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Mechanisms governing the settling velocities of inertial particles in wall-bounded turbulence[1] DAVID RICHTER, University of Notre Dame, ANDREW BRAGG, Duke University, GUIQUAN WANG, University of Twente — In isotropic, homogeneous turbulence, it is well-recognized that inertial particles settle at a rate which can exceed their terminal velocity, due to the so-called preferential sweeping mechanism. At the same time, it is also known that inertialess particles subject to gravitational settling in the logarithmic layer near a wall distribute in such a way as to exhibit a power-law profile in mean concentration. In this study, direct numerical simulations with Lagrangian particle tracking are used to explore the effects of particle inertia on settling through wall-bounded turbulence. As in the case of isotropic turbulence, inertia leads to clustering and an enhanced settling rate as compared to the particle terminal velocity, but the inhomogeneous nature of wall turbulence gives rise to multiple underlying mechanisms and regimes of inertial effects. In this work, we explore these phenomena from a PDF-based description of the dispersed phase, discuss the prospects of applying perturbation theory to account for particle inertia, and explore the possibility of correcting simple theory in order to predict mean settling rates and connect vertical fluxes with average concentration profiles.

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