Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

Enhancement of coalescence in turbulent clouds ALAN KERSTEIN, Consultant, STEVEN KRUEGER, University of Utah — An economical numerical model, called ClusColl, for droplet motions and collisions in turbulent flows has been developed, tested, and applied. In the linear eddy model, 1D turbulent advection of fluid is implemented by rearranging the fluid cells. Each permutation represents an individual turbulent eddy, and is called a "triplet map." The triplet map captures flow processes as small as the smallest turbulent eddy, but the response of cloud droplets to turbulence has important features at scales as small as the droplet radius. ClusColl includes a 3D triplet map for droplets that captures these additional effects. We have also implemented a collision detection algorithm so that ClusColl can simulate collisions and coalescence between finite-inertia particles. For sedimenting droplets with St < 1, there is fairly good agreement between collision kernels obtained from ClusColl and from direct numerical simulation. Collision and coalescence calculations made using ClusColl suggest that turbulence can significantly accelerate rain formation by droplet clustering and/or by spectral broadening due to entrainment and mixing. We are using ClusColl to investigate the relative roles that entrainment and mixing, droplet inertial effects, and ultragiant nuclei play in warm rain initiation.

Alan Kerstein
Consultant

Date submitted: 01 Aug 2017 Electronic form version 1.4