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Air temperature as a criterion for snow and rain separation for Svalbard

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The phase of precipitation occurrence is crucial for many environmental processes and model glaciological and hydrological studies. In cold climates the separation of precipitation into snow and rain is necessary for water balance calculations because it determines how much water is available for runoff and soil infiltration, or is stored as snow (Kienzle 2008).
In this study we analyse the dependence of precipitation phase on daily, maximum and minimum air temperatures in Svalbard Archipelago to assess the geographical and seasonal variation in temperature thresholds for rain and snow occurrence. We use the data from 5 meteorological stations belonging to the Svalbard Archipelago and one station - Jan Mayen - located at lower latitudes for comparison studies. The research period was established as a period with data available at every stations and it covers the years between 1978 and 2016. We used the daily precipitation totals, information on precipitation phase, average, maximum and minimum daily air temperature and notation of weather phenomenon (current and past weather). The data come from the e-klima data base that is no longer available for public use and from OGIMET synoptic database. The data for Hornsund station were taken from the archives of Institute of Geophysics Polish Academy of Sciences and from the Hornsund yearbooks. We analysed the frequency and conditional probability of liquid, mixed and solid precipitation within daily air temperature ranges, and we build the snow and solid precipitation curves to determine the threshold temperatures above which snow or rain are only probable.
Our preliminary results indicate spatial variation in temperature threshold for various precipitation occurrences. For example the air temperature below which 100% of precipitation occur as snow was -4°C at Bjornoya station, -7°C at Hopen situated on the Barents Sea and -5°C at Hornsund while the analogous thresholds for rain occurrence reached: 3°C at Bjornoya station and 4°C at both Hopen and Hornsund station. Daily air temperature range with mixed precipitation probability higher than 10% are as follows: from -6 to 2°C at Bjornowya station, from -4 to 3°C at Hopen station and from-3 to 3°C at Hornsund station. We also noticed that the width of these air temperature ranges narrows along with the increase in latitude.