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Effects of buoyancy on flow evolution in momentum-driven turbulent jets L.K. SU, D.B. HELMER, L.M. DENK, Johns Hopkins University — Local buoyancy effects are potentially significant in systems such as reacting flows with heat release, or atmospheric flows with natural convection, and can pose challenges for modeling efforts that do not explicitly represent small flow scales. The present experiments aim to isolate the effects of local buoyancy variations on turbulent jet mixing in flow regimes where the global flow scaling is momentum driven. Jet Reynolds numbers range up to 2500. Prior results from scalar field measurements indicate that the mixing is noticeably affected on the jet boundary relative to non-buoyant flows. Here, scalar and velocity field measurements allow us to investigate the mechanism by which these small-scale buoyancy fluctuations affect, for example, turbulent intensities in the scalar and velocity fields, or the relationship between turbulent velocity fluctuations and mean scalar field profiles. Also interesting is the effect of buoyancy on instability modes in the jet evolution. The measurements have sufficient spatial resolution and dynamic range to provide information on the manifestation of buoyancy effects at different flow scales, with direct implications for simulations of flows with buoyancy.

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