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Turbulence modulation by inertial particles in Eulerian-Lagrangian simulations of a semi-dilute particle-laden channel flow. HIMANSHU DAVE, MOHAMED KASBAOUI, Arizona State University — We explore the flow modulation by $St^+ = 1$ inertial particles dispersed within a turbulent channel flow at the friction Reynolds number $Re_\tau = 180$ and mass loading $M = 0.2 - 0.6$ using Eulerian-Lagrangian simulations. The particles in this study have a diameter $d_p^+ = 0.2$ in wall units and, thus, fall in the point particle limit. Once a stationary state is achieved, we measure particle and fluid velocity statistics in wall-parallel planes. Due to their inertia, the particles tend to accumulate near the walls where they alter the flow structures by a two-way mechanism that depends on the mass loading. We find that fluid velocity fluctuations in streamwise direction increase with increasing mass loading M, whereas, fluctuations in the wall-normal and spanwise directions have a non-monotonic behavior with M. Despite increasing fluctuations in the carrier flow, the particle phase lags the fluid and displays significantly lower velocity fluctuations. This aspect is addressed by considering fluid velocity conditioned at the particle location and quadrant analysis of the particle distribution.

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