Multi-year precipitation characteristics based on in-situ and remote sensing observations at the Arctic research site Ny-Ålesund, Svalbard

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Precipitation is a key variable in the hydrological cycle. However, observations of precipitation are quite challenging and even more so in remote locations such as the Arctic. The Arctic is experiencing a rapid changing climate with a strong increase in near-surface air temperature, known as Arctic Amplification. In particular, the Svalbard archipelago being located in the warmest region of the Arctic reveals the highest temperature increase (Dahlke and Maturilli, 2017).

Such changes also affect the hydrological cycle. For example, climate models reveal a strong increase in precipitation in the Arctic (McCrystall et al., 2021) with rain becoming the most dominant precipitation type (Bitanja and Andry, 2017). Continuous detailed observations, which can also be set in context to satellite products and reanalyses data, are necessary to better understand precipitation and precipitation related processes in the Arctic.

In this study, we make use of the complementary precipitation observations performed as part of the Transregional Collaborative Research Centre on Arctic Amplification TR172 (http://www.ac3-tr.de; Wendisch et al., 2017) at the Arctic research station AWIPEV at Ny-Ålesund, Svalbard, to analyze precipitation characteristics in detail. The observations include an OTT Pluvio2 weighing gauge, an OTT Parsivel2 distrometer and a METEK MRR-2 micro rain radar (MRR). While the Pluvio and the Parsivel provide information on surface precipitation amount and type, the MRR provides information on the vertical structure of precipitation up to a height of 1 km. Measurements are available since spring/summer 2017 allowing for an analysis of more than 4 years of data.

First results show that the yearly precipitation amount based on Pluvio ranges from 306 mm to 552 mm (values are uncorrected for undercatch). Using the one-minute resolved data of Parsivel, precipitation frequency is highly variable within the different months ranging from 0.4 % to 18.8 % with solid precipitation being the most dominant type typically from September to March and liquid precipitation in the months May to August.

In addition to monthly and yearly statistics, we will also characterize and analyze in detail the individual precipitation events. One question to be addressed is how much of the precipitation is related to atmospheric rivers (ARs). ARs are long, narrow, and transient corridors of strong horizontal water vapor transport which transport 80-90 % of the poleward moisture transport. Although their occurrence in the Arctic is limited, they are a significant source of rain and snow in the Arctic.

Understanding linkages between precipitation and weather events and using observational data to evaluate models and reanalysis in the current climate will aid developing more accurate future predictions.

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