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

Anonymous Referee #1

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Thank you for your response to my comments. I do agree that we have a few "central disagreements". While I do believe that the work presented in your paper is quite a worthwhile study in the context of OSIRIS research, I still fail to see how the community can benefit from it. Yes, you have removed an angular bias, but at the cost of increased noise. A few points: (1) you yourself conclude that getting size distibution from OSIRIS multi-angle observations is fruitless. Note that it may work for a different Limb Scatter (LS) sensor with a wider range of Single Scatter Angles (SSA), but OSIRIS has a limited range (SSA=90+-30 degrees) (2) it is indeed unfortunate that the imager is "noisy". If it was not noisy, then your methodology would have improved OSIRIS aerosol product and that would have been quite valuable to the community, who as you surely know, is in dire needs for information on global stratospheric aerosol

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data. (3) you central point that no size information can be retrieved from visible and NIR wavelengths is fundamentally flawed. The method has been used by SAGE and POAM to infer valuable information on aerosol microphysics. While LS sensors may be blind to shorter wavelengths, aerosol extinctions can be retrieved independently at a series of wavelengths over a wide spectral range, the range depending on SSA. As SSA is decreased, the forward peak of the aerosol phase function ensures that aerosol scattering dominates over Rayleigh, even at shorter wavelengths (450 nm), and even more at longer wavelengths (NIR). So, your point (which I believe is not valid even for OSIRIS), is definitely not valid for LS sensors in a sun-synchronous orbit, such as OMPS or SCIAMACHY. (4) While I would agree that there is as yet no definite method to retrieve aerosol particle size from LS measurements, I want to make two points: a. What you propose here will not help the field: your first method (angular) has failed and your second cannot be used by present or future LS sensors since they do not have a 1.5 micron imager b. It is obvious (from SAGE/POAM) that spectral data can yield some information on particle size. You do not need to "prove" that point. What the community needs is to determine what (how much) size information can be retrieved. Probably only one piece of information, such as one moment of the size distribution, or one of the two parameters defining the lognormal distribution: Mean radius if you con-fine mode width to a constant value, or vice versa. It may be that SCIAMACHY data can yield even more information than OSIRIS or OMPS since SCIAMACHY spectral cov-erage is very large and extend well into the IR where Rayleigh scattering ie relatively small (5) The Angstrom parameter can be retrieved directly from analysis of the extinc-tion spectral shape. The spectral shape is a "strong and unambiguous" parameter if you have sufficient spectral range (wavelength ratio of 2 or more). So your analysis may be better behaved (less sensitive to noise) if you were to derive the Angstrom parameter from your derived extinction at 770 and 1550nm, and subsequently derive a mean mode radius from Mie theory. Rather than derive a mean mode radius through a nonlinear method to then compute the Ansgtrom coefficient.

Specific comments: (1) Again, this figure does not show that you need IR wavelengths

to get particle size from LS sensors. It may only show that your present retrieval method is insensitive to particle size. But it seems you make it more general than it is, and it seems that you are implying that your conclusion is universal and applies to all LS sensors and all retrieval algorithms (2,3) The aerosol phase function varies markedly near forward peak. My statement of "flat" around 90 degrees is to be understood on a relative sense. And indeed a real problem is that the phase function cannot be accurately evaluated since the particle ensemble size distribution is so fuzzy. But I believe that this area is where the work should be done to help the LS community. Tie particle size distribution (with uncertainty on mode radius, mode width, uni-modal, bi-modal, refractive index, particle shape...) directly to the Ansgtrom coefficient, which is a macro parameter which can be derived from the spectral shape of either the extinction (thru iterative process) or even the raw radiances. That is a difficult task, but a necessary one Incidentally, in LS, the exinction retrieval has to be done at same time as retrieval of size: the LS needs a combined retrieval. The problem is Non-linear, and probably necessitates some initial a priori size/extinction, and an iterative process which must converge. Not an easy problem. That is why I am concerned with the rather complex formalism described in the paper. Not because the problem is complex, but rather because the described method is unnecessarily convoluted.

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

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