

Causes of the rapid warming of the North Atlantic in the mid 1990s

Jon Robson[†]; Rowan Sutton; Katja Lohmann; Doug Smith; Matt Palmer

[†] NCAS-Climate, The University of Reading, United Kingdom

Leading author: j.i.robson@reading.ac.uk

In the mid-1990s the subpolar gyre of the North Atlantic underwent a rapid warming, with sea surface temperatures increasing by around 1°C in just 2 years. This rapid warming followed a prolonged positive phase of the NAO, but also coincided with an unusually negative NAO in the winter of 95/96. The anomalous surface heat fluxes associated with the negative NAO undoubtedly favoured warming of the subpolar gyre, but was this the whole story? There is evidence suggesting important changes in the Atlantic Meridional Overturning Circulation (AMOC) at this time; understanding the nature and role of the AMOC is an important challenge, with consequences for the predictability of the warming event. This paper will present results from new ocean model experiments that have been performed to understand the mechanisms involved in the warming. By separating the time varying buoyancy and wind stress forcing, and analyzing the heat budget of the subpolar gyre, we have demonstrated that changes in the AMOC, and associated northward ocean heat transport, played a critical role in the warming event. Furthermore, we show that warming was primarily a response to the high NAO conditions that prevailed during the early 1990s. The negative NAO of 95/96 amplified this warming, and contributed to its rapidity, but was not the most important cause.