

Dear Reviewer,

Thank you very much for your careful review and helpful comments. We have addressed each point below. Reviewer comments are in **black**, and our responses are in **blue**.

Best wishes, Christine Pohl, Ulrike Niemeier and Co-Authors.

In the paper “Evaluating SCIAMACHY-retrieved and ECHAM-simulated stratospheric aerosol characteristics by their comparison after volcanic eruptions” the authors have looked at three different SCIAMACHY-retrieved aerosol data products (v2.0 PSD, SCIA PSD N_WY and v3.0), SAGE II measurements and multiple configurations of the ECHAM model with the goal of demonstrating the usefulness of the SCIAMACHY v2.0 PSD aerosol product. Retrieval of aerosol information in the stratosphere from limb looking instrumentation is challenging and this paper provides useful information related to both the v2.0 data product, and the ECHAM model and how it can be used alongside the measurements to inform on their quality. In the end the authors conclude “This makes the SCIAMACHY v2.0 PSD a valuable data resources, ...”, and I agree. Although the work is not definitive, it belongs in the open literature as it adds yet another piece to the puzzle. Because they speak truth, the last two sentences of the paper explain very nicely why I agree with the value attributed by the authors to the data product. I suggest this paper be accepted with a few revisions/suggestions that I feel are not onerous.

Suggestions

Although I like the synergistic use of the model and the measurements, it seems to me that it could be perceived that the outcome of the study may have been predetermined and that the methodology and analysis were designed to get to the desired result. I would suggest that the authors spend a little time convincing the reader that tweaking the model parameters, so the model agreed well with the other two data products wasn't the right way to go.

[Please see the comment below.](#)

I understand the authors feel more confident with the v2.0 data product, but the reader could maybe use a little more convincing that it was the clear choice.

[Thank you for that comment. We have added a corresponding statement highlighting the advantages of SCIAMACHY v2.0 in the Conclusion:](#)

Comparison with SAGE II data further shows that the SCIAMACHY v2.0 PSD retrieval yields Ext values in better agreement with SAGE II than the direct SCIAMACHY Ext retrieval, supporting that the v2.0 PSD approach provides more realistic Ext. The provision of aerosol size information is an additional advantage of the SCIAMACHY v2.0 PSD approach. Modifications in the assumed N profile slightly affect the magnitude of Ext and τ_{eff} , but have little influence on the vertical profile shape. Given the limited availability of remote-sensing observations of aerosol size, SCIAMACHY v2.0 PSD therefore provides a valuable data resource for studying stratospheric aerosol evolution.

I am not overly familiar with the model parameters that were tweaked and although I think the authors addressed the impact of changes to the parameters, I don't have the background to fully understand these impacts. I would ask the authors to revisit this section with a view toward the measurement community. Is it possible to add a few more sentence, or a paragraph or two, to assure the measurement community that the model is not just being tweaked to make the measurements look better? The shortcoming may be with me, so I trust the authors to add these extra words only if they are necessary.

We thank the reviewer for raising this important point. We agree that it should be made clearer that the ECHAM simulations were not tuned to the SCIAMACHY observations. We therefore added the following section at the end of the Methods section:

Note that the model setup was defined independently of the SCIAMACHY observations and was not optimized to enhance the agreement between the model output and the satellite observations. Thus, the comparison between ECHAM and SCIAMACHY in Sect. 3 is based on independent results.

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Since the introduction to the ECHAM parameter study (Sect. 4.2) could be misleading (former version: "In order to obtain model results closest to the satellite retrieval data, we modified several parameters..."), we have also revised this paragraph as follows:

To identify possible reasons for the differences between SCIAMACHY observations and ECHAM simulations, we modified several ECHAM parameters, including the vertical injection profile, the horizontal injection area, and the aerosol background conditions. We also investigated the role of nudging to ERA5 reanalysis data. The results of these test simulations, shown in Figs. 7 to 10, demonstrate the importance of these factors for realistic simulations.

I am curious as to what was learned about the other two data products used within this

study. If the authors have anything to say about future work with these products, a paragraph devoted to them in the Conclusions would be useful.

Thanks for your curiosity. The SCIAMACHY PSD N_Wy retrieval was generated specifically for this study to investigate the effect of N on retrieval results. SCIAMACHY Ext retrievals are merged with other satellite datasets into the climate data record of stratospheric aerosols (CREST, Sofieva et al., 2024). We have added this description in Section 2.

No future work is planned for these products so far.

Summary

I would like to thank the authors for their contribution to an interesting and challenging area of research. Keep up the good work.