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Large Eddy Simulation of a Turbulent Buoyant Helium Plume GUILLAUME BLANQUART, HEINZ PITSCH, Stanford University — Numerical simulations of fires remain challenging because of the complex coupled physics including buoyancy effects, turbulence, combustion, and soot formation. The present work focuses on a turbulent buoyant helium plume as a canonical test reflecting some of the important features of fires. In this configuration, small scale structures are formed due to Rayleigh-Taylor instabilities. Then, these structures start to interact with large scale features of the flow resulting in a puffing cycle. The simulation of this 1-meter diameter helium plume is performed using Large Eddy Simulation (LES). The simulation is shown to reproduce the main features of the turbulent plume, such as puffing frequency and the development of Rayleigh-Taylor instabilities. Furthermore, comparison of numerical results with experimental measurements shows good agreement not only for mean quantities but also for velocity and scalar fluctuations. Finally, the effects of mesh resolution and subgrid scale modeling are analyzed by considering different meshes and models.

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