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Stratification-dependent Mixing in Box Model of a Wind-Driven Atlantic Overturning under Thermohaline Forcing

Harald Bartenstein (1), Ben Marzeion (1), and Helen Johnson (2)

(1) University of Innsbruck, Institute of Meteorology and Geophysics, Innsbruck, Austria (ben.marzeion@uibk.ac.at), (2) University of Oxford, Department of Earth Sciences, Oxford, UK (helen.johnson@earth.ox.ac.uk)

It has previously been shown that the properties of the Atlantic Meridional Overturning Circulation (AMOC) depend critically on details of the formulation of diapycnal mixing, both in box models and complex AOGCMs. While in box models, a dependency of the diapycnal mixing on the background stratification can lead to reversed sensitivity of the AMOC to freshwater forcing (i. e., increased AMOC with increased freshwater forcing; Nilsson and Walin, 2001; Marzeion and Drange, 2006), in an AOGCM it was shown that stratification-dependent mixing may destabilize the AMOC, increasing the weakening effect of freshwater on the AMOC (Marzeion et al. 2007, 2009).

We use a box model of the AMOC. The model is driven both by wind and thermohaline forcing. In the case of constant diapycnal mixing, the model exhibits multiple equilibria, and millennial scale oscillations in certain regions of the parameter space (Johnson et al., 2007).

Here, we employ stratification-dependent mixing and explore the model's behavior both for the equilibrium and oscillatory regimes.