OS33A-01 - AMOC Stability in GISS-E2-1-G: a case of stochastic bifurcation

Wednesday, 14 December 2022
12:00 - 12:09
S105d (South, Level 1, McCormick Place)

Abstract

A 10-member ensemble simulation using the NASA GISS-E2-1-G climate model shows a clear bifurcation in the Atlantic Meridional Overturning Circulation (AMOC) strength under the SSP2-4.5 future scenario, leading to 8 stable AMOC-on and 2 stable AMOC-off climate states after 400 years of integration, despite identical forcing of each ensemble member. Ocean models have previously shown a tipping point where sufficient forcing (e.g. by freshwater inputs) can shut down the AMOC. A variety of fully coupled models have demonstrated this, either through hosing experiments or increased precipitation and warming at high latitudes due to increased concentrations of greenhouse gases. In the GISS simulations, there are no external freshwater perturbations. The bifurcation arises freely in the coupled system and is the result of stochastic variability associated with sea-ice transport and melting in the Irminger Sea following a slowing of the GHG concentration increase at the end of the twenty-first century. We believe this is the first time that a CMIP-class model has shown such a bifurcation across an initial condition ensemble.

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