RAPIT: Assessing the uncertainty of AMOC projections using a 10,000 member perturbed physics ensemble.

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We present the first results from the "Risk and Probability of Impacts Team" NERC project to assess risk and impacts associated with changes in the Atlantic Meridional Overturning Circulation (AMOC). A very large perturbed physics ensemble of the unfluxadjusted HadCM3 climate model has been conducted using the distributed computing facility of climateprediction.net. Using results from this ensemble and statistical techniques such as 'emulation' to predict the output of the climate model in untried regions of parameter space and 'history matching' to constrain parameter space through comparison with observations, we explore the parametric uncertainty associated with idealised scenarios of increasing CO2 concentrations. In particular we examine the spread of behaviour of the AMOC and associated impacts across the ensemble and parameter space.

 A novel aspect of our approach is that rather than constraining the ensemble from the outset (for example using limits on top-of-atmosphere radiative balance to eliminate unrealistic ensemble members), we use statistical emulators to fully explore the model's parameter space, searching for regions that contain "non-implausible" climate states which could otherwise be overlooked. This method has the advantage that regions of space where the AMOC might behave differently (for instance with a large rapid decrease in strength) are not discarded at the outset.

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