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Atmospheric Measurement Techniques Discussions

Interactive comment on "From model to radar variables: a new forward polarimetric radar operator for COSMO" *by* Daniel Wolfensberger and Alexis Berne

Anonymous Referee #2

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1 General comments

The manuscript describes a new polarimetric radar simulator for COSMO. Although polarimetric radar simulators have already been presented in the literature, the authors strived to include several novelties such as Doppler spectrum simulations from bulk quantities and a representation of solid hydrometeors scattering properties derived from MASC observations. Also, the validation is done with a substantial data set of radar observations. The originality of the scientific material makes the manuscript worth publishing in a journal like Atmospheric Measurement Techniques.

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The formal presentation of the manuscript is overall good. However, a careful proof-reading will be required before the article is published (only part of the language and math errors is reported here below). All in all, I recommend the manuscript for publication once the following specific comments have been addressed satisfyingly.

2 Specific comments

1. p3l25-27. Please split the line in two.
2. p4l14. 'Rutledge' is probably meant here instead of 'Rudledge'.
3. p5. Table 1 contains several typos: 'f' instead of 'free', minus sign instead of empty sign and vice versa, some missing information. Please check it carefully.
4. p7. In the caption of Figure 1, five radars are mentioned whereas there are only three used in the study.
5. p10l25-31. Why is it better to interpolate uncorrelated variables?
6. p10l29. The terms 'number concentration' and 'mass concentration' are both used in the text. Please specify whether you talk about the number or mass whenever the term 'concentration' is used. Alternatively, use another term, like 'contents' to refer to 'mass concentration'.
7. p11l16. Has $Q_N^{(j)}$ been already defined?
8. p11l19-20. I believe that the omission of the contribution of ice crystals in previous radar forward operators is somewhat overestimated by the authors. In particular, ice crystals are actually taken into account by Augros et al. (2016).

9. p12l1-4. I do not understand how the PSDs of ice crystals are retrieved. May the authors provide more details? In particular, I am confused with the different moments that are used.

10. p13. The math symbols 'ln' and 'log' are both used in the study. Do they have different meanings? If not, please use only one notation to avoid confusion.

11. p13. In Equation 6, z'_j and z'_k are not used consistently.

12. p16l3-4. The authors write that the T-matrix method is 'also used for solid hydrometeors (snow, graupel and hail)'. If it was also used for ice crystals, it should be added to the list of solid hydrometeors in parenthesis.

13. p17. Please check Equation 11 which contains some typos: unexpected use of 'd', use of '1' instead of 'l', etc.

14. p18l6 and p19l2. Please check the meaning of 'whereas'. I think 'while' applies better in these contexts.

15. p19. How come ZDR is always above 1 dB in Figure 6?

16. p22. I do not understand Equations 19 and 20. Why introduce f_{wet}^{ms} and f_{wet}^{mg} if they are both equal to $Q^r/(Q^r + Q^s + Q^g)$?

17. p24. Please check Equation 29. I suspect m is actually m^m. Also, are terminal velocities missing?

18. p24l13-19. I do not understand how propagation effects (attenuation, in particular) are taken into account when the number of quadrature points is increased in the melting layer only.

19. p28. Please check Equation 39. A parenthesis is not balanced, the function is not Gaussian, etc.

20. p28. Please check Equation 40 which is wrong, given the definition of k_H in Appendix C.

21. p28l15. What is gamma?

22. p32l29-31. Is μ^{rain} changed in the radar forward operator only, or in the COSMO simulations as well?

23. p34l27. I do not understand why it is argued that GPM tends to underestimate larger reflectivities to explain why larger reflectivities are present more frequently in the simulations. Attenuation is taken into account in the simulations, isn't it? Please elaborate.

24. p46l9-11. The reference is incomplete.

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