Geophysical Research Abstracts
Vol. 16, EGU2014-14020, 2014
EGU General Assembly 2014

An Anatomy of the 1960s Atlantic Cooling.

Dan Hodson, Jon Robson, and Rowan Sutton
University of Reading, Department of Meteorology, Reading, United Kingdom (d.l.r.hodson@reading.ac.uk)

North Atlantic Sea Surface Temperatures (SSTs) exhibited pronounced multidecadal variability during the 20th Century. In particular, the North Atlantic SSTs exhibited a rapid warming between 1920 and 1940 followed by a rapid cooling between 1960 and 1980. SSTs outside the North Atlantic display a much smaller level of decadal variability over the 20th Century. This pattern of North Atlantic warming and cooling has been linked to subsequent changes in rainfall over the Sahel and Nordeste Brazil, Summertime North American Climate and Atlantic Hurricane Genesis.

Several hypotheses for the rapid 1960s Atlantic cooling have been proposed, including a reduction in northward ocean heat transport due to a reduced Atlantic Meridional Overturning Circulation (AMOC) and the significant rise in anthropogenic sulphur dioxide emissions during the latter half of the 20th century.

Here we examine the observed 1960s Atlantic cooling in more detail. We describe the evolution of the rapid cooling by constructing a detailed multivariate anatomy of the cooling period in order to illuminate the possible explanations and mechanisms involved.

We show that the observed 1960s cooling began around 1964-68 in the Greenland-Iceland-Norway (GIN) seas, later spreading to the Atlantic Sub Polar Gyre and much of the subtropical Atlantic. This initial cooling of the Sub Polar Gyre is associated with a marked reduction in salinity (the Great Salinity Anomaly). The cooling peaked between 1972-76, extending into the Tropical North Atlantic. This period also saw the development of a significant Winter North-South Dipole Mean Sea Level Pressure dipole pattern reminiscent of a positive NAO (High over the Azores, Low over Iceland). The cooling then retreated back to higher latitudes during 1976:80.

Our analysis demonstrates that the cooling of the North Atlantic during the 1960s cannot be understood as a simple thermodynamic response to aerosol induced reductions in shortwave radiation. Dynamical changes in the circulation of the atmosphere, and likely that of the ocean too, played an important role. We propose two possible mechanisms, both beginning with a rapid cooling of the Sub Polar Gyre and leading to a subsequent change in atmospheric circulation which pushes the cooling deeper into the Tropical North Atlantic. Further work is required to determine which mechanism was the dominant driver of the observed cooling event. Understanding such past events is essential to improve confidence in decadal predictions.