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Generation of mode-2 internal waves in a two-dimensional stratification by a mode-1 internal wave. (English) [Zbl 07214088](#)

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Summary: The generation of mode-2 nonlinear internal waves (IWs) by the evolution of a mode-1 IW in a two-dimensional stratification is investigated. A generation model accounting for intermodal interaction is derived based on a multi-modal approach in a weakly nonlinear and non-hydrostatic configuration. The generation model is numerically solved to simulate the evolution of mode-1 and mode-2 IWs in an inhomogeneous pycnocline. The numerical experiments confirm that mode-2 IWs are generated due to linear and nonlinear intermodal interaction. The mode-2 IW continues growing and gradually separates with the mode-1 IW during the generation process. The numerical results suggest that the pycnocline strength or thickness prominently affects the generation of mode-2 IWs, followed by pycnocline depth. A weakening or thinning pycnocline favors the generation of mode-2 IWs by evidently enhancing linear and nonlinear intermodal interaction, whereas a shoaling pycnocline favors a rapid growth rate mainly by enhancing linear intermodal interaction. The wave amplitude of an initial mode-1 IW strongly affects the generation of mode-2 IWs and increasing it can noticeably enlarge mode-2 IWs.

MSC:

76 Fluid mechanics

35 Partial differential equations

Keywords:

mode-2 internal wave; two-dimensional stratification; generation; favorable environmental conditions

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