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Schlieren measurements of internal waves in non-Boussinesq fluids HEATHER A. CLARK, BRUCE R. SUTHERLAND, University of Alberta — Previous experiments that have examined the generation of internal gravity waves by a monochromatic source have been restricted to small amplitude forcing in Boussinesq stratified fluids. Here we present measurements of internal waves generated by a circular cylinder oscillating at large amplitude in a non-Boussinesq fluid. The "synthetic schlieren" optical measurement technique is extended to stratifications in which the fluid index of refraction may vary nonlinearly with density. The method is applied to examine disturbances in uniformly stratified ambients consisting either of NaCl or NaI solutions whose concentrations are near-saturation at the bottom of the tank. We report upon the first extensive measurements of the optical properties of NaI solutions as they depend upon concentration and density. Using these results in experiments, we find that large amplitude forcing generates oscillatory turbulence surrounding the cylinder, thereby increasing the effective cylinder size and decreasing the amplitude of the waves in comparison with linear theory predictions. We parameterize the influence of the turbulent boundary layer in terms of an effective cylinder radius and forcing amplitude. Upward propagating waves are observed to grow in amplitude due to non-Boussinesq effects, in agreement with expectations. Surprisingly, however, the waves are observed to break despite propagating over only a fraction of the density scale height.

Heather Clark
University of Alberta

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