Abstract Submitted
for the DFD13 Meeting of
The American Physical Society

The Oceanic Charney Problem SHANE KEATING, University of New South Wales, K. SHAFER SMITH, New York University — We examine the effect of a surface buoyancy gradient on the formation, vertical structure, and transport properties of mesoscale eddies in an 'oceanic' version of the classical Charney problem. The analysis is carried out in the context of a general mean state that permits a systematic study of the competing effects of surface buoyancy, planetary vorticity, and baroclinic shear. We show that the presence of a surface buoyancy gradient subtly modifies the Charney-Stern-Pedlosky necessary criteria for instability and has important implications for the resulting nonlinear equilibrated flow. In particular, a surface buoyancy gradient rapidly generates buoyancy variance close to the surface, strongly modifying the nature of the turbulent cascades, the kinetic energy spectrum, and the vertical structure of the eddies. Idealized numerical simulations of the resulting flow show a transition from surface quasigeostrophic turbulence near the surface to classical geostrophic turbulence in the interior.

Shane Keating
University of New South Wales

Date submitted: 25 Jul 2013 Electronic form version 1.4