Atmos. Meas. Tech. Discuss.,
doi:10.5194/amt-2017-485-AC7, 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.

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Received and published: 19 April 2018

We thank the reviewer for his suggestions and, in particular, for specific prompts to clarify some fundamental issues. Our detailed replies can be found below in after the "REPLY." label. Changes in the manuscript are highlighted in blue text.

Major comments:

1 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

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Discussion paper

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.

REPLY. The aspect ratio is the parameter of the soft-spheroid particle model. It may or may not coincide with the measurable particle property. We have modified the text to make this point clearer.

2 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. Kneifel, S., Redl, S., Orlandi, E., LoÌĹhnert, 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

REPLY. For cross calibration only non precipitating clouds with no or little supercooled

liquid water were used. Since we have used data from the lowest usable range gates, the expected liquid water attenuation should be less than 1 dB. That is why not liquid water or snow attenuation correction is applied.

Specific comments:

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

REPLY. Thanks for the suggestions, we have heavily revised the manuscript by introducing some modifications highlighted in blue text within the revised text. We hope that the overall text revision is helpfully for a clearer understanding of the content.

2 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.

REPLY. Pluvio gauge has been used to check the snow rate from PIP and to estimate the LWE. We have added it in the revised paper a sentence on page 4 line 23-25.

Thank you again for the questions, the supplement to this comment contains the revised AMT manuscript. Changes in the manuscript are highlighted in blue text.

Please also note the supplement to this comment:
https://www.atmos-meas-tech-discuss.net/amt-2017-485/amt-2017-485-AC7-supplement.pdf

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