Project: **1320**

Project title: **Passive and active microwave forward simulations for Arcticapplications**

Principal investigator: **Mario Mech**

Report period: **2022-05-01 to 2023-04-30**

Within the proposed project, we planed to perform passive and active microwave forward simulations that support the measurements taken on various platform within the framework of the German DFG project - TRR 172, ”ArctiC Amplification: Climate Relevant Atmospheric and SurfaCe Processes, and Feedback Mechanisms $(AC)^3$”. Thereby, these simulation rely on input that can either be provided by observations by radiosoundings and dropsondes or by model simulations like the ICON model or ERA5 reanalyses. Whatever is taken as input, careful preparation is required to adapt existing code to these input. This is very time consuming. Unfortunately, due to limited personal resources this took much longer than expected, so that the a lot of the granted project resources decayed without performing massive simulations as intended. Time has been used to setup running process chains, that make efficient use of the available resources. These project chains are now set up and ready to be used.

Having a setup that could easily handle input data from the flights during the Arctic airborne campaigns via ac3airborne python module (Mech et al., 2022a) and process ERA5 datasets available at DKRZ and ICON simulations from other projects (bb1156 and bb1986 by Vera Schemann), helped to understand observations by being able to easily simulate these observations and perform sensitivity tests on input parameters. Although the simulations are not explicit part of the publications, it contributed to their successful compilation (Lauer et al., 2023; Mech et al., 2022b; Schirmacher et al., 2023).

One of the major outcome for upcoming projects is to have running process chains that can easily perform small sensitivity test, case study based simulations, and massive calculations to build databases for retrieval development or as input data machine learning applications.

Although not part of the originally intended project scope, during the cause of the year another aspect came into the focus of the project members that emerged from the published results in Lauer et al. (2023). Therein an algortihm to detect atmospheric rivers has been applied on ERA5 data for tow months during airborne campaigns. It clearly showed up, that is necessary to apply this algorithm to whole available ERA5 dataset to get good and reliable statistics. This will be done in the extension of this project.

Lauer, M., Rinke, A., Gorodetskaya, I., Sprenger, M., Mech, M., and Crewell, S.: Influence of atmospheric rivers and associated weather systems on precipitation in the Arctic, EGUsphere, 1–32, https://doi.org/10.5194/egusphere-2023-261, 2023.

Mech, M., Risse, N., Marrollo, G., and Paul, D.: ac3airborne, , https://doi.org/10.5281/zenodo.7305585, 2022a.

Mech, M., Ehrlich, A., Herber, A., Lüpkes, C., Wendisch, M., Becker, S., Boose, Y., Chechin, D., Crewell, S., Dupuy, R., Gourbeyre, C., Hartmann, J., Jäkel, E., Jourdan, O., Kliesch, L.-L., Klingebiel, M., Kulla, B. S., Mioche, G., Moser, M., Risse, N., Ruiz-Donoso, E., Schäfer, M., Stapf, J., and Voigt, C.: MOSAiC-ACA and AFLUX - Arctic airborne campaigns characterizing the exit

area of MOSAiC, Sci Data, 9, 790, https://doi.org/10.1038/s41597-022-01900-7, 2022b.

Schirmacher, I., Kollias, P., Lamer, K., Mech, M., Pfitzenmaier, L., Wendisch, M., and Crewell, S.: Assessing Arctic low-level clouds and precipitation from above - a radar perspective, EGUsphere, 1–30, https://doi.org/10.5194/egusphere-2023-636, 2023.