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Internal Wave Generation by Tide-Topography: Effects of a Mean Background Current

Tide-topography interactions are the source of approximately half the internal wave energy and of most internal solitary waves in the oceans. In this talk the effects of a surface trapped uni-directional current on the generation of internal waves by tidal currents over a symmetric ridge will be discussed using idealized linear and two-layer stratifications. The current introduces an asymmetry in the background state that results in asymmetries in energy fluxes and internal solitary waves and makes kinetic energy fluxes a leading-order contribution to the total energy flux. A linear theory for the wave generation process will be presented along with results from two-dimensional numerical simulations. Using linear stratifications the dependence on the ridge width is explored. For wide ridges the downstream energy flux is larger than the upstream energy flux while the opposite is true for narrow ridges. Using continuous two-layer stratifications internal solitary waves can be generated. Broader waves form in the downstream direction and in extreme cases internal solitary waves in the downstream direction can be waves of elevation while internal solitary waves in the upstream direction are waves of depression.