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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 #1

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General comments: This paper deals with aerosol retrieval algorithms applied to limb scattered solar radiation measured by OSIRIS and SCIAMACHY. The paper is well written and contains interesting and important observations for users of OSIRIS and SCIAMACHY aerosol data. One part of the paper, Sec. 4, is in my mind a little tedious reading if you are not expert user of aerosol data from these instruments. Anyhow, I would like to recommend the publication of this paper in AMT. I have the following comments and questions.

Specific comments: 1. p.3, Eq. (1): I don't find this equation from Bourassa (2012). Please explain and add general explanation why this odd complicated form. 2. p.3,

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Eq.(1): Please explain N and m. 3. p.3, line 20: How do you determine where the aerosol contribution and stray light are at minimum, they both are unknowns? 4. p.3, line 18: At reference altitude, where do you get the reference atmosphere for the model vector? 5. p.4, Eq. (2): Please use the same ratio format as in Eq (1). 6. p.4, Eq. (2): Please explain what is the reason for these two very similar approaches (Eq. (1) and Eq.(2)) being still not identical? 7. p.4, Eq. (2): On line 11 you said that you drop the shorter wavelength normalisation, so what is lambda_ref in this equation? 8. p.4, line 18: Because your notation does not show that you normalise I by radiance from reference altitude, express this fact more clearly. Your I's are not measured physical quantities but ratios. Same applies to Eq. (1). 9. p.4, line 18: Same as above, what is your reference atmosphere? Is it same as with Eq. (1). 10. p.4, line 24: A constant S/N-ratio of 200, how is it possible? Radiance varies a lot as a function of altitude and wavelength. 11. p.5, line 2, SAGE was launched in 1984. 12. p 15, Fig.1: The legend box shows lines but not text Also axis labels are missing. These two things seem to be a problem for many other figs in this ms (only Fig. 7 looks OK). I have not been able to get a pdf of this ms. where figures are OK. 13. Sec. 4: I found this section quite tedious to read, that's why I have no specific comments except the following: 14. Sec. 4: Method: Use are using a method where you cross feed each intrument's retrieval system by data from other instrument's radiative transfer model. OK, perhaps this is a valid approach. I would like to see a more traditional approach as follows: 1) Agree about the atmospheric model or models (nor agreeing completely with a priori in retrievals), 2) Perform the radiative transfer calculation using Monte Carlo or other reasonably accurate scheme, 3) Make instrument simulations using OSIRIS and SCIAMACHY instrument simulation software (adding also noise), 4) Carry out retrievals for the synthetic data, 5) Compare results to the original atmospheric model. This ignores probably stray light but I do not know what to do with that. Is this approach too demanding for available time and resources? 15. p12, line12: "Robust measurements of high altitude aerosol. . .". What kind of instruments are you thinking about?

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