The role of clouds in the Arctic Amplification: insights from new observations at the Arctic research base AWIPEV

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Within the last two decades, a significant increase of the Arctic near–surface air temperature exceeding the global warming by a factor of two has been observed [1]. This phenomenon – commonly referred to as Arctic Amplification – is related to changes of a multitude of climate variables and their interaction within various feedback processes. Within the Transregional Collaborative Research Centre TR172 "ArctiC Amplification: Climate Relevant Atmospheric and SurfaCe Processes, and Feedback Mechanisms $(AC)^3$" (www.ac3-tr.de, [2]), we want to identify, investigate, and evaluate the key processes of Arctic Amplification and improve the understanding of the major feedback mechanisms. To this end, observations and models will be exploited on various spatial and temporal scales.

One of the feedback mechanisms being investigated is related to clouds: Arctic clouds mostly warm the near–surface air because of low sun and high surface albedo. Consequently, in a warmer Arctic with more clouds an initial warming is amplified by clouds – a positive feedback. In order to better understand the role of clouds in Arctic climate, highly temporally and vertically resolved cloud observations are needed. With the installation of a 94 GHz cloud radar at the French-German Arctic Research Base AWIPEV at Ny-Ålesund/Svalbard in 2016, clouds and related physical processes at Ny-Ålesund can now be characterized – in combination with the additional instrumentation of AWIPEV – much more comprehensively than before. In this work, we will present results of more than 1 year vertically resolved cloud observations at Ny-Ålesund. Such observations will subsequently be used to investigate the impact on the radiative fluxes and heating rates of the Earth-atmosphere system. The continuous ground-based remote sensing observations at Ny-Ålesund are also supported by extensive aircraft-based cloud observations, which have been performed in May/June 2017 as part of the $(AC)^3$ ACLOUD campaign. First results will also be shown.

[1] Serreze, M. C. and R. C. Barry: Processes and impacts of Arctic amplification: A research synthesis, Global Planet Change, **77**, 85–96, DOI: 10.1016/j.gloplacha.2011.03.004, 2011.

[2] Wendisch, M., M. Brückner, J. P. Burrows, S. Crewell, K. Dethloff, K. Ebell, C. Lüpkes, A. Macke, J. Notholt, J. Quaas, A. Rinke, and I. Tegen, 2017: Understanding causes and effects of rapid warming in the Arctic. Eos, **98**, doi:10.1029/2017EO064803. Published on 17 January 2017.