Abstract Submitted
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Propagation and Overturning of Three-Dimensional Boussinesq Wavepackets with Rotation[1] ALAIN GERVAIS, QUINLAN EDE, GORDON SWATERS, Univ of Alberta, TON VAN DEN BREMER, Univ of Oxford, BRUCE SUTHERLAND, Univ of Alberta — Internal gravity waves (IGWs) propagate horizontally and vertically within stably stratified fluids. As IGWs propagate vertically, nonlinear effects can lead to instabilities that may cause the waves to overturn and eventually break, irreversibly depositing their energy to the background flow. Even before breaking, moderately large amplitude IGW packets induce a mean flow that interacts nonlinearly with the waves, Doppler shifting their frequency, and altering the height at which the waves would have otherwise overturned. Here we derive explicit integral formulae for the flows induced by 3D IGW packets influenced by Coriolis forces. Numerical simulations of quasi-monochromatic wave packets with a range of initial amplitudes and vertical wavenumbers are initialized with the predicted induced flow superimposed. In simulations with moderately large initial amplitudes – but still smaller than the overturning amplitudes predicted by linear theory – interactions between the waves and their induced flow caused the waves eventually to overturn. In all cases shear instability did not play a role in driving the waves to overturn. The influence of the wave-induced flow acting upon IGWs interacting with retrograde shear is also examined as it affects wave reflection and transmission.

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