

**Title:** 'The Atlantic Multi-decadal Oscillation without a role for ocean circulation'

**Authors:** Amy Clement, Mark Cane, Katinka Bellomo, Lisa Murphy

**Abstract:** The Atlantic Multidecadal Oscillation (AMO) is a major mode of climate variability with important societal impacts. Most previous explanations identify the driver of the AMO as the ocean circulation, specifically the Atlantic Meridional Overturning Circulation (AMOC). Here we show that the main spatial features of the observed AMO are reproduced in models where the ocean heat transport is prescribed and thus cannot be the driver. Allowing the ocean circulation to interact with the atmosphere does not significantly alter the characteristics of the AMO in the current generation of climate models. These results suggest that the AMO in models is the response to stochastic forcing from the mid-latitude atmospheric circulation, with thermal coupling playing a role in the tropics. In this view, the AMOC and other ocean circulation changes would be largely a response to, not a cause of, the AMO.

The real world AMO, however, has significant multi-decadal variability that is not simulated in free-running (unforced) climate models. In the second part of this talk, we will examine the effect of time-varying historical climate forcing on the model simulations of the AMO. We find that including this forcing brings models and observations into better agreement with respect to the temporal variations of the AMO, and conclude that external forcing is critical in setting the pace, phase and amplitude of the observed AMO. Implications of these results for predictability will be discussed.