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Cloud processing, cloud evaporation and Angström exponent

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Abstract. With a cloud parcel model we investigate how cloud processing and cloud evaporation modify the size distribution and the Angström exponent of an aerosol population. Our study provides a new explanation for the observed variability of the aerosol optical thickness and Angström exponent in the vicinity of clouds. Cloud processing causes a decrease of aerosol particle concentrations, relatively most efficiently in the coarse mode, and reduces the relative dispersion of the aerosol distribution. As a result the Angström exponent of the aerosol increases. The Angström exponent is very sensitive for changes in relative humidity during cloud evaporation, especially between 90% and 100%. In addition, kinetic limitations delay evaporation of relatively large cloud drops, especially in clean and mildly polluted environments where the coarse mode fraction is relatively large. This hampers a direct relation between the aerosol optical thickness, the Angström exponent and the ambient relative humidity, which may severely complicate interpretation of these parameters in terms of aerosol properties, such as the fine mode fraction.

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