Geosci. Model Dev. Discuss., 5, C608–C611, 2012
www.geosci-model-dev-discuss.net/5/C608/2012/

Geoscientific
Model Development
Discussions

Interactive comment on "Lidar signal simulation for the evaluation of aerosols in chemistry-transport models" *by* S. Stromatas et al.

Anonymous Referee #2

Received and published: 21 August 2012

In this paper a post-processing tool is described which can be used to derive aerosol optical properties and lidar attenuated backscatter data from the resulting aerosol information from chemistry models. The aim is to provide a tool to compare the model results directly to observables provided by active remote sensing instruments. The functionality is shown on a simplified test case and an observed situation of dust transport over the Mediterranean. The tool can be useful to obtain directly observable quantities from chemistry models which do not rely on the assumptions made in the algorithms used to provide processed data products from observing facilities. Overall the paper is well written and concise, although it could be shortened in some parts. Additionally, some careful check of language and punctuation is still necessary, acronyms and abbreviations should be written out at first occurence. I recommend this paper for publication after revisions.

Specific comments:

Section 2

The non-sphericity of aerosol particles and multi-scattering effects are mentioned as a source of uncertainty, however, this is not quantified. In particular with respect to the test cases and the case study presented later in the paper it would be important to have an estimate of the uncertainty introduced by those effects because the case studies consider mineral dust layers where this is most significant. Quantifying those uncertainties would also make the comparisons of model results to observed data more meaningful.

The formula for the molecular scattering cross section given in Eq 8 is outdated and should not be used anymore because the accuracy of modern lidar observations is better than the accuracy of this fit. Check e.g, Adam (2012), Applied Optics, 51, 2135 for updates.

Section 3

The description of the case study setup in 3.1 is not clear. What is the difference between size sections and size bins? Does “log-normal interpolation” mean that a log-normal parametrization is assigned to the size distribution? How is this done, what are the uncertainties introduced by that parametrization? If the test cases are run with just one size bin populated, what does the interpolation make of this “mono-disperse” aerosol? Possibly a plot a size distribution might be helpful to interpret Fig 3-5. Also, the different symbols those figures are difficult to distinguish – the plots might benefit from using different colors for the lines.

Section 4

The discussion of AERONET and MODIS observations seems somewhat off-topic for this paper since so far the discussion was primarily focused on lidar observations. The problem I see here is, that the aerosol optical properties derived from different

GMDD

5, C608–C611, 2012

observing techniques, such as sun photometers and lidar, will not necessarily agree with each other, especially if the measurements involve different wavelengths (see. e.g., Müller et al, 2012 doi:10.1029/2011JD016825). Neither MODIS nor AERONET measure the AOD directly, therefore one would not necessarily expect to obtain the "true" answer derived by the model from a measurement. It might be better to focus this work on lidar instruments where the results of the simulator are directly comparable with observed quantities and cut all sections discussing other measurements.

Section 5

This section could probably be shortened in some places since most of this is published elsewhere.

Section 6

Choosing a case with mineral dust is interesting to test the model performance under conditions where some of the approximations made in the model are questionable (non-sphericity and multi scattering effects). It would, however, be important to quantify the uncertainty introduced by those assumptions in the comparisons.

Other comments:

- p 1692, l 23: might be good to also cite a review paper about aerosol transport and effects on atmospheric composition
- p 1693, l 9-10: This sentence does not seem to make sense.
- p 1693, l 17: MODIS is on AQUA and TERRA
- p 1694, l 15-16: The difference of "aerosol layer" and "aerosol type" is not obvious. Rephrase this sentence for clarity.
- p 1696, l 5: Start a new sentence after (λ)

GMDD

5, C608–C611, 2012

- p 1696, l 10: an → a
- p 1696 l 24: “finer distribution“ should probably read ”finer resolution“
- p 1697, Eq 4: η has been used for the refractive index earlier. Please assign a different symbol to either of the quantities.
- p 1698, l 13: Parenthesis in citation is in the wrong place.
- p 1700, l 25: ”on Fig 2” → “in Fig 2”
- p 1701, l 1: particle optical properties
- p 1701, l 21: write out “1st”
- p 1713, l 4: “plume’s vertical extent” → vertical extent of the plume
- Fig. 1: The caption should state what “ASR” stands for.
- Fig. 4: spell out what ATB stands for at least in the figure caption or use the same symbol as in the text

---

Interactive comment on Geosci. Model Dev. Discuss., 5, 1691, 2012.

GMDD

5, C608–C611, 2012