Abstract Submitted
for the DFD06 Meeting of
The American Physical Society

Anomalous diffusion in rotating stratified turbulence YOSHI KIMURA, Nagoya University, JACKSON HERRING, NCAR — Diffusion in rotating and stratified fluids is one of the central subjects in geophysical and astrophysical dynamics. In this paper, we report features of the dispersion of Lagrangian fluid particles in rotating stratified flows using the Direct Numerical Simulations (DNS) of the Navier-Stokes equations. And for calculation of particle dispersion, we use the cubic spline interpolation method by Yeung and Pope. Our main concern is the picture different from the Taylor dispersion theory, i.e. $\langle X(t)^2 \rangle \sim t^2$ for $t \ll t_B$ (ballistic mode) and $\langle X(t)^2 \rangle \sim t$ for $t \gg t_B$(Brownian mode), where t_B is the time after which the Lagrangian velocity auto-correlation function drops rapidly. The different features of diffusion from the standard Taylor picture is often called anomalous diffusion. Particle dispersion shows quite large anisotropy. In the vertical direction, particles stop migration after they pass the time interval of the ballistic mode when only stratification is active and rotation enhances this tendency (for decaying turbulence). In the horizontal direction, we observe that t^2 behavior is more evident not only for the initial ballistic mode but also at later times, and that there is a transition period between the two t^2 regimes. The duration and the starting time of the transition period are a function of the parameters of stratification and rotation. For a fixed value of stratification, the transition period shifts to earlier time with rotation. And with strong stratification, the transition period disappears.

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Date submitted: 04 Aug 2006 Electronic form version 1.4