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Comparative study of cloud droplet number concentration parameterizations for use in regional climate models

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A reliable assessment of the amount of cloud droplet number concentration (CDNC) that form starting from a given concentration of aerosol is valuable information for the computation of radiative atmospheric forcing. In order to improve the radiation performance of the KNMI RACMO regional climate model, a more realistic parameterization for the CDNC will be shortly introduced. As starting work, a number of existing parameterizations has been analyzed to test the actual applicability into a RCM.

The present study shows the comparison among 4 different parameterizations, chosen from the available literature for their characteristics of making distinctions between sea and land locations, and among different aerosol species. All the parameterizations taken into consideration are based on fitting procedures of experimental data collected in different locations, with diverse ambient and climate conditions. Aerosol concentration fields from the 3-D chemistry-transport regional model LOTOS have been used as input in the parameterization formulas, and CDNC has been computed over Europe. From the CDNC amounts, a simple algorithm has been used to derive the maximum albedo differences between pairs of parameterizations. Results look promising and inside reasonable ranges for Europe, but there are substantial differences in albedo's derived from the different parameterizations. These differences reflex the uncertainty in albedo computation on which typical estimates of the aerosol indirect effect are made.