Cloud observations at the Arctic atmospheric observatory AWIPEV: results from a novel 94-GHz FM-CW cloud radar

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In order to better understand the role of clouds in affecting the Arctic climate and in the so-called Arctic Amplification, high quality cloud observations are needed. Such observations require highly advanced stations for continuously monitoring the Arctic atmospheric column. Such supersites, exist for example in Barrow and Atqasuk at the North Slope of Alaska, in Eureka, Canada, and at Summit station, Greenland. In addition to meteorological and radiation measurements, they comprise a suite of remote sensing instruments, e.g. cloud radar, lidar/ceilometer, micro- and millimeter wave radiometers, infrared spectrometer, enabling the retrieval of temperature and humidity profiles, vertically resolved cloud properties, as well as aerosol information.

Within the Transregional Collaborative Research Centre TR172 "ArctiC Amplification: Climate Relevant Atmospheric and SurfaCe Processes, and Feedback Mechanisms $(AC)^3$" (www.ac3-tr.de), the French - German Arctic Research Base at Ny-Ålesund / Spitsbergen AWIPEV in Ny-Ålesund will state a further important puzzle piece of Arctic cloud observations in the warmest part of the Arctic. With the installation of a 94 GHz frequency modulated–continuous wave (FM–CW) cloud radar at Ny-Ålesund in June 2016 and the combination with existing instrumentation, clouds and related physical processes can now be characterized in Ny-Ålesund in a much more comprehensive way than done so far.

In this work, we will present first results of almost 1-year vertically resolved cloud observations. As a first step, the Cloudnet algorithm suite (Illingworth et al., 2007) has been applied to the Ny-Ålesund observations. The Cloudnet algorithms encompass a target categorization which is based on cloud radar, ceilometer and microwave radiometer measurements and information from a numerical weather prediction model. Such a categorization is an essential precondition for applying subsequently appropriate microphysical cloud retrieval schemes.

In addition to the long-term analysis of cloud properties, we will also have a more detailed look on low-level mixed phase clouds, which frequently occur in the Arctic and can persist from hours to several days. To describe low-level mixed phase clouds, and the atmospheric conditions in which they occur, we present a case study of a persistent mixed phase cloud observed above the AWIPEV station. In addition to radar reflectivity and mean vertical velocity, we also utilize the higher moments of the Doppler spectra, such as skewness and kurtosis.

Illingworth, A. J. et al., 2007: CLOUDNET Continuous evaluation of cloud profiles in seven operational models using ground-based observations, *Bulletin of the American Meteorological Society*, 88 (6), 883–898.