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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.

Marta Tecla Falconi et al.

martatecla.falconi@uniroma1.it

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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 comment: My only major comment is about the classification of snow, as either fluffy or rimed. Further details should be given about how this distinction is made, and propose for example some shape descriptors to discriminate the transition. This

appears as the only major subjective choice to be motivated. I suggest a piece of literature on the subject: "Solid hydrometeor classification and riming degree estimation from pictures collected with a Multi-Angle Snowflake Camera", by Praz et al, AMT 2017. In this study, the authors presented a classification method that tried to be as much as possible in line with the classification of Magono and Lee (1966).

REPLY. Thank you for pointing out the problem. We agree on the fact that the original definition of rimed and unrimed snowfall was vague and not properly explained. In the modified manuscript we are using microwave observations of liquid water path (LWP) to separate events into lightly, moderately rimed and heavily rimed snow. Even though LWP is not a direct measure of degree of riming, LWP and riming are related as shown for example in (Moisseev et al., 2017).

The resolution of PIP instrument is coarse compared to MASC and quantitative classification of riming degree cannot be achieved with the same accuracy than in Praz et al.. In this study the descriptor for riming is performed based on radiometer measured liquid water path (LWP).

Minor comment: 1 Page 4: Could you add a sentence summarizing the possible limitations/error sources of PIP? (i.e. beef up the final sentence about the wind)

REPLY. The revised text states the sizing error because of the blurring in line 6 (Page 4) and the minimum threshold for velocity in line 10 (Page 4) and size resolution in line 1 (Page 4). The limitations of observing the particle from a single projection is stated also in Section 2.1. To avoid repetition between the manuscripts we have published concerning the measurements during BAECC campaign we have stated that the more precise description of the uncertainty can be found in Tiira et al. 2016, von Lerber et al. 2017.

2 Page4, Line 14: add the percentage of "rejected" particles for this specific campaign, if applicable

REPLY. The fit of observed v(D) and retrieved m(D) is used, therefore the amount of rejected particles are not known. There is a threshold of 30 observed particles during the 5-minute period in order to compute the fit. Typically during the 5- minute period 10ˆ3 particles are observed. The error analysis of the m(D) is discussed more in detail in von Lerber et al. 2017. We have added two sentences on page 4 line 16-18.

3 Page 5, Line 24: add an error measure (standard deviation) of such intercomparison

REPLY. Standard deviation for the 15 February 2014 at 17:13 UTC where calibration is performed within in the most stable height interval between 4 and 6 km is: 1.04 dB (C Band), 1.14 dBZ (X Band), 1.28 dB (Ka Band), 1.28 dB (W Band).

4 Page 7, line 5: could you elaborate also in term of sampling volume sizes, other than time?

REPLY. The radar sampling volumes are not exactly the same, but similar. Since we are not performing any direct comparison of radar observations, the exact matching of radar volumes is not necessary. The main discrepancy is in sampling volumes between radar and PIP observations. Then PIP sampling volume depends on particle size and fall velocity. For the 5-min observation time it is about 1 mˆ3 for a snowflake with falle velocity of 1 m/s. It is still much smaller than the radar volume, but this is the best we can do.

5 Page 8, Line 15: as a curiosity, did you perform any evaluation about the goodness of fit?

REPLY. RMSE and NRMSE can be considered a measure of the goodness of fit, but more details will be in a proceeding paper at ERAD 2018 mostly concerning the fit evaluation.

6 Typos Page 2, l.35: typo from from

REPLY. Done.

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-AC6-supplement.pdf

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