Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

Turbulence closures in variable density jet flow JOHN CHARONKO, KATHY PRESTRIDGE, Los Alamos National Laboratory — Variable density mixing plays a role in a variety of physical systems across many orders of length and time scales. Frequently, these effects take place in buoyant jets and plumes. While turbulence has been studied in these systems for many years, theory is less developed than for single-fluid jets and when modeling these systems using density-weighted (Favre) Reynolds-averaged equations it is not clear which closures developed for constant-density flows also apply to cases with large density ratios. Here we present an analysis of several turbulence closures compared to the exact forms of the correlations using a previously acquired dataset (Charonko and Prestridge 2017) from an open circuit wind tunnel featuring initial buoyant jet conditions of Re $\approx$ 19,000 and $\rho_{jet}/\rho_{\infty} = 1.2$ and 4.2, measured with simultaneous PIV and acetone PLIF. This allows computation of the correlated velocity and density terms in the turbulent kinetic energy and Reynolds stress budgets. In particular we will focus on the turbulent transport, including the velocity triple correlation and the pressure-velocity terms, and evaluate several proposed models by comparing the directly-calculated dissipation rate to the residual from the proposed models and the remaining budget terms.

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Date submitted: 31 Jul 2017 Electronic form version 1.4