Abstract Submitted
for the DFD11 Meeting of
The American Physical Society

New equations for the slow dynamics in the presence of strong rotation and weak stratification[1] BETH WINGATE, Los Alamos National Laboratory, PEDRO EMBID, University of New Mexico — We explore the strong rotation limit of the rotating and stratified Boussinesq equations with periodic boundary conditions when the stratification is weak. This regime corresponds to the limit where (Rossby number) $Ro = \epsilon$, (Froude number) $Fr = O(1)$, as $\epsilon \to 0$. We show that the slow dynamics decouples from the fast and derive new equations for the slow dynamics. The new equations for the slow dynamics describe the dynamics of Taylor-Proudman flows and their conservation laws including a new conserved quantity for vertical kinetic energy and potential energy. The leading order potential enstrophy is slow while the leading order total energy retains both fast and slow dynamics. We also perform forced numerical simulations of the rotating Boussinesq equations to demonstrate support for the theory.

[1]Thank you for support from the DOE office of Advanced Scientific Research and the DOE office of biological and environmental resesarch.

Beth Wingate
Los Alamos National Laboratory

Date submitted: 12 Aug 2011 Electronic form version 1.4