Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

Propagation of 3D internal gravity wave beams in a slowly varying stratification[1] BOYU FAN, T. R. AKYLAS, MIT — The time-mean flows induced by internal gravity wave beams (IGWB) with 3D variations have been shown to have dramatic implications for long-term IGWB dynamics. While uniform stratifications are convenient both theoretically and in the laboratory, stratifications in the ocean can vary by more than an order of magnitude over the ocean depth. Here, in view of this fact, we study the propagation of a 3D IGWB in a slowly varying stratification. We assume that the stratification varies slowly relative to the local variations in the wave profile. In the 2D case, the IGWB bends in response to the changing stratification, but nonlinear effects are minor even in the finite amplitude regime. For a 3D IGWB, in addition to bending, we find that nonlinearity results in the transfer of energy from waves to a large-scale time-mean flow associated with the mean potential vorticity, similar to IGWB behavior in a uniform stratification. In a weakly nonlinear setting, we derive coupled evolution equations that govern this process. We also use these equations to determine the stability properties of 2D IGWB to 3D perturbations. These findings indicate that 3D effects may be relevant and possibly fundamental to IGWB dynamics in nature.

[1]Supported by NSF grant DMS-1512925

Boyu Fan
MIT

Date submitted: 25 Jul 2017 Electronic form version 1.4