

Abstract Submitted
for the DFD11 Meeting of
The American Physical Society

Dynamics and structure of stably stratified turbulence SIMON SCHAAD, SUBHAS VENAYAGAMOORTHY, Colorado State University, DEREK STRETCH, University of KwaZulu-Natal, South Africa — The structural features of stratified turbulence and its relationship to the flow dynamics has been the subject of many recent investigations. In strongly stratified turbulent flows, the formation of large-scale quasi-horizontal vortices in layers with strong vertical variability has been observed in laboratory experiments. In this study, direct numerical simulations (DNS) of stably stratified turbulence are used to investigate the evolution of flows in terms of overturns and their relationship to mixing. Isosurfaces of enstrophy of strongly stable flows indicate the emergence of randomly distributed “pancake-like” structures with near horizontal orientation at later times. The vertical dynamics of such strongly stratified flows are dominated by linear internal waves and can be described using rapid-distortion theory (RDT) while their horizontal dynamics are dominated by nonlinear effects that cannot be described by RDT. This suggests a decoupling of the vertical and horizontal dynamics of the flow. The “pancake” enstrophy structures appear to be associated with shear layers between layered vortex modes. It has been suggested by others that these shear layers could become locally unstable leading to additional source of turbulence in these strongly stable flows.

Subhas Venayagamoorthy
Colorado State University

Date submitted: 08 Aug 2011

Electronic form version 1.4