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Probability Density Function Analysis of Turbulent Condensation Using GPU Hardware RYAN KEEDY, Sandia National Laboratories, JAMES RILEY, ALBERTO ALISEDA, University of Washington — Growth of liquid droplets by condensation is an important phenomenon in many environmental and industrial applications. In a homogenous, supersaturated environment, condensation will tend to narrow the diameter distribution of a poly-disperse collection of droplets. However, free shear turbulence can broaden the diameter distribution due to intermittency in the mixing and by subjecting droplets to non-Gaussian supersaturation statistics. In order to understand the condensation behavior of water droplets in a turbulent flow, it is necessary to understand the dispersion of the droplets and transported scalars. We describe a hybrid approach for predicting droplet growth and dispersion in a turbulent mixing layer and compare our computational predictions to experimental data. The approach utilizes a finite-volume code to calculate the fluid velocity field and a particle-mesh Monte Carlo method to track the locations and thermodynamics of the large number of stochastic particles throughout the domain required to resolve the Probability Density Function of the water vapor and droplets. The particle tracking algorithm is designed to take advantage of the computational power of a large number of GPU cores, with significant speed-up when compared against a baseline CPU configuration.

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