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Atmospheric Measurement Techniques Discussions

Interactive comment on "A study of the approaches used to retrieve aerosol extinction, as applied to limb observations made by OSIRIS and SCIAMACHY" *by* Landon A. Rieger et al.

Anonymous Referee #3

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General comments on Rieger et al. (2018):

I look forward to reviewing a revised version of this paper. It is a well-defined study that addresses several important questions about limb scattering aerosol extinction retrievals, and makes useful recommendations for how they can be improved.

Unfortunately, the current version of this paper has a glaring deficiency: Most of the figures have been distorted at some point between their creation by the authors and their presentation in this journal. The fact that 7 of the 9 figures are in such poor condition makes the paper frequently tedious (and sometimes impossible) to review properly. Fixing this situation during the revision process will enable much more detailed analysis

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Discussion paper

of the work.

Specific comments:

Sect. 1, last paragraph:

Text should say "...a triple comparison among OSIRIS, SCIAMACHY and SAGE II..."

Sect. 2.1:

It would be useful to give the values of the assumed refractive index at the relevant wavelengths (470 and 750 nm).

The parameters m and N should also be defined more clearly.

Equation (1) also appears to contain an error: If N = the number of altitudes averaged together to produce the altitude normalization, then the summation should cover $j_{ref} = m$ to $j_{ref} = m + N - -1$.

The next-to-last sentence of this section is also confusing: It states that "a modelled measurement vector assuming a molecular atmosphere... is also used as a normalization." Is this always done? If so, then why is it not included in equation (1)? And if not, how does the algorithm decide when it should be done or not done? And does one form of normalization replace the other, or are both used together? Finally, how does this change improve the convergence speed? (Some of these may be answered in another reference, so a citation may be all that's needed here.)

Sect. 2.2, 1st paragraph:

The fact that SCIAMACHY views the atmosphere in the "ram" direction (viewing direction aligned with satellite motion vector) should also be mentioned.

Sect. 2.2, 2nd paragraph:

Just to clarify: The v1.4 algorithm uses a fixed a priori extinction profile for altitudes outside the retrieval range, regardless of how large the difference between the a priori

and retrieved profile becomes? So the aerosol extinction profile used to simulate radiances by the radiative transfer model during the retrieval will contain (sometimes large) discontinuities at the edges of the retrieval range?

Sect. 2.2, 3rd paragraph:

Similar to the previous comment, it would be useful to give the assumed refractive index value at 750 nm.

Sect. 3, 1st paragraph:

The coincidence criteria are clearly stated and reasonable, but was an assessment of the resulting set of coincidences done to detect cases for which these criteria were met, but significant geophysical variability occurred between the 2 observations being compared? The relatively high sampling of the limb scattering measurements might make such an assessment possible, and it would be interesting to estimate how much of the differences between the occultation and scattering retrievals might result from true atmospheric variation (rather than deficiencies in either measurement).

Sects. 4 - 6:

This part of the paper contains many useful points, but it is difficult to evaluate the claims without better versions of the figures. Specifically:

Fig. 1 - Latitude ranges (upper right corner of each panel) are illegible, $x-$ and $y-$axes are not labeled, and legend (indicating the meaning of the line colors) is blank

Fig. 2 - Legend is again blank, $y-$axis numbers are garbled, and $x-$ and $y-$axes again are not labeled

Fig. 3 - Same problems as Fig. 2

Fig. 5 - Legend is again blank, and $x-$ and $y-$axes again are not labeled

Fig. 6 - Same problems as Fig. 5

Fig. 8 - Same problems as Fig. 1

Fig. 9 - Same problems as Fig. 1

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