**ATS/CIRA Colloquium**

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# A study of aerosol impacts on clouds and precipitation development in a large winter cyclone

**Friday, February 28, 2014**

**ATS room 101; Discussion will begin at 11:15am**
**Refreshments will be served at 10:45am in Weather Lab**

Aerosols influence cloud and precipitation development in complex ways due to myriad feedbacks at a variety of scales from individual clouds through entire storm systems. This paper describes the implementation, testing, and results of a newly-modified bulk microphysical parameterization with explicit cloud droplet nucleation and ice activation by aerosols. Idealized tests and a high-resolution, convection-permitting, continental- scale seventy-two hour simulation with five sensitivity experiments showed that increased aerosol number concentration results in more numerous cloud droplets of overall smaller size and delays precipitation development. Furthermore, the smaller droplet sizes cause the expected increased cloud albedo effect and more subtle longwave radiation effects. Although increased aerosols generally hindered the warm- rain processes, regions of mixed-phase clouds were impacted in slightly unexpected ways with more precipitation falling north of a synoptic-scale warm front. Aerosol impacts to regions of light precipitation, less than approximately 2.5 mm per hour, were far greater than impacts to regions with higher precipitation rates. Comparisons of model forecasts with five different aerosol states versus surface precipitation measurements revealed that even a large scale storm system with nearly a thousand observing locations did not indicate which experiment produced a more correct final forecast indicating a need for far longer duration simulations due to magnitude of both model forecast error and observational uncertainty. Lastly, since aerosols affect cloud and precipitation phase and amount, there are resulting implications to a variety of end-user applications such as surface sensible weather and aircraft icing.

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