Project: 1086
Project title: High-resolution modelling around supersites for cloud and precipitation observations
Principal investigator: Vera Schemann
Report period: 2022-05-01 to 2023-04-30

The transition to the new computing system (Levante) as well as some issues with a new ICON release, caused several delays in our simulation plans. Nevertheless, we managed to make progress and perform interesting simulations on several topics.

Sensitivity simulations for Arctic research

We performed several simulations for the Ny-Ålesund, Svalbard, region to analyse the effect of better resolved processes on cloud formation and to provide higher-frequency output for the evaluation of microphysical processes (testing of a new postprocessing framework). While we could show in our analysis (accepted at JAMES), that the overall thermodynamic and dynamic atmospheric structure at Ny-Ålesund is captured well, we are now focusing on the microphyiscal processes and their influence on the phase partitioning. The separation into ice, mixed-phase and liquid clouds was less well represented in the model and needs further evaluation and improvement.

Another research topic is the spatial distribution of moisture around the fjord, which can be observed by scanning instruments. We performed dedicated simulation for the comparison with the observed structure and to provide a larger context. The research is still ongoing.

Postprocessing and Retrieval development

To compare our simulations with observational data, the simulation output and observed quantities have to be comparable. For this we can either use instrument simulator – to transfer the model output to observable quantities – or retrievals – to retrieve simulated quantities from the observed ones. Retrieval development is often based on simulation output and requires several postprocessing and analysis steps. In order to retrieve information on the liquid water path and ice water path during the HALO-(AC)^3 campaign, our simulations have been used for retrieval development.

Additionally, we started to work on new algorithms to compare the cloud resolving simulations with airborne measurements – which requires to select a 2D path from the 3D simulation field. At the moment we are testing more sophisticated approaches than constraining only latitude and longitude. During our analysis of our simulations for the ACLOUD and HALO-(AC)^3 campaigns, such an algorithms turned out to be very important for the further analysis.

Simulations for three arctic supersites

We continued on our aim to compare the ICON-LEM model on three different arctic supersites (Ny-Ålesund (Svalbard), Utqiagvik (Alaska), Polarstern (Ship, central arctic)), to investigate the applicability of the model under arctic conditions. A special focus is on the three different surface representations. We refined our model setup again (with respect to forcing and parameterization settings) and performed 1 month (7.12.2019-7.1.2020) for each station with 2 km NWP setup and 600 m LEM. The simulations were also performed for two different forcing sets, which allows an additional evaluation of differences introduced through the forcing from global NWP simulations. The evaluation is ongoing and we expect a publication during the next months.

First simulations for the Atacama Desert (Chile)

We performed first test evaluations with different forcing data, different domain sizes and different resolutions for the region around Iquique (Chile) in the Atacama desert. The interesting question is, how the moisture is transported from the ocean to the land. As a first attempt, we evaluated if the model is able to capture the boundary layer structure over the ocean in front of the coast and shows a reasonable topography structure. The evaluation as well as further analysis will be intensified during the next year (if our proposal is accepted).