Abstract Submitted
for the DFD08 Meeting of
The American Physical Society

Mixing in turbulent clouds[1] R.A. SHAW, Dept. of Physics, Michigan Technological University, K. LEHMANN, U C San Diego, H. SIEBERT, Leibniz Inst. for Tropospheric Research — Turbulent clouds in the earth's atmosphere constantly entrain dry air from the surrounding environment, and this entrainment process influences the cloud microphysical properties, and therefore cloud optical properties relevant to climate. How cloud droplet size distributions respond to turbulent mixing is analogous to the problem of turbulent reactive flows, and therefore depends on relative time scales for mixing and for water phase changes (Damkoehler number). We have studied turbulent mixing in small cumulus clouds using a helicopter-borne instrument payload with high resolution measurements of the three-dimensional wind, temperature and humidity fields, and the droplet size distribution. Small Damkoehler numbers correlate uniform evaporation of droplets, while large Damkoehler numbers correlate with constant mean droplet size and a reduction in droplet number density due to complete evaporation of a subset of droplets. In some cases the latter, inhomogeneous mixing led to the formation of drops that are larger than in the unmixed adiabatic cloud core, which is of potential importance for precipitation formation in warm cumulus clouds.

[1]We acknowledge support from the German and U.S. Science Foundations, and from the Alexander von Humboldt Society.

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Date submitted: 12 Aug 2008 Electronic form version 1.4