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Near-critical reflection of nonlinear obliquely incident internal wave beam from a slope[1] TRIANTAPHYLLOS AKYLAS, MIT — The reflection of internal gravity waves from sloping boundaries is believed to contribute significantly to vertical mixing in the ocean. This mechanism is likely to be enhanced when a wave is incident at an angle to the horizontal that is close to the slope of the boundary, given that the amplitude of the reflected wave becomes infinite according to linear inviscid theory if the angle of incidence exactly matches the slope. To clarify the role of nonlinear effects in this resonance, the reflection of a nonlinear wave beam of finite cross-section is analyzed by a matched-asymptotics approach, exploiting the fact that, near the critical angle, the reflected disturbance is confined to a thin boundary layer in an "inner" region close to the slope. Unlike prior studies, which assume that incident waves approach the boundary in a plane normal to the isobaths, here the oncoming wave is oblique. This gives rise to an alongslope mean flow component that is equally strong to the upslope induced mean flow, and the evolution of the reflected wave is fully nonlinear, in sharp contrast to the case of normal incidence where nonlinear effects are minor. The theoretical predictions are discussed in connection with related numerical and experimental results.

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