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Simulating the effects of Ice-nucleating particles in Antarctica in COSMO-CLM²

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The remoteness of the Antarctic continent has important implications for the microphysical properties of clouds: In particular, the rare abundance of ice-nucleating particles (INP) limits the primary nucleation of ice crystals. Yet, persistent mixed-phase clouds with ice crystal number concentrations of 0.1-1l^{-1} are still observed in the Arctic and Antarctic. However, the ability of regional climate models to reproduce these mixed-phase clouds remains limited, much like the knowledge about their climatological effects. Thus, we added a module to the regional climate model COSMO-CLM² aimed at improving the parametrisation of the aerosol-cycle, which allows us to prescribe different concentrations of INPs. We examined the model response to different concentrations by running it in an area around the Belgian Princess Elisabeth Station in Dronning Maud Land for one month and with four different concentration settings: The first, corresponding to the low end of INP concentrations we observed at the station, the second, corresponding to the high end of INP concentrations we observed at the station, and the third and fourth, to the low and high end of continental observations. The performance was evaluated by comparing the simulation results with radar and ceilometer observations taken at the station. Finally, we analysed the differences between the four simulations to determine the overall sensitivity of the model to variability in INP concentrations, which allows us to draw conclusions about the importance of accurately simulating processes related to ice nucleation, and about the climatological implications that a change in aerosol concentrations would have.