Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

Quasigeostrophic investigations of non-hydrostatic, stably- stratified and rapidly rotating flows[1] KEITH JULIEN, DAVID NIEVES, IAN GROOMS, Dept. Applied Mathematics, University of Colorado at Boulder, JEFFREY WEISS, Dept. Atmospheres and Oceans, University of Colorado at Boulder — We present an investigation of rapidly rotating stratified turbulence where the stratification strength is varied from weak to strong. The investigation is set in the context of a reduced model derived from the Boussinesq equations that retains anisotropic inertia-gravity waves with order-one frequencies and highlights a regime of waveeddy interactions. Numerical simulations are performed where energy is injected by a stochastic forcing of vertical velocity, which forces wave modes only. The simulations reveal two regimes characterized by the presence of well-formed, persistent and thin turbulent layers of locally weakened stratification at small Froude numbers, and by the absence of layers at large Froude numbers. Both regimes are characterized by a large-scale barotropic dipole enclosed by small-scale turbulence. When the Reynolds number is not too large, a direct cascade of barotropic kinetic energy is observed, leading to total energy equilibration. We examine net energy exchanges that occur through vortex stretching and vertical buoyancy flux. We find that the baroclinic motions inject energy directly to the largest scales of the barotropic mode, implying that the large-scale barotropic dipole is not the end result of an inverse cascade within the barotropic mode.

[1]NSF DMS 1317666, 1444503; NSF EAR 1067944, NSF OCE 1245944

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Date submitted: 29 Aug 2016 Electronic form version 1.4