

## ***Interactive comment on “Improved stratospheric aerosol extinction profiles from SCIAMACHY: validation and sample results” by C. von Savigny et al.***

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Reviewer comment:

This paper presents a brief description of the updated SCIAMACHY stratospheric aerosol extinction retrieval algorithm and demonstrates the quality of the resulting retrievals by comparison with the previous version and with the SAGE II version 6 and 7 aerosol extinction coefficient profiles. The new algorithm demonstrates substantial improvement, and the SAGE II comparisons highlight the overall agreement and specific regions with possible biases. The sample results section is excellent; it does a very good job of surveying highlights from previous studies with quantitative com-

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parison to the SCIAMACHY results obtained here. This paper is very relevant to AMT and I recommend that it be published with the following suggestions for minor revisions:

Reply:

We thank the reviewer for the encouraging and positive general comments on our manuscript.

Reviewer comment:

Abstract: The sentence beginning, “The results indicate that a series of volcanic eruptions is responsible ..” suggests that this is an original claim. The wording should more appropriately be changed to something like, “The results confirm earlier reports that a series of volcanic eruptions is ..”

Reply:

We agree with the reviewer and changed the sentence as suggested.

Reviewer comment:

8354, line 20: There is also a background size distribution from non-volcanic, natural and anthropogenic source gases.

Reply:

We certainly agree with the reviewer and think that this is correctly represented by this and the following sentences. In the same paragraph we state that OCS is one main source of stratospheric sulfur. To make this point more clear we now speak of ‘naturally produced OCS’.

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Reviewer comment:

8355, line 20: Please reference the work that first showed the effect of the minor tropical eruptions, i.e. Vernier et al., 2011

Reply:

Thanks for pointing this out. Vernier et al. (2011) is now cited here.

Reviewer comment:

8358, line 10: It would be good to reference Bourassa et al., 2007, and the OSIRIS aerosol extinction data product, for the use of the 750 nm /470 nm spectral ratio in the algorithm.

Reply:

Done

Reviewer comment:

8358, line 25: Can the authors include some results and discussion on the impact of using the Matthews (1983) climatological albedo? As the authors state later in Section 4.2, nearly all limb scatter measurements are affected to some degree by clouds below the relatively long line-of-sight, the effect of which would not be captured with climatological albedo. Why can the effective albedo not be retrieved at the normalization tangent altitude?

Reply:

A comprehensive sensitivity study of the stratospheric aerosol profile retrievals from SCIAMACHY limb-scatter observations for data version 1.1 was presented by Ernst (2013; Ph.D. thesis). As part of this sensitivity study the sensitivity to differences

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between the assumed albedo and the actual albedo was investigated. An albedo error of  $\pm 0.15$  is associated with aerosol extinction retrieval changes of 8% at most – for altitudes between 15 and 35 km. The extinction changes are generally below 4%. We added some information on this point. The reviewer is absolutely right, that albedo can be retrieved from the limb radiances at higher tangent heights. This will be done for future versions of the data product.

Reviewer comment:

8361, lines 1-10: It would be beneficial to add a discussion on the possible systematic bias due to uncertainty in the assumed scattering phase function and how that relates to the solar scattering angles of the SCIAMACHY orbit.

Reply:

This is a very good idea. We added a brief paragraph pointing out that differences between the assumed and the actual particle size distribution are associated with the 'assumed' and actual scattering phase functions. These differences can well explain the differences shown in Fig. 3. However, it is impossible to make quantitative statements about the expected retrieval errors – and their dependence on scattering angle and hence latitude – without making specific (and arbitrary) assumptions on the assumed and the actual size parameters.

Reviewer comment:

8362, line 24: Why is the term "backscattering" used here? In fact, for the northern hemisphere, the SCIA observations are in a forward scatter geometry.

Reply:

The reviewer is correct, the wording is not very precise here. We replaced 'backscat-

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tering' by 'limb-scattered radiance'.

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Interactive comment on Atmos. Meas. Tech. Discuss., 8, 8353, 2015.

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