Aerosol effect on warm clouds within the limits of the thermodynamic conditions

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Cloud and rain formation depend on the enviromental thermodynamic conditions. On the other hand the aerosol properties determine how efficient the cloud will be in using this thermodynamic potential. In a very clean environment the clouds are aerosol-limited, meaning there is a missing surface area for efficient condensation while the individual droplets are sparse and large and hence removed fast from the cloud by rain. On the other hand higher aerosol concentration may enhance suppressing processes like efficient entrainment and accumulated drag forces that can inhibit the cloud development. These opposing trends suggest there is an optimal aerosol concentration [1]. The optimal value is a function of the thermodynamic conditions and cloud size. Examination of the conditions that support a maximal rain production, leads to an aerosol loading that drives similar times to maximal cloud development and to maximal collection in the cloud. In this talk numerical simulations of warm clouds will be presented. The trend in clouds and rain properties as a function of aerosol loading will be discussed in light of the thermodynamic conditions.

[1] Dagan, G., I. Koren, and O. Altaratz (2015), Competition between core and periphery-based 381 processes in warm convective clouds – from invigoration to suppression, *Atmos. Chem. Phys.*, **15**, 2749-2760, doi:10.5194/acp-15-2749-2015.