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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Parameterization of sea-salt optical properties andphysics of the associated radiative forcing" *by* J. Li et al.

J. Li et al.

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First we would like to thank Reviewer 3 for his/her supportive review. Indeed, previous dry approaches for aerosol optical properties have not worked properly. Historically, the transport of sea salt is based on two dry size modes with effective radius 0.731 and 6.13 μm. Today, most research groups have the ability to handle a continuous wet size spectrum (http://nansen.ipsl.jussieu.fr/AEROCOM/). To match with this trend, we proposed this new parameterization which can deal with any effective radius.

Reviewer 3 pointed out that the parameterization proposed by Lewis & Schwartz (2006) does not fit the growth curve very well. We have also performed these calculations and we also found that the error produced by that parameterization is relatively large in the range of relative humidity $<$ 85%. The relative error is over 10%. However, that does not affect our results except Figure 4. All our calculations are based on exact growth

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process. Only in Figure 4, we used the Lewis & Schwartz parameterization to trace back the dry size.

As pointed out by Reviewer 3, the error in the parameterization by Lewis & Schwartz could affect the accuracy of sea-salt associated forcings. We propose a new, simple parameterization of the form

$$\eta(\mathcal{H}) = \exp\{0.331 + 0.526\mathcal{H}^2 + 0.00261/(\mathcal{H} - 1.05)^2\}$$

In the top panel of growth.pdf (ftp://ftp.cccma.ec.gc.ca/pub/jli/growth.pdf). we clearly show that the growth factor is also dependent on the dry particle size. The smaller the dry size the weaker the growth rate. However for dry particle size larger than 0.1 μm the dependence on dry size becomes very weak. We consider a mean growth factor as an average of the growth factors for dry radii of 0.1, 1, and 10 μm. In the bottom panel of growth.pdf, it is clearly shown that simple parameterization proposed above fits the mean growth curve better than that by Lewis & Schwartz.

that the simple parameterization proposed above fits the mean growth curve better than that by Lewis & Schwartz. Also this simple parameterization is cheaper in computing. We respect Lewis & Schwartz's effort for parameterizing the growth curve, however science is always in its progress.

Using this new parameterization, we re-calculate the results for the dry approach in Fig. 4. (ftp://ftp.cccma.ec.gc.ca/pub/jli/new-fig4.pdf). It is shown that the errors are reduced. This indicates part of errors are caused by the poor fitting in the growth curve.

We would like to thank Reviewer 3 for his suggestion of parameterizing dependence on effective radius explicitly. There are two important factors which have to be properly accounted for in the parameterization of sea salt optical properties, the relative humidity and the effective radius. It is almost impossible to parameterize the results as a function of the two variables and retain a simple form for the parameterization since

ACPD

8, S2397–S2399, 2008

the dependency is complicated. We therefore decided to only explicitly parameterize the results as a function of relative humidity, which have such a significant variation especially for high values, and represent the variation with effective radius with 5 fixed values. The result for other values can be obtained through simple interpolation. It is clearly shown in the paper that our method generally produces accurate results for any value of effective radius through this approach. We have noted in the paper that we make the raw data available to the reader if they decide they would like to construct a look-up table for their purposes.

Wording corrections: We thank Reviewer 3 for carefully reading the manuscript and providing these corrections, which we have included in the updated text. We are especially appreciative for noting the error in the definition of κ, which is very important.

We appreciate Reviewer 3 very much for their constructive comments.

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 5813, 2008.