Geophysical Research Abstracts, Vol. 8, 02348, 2006
SRef-ID: 1607-7962/gra/EGU06-A-02348

The Aerosol-Cloud Interaction in Deep Convection Simulated by a GCM Parametrisation with Double-Moment Bulk Microphysics and Multiple Aerosol Species

V. T. J. Phillips (1), L. J. Donner (2), Y. Ming (2) and V. Ramaswamy (2)

(1) AOS Program, Department of Geosciences, Princeton University, Princeton, New Jersey, USA; (2) Geophysical Fluid Dynamics Laboratory (GFDL), NOAA, Princeton, New Jersey, USA

A barrier to representation of the nucleation of cloud particles in in general circulation models (GCMs) has been that the supersaturation must be predicted inside clouds, which necessitates information about the vertical velocity. Most conventional parametrisations in the past have not represented the vertical velocity. Now, the Donner scheme for deep convection allows a way out of this dilemma because it represents the family of plumes in a grid-box with a spectrum of entrainment coefficients. Each plume then has a vertical velocity profile.

The Donner scheme has been modified to include double-moment bulk microphysics, with an explicit prediction of the supersaturation profile in each plume. Number of cloud-droplets and crystals are predicted in addition to their mass in each plume. Nucleation processes include droplet nucleation in-cloud and at cloud-base, and heterogeneous and homogeneous processes of ice nucleation. The masses of 5 species of aerosol predicted by the GFDL GCM are utilised to predict the number of particles nucleated. The cloud dynamics interact with the plume microphysics and with the atmospheric radiation.

The inclusion of the double-moment is shown to produce a large impact on the cloud dynamics. The relative roles of heterogeneous and homogeneous nucleation is shown to depend on vertical velocity, with faster updrafts favouring homogeneous nucleation.