A novel active and passive microwave package for the investigation of Arctic mixed-phase clouds

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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. The Transregional Collaborative Research Center (TR 172) "Arctic Amplification: Climate Relevant Atmospheric and Surface Processes, and Feedback Mechanisms (AC)³" tries to increase the understanding of these clouds. A major contribution to the aims of (AC)³ will be made by the field campaign "Arctic Cloud Observations Using airborne measurements during polar Day" (ACLOUD) conducted in summer 2017, where the Polar research aircraft Polar 5 & 6 from the Alfred-Wegener-Institute equiped with remote sensing and in-situ instrumentation are operated from Longyearbyen, Svalbard. The general goal of ACLOUD is to obtain a comprehensive data set of a diversity of atmospheric parameters that will be used to understand and quantify specific physical processes in, above, and below Arctic clouds.

Within this presentation we will introduce the ACLOUD campaign, the instrumentation employed on the aircraft, and a first analyses of the measurements taken during the flights. Special focus will be put on the remote sensing instrumentation and its measurements on Polar 5 with the key component the Microwave Radar/radiometer for Arctic Clouds (MiRAC). MiRAC consists of a 94 GHz frequency modulated continuous wave (FMCW) radar and passive radiometer with frequencies in the millimeter/sub-millimeter range between 183 and 340 GHz similar to future satellites. ACLOUD will include satellite underflights, i.e. CloudSat and polar orbiters carrying microwave radiometers (AMSU-B/MHS) and infrared spectrometers (IASI) as well as overfilghts of vertical profiling sites from the research vessel Polarstern and Ny Ålesund, Spitsbergen. The detailed campaign data will help to evaluate the satellite observation under the demanding Arctic conditions and assess their capabilities for long-term assessment of Arctic clouds and water vapor. Special interest is on the exploration of MiRAC's higher frequency passive channels that were selected to have overlap with the upcomming Ice Cloud Imager (ICI) on MetOp-SG. The synergy of MiRAC measurements and those by lidar, instruments in the visible and infrared spectral region, dropsondes, and the in-situ observations on the Polar 6 aircraft supplemented by satellite data will be used to evaluate regional climate models.