EGU2020-3390
https://doi.org/10.5194/egusphere-egu2020-3390
EGU General Assembly 2020

A parameterization of local and remote tidal mixing

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Vertical mixing is often regarded as the Achilles' heel of ocean models. In particular, few models include a comprehensive and energy-constrained parameterization of mixing by internal ocean tides. Here, we present an energy-conserving mixing scheme which accounts for the local breaking of high-mode internal tides and the distant dissipation of low-mode internal tides. The scheme relies on four static two-dimensional maps of internal tide dissipation, constructed using mode-by-mode Lagrangian tracking of energy beams from sources to sinks. Each map is associated with a distinct dissipative process and a corresponding vertical structure. Applied to an observational climatology of stratification, the scheme produces a global three-dimensional map of dissipation which compares well with available microstructure observations and with upper-ocean finestructure mixing estimates. Implemented in the NEMO global ocean model, the scheme improves the representation of deep water-mass transformation and obviates the need for a constant background diffusivity.