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Large-eddy-simulation and measurements of turbulent transport and mixing in a confined rectangular jet JAMES HILL, KATRINE NILSEN, BO KONG, MICHAEL OLSEN, RODNEY FOX, Iowa State University — Large-eddy simulations of transport and mixing of a passive scalar were performed for a confined rectangular liquid jet (Re = 20,000) and compared to results of simultaneous particle image velocimetry and planar laser induced fluorescence measurements. Reasonably good agreement was obtained for single-point statistics as well as for two-point correlation functions of the turbulent velocity, scalar, and joint velocity-scalar fields. Of particular interest was the determination of the diagonal and off-diagonal components of the turbulent diffusivity tensor, the mis-alignment of turbulent fluxes and mean gradients, and determination of the turbulent Schmidt number, with reasonably good agreement between the simulations and experiments. Some of the results are consistent with the measurements of Tavoularis & Corrsin (JFM 104, 331-367 (1981)) for a homogeneous turbulent shear flow with a uniform mean temperature gradient. In our case we find the ratio of diffusivities to range from 1 to 2 (the latter value in agreement with Tavoularis), Sc_t generally between 0.5 and 1, and the angle between turbulent flux and mean scalar gradient from 120 to 150 degrees.

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