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Assessment of numerical and modeling error interaction on the accuracy of a variable density jet LES GREGORY RODEBAUGH, LESTER SU, Johns Hopkins University — Correctly predicting the scalar concentration fields is essential for the development of precise large eddy simulations (LES) of reacting flow. We perform a comprehensive study of the effects different subgrid scale (SGS) stress and scalar flux models have on both the mixing properties and turbulent statistics of the flow. The SGS closures evaluated are the variable-density extensions of the dynamic mixed nonlinear and eddy diffusivity-type models for both momentum and mixture fraction. Additionally, we vary the order of the spatial discretization to examine numerical model sensitivity. LES results are compared against both direct numerical simulation and experimental data, and it is shown that LES performance depends on the model selected with the mixed models generally outperforming eddy-diffusivity models. The canonical flow selected for the investigation is an isothermal axisymmetric jet governed by the low-Mach number equations. The momentum and scalar fields are coupled using a predictor-corrector time integration scheme. The conservation equations are implemented in cylindrical coordinates, with momentum computation using second- or fourth-order central operators, and mixture fraction computation using bounded upwind operators of third- or fifth-order.

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