Effect on $Ex$ on internal waves created by tidal flow over near-critical topographic features

MASOUD JALALI B., NARSIMHA R. RAPAKA, SUTANU SARKAR, Mechanical and Aerospace Engineering, UC San Diego — Topographic bumps with small horizontal length under energetic surface tides with large velocity lead to internal tide generation in a regime with $O(1)$ values of the excursion number, $Ex$, the ratio of fluid tidal advection to the topographic length scale. DNS is performed for a smoothed triangular ridge to study how internal gravity waves and turbulence change when $Ex$ is varied from a low to $O(1)$ values, keeping the Reynolds number constant. The near-field internal wave field loses its beam-like character with increasing values of $Ex$. Analysis of the baroclinic energy shows significant reduction in the radiated wave flux higher $Ex$ cases owing to a substantial rise in advection and baroclinic dissipation. There is small change in energy conversion consistent with the linear approximation. Turbulence changes qualitatively with increasing $Ex$. When $Ex \sim 0.1$, turbulence is intensified at the near-critical regions of the slope, and is also significant in the beams adjacent to the top of the ridge. However, at $Ex \sim 1$, turbulence is confined to a narrow boundary region spanning the ridge and the adjacent flat bottom. The size of the turbulent overturns increases with increasing $Ex$ until $Ex \sim 0.5$, followed by a substantial decrease.

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