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Internal wave mode resonant triads in an arbitrarly stratified finite-depth ocean with background rotation[1] DHEERAJ VARMA, MANIKANDAN MATHUR, Department of Aerospace Engineering, IIT Madras —
Internal tides generated by barotropic tides on bottom topography or the spatially compact near-inertial mixed layer currents excited by surface winds can be conveniently represented in the linear regime as a superposition of vertical modes at a given frequency in an arbitrarily stratified ocean of finite depth. Considering modes (m, n) at a frequency ω in the primary wave field, we derive the weakly nonlinear solution, which contains a secondary wave at 2ω that diverges when it forms a resonant triad with the primary waves. In nonuniform stratifications, resonant triads are shown to occur when the horizontal component of the classical RTI criterion $\vec{k}_1 + \vec{k}_2 + \vec{k}_3 = 0$ is satisfied along with a non-orthogonality criterion. In nonuniform stratifications with a pycnocline, infinitely more pairs of primary wave modes (m, n) result in RTI when compared to a uniform stratification. Further, two nearby high modes at around the near-inertial frequency often form a resonant triad with a low mode at 2ω, reminiscent of the features of PSI near the critical latitude. The theoretical framework is then adapted to investigate RTI in two different scenarios: low-mode internal tide scattering over topography, and internal wave beams incident on a pycnocline.

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