Project: **1037**

Project title: **AC3 - ACLOUD**

Project lead: **Johannes Quaas**

Report period: **1.1.2019 – 31.12.2019**

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 are reported in Wendisch et al., (201(9)

In the report period, we continued in the comparison of ICON-NWP to the ACLOUD observations. We sampled to ICON output in space and time to consistently compare it to the aircraft observations and found that clouds over sea ice seem to be optically too thin, as indicated by comparison of surface radiation observations vs. model results.

Thanks to a set of ICON-NWP model sensitivity studies, this could be attributed to a too low liquid water content of clouds that is caused by a too effective autoconversion process and warm rain being the major sink for cloud water in the Arctic mixed-phase clouds. Further sensitivity studies revealed that it was not the autoconversion itself that caused the bias. Neither was the cloud condensation nuclei (CCN) concentration the culprit. In turn, we found out that it was a lack of droplet activation due to a too weak vertical velocity in the activation parameterisation.

By introducing a subgrid-scale component of vertical velocity in the activation of CCN, more CCN where activated which subsequently led to larger droplet concentrations, reduced autoconversion, reduced warm rain, increased cloud liquid water content (Fig. 1), and improved optical properties of Arctic stratocumulus.

Figures

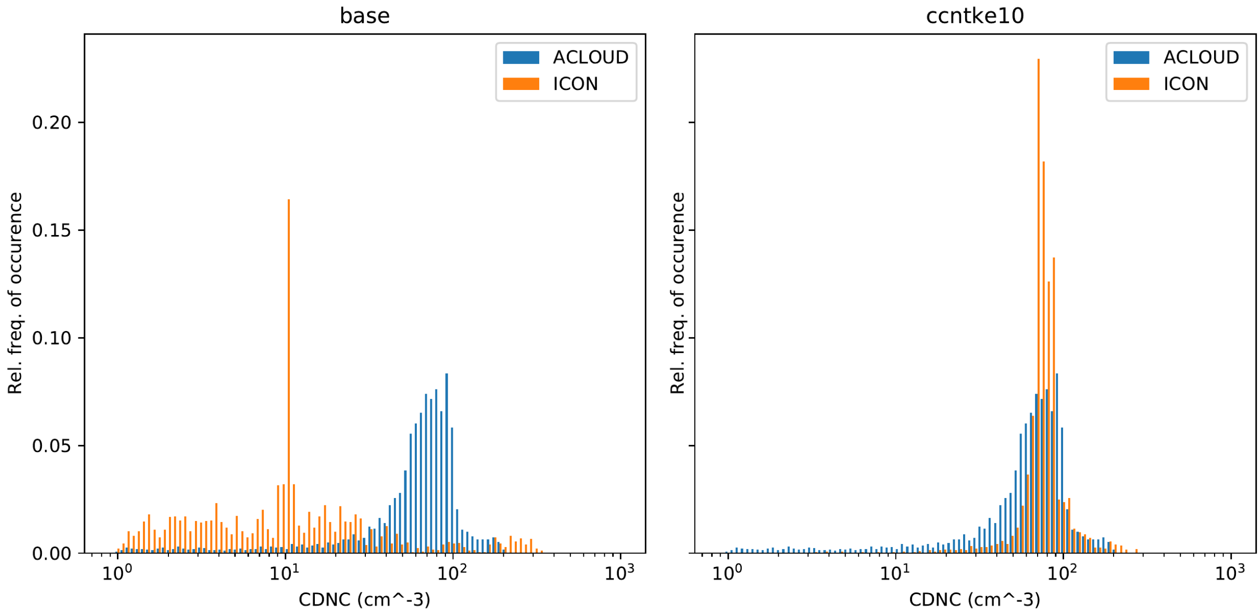

Fig. 1: Normalized histogram of cloud droplet number concentration (CDNC) for the ACLOUD aircraft measurements (blue) and ICON-NWP model results (orange). Left: standard model, right: model with additional vertical wind information from the turbulence scheme (square root of turbulence kinetic energy, TKE).

References

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