Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

Instability properties under a model mode-1 internal tide. JOHN SEGRETO, PETER DIAMESSIS, Cornell University, Ithaca NY — 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 direct numerical simulations (DNS) based on a spectral multidomain penalty method model. This model internal tide is a proxy for its lower-mode oceanic counterpart which is generated when stratified water is forced over topography by barotropic tidal currents. Such low-mode internal tidal waves tend to propagate long distances from the point of generation, carrying with them large amounts of energy. One mechanism through which this energy is dissipated is through wave-BBL interactions, where strong shear layers develop along the bed, leading to focused instabilities which are precursors for localized turbulent events. Such events in the BBL can cause sediment resuspension and drive benthic nutrient fluxes, playing a crucial role in ecosystem balances. In the model problem, the stability response of the time-dependent BBL is examined by introducing low-amplitude perturbations near the bed. The corresponding time-evolving BBL-integrated perturbation energy growth rates are then computed, by comparing both the perturbed and unperturbed cases. When an instability actually occurs, its vorticity structure and preferred location is identified. Ultimately, a stability boundary is constructed as a function of perturbation amplitude and internal wave steepness, aspect ration and Reynolds number.

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Date submitted: 18 Oct 2016 Electronic form version 1.4