A new parameterization of tidal mixing enhanced over rough seafloor topography

*Toshiyuki Hibiya[1]

1. Department of Earth and Planetary Science, Graduate School of Science, University of Tokyo

It is believed that tidal interaction with rough seafloor topography can create mixing hotspots extending off the seafloor. Although there exist fine-scale parameterizations of tidal mixing enhanced over rough seafloor, they do not reflect the fact that the internal waves emanating from rough seafloor transform from internal tidal waves to internal lee waves as tide-seafloor interaction strengthens with $k_H U_0 / \omega$ exceeding unity where k_H is the dominant horizontal wavenumber of rough seafloor, U_0 is the amplitude of tidal flow, and ω is tidal frequency. Taking into account this fact, we formulate here the vertical decay scale of energy dissipation rates over rough seafloor by multiplying the theoretically obtained vertical group velocities of internal lee waves by the time scale of their nonlinear interaction with the background Garrett-Munk internal wave field. The resulting formulation explicitly shows that the vertical extent of mixing hotspots over rough seafloor becomes independent of k_H but proportional to U_0 squared, which agrees very well with the results of eikonal experiments and consistent with the available data from the Diapycnal and Isopycnal Mixing Experiment in the Southern Ocean (DIMES).

Keywords: Parameterization, Energy dissipation rates , Vertical decay scale , Tidal flow , Rough abyssal seafloor , Internal lee waves

