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Further development and initial evaluations of the aerosol dependence modeled by the Grell and Freitas convective parameterization

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A convective parameterization is described and evaluated that may be used in high resolution non-hydrostatic mesoscale models as well as in modeling system with unstructured varying grid resolutions and for convection aware simulations. This scheme is based on a stochastic approach originally implemented by Grell and Devenyi (2002) and described in more detail in Grell and Freitas (2014). Interactions with aerosols have been implemented through a CCN dependent autoconversion of cloud water to rain as well as an aerosol dependent evaporation of cloud drops. Initial tests with this newly implemented aerosol approach showed plausible results with a decrease in predicted precipitation in some areas, caused by the changed autoconversion mechanism. This change also caused a significant increase of detrainment of cloud water and ice near the cloud tops. Some areas also experience an increase of precipitation, most likely caused by strengthened downdrafts. Here we test the dependence of the results on various tuning parameters. The parameterization is further generalized to be able to handle CCN distributions provided by WRF-Chem forecasts as well as CCN distributions provided from AOD initial fields.