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Atmospheric Measurement Techniques
Discussions

Interactive comment on "Improved scattering radiative transfer for frozen hydrometeors at microwave frequencies" *by* A. J. Geer and F. Baordo

Anonymous Referee #2

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On the request of the editor, I am reposting my initial review here for consideration:

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The results presented in this manuscript offer significant advances to the assimilation of passive microwave radiometer data into NWP models. Although I would expect that DDA-based simulations of realistic crystals offer an improvement over Mie spheres, I was surprised to see the big improvements resulting from the pragmatic "one-shape-fits-all" approach. The ideas are presented clearly and concisely.

Without going to the details that would be outside of the scope of this initial review, I

can offer a few general points of improvement or consideration:

1. I noted that the sector snowflake, your model of choice, is the extreme (or near extreme) case in many of the plots in Figs. 2-3 (e.g. it has the lowest asymmetry parameter at all frequencies). Thus I wonder if your search for the optimal model is constrained by the available models, and that one would ideally use something outside the search range.

2. Your proposed method for histogram comparison bears close resemblance to the concept of Kullback-Leibler divergence, so I would be hesitant to call it a new statistical measure.

3. On the subject of the mass-size relations (equation 6): firstly, the exponent b need not necessarily be 3 for spheres if one uses a size-dependent density, as is quite commonly done (e.g. the snowflake model of Matrosov (2007)). Secondly, the b for your crystals (around 1.5) seems to be unrealistic for larger snowflakes, where aggregation is the dominant growth mechanism and both theory experiments indicate that b should be roughly 2 (e.g. Mitchell (1996), Westbrook (2004)) and can be even higher for rimed snow. One could speculate that neglecting aggregation is one reason why your approach performs worse for large snow - especially as you do not consider aggregates as potential models.

4. Concerning the consistency of Mie spheres: there have also recently been attempts to fix the inconsistency by using spheroidal models for snowflakes. However, the results of Leinonen et al. (2012) indicate that spheroids cannot be made consistent with physical shapes at different frequencies, either (at least in the backscattering direction).

References:

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Interactive comment on Atmos. Meas. Tech. Discuss., 7, 1749, 2014.