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Resolving the horizontal direction of internal tide generation: Global application for the first mode M2-tide

Jonas Nycander[1] and Friederike Pollmann[2]
[1]Stockholm University, Dept of Meteorology, Stockholm, Sweden (jonas@misu.su.se)
[2]Center for Earth System Research and Sustainability (CEN), Universität Hamburg, Germany

Breaking internal tides contributes substantially to small-scale turbulent mixing in the ocean interior and hence to maintaining the large-scale overturning circulation. How much internal tide energy is available for ocean mixing can be estimated by using semi-analytical methods based on linear theory. Until recently, a method resolving the horizontal direction of the barotropic-to-baroclinic energy transfer was lacking. We here present the first global application of such a method for the first vertical mode of the principal lunar semi-diurnal tide. The conversion rate estimates are in general agreement with those obtained in previous studies, albeit somewhat smoother since the non-locality of the internal tide generation problem is taken into account more strongly. An advantage is that the conversion rate is positive definite with the new method. We also show that the effect of supercritical slopes on the modally decomposed internal tides is different than previously suggested. To deal with this the continental shelf and the shelf slope are masked in the global computation. The result shows that the energy flux can vary substantially with direction depending on the shape and orientation of topographic obstacles and the flow direction of the local tidal currents. Taking this additional information into account in tidal mixing parameterizations could have important ramifications for vertical mixing and water mass properties in global numerical simulations.