Geophysical Research Abstracts, Vol. 8, 04903, 2006
SRef-ID: 1607-7962/gra/EGU06-A-04903


# Indirect impact of atmospheric aerosols in idealized simulations of convective-radiative quasi-equilibrium

W. W. Grabowski

National Center for Atmospheric Research, Boulder, Colorado, USA (grabow@ucar.edu / Phone: 303-497-8974)

This paper will discuss a cloud-resolving modeling study concerning the impact of warm rain microphysics on convective-radiative quasi-equilibrium with fixed surface characteristics and prescribed solar input, both mimicking the mean conditions on Earth. Two limits of the concentration of cloud droplets, either 100 cm**(-3), referred to as PRISTINE, or 1000 cm**(-3), referred to as POLLUTED, are considered. In addition, three formulations of the effective radius of water droplets in diluted cloudy volumes are used, corresponding to the homogeneous, intermediate, and extremely inhomogeneous mixing scenarios. The convective-radiative quasi-equilibrium mimics the estimates of globally- and annually-averaged water and energy fluxes across the Earth's atmosphere to within less than 10 W m**(-2). As on Earth, the model cloudiness is dominated by shallow convection. It is found that the impact of warm microphysics is dominated by the first (Twomey) indirect effect, whereas the second indirect effect has a smaller impact. The assumed droplet concentration and mixing scenario impact the mean "planetary" albedo and thus the amount of solar energy reaching the surface, with all other components of atmospheric energy and water budgets virtually the same in all simulations. The formulation of the effective radius in the diluted cloudy volumes turns out to be of critical importance, with the amount of solar energy reaching the surface being the same in the PRISTINE case assuming the homogeneous mixing scenario and in the POLLUTED case with the extremely inhomogeneous mixing. This result emphasizes the essential role of poorly understood microphysical transformations within diluted convective clouds, which strongly impact the magnitude of the first indirect effect. Implications for current estimates of the indirect aerosol effect using contemporary climate models will be discussed.