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Integral length-scale approximation based modeling of subfilter-scale scalar flux for large-eddy simulation of stratified turbulent flows REETESH RANJAN, University of Tennessee at Chattanooga — The integral length-scale approximation (ILSA) model for the subfilter-scale (SFS) stress is extended in this study for large-eddy simulation (LES) of stably stratified turbulent flows. The ILSA model is an algebraic eddy viscosity model, where for the model length scale an approximation of the integral length scale of turbulence is used instead of relating it to the grid size. The approximated length scale depends upon the local flow conditions and the SFS activity, thus allowing to obtain accurate results on relatively coarser grids compared to the other algebraic closures. In this study, two approaches relying on the eddy diffusivity based formulation are considered for modeling of the SFS scalar flux, which requires a closure while performing LES of stratified turbulent flows. The first approach utilizes the conventional dynamic eddy diffusivity model, and the second approach uses an approximation of the integral length scale for the scalar field. In both these approaches, the ILSA model is used for the SFS stress. These approaches are assessed for their accuracy by performing LES of a fully developed turbulent channel flow at frictional Reynolds number of 550 and frictional Richardson number of 0 and 60, corresponding to a neutral and stable stratification, respectively.

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