# Small Scale Statistics of Turbulence and Inertial Particles in Clouds and in the laboratory

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We describe recent measurements of inertial particles and turbulence statistics in clouds and compare them with laboratory measurements. In the atmosphere a Phase-Doppler Interferometer and a Fast Forward Scattering Spectrometer Probe were used to measure particle velocity and diameter. In the laboratory water droplets in grid-generated, wind tunnel turbulence were tracked by means of a high-speed camera located on a sled moving at the same speed as the mean flow. In both the laboratory and in the clouds, the background turbulent flow was measured by means of hot wire probes. We show that the turbulence fine scale statistics in a stratocumulus cloud are similar to classical laboratory results, exhibiting anomalous scaling for the higher order structure functions and an intermittency factor of approximately 0.25[a]. Laboratory experiments show stretched exponential tails in the probability density functions (pdf's) of the inertial particle acceleration [b]. Because we have demonstrated that the turbulence characteristics in the clouds are similar to those in the laboratory, we scale the laboratory pdf's to reflect atmospheric conditions. We show that the extreme accelerations observed in clouds may compete with the gravitational acceleration. The implications of this for raindrop formation are discussed. Particular emphasis is placed on comparing parameter ranges (Stokes and Froude numbers) in the cloud and in the laboratory.

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[b] S. Gerashchenko, N. Sharp, S. Neuscamman and Z. Warhaft. 2008. Lagrangian measurements of inertial particle accelerations in a turbulent shear flow. Journal of Fluid Mechanics. **617**, 255-281