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Local analysis of the clustering, velocities and accelerations of particles settling in turbulence MOHAMMADREZA MOMENIFAR[1], ANDREW D. BRAGG[2], Duke University — We use Direct Numerical Simulations (DNS) and 3D Voronoï tessellation to analyze the local dynamics of small inertial particles in isotropic turbulence, considering the effect of Taylor Reynolds number (R_λ), Froude number (Fr), and Stokes number (St). In line with previous results using global measures of particle clustering, we find that for small Voronoï volumes, the behavior is strongly dependent upon St and Fr, but only weakly dependent upon R_λ, unless $St > 1$. However, larger Voronoï volumes (void regions) exhibit a much stronger dependence on R_λ, even when $St \leq 1$. This, rather than the behavior at small volumes, is the cause of the sensitivity of the standard deviation of Voronoï volumes to R_λ that has been previously reported. Particle acceleration results indicate a non-trivial effect of gravity, while results for the fluid acceleration at the particle position call into question the sweep-stick mechanism for clustering. Comparing the local dynamics of particles in clusters to all particles in the flow reveals that while their kinetic energies are nearly the same, the clustered particles settle much faster on average, and this difference grows significantly with increasing R_λ.

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