Arctic mixed-phase clouds as observed during $(AC)^3$ airborne campaigns and their representation in the ICON-LEM model

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The contribution of Arctic mixed-phase clouds to the Arctic Amplification is still not clear as there are major deficits in their representation in regional and climate models. One of the main interests of the Transregional Collaborative Research Center (TR 172) "Arctic Amplification: Climate Relevant Atmospheric and Surface Processes, and Feedback Mechanisms (AC)3" is to increase the understanding of these clouds by observation and modeling activities. Within the framework of (AC)3, the polar research aircraft of the Alfred-Wegener-Institute for Polar and Marine Research, Germany, were operated from Longyearbyen at Spitsbergen equipped with remote sensing and in situ probes to investigate Arctic boundary layer mixed-phase clouds within three airborne field campaigns. Key instruments of the remote sensing setup are the MiRAC 94 GHz FMCW radar along with passive microwave observations between 22 and 340 GHz and the AMALi lidar. In total, 192 flight hours have been collected with the remote sensing instruments on board.

For each of the campaigns, various atmospheric models on different resolutions in space and time have been employed. A special focus has been put on the Large Eddy Simulation (LES) version of the ICON model which allows a resolution O(50 m) while using heterogeneous surface and lateral boundary conditions to capture the observed synoptic situations. The analyzed simulations are using a 2-moment microphysics parameterization.

Within this presentation we will juxtapose Arctic mixed-phase clouds as seen in measurements taken during the different airborne campaigns to their representation within the ICON-LEM model. This will be done in physical variable space as well as in observational space by applying the PAMTRA forward simulator for passive and active observations to ICON-LEM model fields. The setup also allow to i) improve the representation of clouds by modifying the cloud scheme and comparing to real measurements and ii) to explore the benefit of future (virtual) instrumentation, e.g. G-Band radar.

References