Atmos. Meas. Tech. Discuss., 7, C130–C132, 2014
www.atmos-meas-tech-discuss.net/7/C130/2014/

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 #1

Received and published: 6 March 2014

This manuscript is a valuable addition to the literature and a very interesting global assessment of snow scattering models at microwave frequencies. It represents a unique comprehensive global assessment of numerical modeling output combined with snow scattering models used in microwave radiative transfer simulations. Such assessments on a global scare are difficult to find in the literature, and this study pushes the modeling and microwave remote sensing community forward in a useful direction. The complex interplay between modeling output, prescribing models to represent snow and cloud ice, and underlying microphysical details related to the size distribution makes this topic particularly vexing, so it is refreshing to see an exhaustive study that tackles some of

these issues in a piecemeal fashion. While no perfect solution was indicated in this manuscript, the authors attempted to find a common-ground solution to the excessive Mie scattering issue that has been documented by numerous previous investigations and offer insightful statistical measures to document the advantage of certain DDA-based scattering models over Mie spheres.

I ask the authors to consider the following mostly minor detail-oriented comments to improve the manuscript for publication.

Section 3.1: The tropical version of Field et al. (2007) was used in this study, and I presume this methodology was applied globally to generate, eg..=, Figures 2 & 8 that show results from a broader latitudinal range. Are there potential deleterious effects for doing so, or do the authors surmise that the relative difference between the various snow scattering models will accordingly remain the same if the midlatitude Field et al. (2007) relationships are applied outside of the tropics? The Field et al. parameterization is appealing due to its simple temperature-dependence, so I am encouraged to see improved results using DDA with the Field et al. methodology versus the Mie and Marshall Palmer combination.

Section 3.1: Regarding integrating the bulk scattering properties over the size distribution, did the authors methodologically extrapolate scattering properties from the DDA databases if, for instance, the derived size distribution contained particles of sizes larger than the original DDA simulations? Or were scattering properties truncated at a dynamically maximum particle size for each of the respective snow models? This effect would probably only matter for certain DDA models like plates and columns.

Section 3.2: While I'm marginally disappointed that the frequency-dependent Mie adjustment exercises were not officially documented, it's clear that this issue exists from numerous other investigations. It is difficult to rectify using Mie scattering to represent snow in its various forms if reliable tuning mechanisms cannot be found.

Section 4.1: The authors, I believe, choose wisely to compare gross statistical measures between simulations and observations in this section.

Section 4.2: Using a new statistical approach ("h" presented in this section) seems very well-suited to this application and provides ample new insights when comparing the models.

Section 5.1: In the first paragraph, the 3- and 6-bullet rosettes, plus dendrite and sector snowflakes, are presented as the more realistic snow models, yet they individually fall on either side of the ideal fit. Would a better strategy be to take a small ensemble average of these particles' scattering properties to see if this is doctrine works better on a global scale? This ensemble strategy, however, might mask some of the deficiencies outlined on P. 18 related to individual DDA models.

Section 5.1: I find the Mie results at 10 GHz very interesting and very suggestive of major scattering issues. I do not recall any previous studies that have hinted at 10 GHz Mie-related issues.

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