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Interactive comment

Interactive comment on "Evaluation of a Method for Converting SAGE Extinction Coefficients to Backscatter Coefficient for Intercomparison with LIDAR Observations" *by* Travis N. Knepp et al.

Anonymous Referee #1

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This is a well written paper dealing with a very important issue in observing stratospheric aerosols. The paper analyzes the SAGE II and SAGE III ISS extinction data at multiple wavelengths, makes very reasonable assumptions for a Mie scatter model, and then computes the 180 degree backscatter. SAGE II is a very long and important data set and hopefully if SAGE III operates for many years it will be equally valuable. Lidars can complement the satellite aerosol measurements by giving measurements at a single location with high time and altitude resolution. But the valuable quantity is extinction, not the lidar 180 degree backscatter, so the Lidar Ratio (Ext/Backscatter) is needed for the conversion. The paper analyzes the SAGE data to show different wavelengths give self-consistent results, and quantifies the errors. The time period

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Discussion paper

includes both the Mt. Pinatubo eruption and the relaxation to background conditions. The Lidar Ratio is seen to smoothly change during the eruption which is very useful for interpreting lidar data taken during the eruption. The only major comment is that the backscatter wavelength from the three lidars is 355 nm. Lidar measurements at 532 nm may be even more numerous and have an advantage in signal to noise. The fundamental lidar quantity is the ratio (molecular + aerosol)/molecular scatter. The aerosol scatter at 355 and 532 nm will be similar but the molecular scatter at 355 will be 5 times stronger than at 532 nm. So you are effectively looking at smaller changes in the ratio. It would be valuable to repeat the analysis for 532 nm backscatter.

Interactive comment by Bingen: If I understand her correctly Bingen is saying this paper implies beta is not wavelength dependent, which it clearly is. Line 166 states that beta(Sage) is independent of wavelength combination. I take this to mean that different combinations of the SAGE wavelengths can be used in the analysis and the results are the same with error bars. This is a strong result of the paper and maybe it can be explained better.

In the second part of Bingen's comment she makes the point that a comparison of S should be made with this paper and previous papers. I would agree. Papers by Jaeger et al. (already referenced), Bingen (referenced in comment), and Altuna (below) are ones I know of.

Antuña, J. C., A. Robock, G. Stenchikov, J. Zhou, C. David, J. Barnes, and L. Thomason, Spatial and temporal variability of the stratospheric aerosol cloud produced by the 1991 Mount Pinatubo eruption, J. Geophys. Res., 108(D20), 4624 (2003).

Antuña, J. C., A. Robock, G. L. Stenchikov, L. W. Thomason, and J. E. Barnes, Lidar validation of SAGE II aerosol measurements after the 1991 Mount Pinatubo eruption, J. Geophys. Res., 107(D14), 4194 (2002).

Specific comments:

Line 72: charge coupled device (with) a resolution . . . Line 88: typo . . .Backscatter . . . Line 128: Why was this sigma range chosen? Is there a reference? Line 141: You might add a note that although Ext/beta is defined as S, Ext and beta are normally at the same wavelength. In this paper you sometimes use this quantity with two different wavelengths. Figure 6, 7, & 8: The legend overwrites some of the data. Can this be fixed?

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