Project: **1037**
Project title: **AC3 - ACLOUD**
Project lead: **Johannes Quaas**
Report period: **1.1.2018 – 31.12.2018**

The aim of this project was to accompany the ACLOUD measurement campaign within the Arctic Amplification ((AC)³) Collaborative Research Centre (http://ac3-tr.de). Details about the ACLOUD campaign, that also was well-covered by public-outreach media (www.ac3-tr.de/outreach/), can be found at acloud2017.blogspot.de.

The high-resolved (1 km resolution) ICON model in NWP mode consistent with the NARVAL-II - simulations for the Tropical Atlantic Ocean were successfully conducted and we already reported about these in the last report (for 2017). A first publication that includes the simulation results is submitted (Wendisch et al., revised).

The goal of the research in the past reporting period (2018) was to investigate in depth the remaining discrepancies of the ICON model and the observations. A special focus was on the analysis of the aircraft observations of radiation. A key problem that was identified was the surface albedo. Our analysis thanks to sensitivity simulation led to the conclusion that the initialisation with the ECMWF analyses was the problem, as the model presently doesn't use the albdeo from ECMWF but performs a cold start of the surface albedo. For this cold start, the albedo is just a function of temperature and the relatively high temperature during that campaign led to a underestimtated seaice albedo. To ensure better comparability, we revised the albedo parametrization and implemented a time-dependent functional relationship by using making use of observed surface albedo during the campaign.

A direct model-data comparison is shown as an example in Fig. 1. The observations show in the relationship between net surface flux in the terrestrial spectrum and surface albedo four distinct clusters of state: two clusters that separate in the surface albedo, attributable to the difference between open ocean (low albedo) and sea ice (high albedo). Two other clusters separate in the terrestrial-spectrum flux, attributable to the presence or not of overlying low-level clouds. The model reproduces these broadly, but the albedo deficiency mentioned above is evident. Also the clear state is overly frequent in the model. Besides, a comparison is shown between the surface net flux in the solar spectrum and surface albedo. there is an expected correlation, but also the scatter that is due to the variability in cloudiness and aerosol. The result is useful to investigate further details of the cloud parameterisation deficiencies.

A publication on these results is currently being prepared (Kretzschmar et al.).

References

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Figures

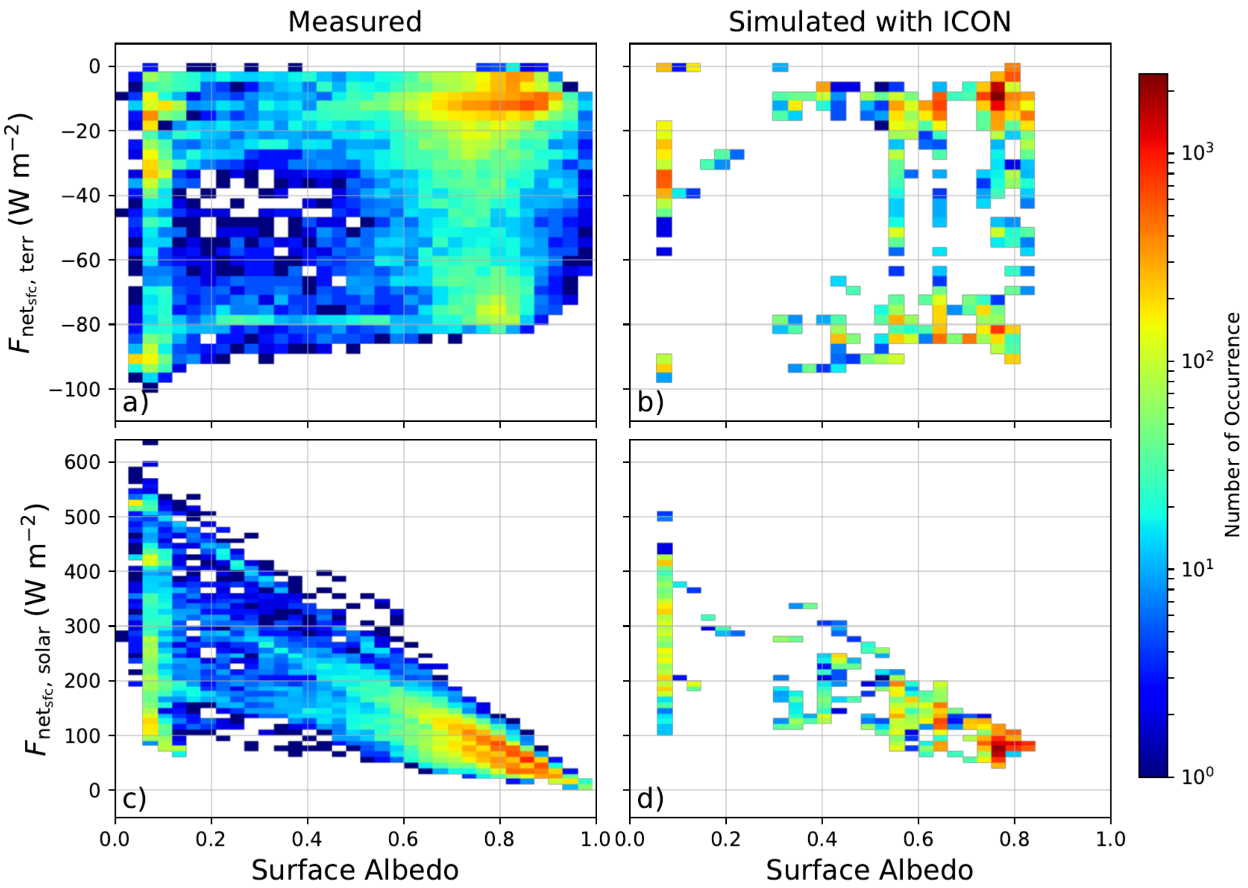

Fig. 1: Comparison of surface radiative fluxes during ACLOUD campaign with limited-area ICON simulations (1.2 km). Joint histograms are shown (color scale is frequency of occurrence). Top row: surface net flux in the terrestrial spectrum vs. surface albedo; bottom row: surface net flux in the solar spectrum vs. surface albedo. Left column: ACLOUD observations that were measured using the SMART albedometer (Wendisch et al., 2001). Right column: ICON model output co-located to the ACLOUD flights.