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Experimental measurements of lee wave interaction with wind shear, wakes, and boundary layers MICHAEL PATTERSON, University of Bath, COLM CAULFIELD, DAMTP & BPI, Cambridge University, STUART DALZIEL, DAMTP, Cambridge University — We present quantitative whole field measurements of the nonlinear internal wave field generated by a linearly stratified fluid that is perturbed by an idealized isolated "mountain" obstacle. We carried out experiments in a recirculating "Kovasznay" tank, which allows both the steady wave field to be quasi-stationary in the laboratory frame, and also for the effect of vertical variations in horizontal velocity to be studied straightforwardly. We observe critical layer absorption and total reflection at turning points, and we compare the effect of externally imposed shear with the behaviour associated with boundary layers both in the vicinity of the obstacle, (when the obstacle is located at the base of the tank) and at some distance (when the obstacle is located at the free surface). Post-processing of the experimental data using the Hilbert transform allows us to separate both the emitted outgoing and reflected incoming wave fields. Our results show that the the emission is a fundamentally nonlinear effect, with significant emission and absorption associated with the wake flow structure downstream of the obstacle. Our results suggest that wake effects may be responsible for the wave field observed downstream of many obstacles in atmospheric and oceanographic flows.

Michael Patterson
University of Bath

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