Abstract Submitted
for the DFD05 Meeting of
The American Physical Society

Density evolution of fresh water above salt with homogeneous mixing JOHN WHITEHEAD, Woods Hole Oceanographic Institution, IAN STEVENSON, Rice University — A two-layer density-stratified fluid was turbulently mixed with a horizontally moving vertical rod. The rod ran throughout the fluid to create homogenous turbulence, and we observed the evolution of the density profiles as mixing occurred. In the highly-turbulent regime in which this study was conducted, where Reynolds Number Re $>$ 600 and Richardson Number Ri $<$ 0.4, step-formation does not occur. The density profile of the fluid evolved smoothly from a single step to a constant density profile in the fully mixed state. The density flux and buoyancy frequency evolve in rough agreement with that predicted by Posmentier (1977), but in the low Ri regime this data is far from conclusive. Examination of the amount of turbulent kinetic energy going into mixing agrees with previous results (Holford and Linden 1999) with a maximum of 5% of the kinetic energy contributing to the change in potential energy. Finally, we propose a theoretical expression for the buoyancy flux due to turbulent mixing. Using this expression, the solutions to the equation for conservation of density collapse when a similarity variable is used. We verify this collapse experimentally for a range of Reynolds and Richardson Numbers.

John Whitehead
Woods Hole Oceanographic Institution

Date submitted: 04 Aug 2005 Electronic form version 1.4