

## Z-R Relationship and DSD Based on Precipitation Classification: An Arctic Study from Ny-Ålesund

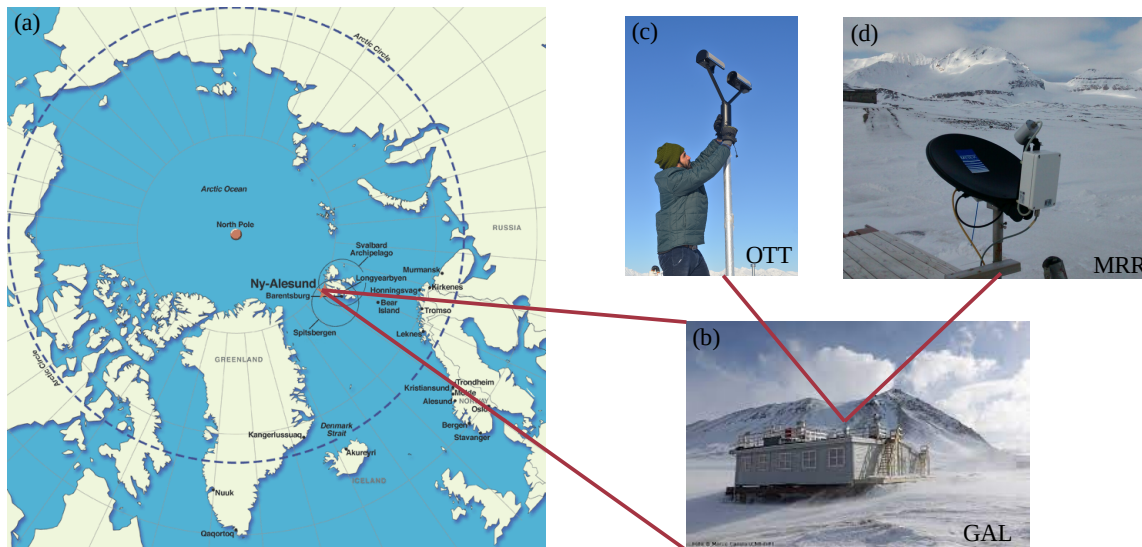
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The ecosystems in the Arctic will alter as a result of climate change. The alteration in the precipitation-forming process will modify the snowfall patterns over the pole, which will impact the Earth's radiative balance. The occurrence of more rain over snow is one such consequence. This will not only have an impact on the stability of the area covered in snow, but it also serves as an excellent predictor of the effects of climate change. Himadri, 1231 kilometers from the North Pole, is India's first research facility in the Arctic. located at 78°55'N 11°56'E in Ny-Ålesund on Svalbard's western shore. Due to its location, the atmosphere of this station is primarily impacted by the neighboring orographic features and the diabatic heating of the heated ocean. But since arctic precipitation is so poorly understood, we know relatively little about the unique physical processes that underlie it. It takes experimental measurements of many meteorological parameters and long-term field campaigns to fully comprehend the precipitation creation process and the function of meteorological components. Since 2013, Himadri Research Station has been conducting field observations in the Arctic at Gruvabadet Atmospheric Laboratory (GAL) using remote sensing tools including the Micro Rain Radar and OTT2 Parsivel Disdrometer. Observational data from the years 2019 to 2022 were taken into consideration for this study, depending on availability.

Six different types of precipitation have been seen in Himadri in 2019 based on their drop size, velocity, and density. These types include Graupel/small hail, rain, snow, and drizzling, including rain combined with snow and drizzling combined with rain. Changes in the weather quickly in Ny-Ålesund caused all types of precipitation to fall on April 16, 2019, in a single day. According to World Meteorological Organization (WMO) criteria, the intensity of overall precipitation has been divided into five separate categories (Guide to Meteorological Instruments and Methods of Observation, 2021). These Categories have been analyzed for different seasons with their corresponding Precipitation fall contribution.



**Figure 1. (a)Geographic Map of arctic region with the location of Ny-Ålesund (credit: vacationstogo.com) (b) Picture of Gruvabadet Atmospheric Laboratory (GAL)(credit: isp.cnr.it) with the position of co-located instrumentation used in the study, namely OTT disdrometer (c) and MRR (d).**

To understand the distribution of each type of precipitation, it is helpful to calculate the DSD of Arctic precipitation using OTT2 data from 2021–22. Along with this, we generated the Z-R relation for each form of precipitation and examined their fluctuation in accordance with drop size and velocity to better understand the precipitation process.