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Resolving the horizontal direction of internal tide generation

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The mixing induced by breaking internal gravity waves is an important contributor to the ocean's energy budget, shaping i.a. nutrient supply, water mass transformation and the large-scale overturning circulation. Much of the energy input into the internal wave field is supplied by the conversion of barotropic tides at rough bottom topography. A new semianalytical method to describe this internal wave forcing, calculating not only the total conversion but for the first time also the direction of this energy flux, is presented. It is based on linear theory for variable stratification and finite depth, and computes the energy flux into the different vertical modes for subcritical topography and small tidal excursion. In contrast to earlier semi-analytic approaches, the new one gives a positive definite conversion field. Sensitivity studies using both idealised and realistic topography allow the identification of suitable numerical parameter settings and corroborate the accuracy of the method. This motivates the application to the global ocean in order to better account for the geographical distribution of diapycnal mixing induced by low mode internal gravity waves, which can propagate over large distances before breaking. The first results highlight the significant differences of energy flux magnitudes with direction, confirming the relevance of this more detailed approach for energetically consistent mixing parameterisations in ocean models. The method used here should be applicable to any physical system that is described by the standard wave equation with a very wide field of sources.