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Mixing and dispersion in stably stratified sheared turbulence
KEIKO NOMURA, LINHDUNG PHAM, JAMES ROTTMAN, University of California, San Diego — Direct numerical simulations are performed to study turbulent dispersion in stably stratified homogeneous shear flow. Lagrangian statistics are obtained for subcritical, critical, and supercritical flow conditions. In particular, we examine the density perturbation following fluid particles which has two components: that due to vertical advection in the stratified fluid (isopycnal displacement) and that due to the change in particle density by molecular diffusion (diapycnal mixing). For subcritical and critical flows, the isopycnal displacement increases while diapycnal mixing counterbalances this at a rate which limits the density perturbation carried. In subcritical flow, the buoyancy flux is described by the dispersion coefficient. For supercritical flows, stratification strongly suppresses the isopycnal displacement. The particle density relaxes to the background mean value through diapycnal mixing as the particle settles into its new equilibrium height. In these flows, the correlation between vertical velocity and mixing is no longer negligible. Implications on dispersion modeling for stratified turbulence is considered.

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