

ATS/CIRA Colloquium

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**Some problems at the foundation
of aerosol-cloud interaction in climate models**

or

**Why the IPCC may have got it wrong because of what we
do to data, physics and numerics in
bin-microphysics LES models**

Hosted by David Randall

Friday, September 9, 2016

ATS room 101; Discussion will begin at 11:15am

Refreshments will be served at 10:45am in the weather lab

Autoconversion, that is the initial formation of drizzle drops from smaller cloud droplets through coalescence, is a critically important process to get right in climate models.

Usually autoconversion is calculated through dependence on cloud droplet concentration and cloud liquid water mixing ratio. The more and the larger the cloud droplets are, the faster the autoconversion rate is assumed to be. Some expressions are relatively simple (e.g. Manton and Cotton, 1977), others are based on results of complex bin-microphysics LES models (e.g. Khairoutdinov and Kogan, 2000). Both of these are implemented in state-of-the-art climate models as submitted to the latest IPCC reports.

In either case, the droplet size dependence is dominated by the droplets formed on the numerous smaller aerosol particles, with very little dependence on the few giant aerosol particles. Yet many studies, that have used simple parcel model calculations, point to drizzle drops almost exclusively being formed on giant sea-salt aerosol particles (GCCN) in the climatically important marine stratocumulus (e.g. Jensen and Lee, 2008; Jensen and Nugent, 2016 submitted).

Thus there seems to be a discrepancy between the predictions of parcel models and the bin-microphysics LES models regarding the importance of GCCN. Rather than applying increasingly massive computers to solve the problem, this talk will in essence de-construct bin-microphysics LES models, by examining the set of equations under simplified conditions, in order to understand some of the reasons for the discrepancies.

Thus the talk will include observations of aerosols, cloud and precipitation drops using in-situ aircraft instrumentation, as well as process models. Although the emphasis is two-fold: (i) to understand what to include in the calculation of autoconversion, and (ii) to examine the discrepancy between parcel and bin-microphysics models, the speaker emphasizes that he does not have access to any actual bin-microphysics LES model code.

Link to colloquium videos and announcement page: <http://www.atmos.colostate.edu/dept/colloquia.php>