Geophysical Research Abstracts,
Vol. 11, EGU2009-4495, 2009
EGU General Assembly 2009

Stratification-dependent Mixing May Increase Sensitivity of a Wind-driven Atlantic Overturning to Surface Freshwater Flux

B. Marzeion (1) and A. Levermann (2)

(1) Tropical Glaciology Group, Institute of Geography, University of Innsbruck, Innsbruck, Austria (ben.marzeion@uibk.ac.at), (2) Earth System Analysis, Potsdam Institute for Climate Impact Research, and Physics Institute, Potsdam University, Potsdam, Germany (anders.levermann@pik-potsdam.de)

Stratification-dependent mixing is employed in a coupled climate model of intermediate complexity with a 3-dimensional ocean component. The vertical diffusivity in the ocean is calculated as $\kappa \sim N^{-\alpha}$, where N is the local buoyancy frequency. The sensitivity of the Atlantic meridional overturning circulation (AMOC) to freshwater forcing is tested for exponents of $0 \leq \alpha \leq 2$ by first slowly increasing, then decreasing the freshwater forcing over the North Atlantic, keeping the model close to equilibrium.

The fresh anomaly imposed at the surface between $20°$N and $50°$N in the Atlantic reaches the deep ocean by vertical diffusion, and by AMOC advection via the northern convection sites. Higher values of α lead to enhanced stratification and thereby reduced vertical mixing in the subtropical forcing region. Consequently, the freshwater anomaly reaches the northern deep water formation regions less diluted, and reduces the AMOC more strongly compared to lower values of α.