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Modification of postfrontal convective clouds and precipitation by natural and anthropogenic aerosols

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Shallow postfrontal convective clouds are thought to be sensitive to the aerosol burden. In our case study we present results of model runs, simulating April 25, 2008. On this day a cold front passes Germany from north to south. During this situation the sea salt aerosol transported by the northerly flow into the model domain replaces the preexisting anthropogenic aerosol. We quantify the effect of the aerosol on the microphysical properties of the convective clouds that develop after the passage of the cold front.

The model system COSMO-ART (Vogel et al., 2009, Bangert et al., 2010) is a comprehensive online coupled model system to simulate the spatial and temporal distribution of reactive gaseous and particulate matter. It is used to quantify the feedback processes between aerosols and the. state of the atmosphere on the continental to the regional scale with two-way interactions between different atmospheric processes. The model system enables further investigations of the aerosol-cloud-interactions and associated feedback processes. The model framework contains a two-moment cloud microphysics scheme (Seifert and Beheng, 2006) in combination with sophisticated activation parameterizations (Bangert et al., 2012).

We carried out sensitivity runs. One applies a bulk microphysics scheme as used in the operational forecasts of the German weather service. In two of them the aerosol was. prescribed (continental, maritime) and kept constant in space and time. In the fourth one we used the full capabilities of COSMO-ART to simulate the dynamic behavior of aerosol and its feedback with radiation and cloud microphysics. We compare our model results with radar data, satellite IR images, and rain gauges.