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Harmonic Generation of Internal Waves Reflected from a Slope

BRUCE RODENBORN, D. KIEFER, H.P. ZHANG, HARRY L. SWINNEY, Center for Nonlinear Dynamics, University of Texas at Austin, USA — The reflection of oceanic internal waves from bottom topography can generate harmonics and cause mixing that could be important in sustaining the meridional overturning circulation. Internal wave reflection is often treated as a linear or a weakly nonlinear inviscid problem¹. Under these assumptions, and for a linearly stratified fluid, Thorpe² and Tabaei et al.³ derived predictions for the boundary angle where second harmonic generation should be most intense. We have conducted laboratory experiments and two-dimensional numerical simulations of the Navier-Stokes equation in the Boussinesq approximation to test these predictions. The results from experiments and simulations are in agreement but differ from both theories, except for very low intensity incoming waves. However, we obtain an empirical geometric relationship between the wave beam and boundary angles that predicts a condition for maximal second harmonic generation, and that agrees with the results from our experiment and simulation.

¹T. Dauxois and W.R. Young, *J. Fluid Mech.* **390**, 271-295 (1999)

²S. A. Thorpe, *J. Fluid Mech.*, **178**, 279-302 (1987)

³A. Tabaei, T. R. Akylas and K. G. Lamb, *J. Fluid Mech.* **526**, 217-243 (2005)

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