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Particle Plumes Falling Through Quiescent and Turbulent Environments[1] ALEC PETERSEN, LUCI BAKER, FILIPPO COLETTI, University of Minnesota — Heavy plumes form when dense particles are injected into an ambient fluid, and are found in countless engineering and natural processes. A predictive understanding of the settling, entrainment, and spreading processes is therefore critical when assessing the environmental impact of, for example, discharging industrial waste or dredging operations. Present models focus either on very dilute regimes (in which the particle backreaction on the fluid is small) or on highly concentrated ones (in which the discrete nature of the particles is immaterial). Additionally, most studies have focused on plumes in quiescent environments. In the present study, we investigate dense plumes falling in both quiescent and turbulent air. We drop size-selected microscopic particles into a jet-stirred chamber that generates a large region of homogeneous air turbulence. We measure the particle spatial distribution and velocity by means of time-resolved velocimetry and tracking techniques. This allows us to characterize the effect of ambient turbulence on the plume spread, concentration distribution, and fall speed.

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