Project: **1036**
Project title: **ArctiC Amplification: Climate Relevant Atmospheric and SurfaCe Processes, and Feedback Mechanisms, (AC)³ – University of Leipzig contribution**
Principal investigator: **Johannes Quaas**
Report period: **2021-11-01 to 2021-09-30**

An overarching issue with the resource utilization in the reporting period was the move from mistral to levante. The familiarization with the new HLRE environment by all staff, including the efficient utilization of the model codes, took a fairly long time. Meanwhile, the codes run and simulation activity takes up again. Nevertheless, some successes can be reported about.
There were three contributions to the overall project.

D01 is interested in dynamical contributions to Arctic amplification. This included an analysis of the different transport pathways into the Arctic, by using a machine learning / clustering approach. The results from the ICON model were compared with re-analysis results. A paper on this is in the process of being written (Mehrdad et al.). Unfortunately, due to the reasons detailed above, so far few of the simulations actually were conducted and so have to be requested again.

In project D02, we are interested in the role of cloud condensation nuclei (CCN) and ice nucleating particles (INP) on clouds in the Arctic. Trends in CCN and INP, due to remote or local sources, may lead to changes in the Arctic energy budget and thus modulate Arctic amplification. In light of the observations-based studies from this project (Papakonstantinou-Presvelou et al., 2022), we decided to shift our method from the originally-planned ICON-HAM global (GCM) simulations to regional simulations with the kilometre-resolution ICON-NWP model (following also earlier experience, Kretzschmar et al., 2020). The model is now set-up, with a number of sensitivity studies conducted in order to test the reliability. Scientific exploitation of these simulations is ongoing.

In project E01, the interest is in the Arctic lapse-rate feedback. The analysis follows up on previous work using the CMIP6 multi-model archive (Linke and Quaas, 2022). It turned the focus to the period for which observations are available from satellite retrievals, i.e. starting 1980. The first analyses are now conducted and a paper on this is on its way.

References

Kretzschmar, J., J. Stapf, D. Klocke, M. Wendisch, and J. Quaas, Employing airborne radiation and cloud microphysics observations to improve cloud representation in ICON at kilometer-scale resolution in the Arctic, Atmos. Chem. Phys., 20, 13145-13165, doi:10.5194/acp-20-13145-2020, 2020.

Linke, O., and J. Quaas, The impact of increasing CO2 levels on the Arctic atmospheric energy budget in CMIP6 climate model simulations, Tellus, 74, 106-118, doi:10.16993/tellusa.29, 2022.

Papakonstantinou-Presvelou, I., O. Sourdeval, and J. Quaas, Strong ocean/sea-ice contrasts observed in satellite-derived ice crystal number concentrations in Arctic ice boundary-layer clouds, Geophys. Res. Lett., 49, e2022GL098207, doi:10.1029/2022GL098207, 2022.