Atmos. Meas. Tech. Discuss.,
doi:10.5194/amt-2016-228-RC1, 2016

Atmospheric Measurement Techniques Discussions
Open Access

Interactive comment on "A Polarimetric Scattering Database for Non-spherical Ice Particles at MicrowaveWavelengths" *by* Yinghui Lu et al.

Anonymous Referee #1

Received and published: 22 August 2016

This manuscript presents the content and some of the results of an extensive database of scattering properties of different ice particles at microwave frequencies. As the authors also note, there has been several releases of similar databases during the last eight years. These kind of databases are useful in many applications and can bring more accurate scattering properties into solving inverse problems and can also improve numerical weather models. My hope is that in the near future, there will be studies that compare these databases and how they differ in inversion problems.

For a more specific comment about your database, it's nice that you decided to store the amplitude scattering matrices in the database. This means that you also need to store each angular (scattering, azimuth, incidence) combination separately. Not many have done that and if you further add more of these angles in future releases, it can be very valuable indeed for interpolation purposes.

Printer-friendly version

Discussion paper

I have only minor corrections for this manuscript.

minor comments:

page 2, line 26: 'Examples of publically available numerical methods capable ...'

I must comment here that not all of these methods are publicly available as usable codes, only as algorithms.

page 2, line 34: You missed the database by Kuo et al. (2016). They use random orientation. There is also the database by Tyynela and Chandrasekar (2014), which also uses fixed orientation for ice crystals and it is also publicly available at http://helios.fmi.fi/∼tyynelaj/database.html, but the database itself has not been officially published.

K.-S. Kuo, W. S. Olson, B. T. Johnson, and R. Meneghini (2016), The Microwave Radiative Properties of Falling Snow Derived from Nonspherical Ice Particle Models. Part I: An Extensive Database of Simulated Pristine Crystals and Aggregate Particles, and Their Scattering Properties, J. Appl. Meteor. Clim. 55, 691-708, doi:10.1175/JAMC-D-15-0130.1

page 3, line 25: 'As such, we do not use this method ...'

It this unclear what method you are referring to here. Do you mean you are not using cubic lattice? Maybe it would be clearer if you mention that you are not using FFT and that you are using the 'sparse' mode in ADDA.

page 6, line 14: You are using the dimensional relationship and sizes of needles, but you specify them as columns. These are two different crystal types (N1e vs N1a).

page 7, line 9: 'In order to retain polarimetric information for each ...'

The motivation seems to be a bit backwards here. To me it seems like the reason for using fixed orientation is that, according to many studies (e.g., Cho et al. 1981, Thomas et al. 1990, Matrosov et al. 2005, Noel and Sassen 2005), some single ice crystal types tend to fall in preferential orientations and that is why we get more information using polarimetric observables.

Cho, H. R., J. V. Iribarne, and W. G. Richards, On the orientation of ice crystals in a cumulonimbus cloud, J. Atmos. Sci. 38, 1111-1114, doi:10.1175/1520-0469(1981)038<1111:OTOOIC>2.0.CO;2

Thomas, L., J. C. Cartwright, and D. P. Wareing (1990), Lidar observations of the horizontal orientation of ice crystals in cirrus clouds, Tellus B, 42, 211-216, doi:10.1034/j.1600-0889.1990.00001.x-i1

Matrosov, S. Y., A. J. Heymsfield, and Z. Wang (2005), Dual-frequency radar ratio of nonspherical atmospheric hydrometeors, J. Geophys. Res. 32, L13816, doi: 10.1029/2005GL023210

Noel, V., and K. Sassen (2005), Study of planar ice crystal orientations in ice clouds from scanning polarization lidar observations, J. Appl. Meteor. 44, 653-664, doi:10.1175/JAM2223.1

page 7, line 16: 'The right-handed xyz-coordinate system used to describe ... is one important coordinate system.'

The ending seems arbitrary. Why is it important?

page 8, line 9: 'Unfortunately, the GMM and DDA methods have no efficient ...'

Actually for DDA, there is a way, as described by Mackowski (2002).

Mackowski D. W. (2002), Discrete dipole moment method for calculation of the T matrix for nonspherical particles, J. Opt. Soc. Am. A 19, 881-893

page 11, line 8: 'The residual spread about the best-fit line ... is explained by near field interactions within the crystals.'

This explanation seems like a non-explanation, since DDA includes the near-field inter-

Printer-friendly version

Discussion paper

action between dipoles. You can explain anything with near-field interactions. Besides, for Rayleigh-type scattering, the induced dipole moments should be the same inside the particles, so there is no 'near-field effects'. If you want to provide an explanation, you should at least argue, how the effective density (mass for a given size) along the horizontal direction is different between the particle types, which will produce differences for Rayleigh-type scattering.

page 11, line 13: 'Finally, the spread in the backscattering cross sections of aggregates...'

You start this sentence by explaining the spread of the backscattering properties of aggregates, but you switch to explain all the types including single crystals and graupels.

page 11, line 27: You can also say that they are Rayleigh-scatterers in this orientation since the dipoles are all in phase.

page 11, line 30: You should add that, at oblique incidence for wavelength-scale particles, there are both constructive and destructive interference happening for the scattered waves.

page 12, line 21: It would have been interesting to see the scattering properties plotted as a function of the incidence angle. You already stated earlier that your database is unique in this sense, so why not then show it?

Interactive comment on Atmos. Meas. Tech. Discuss., doi:10.5194/amt-2016-228, 2016.