Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Lagrangian and Eulerian Statistics of Vorticity Dynamics in Turbulent Stratified Shear Flows FRANK JACOBITZ, University of San Diego, KAI SCHNEIDER, Aix-Marseille Universit, MARIE FARGE, Ecole Normale Suprieure — The Lagrangian and Eulerian time-rate of change statistics of vorticity in homogeneous turbulence with shear and stable stratification are studied. Direct numerical simulations are performed, in which the Richardson number is varied from Ri=0, corresponding to unstratified shear flow, to Ri=1, corresponding to strongly stratified shear flow. The probability density functions (pdfs) of both Lagrangian and Eulerian time-rates of change show a strong influence on the Richardson number. The Lagrangian time-rate of change pdf has a stretched-exponential shape due to the vortex stretching and tilting term in the equation for fluctuating vorticity. The shape of the Eulerian time-rate of change pdf was also observed to be stretched-exponential and the extreme values for the Eulerian time-rate of change are larger than those observed for the Lagrangian counterpart due to the nonlinear term in the vorticity equation. The Lagrangian and Eulerian acceleration pdfs are mainly determined by the pressure-gradient and nonlinear terms in the Navier-Stokes equation, respectively. The Lagrangian time-rate of change pdf of fluctuating density does not show a stretched exponential shape, while its Eulerian counterpart does due to the nonlinear term in the in the density advection-diffusion equation.

Frank Jacobitz
University of San Diego

Date submitted: 25 Jul 2015 Electronic form version 1.4