Abstract Submitted
for the DFD10 Meeting of
The American Physical Society

A study of the interactions between turbulence and small inertial droplets[1] COLIN BATESON, ALBERTO MOLINA, University of Washington, BOGDAN ROSA, LIAN-PING WANG, University of Delaware, ALBERTO ALISEDA, University of Washington — Understanding the dynamics of particles in turbulent flows is important to many engineering and environmental problems including spray atomization and cloud droplet growth and precipitation. Specifically, we have studied the effect of turbulence on droplet collision-coalescence in an effort to clarify its role in the process of warm rain formation. The hypothesis that turbulence-induced-collisions can explain the size gap between the limit of condensational growth and the onset of gravitational collisions and sedimentation is supported by our measurements and analysis. Wind tunnel experiments were used to study the evolution of water droplets in homogeneous, isotropic, slowly decaying grid turbulence. Droplets between 1 and 120 μm were injected into the wind tunnel and their diameter, position and velocity were measured at different distances downstream by Phase Doppler Particle Analysis (PDPA). Statistics of the radial distribution function (RDF), relative velocity distribution and settling velocity have been produced and analyzed. They will be compared to the same statistics computed from 3D hybrid direct numerical simulations (DNS) at similar Re. High-speed visualizations of the droplet dynamics will be explored in an effort to understand and quantify coalescence efficiency.

[1]Supported by NSF grant ATM-0731248

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Date submitted: 06 Aug 2010 Electronic form version 1.4