Project: **1036**

Project title: **ArctiC Amplification: Climate Relevant Atmospheric and SurfaCe Processes, and Feedback Mechanisms, (AC)³ – University of Leipzig contribution**

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Report period: **1.1.2019 – 31.12.2019**

The results on the Arctic cloud evaluation are not published as Kretzschmar et al. (2019). Some additional simulations were required to address the reviewer comments. One of the new results produced in the report period is shown in Fig. 1 and provides evidence for the need to apply a satellite simulator to the model output. It shows the difference between the ECHAM6 results for cloud cover as diagnosed directly from the model, and as diagnosed after post-processing with the Cloud Feedback Model Intercomparison Project (CFMIP) Observational Simulator Package (COSP satellite simulator), and the difference between the satellite product (general circulation model -oriented CALIPSO cloud product; GOCCP, where CALIPSO is the spaceborne lidar instrument) and surface remote sensing. As can be seen the two differences are consistent, showing nicely the need to employ a satellite simulator in the model when aiming at model evaluation using satellite data.

The other aspect studied was the Arctic feedback analysis. As we show in Block et al. (2019), the two most important feedbacks are the surface albedo and lapse rate feedbacks, which can even lead to a local runaway climate in the Arctic.The lapse-rate feedback is studied further in Lauer et al. (revised). From this analysis it appears that the strength of the lapse-rate feedback is a function of the underlying surface and the inversion strength.

Figures

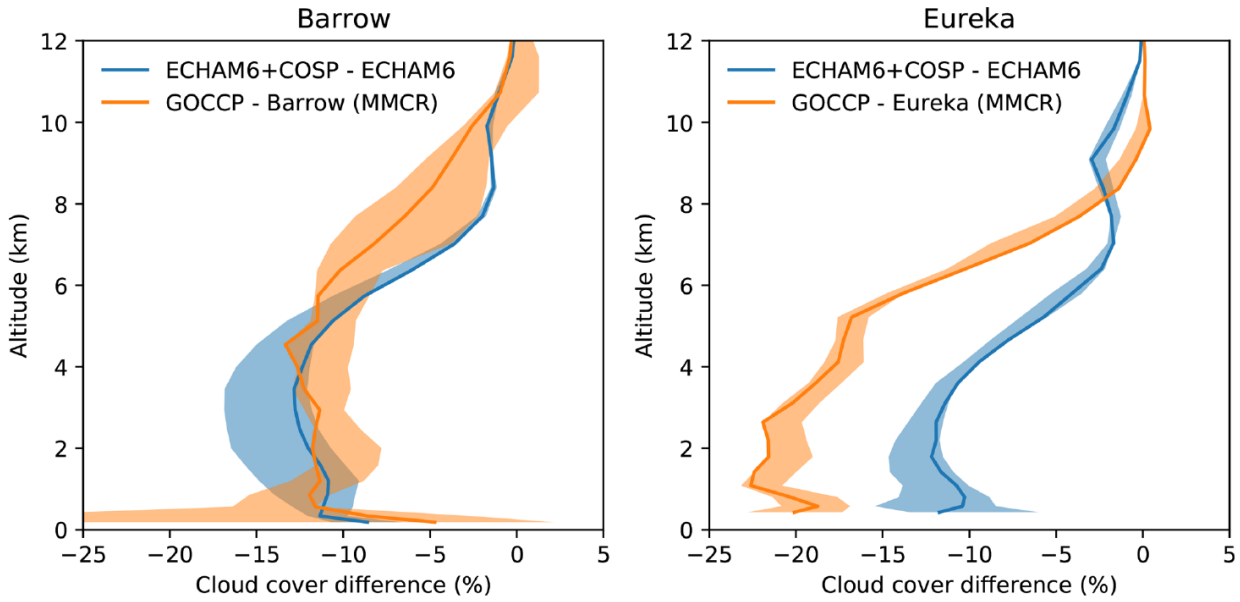

Fig. 1. Difference in cloud cover profiles (from 2007 to 2009) of ECHAM6+COSP minus ECHAM6 and climate-model oriented satellite lidar cloud product minus ground-based remote sensing observations. Cloud cover profiles from ground-based observations are derived from 35 GHz millimeter cloud radars (MMCRs) in Barrow and Eureka. Shaded areas show the effect of using the neighboring grid points around the location in the grided data.

References

Block, K., F. Schneider, J. Mülmenstädt, M. Salzmann, and **J. Quaas**, Climate models disagree on the sign of total radiative feedback in the Arctic, Tellus A, in press, 2019.

Kretzschmar, J., M. Salzmann, J. Mülmenstädt, and **J. Quaas**, Arctic cloud cover bias in ECHAM6 and its sensitivity to cloud microphysics and surface fluxes, Atmos. Chem. Phys., 19, 10571-10589, doi:10.5194/acp-19-10571-2019, 2019.

Lauer, M., K. Block, M. Salzmann, and **J. Quaas**, CO2-forced changes of Arctic temperature lapse-rates in CMIP5 models, Met. Z., in revision.