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Comparison of Direct Numerical Simulation and Experimental Observation of Particle Clustering in Isotropic Turbulence JUAN SALAZAR, JEREMY DE JONG, LUJIE CAO, SCOTT WOODWARD, HUI MENG, LANCE COLLINS — Experimental observation of particle clustering in turbulent flow is often complicated by particles of non-uniform in size, and the accuracy of most diagnostic techniques is sensitive to the particle size. To make meaningful comparisons with experiments direct numerical simulations (DNS) must take into consideration the properties of the particles and model the limitations introduced by the diagnostics. We present a series of DNS of inertial particles in turbulence that were designed to match the measurements of Cao et al. In their experiments, the particle radial distribution function (RDF) was obtained from 3-D holographic images of particles in a turbulence box. DNS was done using the same particle size distribution as the particles in the experiments. The parameters of the flow (Re #) and the particles (St #) were matched. In the DNS, we eliminated particles below a specified size and recalculated the RDF to better match the experiments. Trends in the variation of the RDF with size cutoff were found to be non-intuitive, but can be explained based on an extension of the theory of Chun et al. (2005) to polydisperse particles. We optimized the cutoff size based on the comparison of the experimental and numerical RDF at one fan speed and applied the same cutoff to other fan speeds. The results showed good agreement. The comparison highlights the complexity of matching DNS and experimental observations.

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