

Measuring snow with a low-power K-band radar (Micro Rain Radar) at high latitudes

M. Maahn¹, S. Kneifel¹, I. Gorodetskaya², G. Peters³ and C. Simmer⁴

The Micro Rain Radar (MRR) is a low-cost, low-power vertically pointing Frequency Modulated Continuous Wave (FM-CW) radar operating at 24 GHz which is widely used to measure rainfall. Kneifel et al., 2011 [1] recently reported that it can also be used to measure snowfall and it compares well with a pulsed Ka-band cloud radar for reflectivities exceeding 0 dBz. Events with smaller reflectivities are not detected, due to limitations of the hardware design and rain-specific MRR noise processing.

This fact limits the use of MRR for snowfall statistics, because, according to Cloudsat measurements [2], almost half of all snow events have reflectivities lower than 0 dBz, even though they contribute insignificantly to the accumulated amount of precipitation. On the other hand, MRR has broad potential applications, due to the lightweight and robust design, which makes it also feasible for remote areas. Thus, MRR would be an appropriate tool to discuss and compare snowfall climatologies from various climate zones, if its sensitivity could be increased. For this, also data from existing MRR networks could be reprocessed.

For this study, the software processing was completely redesigned using the raw Doppler spectra. The key is an improved noise algorithm which increases the sensitivity and allows the use of the full potential of the MRR hardware. The improved data processing is exemplary used to discuss and compare observations from Spitsbergen (Norway) and Utsteinen (East-Antarctica), which were, to the authors' knowledge, the first precipitation radar measurements in these locations. The obtained results are used to reevaluate MRRs capabilities of observing snow.

[1] Kneifel, S., Maahn, M., Peters, G. and Simmer, C. Observation of snowfall with a low-power FM-CW K-band radar (Micro Rain Radar). *Meteorology and Atmospheric Physics* 113, 75-87 (2011).

[2] Kulie, M.S. and Bennartz, R. Utilizing Spaceborne Radars to Retrieve Dry Snowfall. *Journal of Applied Meteorology and Climatology* 48, 2564-2580 (2009).

¹ Institute for Geophysics and Meteorology, University of Cologne

² Department of Earth and Env Sciences, University of Leuven

³ Metek GmbH, Elmshorn

⁴ Meteorological Institute, University of Bonn