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Turbulence Modulation and Particle Segregation in a Turbulent Channel Flow KEE ONN FONG, MOSTAFA TOLOUI, OMID AMILI, JIARONG HONG, FILIPPO COLETTI, Univ of Minnesota - Twin Cities — Particle-laden flows are ubiquitous in biological, environmental, and engineering flows, but our understanding of the mechanism by which particles modulate turbulence is incomplete. Simulations involve a wide range of scales, and shall be corroborated by measurements that reconstruct the motion of both the continuous and dispersed phases. We present experimental observations on the interaction between inertial particles and turbulent flow through a vertical channel in two-way coupled regime. The working fluid is air laden with size-selected glass particles, which we investigate by planar particle image velocimetry and digital inline holography. Unlike most previous experiments, we focus on a regime in which particle segregation and turbulence modulation are both strong. PIV shows that turbulence modulation is especially pronounced near the wall, where particles accumulate by turbophoresis. The segregation, however, is much weaker than what suggested by one-way coupled simulations. Results from digital holography confirm the trends in particle concentration and velocities, and additionally provide information on the three-dimensional clustering. The findings are compared to previous investigations and discussed in the context of modeling strategies.

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