Atmos. Chem. Phys. Discuss., 15, C181–C184, 2015
www.atmos-chem-phys-discuss.net/15/C181/2015/

Atmospheric Chemistry and Physics
Discussions

Interactive comment on "Technical Note: Optical properties of desert dust with non-spherical particles: data incorporated to OPAC" *by* P. Koepke et al.

Anonymous Referee #1

Received and published: 12 February 2015

General comments

The manuscript is well written and covers an update of the widely used OPAC database for optical properties of (clouds and) aerosols. I have a couple of (minor) comments, which I encourage the authors to carefully consider in order to further improve the manuscript. As the comments involve only textwork and re-phrasing, I suggest publication in ACP after these minor revisions.

Specific comments:

l. 17: I would use rather Mineral dust or Desert dust, not both.

l. 20: It is quite unusual to use referemces in the abstract.

l. 23: It is an (of course quite reasonable) assumption, that the T-matrix approach improves the phase function. Nevertheless there is no proof shown in the study, thus I would rather suggest to be a bit more conservative here and use "changes" or "assumed to improve" or something similar instead (Remember that dust particles are no perfect spheroids either).

ll. 25ff.: It would be good to provide the corresponding changes in asymmetry parameter here also, as this property is still used in a variety of applications.

l. 40: For full reliable optical properties you also need an absorption theory (not only a scattering theory) as long as you do not constrain yourself to spectral regions with very high single scattering albedo (>0.9), i.e. solar wavelengths for aerosols. I fully acknowledge that Mie is an inappropriate absorption theory as well near absorption bands.

ll. 42ff.: There is another reason. One can assume, that particles have no preferential direction, thus on average effective spheres could in many cases serve the needs quite well. Nevertheless I agree that it is a very good idea to advance beyond spherical Mie theory for dust optical properties.

l. 51: Is the "largest fraction" meant with "biggest part"? Otherwise I do not understand this sentence.

ll. 54ff.: I do not agree with this statement. Especially in recent years dust modelling has made substantial progress.

ll. 67f.: That is too much a simplification. The major error source depends on the method as well as cloud screening, surface treatment, general selection of aerosol type and optical properties, ... Moreover, passive remote sensing also includes infrared methods, which not so much rely on the scattering phase function.

ll. 70ff.: You should clarify somewhere above that your major concern is on solar wavelengths and define your spectral region of interest. In the terrestrial infrared similar problems occur, but dust absorption there easily outweighs scattering, so that the impact of particle sphericity may be smaller. Nevertheless Mie also has significant limitations in TIR, as it is a SCATTERING theory (see comment above). Thus maybe T-Matrix might also there be the method of choice (see e.g. Legrand et al., 2014).

l. 88: The authors need to show that T-Matrix really improves for the selected method. Otherwise I would be a bit careful on making such strong statement (see comment l. 23).

l. 92: I am sure there is physical reasoning for that?

l. 106: Amongst a couple of others the British-French Fennec campaign in 2011 and 2012 showed abundance of much larger particles (Ryder et al., 2013). So it would be worth stating that such a giant particle mode (effective radius around 5μm or larger) is not covered by OPAC.

l. 187: I would recommend to rephrase, as "mineral component" sounds like you are distinguishing between mineralogical abundances, i.e. taking into account variable dust composition.

l. 197: Could you also provide a physical reasoning for assuming prolate particles, i.e. from microscopic imagery? Selecting just what fits better is quite a weak justification given the assumption that you improve the phase matrix based on better physics representation.

l. 274: This holds only for methods based on reflected sunlight. Recently there has been quite an incerase in dust remote sensing methods from TIR observation. So please be more specific on spectral regions here.

l. 275: Again, this is mainly true for the shortwave radiative forcing (RF). Nevertheless dust also has significant longwave RF, which will not be effected. Over deserts it is not entirely obvious that SWRF outweighs LWRF.

l. 306: It is just not true, that solar wavelengths are "generally used for aerosol remote sensing". Please be more specific.

l. 306: As above, this statement is only corect for SWRF, not for LWRF (which is also active at night and the thus the daily sum might balance or even outweigh the solar forcing over deserts).

l. 313: There is quite some debate about this assumption. Ryder et al. (2013) report abundance of very large particles also in transported dust, SAMUM-2 as well. It will be interesting to see upcoming results of the recent German SALTRACE campaign for this interpretation, i.e. if the large particles also reach the Carribbean.

l. 376: There is pretty much literature available for sensitivity of TIR spectra to dust composition. It would potentially be worth to comment a bit on that only one specific set of refractive index is used and that deviations may occur due to dust mineralogy in the infrared (see e.g. Legrand et al., 2014).

l. 429: I am missing information about the spectral resolution in the different wavelength ranges as this also determines the applicability in many Remote Sensing studies.

Additional References:

Legrand, M., O. Dubovik, T. Lapyonok and Y. Derimian (2014), Accounting for particle non-sphericity in modeling of mineral dust radiative properties in the thermal infrared, J. Quant. Spectrosc. Rad. Transfer, 149, 219-240.

Ryder, C. L., Highwood, E. J., Rosenberg, P. D., Trembath, J., Brooke, J. K., Bart, M., et al. (2013), Optical properties of Saharan dust aerosol and contribution from the coarse mode as measured during the Fennec 2011 aircraft campaign. Atmospheric Chemistry and Physics, 13, 303–325.

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 3995, 2015.