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Atmospheric Measurement Techniques Discussions

Interactive comment on "Stratospheric aerosol particle size information in Odin-OSIRIS limb scatter spectra" *by* L. A. Rieger et al.

Anonymous Referee #2

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This paper is clearly written and contains some useful results, but some of the analysis is incomplete and/or confusing. With some sharpening of the presentation, I believe it could be improved significantly. Some of its conclusions are negative (describing approaches that upon examination do not prove to be beneficial), but that can still be positive for the community (providing information for both the community evaluating data collected by current sensors and the community focused on building future sensors). I hope that the authors will consider addressing the following areas in the revised manuscript:

Page 5067, Section 1, 1st paragraph:

When describing the "simplicity" of the occultation technique, it would be helpful to

note that (in the case of SAGE, and probably other occultation instruments as well) the aerosol extinction is computed as a residual: The extinction due to Rayleigh scattering and all gaseous absorbers is estimated first, and any remaining signal is treated as aerosol extinction. This procedure clearly allows errors from a variety of sources to "accumulate" in the aerosol extinction estimate, complicating the interpretation of the aerosol retrieval.

Page 5069, text prior to equation (3):

Presumably the "modeled Rayleigh signal" is calculated for the same viewing geometry as the measured radiance, using an assumed atmosphere that contains no aerosol?

Pages 5071-5072:

The result shown in Figure 2 and the accompanying analysis seem surprising to me: The extinction ratio is said to differ most (between ascending and descending node observations) for the tropics at 25-28 km, with much lower bias for higher latitudes and lower altitudes. I would like to see the variation with altitude and latitude quantified, and also discussed further. For example, your result presumably means that the assumed aerosol microphysical properties are most correct at 25-28 km in the tropics. How low are the "lower altitudes" considered? Do you look into the upper troposphere / lower stratosphere (UT/LS) region? Such a simple, static model of aerosol microphysical properties seems less likely to resemble the true atmospheric conditions in the UT/LS region, or in higher-latitude regions where tropopause folds, etc. appear in the 10-20 km altitude range. Can you comment on this issue further?

Page 5072, 1st paragraph:

It would be helpful to present the 470 nm measurement vector kernels in Figure 4, to illustrate the point that you make in this paragraph.

Page 5077, equation (14):

The atmospheric state vector x should be defined clearly, since this symbol was used

earlier in equation (5) with a different definition.

Pages 5078-5079:

First sentence should read “measurement errors for the optical spectrograph and infrared imager are quite different. . .”

Also, how does the timing of the optical spectrograph observation (taken sequentially at numerous tangent heights) compare to the timing of the 30 or more infrared imager observations that are averaged together? I’m concerned that systematic effects (such as changes of the underlying scene) should affect the two observations differently, but that possible error source is not mentioned in the text.

Pages 5082-5083:

Could you include some references to support attributing the change in retrieval accuracy to the Mt. Manam eruption?

Page 5084:

Can you flesh out the statement that “While the wavelength difference accounts for much of the discrepancy some is likely due to the particle size assumptions”? These could (and should) be estimated, based upon the assumptions that are made for aerosol microphysics.

Table 1:

These criteria are used for both mode radius and aerosol extinction, correct? In that case, some clarification is required (units, what is done when convergence requirements are met for one parameter, but not the other, etc.).

Figure 3:

Adding a percentage difference plot of y would improve this figure.

Figure 7:

Relative errors (rather than absolute errors) would be much easier to interpret, especially in the case of extinction.

Figures 9 and 10:

I would like to see the geographic locations of the SAGE / OSIRIS coincidences. Based on the information given, it is difficult to reconcile Figure 9 (showing that Version 6 improves the retrieval relative to Version 5) with Figure 10 (showing little / no improvement for Version 6 relative to Version 5).

Interactive comment on Atmos. Meas. Tech. Discuss., 6, 5065, 2013.