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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: The paper and measurements presented are interesting but there is one important conclusion that is not adequately supported by quantitative analysis. In particular, when discussing figure 13, the authors conclude: "... i) looking at the product

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between the PIP-derived PSD and the radar cross section σ, we note that the TMM-based product is higher than the DDA one for small ice particles and is lower for the larger particles. The latter consideration leads to the conclusion that the soft-spheroid approximation may work rather well for computing radar reflectivity since the errors for larger particles are compensated by those for smaller particles." This could not be true in general. It depends by the extreme of integration in terms of particle's diameter of the quantity σ*N(D) shown in figure 13 on the right side axis. If you integrate between 0 and 2.5 mm you will probably have a sort of compensation effect. This not likely happens if you consider larger integration limits. Unfortunately, the Authors do not report a figure where they show a statistic of N(D) measured from PIP to have an idea of typical show particle's range diameters for the considered case studies. They should add N(D) figure.

REPLY. Thank you for the consideration. We have forced the conclusion, our final assessment is valid but only related to our dataset. Now we have changed the conclusion also looking at the new modified manuscript in which we are using microwave observations of liquid water path (LWP) to separate events into lightly, moderately rimed and heavily rimed snow. Thank you also to highlight the need to add a figure on N(D). We have integrated the TMM between 0 and 2.5D0 mm and this was not justified indeed. In the revised paper we have added Figure 13 in which we show the difference between the measured N(D), the estimated Gamma N(D) and the estimated Gamma N(D) truncated at 2.5 multiplied for D0. From Figure 13, respectively for (a) 12 February and (b) 15/16 February, it is noted that there is an under-estimation of the PSD for higher diameter.

Minor comments: 1 why in figure 13, bottom panel Deq extends up to 14 mm whereas in the other panel it is up to 6 mm?

REPLY. Figure 13 (now Figure 12) shows horizontally-polarized cross-section modelled by TMM and DDA but the diameter disk-equivalent used to set up the numerical simulations is from PIP data, then the maximum value of 2.5*DDeq depends from the

observed particles. Now we have changed the maximum value at DDeq=6 mm to fixed the scale limit.

2 why DDA simulations starts from Deq =0.4 mm whereas TMM starts from approximatively 0.05 mm? Differences of σ*N(D) in that range of diameter can play a role.

REPLY. As explained in section 3.3 the DDA cross sections are computed by averaging particle properties within each bin of the PIP measured PSD and plotted at the bin center. Minimum bin center was 0.375 mm which is representative of particles with sizes ranging from 0.250 to 0.5 in size. However, thanks to the reviewer suggestion, we have extended the plot of DDA scattering cross section down to particles of 0.125 mm in size as they are plotted for the TMM quantities for an easier comparison.

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-AC1-supplement.pdf

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