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Diagnosing the numerically-induced diapycnal mixing in OGCMs

Abstract

This talk focuses on the spurious (i.e., numerical) diapycnal mixing that exists in fixed coordinates OGCMs. This numerical diapycnal flux arises in fixed coordinates models because the numerical framework cannot properly maintain the adiabatic properties of an advected water parcel. The main goal of this study is to document and quantify the numerically-induced diapycnal mixing using a series of idealized experiments. For this purpose, we use the tracer flux method to compute the numerically-induced diffusivities in two widely used fixed coordinate ocean models (i.e., ROMS, terrain-following, and the MITgcm, geopotential) for two experiments: a lock exchange scenario and a propagating internal wave field scenario. The results for the lock exchange are compared to a similar study recently performed using the General Estuarine Turbulence Model (GETM, *Burchard and Rennau*, 2008). For both series of experiments, the impact of the choice of advection schemes and model resolutions on the magnitude of the spurious diapycnal mixing is also quantified. For both models (ROMS, and MITgcm), the results show that this numerically-induced diapycnal mixing could overshadow the natural background mixing and thus, could be a significant source of error on reproducing accurate water mass properties.