Abstract Submitted
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Inertial particle velocity and distribution in vertical turbulent channel flow: a numerical and experimental comparison[1] DAVID RICHTER, GUIQUAN WANG, University of Notre Dame, KEE ONN FONG, FILIPPO COLETTI, University of Minnesota, JESSE CAPECELATRO, University of Michigan — This study is concerned with the statistics of vertical turbulent channel flow laden with inertial particles for two different volume concentrations ($\Phi_V = 3 \times 10^{-6}$ and $\Phi_V = 5 \times 10^{-5}$) at a Stokes number of $St^+ = 58.6$ based on viscous units. Two independent direct numerical simulation models utilizing the point-particle approach are compared to recent experimental measurements, where all relevant nondimensional parameters are directly matched. While both numerical models are built on the same general approach, details of the implementations are different. At low volume loading, both numerical models are in general agreement with the experimental measurements, with certain exceptions near the walls. At high loading, these discrepancies are increased, and it is found that particle clustering is overpredicted in the simulations as compared to the experimental observations. Potential reasons for the discrepancies are discussed. As this study is among the first to perform one-to-one comparisons of particle-laden flow statistics between numerical models and experiments, it suggests that continued efforts are required to reconcile differences between the observed behavior and numerical predictions.

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