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Large eddy simulation study of mixing in stratified jets NIRANJAN GHAISAS, DINESH SHETTY, STEVEN FRANKEL, School of Mechanical Engineering, Purdue University — The structure and dynamics of a horizontally injected round turbulent buoyant jet are studied using Large Eddy Simulation (LES). A high-order accurate numerical procedure and different constant coefficient and dynamic eddy-viscosity sub-grid scale (SGS) models are used. The numerical procedure and SGS models are validated by conducting simulations at previous experimental flow conditions (characterized by Reynolds number, Re, and Richardson number, Ri), and comparing with the existing experimental results. The experimental results are then supplemented by simulations at different Re and Ri. Previous studies have shown that interaction between buoyancy and turbulence in this configuration leads to suppressed mixing in stably stratified regions and enhanced turbulence and mixing in unstably stratified regions. The ability of different SGS models to capture this phenomenon is studied by examining the jet trajectory, decay of the centerline velocity, radial spread and turbulent kinetic energy budgets at different axial locations. Schmidt number dependence of the results is also analyzed. Finally, the existence of secondary flows which lead to a plume-like vertical motion in addition to the primary horizontal injection is discussed and quantified.

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