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MICROPHYSICAL RELATIONSHIPS OF CLOUDS OBSERVED DURING MARCH 2000 CLOUD IOP AT SGP SITE AND IMPORTANT IMPLICATIONS

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ABSTRACT

Cloud droplet size distributions ---- hence the key microphysical quantities of climate importance (e.g., the total droplet concentration, liquid water content, relative dispersion, mean-volume radius, radar reflectivity, and effective radius) are determined by different physical mechanisms such as pre-cloud aerosols, cloud updraft and turbulent entrainment-mixing processes. Therefore, the relationships among these microphysical properties are expected to behave differently in response to aerosols, cloud updrafts and turbulent entrainment-mixing processes. Identifying and quantifying the influences on these microphysical relationships of the various mechanisms is critical for accurately representing cloud microphysics in climate models and for reducing the uncertainty in estimates of aerosol indirect effects.

This study first examines the characteristics of the relationships between relative dispersion, droplet concentration, liquid water content, mean-volume radius, effective radius and radar reflectivity calculated from in-situ measurements of cloud droplet size distributions collected during the March 2000 Cloud IOP at the SGP site. The relationships are further analyzed to dissect the effects from different mechanisms/factors (aerosols, updraft, and different turbulent entrainment-mixing processes). Potential applications to improve radar retrievals of cloud properties will be explored as well.