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# Mechanisms for AMOC decline in the late 20th Century

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The recent decline in the Atlantic meridional overturning circulation (AMOC) has attracted more than a little interest. The strongest AMOC recorded by the RAPID campaign at 26°N was at the start (2004/5), after which it declined about 3 Sv with a pronounced minimum in 2010. Proxies based on temperature and surface elevation have been used to extrapolate the AMOC strength before the RAPID era, and point reasonably reliably to a maximum strength in the mid 1990s, followed by a rise to a maximum at the start of the RAPID campaign in around 2005. Further back, less robust proxy data suggest that the AMOC gradually rose from the 1970s to the peak in 1990. This raises two questions: firstly, what drove these decadal variations in the overturning circulation (and hence of the ocean heat transport); and secondly whether there are observations that lead to useful predictive skill for changes in the AMOC. The surface-forced streamfunction, estimated from modelled/observed buoyancy fluxes, has been shown to be a reasonably good predictor of decadal changes in the overturning strength, preceding the latter with a lead time of about 5 years. although the reliability of the correlations before 2000 is limited by data sparsity, and especially so in the pre-satellite era.

To verify a causal link between surface forcing and decadal variations in the AMOC over longer timescales, numerical simulations present a powerful tool. A set of hindcast integrations of a global 0.25° NEMO ocean configuration has been carried out from 1958 until nearly the present day, with a selection of standard surface forcing datasets (CORE2, DFS5.2 and JRA55). These show an evolution of the AMOC strength from 1970 onwards which is consistent, both between forcing datasets and with that inferred from observations. The surface-forced streamfunction is evaluated for these experiments and is used to relate the time evolution of the AMOC to changes in the individual components of the buoyancy flux, and the surface heat loss from the Labrador and Irminger Seas is found to be the dominant predictor of AMOC changes.