Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Fall velocities of Hydrometeors in Turbulent Flow[1] AHMAD TALAEI, TIM GARRETT, University of Utah — An understanding of the interactions of precipitating aerosols, droplets and ice crystals within an atmospheric turbulent flow is fundamental to predictions of atmospheric weather and climate. Here we examine the mean settling velocity of a hydrometeor falling into a random Gaussian turbulent flow using hydrometeor images and velocities captured by the Multi-Angle Snowflake Camera (MASC) at Oliktok Point, Alaska. Analyses reveal hydrometeor Reynolds numbers ranging from 1 to 1000, sharply peaked at 200. Due to mathematical difficulties, previous analytical solutions of the equation of motion of a falling sphere in a viscous liquid have been constrained to the slowly falling particles in the Stokes regime with Reynolds numbers less than unity. In this study, we introduce an analytical solution for higher Reynolds numbers and develop an equation of motion for studying the interaction of atmospheric turbulence and hydrometers. The results show settling velocity reduction in weak turbulence and enhancement in strong turbulence.

[1]The research is granted by Department of Energy Atmospheric System Research Award No. DE-SC001282

Ahmad Talaei
University of Utah

Date submitted: 29 Jul 2019 Electronic form version 1.4