, as well as changes in SST over the whole North Atlantic. We show that initialisation of an anomalously weak AMOC, and hence weak northward heat transport, is important for DePreSys to predict the magnitude of the observed cooling. Such an anomalously weak AMOC is not captured when ocean observations are not assimilated (i.e. it is not a forced response in this particular model). Therefore, the DePreSys hindcasts suggest that ocean dynamics and specifically the AMOC played an important role in the cooling of the North Atlantic in the 1960s. They also suggest that this event was predictable at a lead time of several years.