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IDEMIX: a model of internal gravity wave energetics and diapycnal mixing

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Breaking of internal gravity waves is a major source of diapycnal mixing, driving the large-scale circulation. An energetically consistent model of the diapycnal diffusivity requires a closed model of the wave energetics, including generation, non-linear transfer and dissipation. IDEMIX meets this requirement by heavy truncation of the radiation balance equation: the energetics are formulated for a small number of compartments as integrals over respective parts of the spectral wavenumber space. The current version has compartments for up- and downward propagating waves in the frequency-wavenumber continuum and low-mode near-inertial and tidal waves. Forcing occurs by radiation of wind-driven near-inertial waves from the surface mixed layer and barotropic to baroclinic conversion of tidal energy at submarine topography. The compartments are coupled by wave-wave interactions and bottom scattering. Energy transferred by wave-wave interactions to high wavenumbers is dissipated and partly used for mixing. The model is working in physical space - the global ocean - with wave propagation by mean group velocities. IDEMIX has been studied as stand-alone module (using a Brunt-Väisälä frequency climatology and the Osborn-Cox relation to infer diapycnal diffusivities) and in a coupled mode in a global OGCM. The inferred diapycnal diffusivities have a reasonable size and plausible spatial pattern. We report on new developments in IDEMIX as the incorporation of topographic lee-waves and wave-mean flow interaction.