
An Argo-data based validation of the internal gravity wave model IDEMIX

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Abstract

Breaking internal gravity waves are considered to be a major source of small-scale turbulence, that acts to mix density in the vertical and thus contributes to driving the global overturning circulation. To represent this turbulent mixing consistently, recently developed parameterizations therefore take internal wave energetics into account. The model IDEMIX (“Internal Wave Dissipation, Energy and Mixing”) predicts the propagation and dissipation of oceanic internal gravity waves as well as the corresponding diapycnal diffusivities based on a simplification of the spectral radiation balance of the wave field and can be used as a mixing module for global numerical simulations. The aim of this study is to validate the model through a comparison with observations. Since direct observations of turbulent mixing are sparse, we follow the approach by Whalen et al. (2012) and compute finescale strain variance from Argo-float CTD-profiles to estimate the turbulent kinetic energy dissipation and the related diapycnal diffusivity.

Both the spatial variation as well as the magnitude of the observed energy dissipation rate are in general well reproduced by the IDEMIX-model. Sensitivity experiments show that the dissipation rate’s strength and pattern (especially in the Gulf Stream) cannot be explained when meso-scale eddies and the dissipation of their energy are not accounted for. The observed seasonal cycle, too, can in the model only be explained by the seasonal variations in eddy kinetic energy. A detailed fine-tuning of the IDEMIX-module will be attempted based on parameters like the bandwidth of the Garrett-Munk spectrum or the symmetrization time scale of the internal wave field, using a global ocean general circulation model with a special focus on seasonal variations. For this validation, the newer version of IDEMIX is used, that not only describes the internal wave continuum but features additional compartments for near-inertial waves and internal tides.

Whalen, C. B., L. D. Talley, and J. A. MacKinnon. ”Spatial and temporal variability of global ocean mixing inferred from Argo profiles.” *Geophysical Research Letters* 39.18 (2012).
Olbers, Dirk, and Carsten Eden. ”A global model for the diapycnal diffusivity induced by internal gravity waves.” *Journal of Physical Oceanography* 43.8 (2013): 1759-1779.

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