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Instability properties in the bottom boundary layer under a model mode-1 internal tide. JOHN SEGRETO, PETER DIAMESSIS , Cornell University, Civil and Environmental Engineering — The instability properties of the bottom boundary layer (BBL) under a model mode-1 internal tide in linearly stratified finite-depth water are studied, using 2-D fully nonlinear and non-hydrostatic direct numerical simulations (DNS) based on a spectral multidomain penalty method model. Low-mode internal tides are known to transport large amounts of energy throughout the oceans. One possible mechanism, among others, through which the energy of the particular tidal waves can be directly dissipated, without transfer to higher modes, is through wave-BBL interactions, where strong near-bottom shear layers develop, leading to localized instabilities and ultimately mixing. In the model problem, the stability response of the time-dependent wave-induced BBL is examined by introducing low-amplitude perturbations near the bed. For the linear stage of instability evolution, the time-dependent perturbation energy growth rates are computed by tracking the largest perturbation energy density in the domain through the wave-modulated shear and stratification, ultimately the formation of distinct localized near-bed Kelvin-Helmholtz billows are observed. The average growth rate, σ, is then compared to the time, T, that a parcel of fluid is subject to a local Richardson number less than 1/4, resulting in a nondimensional criterion for instability, σT. A stability boundary is then constructed as a function of perturbation amplitude, wave steepness, aspect ratio and Reynolds number.

John Segreto
Cornell University

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