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Title: THERMOHALINE FEEDBACKS AND MULTIPLE EQUILIBRIA IN THE ADIABATIC REGIME

In the limit of small diapycnal diffusivity, the deep meridional overturning circulation (MOC) is dominated by an adiabatic pole-to-pole cell with downwelling in the North Atlantic (NA) and wind-driven upwelling in the Southern Ocean (SO). Wolfe and Cessi (2011) have shown that two elements are necessary for the existence of an adiabatic pole-to-pole cell: a thermally-indirect overturning circulation driven by westerlies in the SO, and a set of buoyancy values which are shared between the SO and the NA. Under these conditions, the size of buoyancy window shared between the NA and the SO -- and thus the strength of the MOC -- is maintained by a salt-advection feedback that tends to return the system to its original state after a freshwater perturbation. The MOC is thus strongest when the pole-to-pole buoyancy difference is minimum, contrary to the diffusive regime, where a pole-to-pole flow is driven by buoyancy differences. However, if the freshwater is sufficiently large and persistent to destroy the window of shared buoyancy completely, the MOC will shut down, the salt-advection feedback operates against the MOC, and the MOC may remain in its "off" state even the forcing perturbation is removed. The possibility of such multiple equilibria is investigated using a GCM in an idealized domain supporting a pole-to-pole overturning cell. At low diffusivity, self-sustained multidecadal oscillations are observed with amplitudes which increase as the critical freshwater forcing for MOC shutdown is approached. These oscillations mediate the transition between MOC "on" and "off" states and destroy the multiple equilibria observed at higher diffusivities.