Analysis of the aerosol-cloud interactions from aircraft, surface measurements, and cloud parcel model during the March 2000 IOP at the ARM SGP site

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Objective
To compare cloud droplet number concentration values obtained from aircraft measurements, surface based cloud retrievals, and cloud parcel model results during the March 2000 IOP at the Atmospheric Radiation Measurement (ARM) Southern Great Plains (SGP) site.

Data

Aerosol Measurements: Surface measurements from a condensation nucleus counter and an optical particle counter (Sheridan et al., 2001) are used to estimate cloud base aerosol concentration under conditions of a well-mixed atmosphere.

Updraft Velocity: The maximum doppler velocity near cloud base from the Millimeter Radar is used to estimate updraft velocity.

Aircraft Measurements: The Forward Scattering Spectrometer Probe on the University of North Dakota Citation II research aircraft is used to measure cloud droplet number concentration.

Cloud Parcel Model: Aerosol properties and updraft velocity are used in a cloud parcel model to determine the cloud droplet number concentration.

Cloud Retrieval: The cloud droplet number concentration is retrieved from a 32-stream radiative transfer model with the input of ground-based measurements (Dong et al., 1998).

References

Conclusions
The March 2003 comparison of aircraft measurement, cloud retrieval, and the cloud parcel model show similar relative changes in cloud droplet concentration but different magnitudes. The changes in cloud droplet concentration correspond to changes in the updraft velocity.

The cloud parcel model and cloud retrievals show similar relative changes in cloud droplet number concentration for the three cases analyzed. Agreement between the surface retrieval and cloud parcel model was better for day time, over cast stratus clouds (March 17 & 19) than for night time, broken clouds (March 7).

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