Geophysical Research Abstracts, Vol. 8, 02161, 2006
SRef-ID: 1607-7962/gra/EGU06-A-02161

Observations and modeling of drizzling marine stratocumulus

P. Rasinski (1), H. Pawlowska (1), W. Grabowski (2)

(1) Institute of Geophysics, Warsaw University, Warsaw, Poland, (2) NCAR, Boulder, Colorado, USA

This paper describes a study of microphysical processes in drizzling marine stratocumulus using aircraft observations and a simple numerical model. The overall goal is to further the understanding of precipitation formation processes that influence the indirect effects of atmospheric aerosols on weather and climate. Data discussed in this paper are in-situ airborne measurements from the Second Aerosol Characterization Experiment (ACE2) and the Dynamics and Chemistry of Marine Stratocumulus Experiment (DYCOMS-II). The observed cloud droplet number concentrations (CDNCs) during ACE2 and DYCOMS-II were between 55 and 250 cm-3. In DYCOMS-II, the stratocumulus was thicker (up to 500m) and more homogeneous. Maximum drizzle concentration of these two experiments was 1.35 cm-3. As anticipated, the observed amount of drizzle was positively correlated with the stratocumulus depth and negatively correlated with CDNC. To investigate the non-linearity of drizzle formation and to separate the impact of the CDNC from the cloud depth effect, a simple two-dimensional numerical model with a prescribed flow pattern and detailed microphysics (including droplet nucleation and growth by condensation and by collision/coalescence) was developed and it was applied in a large series of model simulations. In these simulations, the characteristics of cloud condensation nuclei, the cloud depth and the vertical velocity pattern and magnitude were systematically varied. Model results compared favorably with the observed cases and suggest scaling relationships that can be used in parameterizations of indirect aerosol effects in stratocumulus clouds for large-scale models of weather and climate.