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The impact of aerosols on clouds in the pristine environment of East Antarctica

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Clouds are an important regulator of the Antarctic climate. They transport moisture and precipitation towards the Antarctic Ice Sheet (AIS), contributing positively to the surface mass balance. Additionally, clouds have a profound impact on the surface energy balance of the AIS by reflecting incoming shortwave radiation and increasing the amount of longwave radiation that is returned towards the Earth's surface. Cloud active aerosols, i.e. cloud condensation nuclei (CCN) and ice nuclei (IN) determine to a large extent the microphysical and macrophysical properties of clouds. Variability in the concentration and composition of CCN and IN impacts the amount of condensation in the cloud, its albedo, lifetime and has a profound impact on resulting precipitation numbers.

The Antarctic region is considered a pristine region, with little or no anthropogenic sources of aerosols. In this study we set up the regional climate model COSMO-CLM^2 at high resolution (0.025°x0.025°) over Dronning Maud Land, East Antarctica. This model has been adapted to represent the Antarctic climate and surface mass balance and is now expanded with a two-moment microphysical scheme and an aerosol module (Possner et al., 2017). Based on a range of aerosol observations at the Belgian Princess Elisabeth station in Dronning Maud Land, a set of simulations with varying aerosol content are executed. The effect on the cloud structure, its phase and the cloud radiative effect are considered. Furthermore, the impact on the total snowfall amount over the region will be investigated.