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Experimental investigation of disks settling in homogeneous air turbulence AMY TINKLENBERG, MICHELE GUALA, University of Minnesota, FILIPPO COLETTI, ETH Zurich — The dynamics of non-spherical particles falling through turbulent air is directly relevant to atmospheric precipitation. The detailed interaction with the surrounding fluid has largely been studied in water due to reduced requirements in spatio-temporal resolution. This, however, limits the applicability of these results to systems with small particle-fluid density ratios. The aim of the present study is to realize, in a controlled laboratory environment, conditions comparable to those experienced by frozen hydrometeors falling in the atmospheric surface layer. Using a turbulence chamber forced by hundreds of individually actuated jets, we create a large region of homogeneous air turbulence with negligible mean flow. We consider 1 mm disks to approximate plate snow crystals, which we drop in the chamber through a 3-m chute. High-speed laser imaging is performed with two cameras to obtain time-resolved images with different window sizes and resolutions. This allows us to capture the carrier fluid flow from the integral scales down to the Kolmogorov scales using particle image velocimetry (PIV). Simultaneously, particle tracking velocimetry (PTV) is used to determine the instantaneous locations of the disks and their orientation. We investigate the turbulence effect on the velocity, acceleration, rotation rate, and fall pattern of the disks, as well as their backreaction on the flow.

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