Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

Effect of Prandtl number and bulk Richardson number on the secondary nonlinear dynamics of the Taylor-Caulfield instability. THOMAS EAVES, NEIL BALMFORTH, U. British Columbia — Layered density stratifications are ubiquitous in the natural environment. When such layered stratification is subject to a shear flow, the Taylor-Caulfield instability can arise for arbitrarily large bulk Richardson number through the Doppler-shifted interaction of internal gravity waves at the interfaces between density layers. Beyond this mechanistic description of the linear instability, only a few studies have investigated the nonlinear evolution of the primary linear instability, over relatively limited parameter ranges. Here we present a large number of two-dimensional fully nonlinear simulations of the evolution of the Taylor-Caulfield instability over a wide range of Prandtl and bulk Richardson numbers and identify three distinct regimes; a relatively quiescent wavelength-cascade of Taylor-Caulfield instabilities at small bulk Richardson number, highly energetic and efficiently mixing dynamics at large bulk Richardson number, and reconfirmation of the emergence of parasitic nonlinear Holmboe waves at high Prandtl number.

Thomas Eaves
U. British Columbia

Date submitted: 25 Jul 2017 Electronic form version 1.4