Abstract Submitted
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Sedimentation of finite-size particles in quiescent and turbulent environments[1] LUCA BRANDT, WALTER FORNARI, Linne FLOW Centre, KTH Mechanics, Stockholm, Sweden, FRANCESCO PICANO, Department of Industrial Engineering, University of Padova, 35131 Padua, Italy — Sedimentation of a dispersed solid phase is widely encountered in applications and environmental flows. We present Direct Numerical Simulations of sedimentation in quiescent and turbulent environments using an Immersed Boundary Method to study the behavior of finite-size particles in homogeneous isotropic turbulence. The particle radius is approximately 6 Komlogorov lengthscales, the volume fraction 0.5% and 1% and the density ratio 1.02. The results show that the mean settling velocity is lower in an already turbulent flow than in a quiescent fluid. The reduction with respect to a single particle in quiescent fluid is about 12% in dilute conditions. The probability density function of the particle velocity is almost Gaussian in a turbulent flow, whereas it displays large positive tails in quiescent fluid. These tails are associated to the intermittent fast sedimentation of particle pairs in drafting-kissing-tumbling motions. Using the concept of mean relative velocity we estimate the mean drag coefficient from empirical formulas and show that non stationary effects, related to vortex shedding, explain the increased reduction in mean settling velocity in a turbulent environment.

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