Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

Snowflakes as inertial particles in turbulence FILIPPO COLETTI, ANDRAS NEMES, TEJA DASARI, JIARONG HONG, MICHELE GUALA, University of Minnesota — We report on the first direct measurements of trajectories and settling velocity of snow particles in the atmospheric surface layer. During a nocturnal snowfall we deploy an imaging system consisting of a searchlight and high speed cameras to illuminate and track thousands of snowflakes over a 7 m by 4 m vertical plane. We simultaneously characterize their shape and size using digital holography, while recording the air turbulence properties via sonic anemometry. We show that, in the meteorological conditions in object, the snowflake motion exhibits hallmark features identified by fundamental studies of particle-laden turbulence in both the Lagrangian and the Eulerian framework. The acceleration distribution displays stretched exponential tails, and by comparing with previous laboratory and computational studies we infer the Stokes number and aerodynamic response time of the snowflakes. The fall speed is found to be much greater than the expected value in still air, indicating that turbulence enhances settling according to the preferential sweeping mechanism. These observations demonstrate the major role of turbulence in determining the snow fall speed, and create the basis for leveraging results from particle-laden turbulence research towards improved snow precipitation models.

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Date submitted: 31 Jul 2016 Electronic form version 1.4