Abstract Submitted
for the DFD06 Meeting of
The American Physical Society

Progressive internal waves JOHN MCHUGH, University of New Hampshire — Progressive internal waves of permanent form in a finite-depth layer of stratified fluid are considered. Such waves were previously considered by Thorpe (1968)and Yih (1974) using a Stokes expansion and including non-Boussinesq effects. The non-Boussinesq effects are important for obtaining the correct wave-generated mean flow. The previous results give the now well-known exponential growth of wave amplitude with altitude. Each successive nonlinear harmonic also has an exponential growth with altitude, with each successive harmonic growing faster than the previous one. This result indicates a problem with uniform validity, which becomes critically important in the unbounded layer. Uniformly valid results are obtained here for a finite depth layer using a different expansion, but still assuming small wave amplitude. Long's equation is used for the governing equation.The upstream velocity is assumed constant and equal to the wave speed, making the problem steady. The upstream density profile is adjusted to match the downstream average density profile, as in Yih (1974). This adjustment provides the mostimportant nonlinear effects. The results show a saturated wave profile. The second-order correction to wavespeed for some parameters is negative, meaning larger amplitude waves travel slower, in agreement with Yih (1974). However, other parameter values have a positive value, indicating that larger amplitude waves travel faster.

John McHugh
University of New Hampshire

Date submitted: 04 Aug 2006 Electronic form version 1.4