Geophysical Research Abstracts, Vol. 7, 02254, 2005
SRef-ID: 1607-7962/gra/EGU05-A-02254

Model simulations of the impact of aerosol characteristics on drizzle formation in warm cumulus cloud

G.J. Roelofs (1), S. Jongen (1,2)

(1) IMAU, Utrecht University, Princetonplein 5, 3488CC Utrecht, The Netherlands, phone: +31(0)302532821, fax: +31(0)302543163, e-mail: roelofs@phys.uu.nl.

(2) *Now at: ARPA Emilia Romagna, Bologna, Italy

With a detailed microphysical cloud parcel model we investigated the response of the efficiency of precipitation formation in warm clouds to variations in the aerosol number concentration, solubility, organic content, and updraft velocity at the cloud base. The efficiency is evaluated in terms of the growth rate of precipitation droplets and the amount of precipitation water. It was found that the effect of increasing aerosol on these two precipitation formation parameters and the dependence on updraft velocity is highly non-linear. In relatively clean clouds (with a cloud drop number concentration below $\sim$200 cm^{-3}) both the size and the total water content of the precipitation drops decrease with increasing aerosol abundance. In more polluted clouds ($\sim$400 cm^{-3} and more) the precipitation drops also grow slower when the aerosol abundance is larger, but now the amount of precipitation increases. This suggests that the pollution level co-determines whether both responses augment or counteract their effect on the cloud lifetime. Additionally, precipitation formation is found to depend in a complex way on the updraft speed, especially in polluted clouds that are characterized by a relatively dispersed drop size distribution. The dispersion of the cloud drop size distribution, co-controlled by competition for condensable water between activating accumulation and coarse mode particles, plays an important role in this. We will discuss the implications of this study for estimates of the aerosol second indirect effect in global models.