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CONNECTION BETWEEN ENTRAINMENT-MIXING AND MICROPHYSICAL RELATIONSHIPS IN DRIZZLING AND NON-DRIZZLING CLOUDS

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ABSTRACT

Various entrainment-mixing processes have been proposed to explain cloud droplet size distributions and rain formulation; however, the connection between entrainment-mixing mechanisms and the relationships between key microphysical variables (e.g., liquid water content, droplet concentration and dispersion) remains elusive. This study seeks to examine this connection in drizzling and non-drizzling stratus observed during the March 2000 cloud Intensive Observation Period (IOP) at the Southern Great Plains (SGP) site, USA. Three drizzling and two non-drizzling cases are explored. The results show that the inhomogeneous entrainment-mixing process can be found both near the cloud top and in the middle of a cloud, and both in the drizzling and non-drizzling clouds, and occurs more frequently than the homogeneous entrainment-mixing process. Furthermore, most horizontal legs with inhomogeneous entrainment-mixing signatures are close to the extreme whereby both volume-mean radius and standard deviation do not vary much. We further examine the relationships of droplet concentration vs. standard deviation and droplet concentration vs. the autoconversion threshold to seek the influence of collision-coalescence process in drizzle formation. It is shown that droplet concentration is negatively correlated to both the standard deviation and the autoconversion threshold, and the slope of the concentration-standard deviation relationship increases with increasing threshold, suggesting that stronger collection processes are associated with more droplet spectral broadening.