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Resonant generation of internal waves on a model continental slope

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Away from shallow, well-mixed surface regions, the density of sea water increases with depth due to variation in salinity and temperature. This continuous density stratification supports *internal* gravity waves, which are the counterpart within the fluid interior of *surface* gravity waves. Internal gravity waves are import for many oceanic processes, such as sediment transportation and ocean mixing. We study internal wave generation in a laboratory model of oscillating tidal flow on a continental margin. Waves are found to be generated only in a near-critical region where the slope of the bottom topography matches that of internal waves. Fluid motion with a velocity an order of magnitude larger than that of the forcing occurs within a thin boundary layer above the bottom surface. The resonant wave is unstable because of strong shear; Kelvin-Helmholtz billows precede wave breaking. We construct a model to extrapolate our results to oceanic conditions. This work [1] provides a new explanation for the intense boundary flows on continental slopes.

[1] H. P. Zhang, B. King and Harry L. Swinney, Phys. Rev. Lett. 100, 244504 (2008).