Interactive comment on "Odin-OSIRIS stratospheric aerosol data product and SAGE III intercomparison" by A. E. Bourassa et al.
Anonymous Referee #1
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Authors' response in red: Thank you for the review and the suggested changes. We are pleased to respond with a revised manuscript.

General comment
This paper deals with an improvement of the OSIRIS/Odin aerosol retrieval algorithm. The change in algorithm is not very dramatic but anyhow important. The paper is well written and with a few exceptions readable. I would like to suggest that this paper should be published in ACP. I have the following rather minor comments on the paper:

Comments
p 25789, line 7: I would like to suggest that you define the normalized radiances by an equation.
Done, we have added what is now Equation 2.

p 25789, line 17: How do you estimate the stray light contribution?
Stray light is any anomalous systematic increase in high altitude signal beyond the measurement noise, which is well characterized. Because the measurement vector is by definition zero within measurement noise within the reference tangent altitude range, the stray light signal is easily identified and avoided in the retrieval. We have added a sentence in the text to clarify this point.

p 25791, line 13: Is the SASKTRAN calculation single or multiple scattering calculation?
The SASKTRAN calculation is a multiple scattering calculation in a fully spherical geometry that uses the successive orders of scattering technique. These details are now included in the text.

p 25791, line 24: Eq. 3: You are missing tildes above the normalized radiances in both terms. Or ...?
As explained in detail in the following section (2.3), the radiances are not normalized as we introduce a new technique for normalization of the measurement vector itself.

p 25791, line 24: Eq. 3: y has now an extra subindex k. What does it mean?
Yes, we have removed it. Thank you.

p 25793, lines 4-19: Could you rewrite this part a little bit. If we assume that all observed signals are related to true radiances by calibration factors that depend on altitude and wavelength, derive the normalisation factor in Eq. (4).
We have added what is now equation 6 to derive the normalization factor that makes this new expression of the normalization equivalent to that shown in equations 1 and 2. This should now be clear.

p 25796, line 7-: The comparison to the earlier version of the OSIRIS aerosol product is missing. We need to know how much this new product differs from the old one and is it in better agreement with validating measurements. Please, add this information.
This is the first release of an OSIRIS aerosol product and there is no "earlier version" to compare to. We reference the previously published algorithm and show how the sensitivity is improved with the new technique with the averaging kernels given in Figure 2. We feel that the good agreement of the aerosol

product with the SAGE III measurements is the important element for this work and for users of the data product.

p 25798, line 25: Why do not you plot the distribution of r values? What kind of random variable is r? If the nominator and denominator are taken as random variables, the ratio may well be quite a complicated animal.
We have included the r statistic following the work of Thomason et al., 2010, to be consistent. The good correlation between the two data sets, which is demonstrated by Fig 5 is the important thing. Indeed the ratio r may not be normally distributed, but including the mean and standard deviation still provide the reader with a quantitative feel for any bias and the spread of the measurements.

p 25798, line 10: You are introducing here still one more ratio. What is the agreement between OSIRIS and SAGE III Rayleigh extinctions? If they do not agree, the figure 6 is not so useful.
This is a good point; however in both cases the extinction ratio is calculated using a modelled Rayleigh extinction (not measured). The SAGE III Rayleigh extinctions are determined using the NCEP p/T and the OSIRIS Rayleigh extinctions are found using ECMWF p/T. Throughout the lower stratosphere these data sets should be highly consistent and any error from this term negligible with respect to the measured aerosol extinction.

p 25807, Fig. 3: The y-axis goes down to 10 km but curves are shooting out from the frame. Cut altitude axis or extend x-axis.
Here we are mostly concerned with the features in the extinction profile in the lower stratosphere, so we have zoomed the plots to best show this range. We hope it is appropriate.

p 25808, Fig. 4: Add zero-lines to subplots.
The zero lines are in fact there already as well as +/- 50% difference lines; however the light gray color might not show up well. We will ensure that the figure is clear when we preview the final document.