BNL-75614-2006-AB

CONTINENTAL LIQUID-PHASE STRATUS CLOUDS AT SGP: METEOROLOGICAL INFLUENCES AND RELATIONSHIP TO ADIABACITY

Kim, B.-G.
Kangnung National University

Schwartz, S. E. and Miller, M.
Brookhaven National Laboratory

Min, Q.
State University of New York at Albany

For Presentation at the
ARM Science Team Meeting,
Albuquerque, NM
March 27-31, 2006

February 2006

Environmental Sciences Department/Atmospheric Sciences Division
Brookhaven National Laboratory
P.O. Box, Upton, NY
www.bnl.gov

ABSTRACT

The microphysical properties of continental stratus clouds observed over SGP appear to be substantially influenced by micrometeorological conditions, such as static stability and updraft velocity. These influences may contribute to the observed weak correlation of aerosol light scattering coefficient with cloud-drop effective radius [Kim et al., JGR, 2003], although aerosol light scattering coefficient is not necessarily the most suitable surrogate aerosol property for number concentration of cloud condensation nuclei. The previous studies had indicated that most continental boundary layer stratus clouds are subadiabatic, as for the most part they are influenced by frequently occurring drizzle beneath cloud base and by evaporation of cloud droplets associated with entrainment processes around cloud top. These processes would be expected to decrease the amount of column liquid water and accordingly modify cloud properties, such as optical depth and liquid water path (LWP). This study examines meteorological influences, specifically static stability and updraft velocity, on cloud optical and microphysical properties. Smaller droplets are weakly correlated with greater static stability, but no correlations are indicated between microphysical properties and updraft velocity. We have previously demonstrated the strong covariance of cloud optical depth with liquid water path, obtained from narrowband radiometry and microwave radiometry, respectively. The present study shows that the correlation of cloud optical depth with LWP increases slightly with adiabacity, defined here as the ratio of observed to adiabatic LWP. The adiabatic LWP is proportional to the square of cloud thickness and the adiabatic rate of increase of liquid water content with height, which is determined from the vertical profiles of water vapor mixing ratio and temperature. Cloud optical properties are likely to be influenced by adiabacity, mostly associated with drizzle and entrainment processes.