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: **2020-11-01 to 2021-08-31**

There are three sub-projects of the (AC)³ collaborative research centre, at Leipzig University, that make use of this DKRZ projects for the necessary simulations and high-performance computing.

Project D01: Large–scale dynamical mechanisms of Arctic amplification Project D02: Modelling marine organic aerosol and its impact on clouds in the Arctic, and Project E01: Assessment of the Arctic lapse rate feedback using a multi-scale model hierarchy.

In D01, there were delays in starting due to the COVID-19 pandemic, but in late spring 2021, finally, the PhD candidate started. He has now, supported by a post-doc in the team, started to get acquainted with the ICON-GCM modelling on mistral.

In D02, the first work focused on the observational data to be used for model evaluation. This work took longer than anticipated, but now a publication is being written. The simulation works for aerosol-cloud interactions are anticipated to start with a slight delay for this reason. However, the COVID-19 pandemic presented an unexpected opportunity to study the impact of aerosols on clouds, albeit not with the regional focus on the Arctic, and also not so much for boundary-layer clouds, but for cirrus under the influence of aviation emissions. We made use of this opportunity to assess satellite data. There were, however, high-performance computations necessary to assess the radiative effects. The result was a warming impact of aviation cirrus of 61 mW m⁻² in the year 2019 (Quaas et al., 2021).

In E01, the focus is on the lapse-rate feedback in the Arctic. For this, first, the output from the CMIP6 multi-model ensemble was analysed, and a publication has been submitted (Linke and Quaas, submitted). First studies now used the ICON GCM to put the own simulations into the context of the multi-model ensemble.

References

- Linke, O., and J. Quaas, The impact of increasing CO2 levels on the Arctic atmospheric energy budget in CMIP6 climate model simulations, Tellus, submitted.
- Quaas, J., E. Gryspeerdt, R. Vautard, and O. Boucher, Climate impact of aircraft-induced cirrus assessed from satellite observations before and during COVID-19, Environ. Res. Lett., 16, 064051, doi:10.1088/1748-9326/abf686, 2021.