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Can increasing greenhouse gases cause tipping of the AMOC?

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Climate models consistently project a weakening of the Atlantic Meridional Overturning Circulation (AMOC) in response to increasing greenhouse gases (GHGs) over the 21st Century. Models also show the potential for multiple equilibria and tipping points of the AMOC, in response to fresh water forcing. However longer term model integrations at increased levels of GHGs suggest that AMOC weakening is transient, with the AMOC recovering to its initial strength after GHGs are stabilised. Hence the 'traditional' forcing scenarios of increasing GHGs followed by stabilisation do not appear to induce tipping. But with increased interest in 'overshoot' scenarios motivated by the Paris climate agreement, is it possible that there are climate mitigation pathways that do carry a risk of AMOC tipping?

In this study we present a simple AMOC model which captures both the thermal and fresh water forcing associated with GHG increase, and is able to reproduce previous GCM results for both GHG and idealised fresh water ('hosing') scenarios. We identify the conditions under which AMOC tipping could occur, and their significance for 'safe' climate mitigation pathways.