Atmos. Meas. Tech. Discuss.,
doi:10.5194/amt-2017-485-RC5, 2018

Atmospheric Measurement Techniques Discussions

Interactive comment on "Snowfall retrieval at X, Ka and W band: consistency of backscattering and microphysical properties using BAECC ground-based measurements" *by* Marta Tecla Falconi et al.

Anonymous Referee #5

Received and published: 7 February 2018

In this manuscript, the authors use collocated measurements of triple frequency vertically pointing radar measurements of snowfall with surface PIP PSD measurements. Using these collocations, they evaluate T-matrix method (TMM) simulations of snowfall for different snowfall types (fluffy, rimed) to determine the parameterizations that lead to the closest matches to measured reflectivities at different wavelengths.

There are few studies available that directly compare the differences in reflectivity-snowfall relationships at three frequencies, and fewer still that do so with measured data. This paper could be a valuable contribution towards the effort to find simple

calculations for the complex relationships between snowflake PSDs and reflectivity, but the result are based on an ambiguous definition of aspect ratio that appears both subjective to the radar and objective as a particle property (explained in the comments). With some clarification on the language, I would support the publication of this article.

Major comments:

I'm having trouble understanding how I'm supposed to view a particle's aspect ratio (rs). On one hand, rs appears to be a real, measurable property of a particle. It is defined by a major and minor axis (page 7, line 24), and different aspect ratios refer to different specified particle geometries (page 7 lines 25 and 28; page 12 line 6). Throughout the paper, however, rs is also defined and used as a variable tuning parameter that can change for a given PSD depending on the radar frequency (page 12 lines 8-10). If rs signifies a particle shape, than the assumption of that shape shouldn't be able to change depending on the radar being used to observe it. If rs is intended as a tuning parameter, the language in the paper should be clear prevent any interpretations that the rs recommended could represent physical particle properties.

In Section 2.3, the authors claim "The cross-calibration method is based on the assumption that in the low reflectivity region at the cloud top the small crystals basically scatter in the Rayleigh regime (Hogan et al., 2000). In these regions, therefore, the measured radar reflectivity values from by all millimeter wave radars should match". These values may not match if there is substantial liquid water present, and liquid water is common in snowing clouds (Wang et.al 2014). Liquid water attenuation is very difficult to predict at different frequencies for supercooled liquid water droplets (Kneifel et. al 2014), and liquid water is also very hard to measure, so this attenuation may not be possible to fully address. But it should be discussed and, if possible, estimated.

Specific Comments:

Numerous spelling and grammar errors throughout. Suggest closer proofreading before final submission.

Is it necessary to include the information on the Pluvio gauge in 2.1? I don't see the data used in any of the figures.

Kneifel, S., Redl, S., Orlandi, E., Löhnert, U., Cadeddu, M. P., Turner, D. D., & Chen, M. T. (2014). Absorption properties of supercooled liquid water between 31 and 225 GHz: Evaluation of absorption models using ground-based observations. Journal of Applied Meteorology and Climatology, 53(4), 1028–1045. http://doi.org/10.1175/JAMC-D-13-0214.1

Wang, Y., Liu, G., Seo, E. K., & Fu, Y. (2013). Liquid water in snowing clouds: Implications for satellite remote sensing of snowfall. Atmospheric Research, 131, 60–72. http://doi.org/10.1016/j.atmosres.2012.06.008

Interactive comment on Atmos. Meas. Tech. Discuss., doi:10.5194/amt-2017-485, 2018.