Abstract Submitted
for the DFD13 Meeting of
The American Physical Society

Numerical Investigation of Cloud Droplet Growth via Collision Coalescence: One Step Approach[1] HOSSEIN PARISHANI, University of Delaware, ORLANDO AYALA, Old Dominion University, BOGDAN ROSA, Institute of Meteorology and Water Management, Poland, LIAN-PING WANG, University of Delaware — Growth of inertial particles and droplets in a turbulent flow is a critical step in a wide range of applications. It is known that cloud turbulence could make a substantial impact on the growth of cloud droplets by collision and coalescence. Reade and Collins (2000) performed a DNS study of one step growth of coagulating particles in turbulence. They found that the limiting solutions of zero or infinite St numbers are not capable of describing the dynamics of finite-inertia particles. In this talk we extend their work to include the effects of gravity and flow Reynolds number on growth of droplets in turbulence. Starting from an initially monodisperse distribution of particles, we study how turbulent collision coalescence affects the particle size distribution. The simulations are performed with a 256^3 grid resolution and $O(10^6)$ droplets of radii ranging from 10 to 60 microns. We obtain particle size distributions for a range of flow Reynolds numbers to study the effect of flow Reynolds number on the size distribution of inertial particles. The one-step results are compared to those from the kinetic collection equations using gravitational and turbulent collision kernels.

[1]This work is partially supported by NSF.

Lian-Ping Wang
University of Delaware

Date submitted: 31 Jul 2013 Electronic form version 1.4