Atmos. Chem. Phys. Discuss., 15, C5637–C5639, 2015
www.atmos-chem-phys-discuss.net/15/C5637/2015/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Effects of dust particle internal structure on light scattering" *by* O. Kemppinen et al.

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Received and published: 5 August 2015

The manuscript makes a step towards accurate simulation of atmospheric dust particles to be used for processing various remote sensing data. The main value (novelty) is in the well-described numerical experiment, which quantifies the effect of inhomogeneity. The latter is essential for making well-informed decision on accuracy of existent and future remote-sensing retrievals. While interpretation of these data leaves many questions (see below), the manuscript is worth publishing in Atmospheric Chemistry in Physics. However, several issues need to be addressed first:

1) The manuscript is based around numerical experiments, which requires the main "set-up" (the DDA method) to be described in sufficient details, including "experimental

errors". The latter is important, since large errors will make all further quantitative comparisons meaningless. The authors do mention that the used discretization satisfy certain rule-of-thumb, however:

- any quantitative statements related to these rules were ever made only for a very limited set of test cases.

- they are surely meaningless for particles smaller than the wavelength.

See (Yurkin & Hoekstra 2011) or in more details – (Yurkin & Hoekstra, JQSRT 106:558–589, 2007).

Therefore, the authors should provide a quantitative estimate of the DDA accuracy over all test cases (and for all reported scattering quantities). At least, several representative cases should be studied using refined discretization, which can be conveniently done with –jagged command line option of ADDA. More rigorous estimates can be obtained, e.g., with the extrapolation technique (Yurkin et al., J. Opt. Soc. Am. A 23:2592–2601, 2006).

2) Related to the above is the accuracy of shape representation (stochastic errors). The authors do consider three realizations of particular shape for each set of input parameters. However, their discussion is limited to "... however, all of the results are qualitatively similar for each individual particle." (p.20362, line 24). The authors should add quantitative statements, so the reader may judge which part of differences between different particle models can be explained by "random fluctuations".

3) The conclusion does summarize the presented results, but it is hard to employ those conclusions in practice. It does says that given approximate models are not sufficient, but says nothing about other alternatives. The relevant questions are:

- is it possible to fit effective refractive index to get better agreement?

- is it possible to fit a given inhomogeneous shape with a set of ellipsoids (and fitted refractive index)?

- is it possible to employ realistic shapes in practice (retrieval algorithms) or are certain simplifications required anyway?

The authors can't answer all these questions in this manuscript. But they should at least discuss them and show the directions of future research, which would lead to the answers. Otherwise, the manuscript only answers the question that is not very interesting.

There are also several minor issues:

a) p.20363, line 23: "smaller" should probably be "larger".

b) p.20365, line 17: "extend" should be "extent"

c) I recommend combining Tables 1-5 into one (list all minerals and have one column for each case). This will lead to more compact representation.

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 20349, 2015.