Abstract Submitted
for the DFD09 Meeting of
The American Physical Society

Statistics of Small-Scale Velocity Fluctuations and Internal Intermittency in Stratocumulus Clouds RAYMOND SHAW, Department of Physics, Michigan Technological University, HOLGER SIEBERT, Leibniz Institute for Tropospheric Research, ZELLMAN WARHAFT, Mechanical and Aerospace Engineering, Cornell University — Clouds are known to be turbulent but the details of their internal turbulent structure have been largely unexplored. Measurements of turbulent velocities in stratocumulus clouds reveal an intermittent structure consistent with that observed in classic homogeneous isotropic turbulence. The measurements were taken using a hotwire anemometer on the helicopter-borne ACTOS measurement system. Hotwire signal artifacts resulting from droplet impacts are removed without significantly degrading the signal, such that high-order velocity structure functions can be evaluated. The structure function analysis for orders 2 through 8 show statistically significant departures from the Kolmogorov 1941 scaling, yielding scaling exponents consistent with the Kolmogorov-Obukhov refined similarity hypothesis with an intermittency exponent of 0.25. We find no evidence of any departure from the large body of knowledge obtained from the laboratory on the fine scale turbulence structure. This suggests that processes depending on the fine-scale structure of turbulence that cannot presently be measured in clouds can be explored in the laboratory setting.

Raymond Shaw
Department of Physics, Michigan Technological University

Date submitted: 06 Aug 2009 Electronic form version 1.4