



Stability of a minimal model of a wind- and mixing-driven overturning circulation

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In order to investigate the stability properties of the Atlantic meridional overturning circulation (AMOC) depending on its driving mechanism, we present a minimal conceptual model which allows for an overturning that is driven by Southern Ocean winds and by low-latitudinal mixing. The model incorporates the advection of salinity (Stommel, 1961) as well as the basic dynamics of the oceanic pycnocline (Gnanadesikan, 1999). The AMOC exhibits a threshold behavior in both driving limits due to the salt-advection feedback. However the newly added pycnocline dynamics stabilizes the circulation and reduces its sensitivity to freshwater perturbation until the critical threshold is reached at which the transition towards the off-state is more drastic than without pycnocline dynamics. Compared to previous studies the minimalistic nature of the model allows for analytic solutions in both limits.