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Effects of Mass and Volume Fraction Skewness in Variable Density Mixing Processes[1] ADAM J. WACHTOR, JOZSEF BAKOSI, RAYMOND RISTORCELLI, Los Alamos National Laboratory — Among the parameters characterizing mixing by variable density turbulence of fluids involving density variations of a factor of 5 to 10 are the Atwood, Froude, Schmidt, and Reynolds numbers. There is evidence that the amount of each fluid present when the two pure fluids mix, as described by the probability density function of the mass or molar (volume) fraction, also strongly affects the mixing process. To investigate this phenomena, implicit large-eddy simulations (ILES) are performed for binary fluid mixtures in statistically homogenous environments under constant acceleration. These coarse grained simulations are used as data for theory validation and mix model development. ILES has been demonstrated to accurately capture the mixing behavior of a passive scalar field through stirring and advection by a turbulent velocity field. The present work advances that research and studies the extent to which an underresolved active scalar drives the subsequent fluid motion and determines the nature of the mixing process. Effects of initial distributions of the mass and molar (volume) fraction probability density function on the resulting variable density turbulence and mixing are investigated and compared to direct numerical simulations from the Johns Hopkins Turbulence Database.

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