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Resolution and Reynolds number effects on LES of turbulent round jet mixing O.S. SUN, L.K. SU, Johns Hopkins University — In LES, the level of resolution is determined by the filter width, which implicitly defines the cut-off length scale. Smaller-scale motions are unresolved and represented by subgrid scale (SGS) models. In most cases, the SGS model and numerical grid are coupled, precluding truly grid-independent solutions. Understanding the effects of grid and resolution on simulation results is important for determining the utility and limitations of LES. Most LES resolution studies focus primarily on numerical aspects. Here, we explicitly study the effects of resolution on LES of passive scalar mixing in a spatially-developing, round, turbulent jet. With the same initial and boundary conditions, the number of grid points ranges from $80 \times 32 \times 16$ ($N_r \times N_\theta \times N_\phi$) to $176 \times 64 \times 32$. Additionally, the simulation is performed for a range of Reynolds numbers between $Re_D = 5,000$ and $Re_D = 10,000$. The subgrid stress term in the momentum equation is modeled with the dynamic Smagorinsky model, while the subgrid flux term in the scalar transport equation is closed using various models, including the dynamic eddy diffusivity and dynamic mixed models. Mean and higher-order statistics, including RMS, PDFs and spectra, for the resulting velocity and scalar fields are presented, allowing detailed comparisons of the subgrid scalar flux models.

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