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Topographic forcing in the internal gravity wave model IDEMIX

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The internal wave model IDEMIX describes the generation, propagation and dissipation of internal gravity wave energy. By relating the vertical diffusivity and the turbulent kinetic energy (TKE) dissipation rate to the energy transferred out of the internal wave spectrum, the model provides an energetically consistent description of ocean mixing induced by breaking internal gravity waves. Coupled to a global ocean model, it is evaluated against Argo-based finestructure estimates of TKE dissipation rates using the Gregg-Henyey-Polzin parameterization following Whalen et al, 2012/2015. A novel method to calculate the internal wave energy levels from finescale strain or potential density information alone is presented and additionally used for the evaluation of IDEMIX. These fields' magnitudes and geographic variations are well reproduced by IDEMIX, but only if a fraction of the dissipated mesoscale eddy energy is added to the internal wave field at the bottom—an idealized representation of lee wave generation via eddy-topography interaction. The detailed spatial structure is less well reproduced in IDEMIX, suggesting a need to improve the forcing functions. A first step toward that goal is to describe the generation of lee waves and internal tides at the rough ocean bottom in greater detail. This is realized in a (semi-)analytical manner, extending the approach of Bell 1975a,b such that the horizontal direction of this energy conversion is resolved. In idealized simulations, internal wave parameters in IDEMIX are modified substantially when resolving the direction of the bottom forcing compared to the current standard of considering an isotropic energy input.