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Large-Eddy-Simulations with the ICON-LEM around supersites - bridging the gap between GCMs and point measurements

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To develop cloud parameterizations for global climate models (GCM) and better understand the involved processes and how they interact, it is important to investigate the variability and evolution of humidity on small scales. One way to gain insight into those small-scale features are simulations with high-resolution models, which has been done extensively for specific and idealized situations such as the tradewind shallow cumulus testcases. However, as the formation and organization of clouds depend strongly on synoptic and regional situations, it is essential to cover a broad range of synoptic and topographic situations to overcome the limitations of idealized Large-Eddy-Simulations (LES). The new ICON-LEM model offers the possibility to include topography and open boundaries within high-resolution simulations, allowing studies of more specific regions and synoptic situations. In this study, we will present a setup which is large enough to be representative for a typical grid-size of a GCM (20-100 km), but also small and flexible enough to perform sensitivity studies in varying situations. We explore the potential of these simulations by focusing on two observational supersites – Jülich in Germany and Ny-Ålesund on Svalbard. A first basic comparison with the observations taken at the supersites is done in order to evaluate the representation of the mean thermodynamical structure and clouds by the model. This evaluation is essential to show that the setup can be used as a virtual lab for the development of parameterizations and to provide insight into the question how to compare model simulations to point measurements. Additionally it is important to investigate how the variability of humidity depends on the domain size, the forcing, and the resolution. Furthermore, physical questions such as the orographic influence on convective initiation and organization could be explored. In the future, the gained understanding and the created testbed-simulations will be used to evaluate and improve parameterizations.