Atmos. Meas. Tech. Discuss.,
doi:10.5194/amt-2020-277-RC2, 2020

Atmospheric Measurement Techniques
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Discussions

Interactive comment on "Retrieval of stratospheric aerosol size distribution parameters using SAGE-III/ISS extinction measurements at three wavelengths" *by* Felix Wrana et al.

Anonymous Referee #2

Received and published: 2 November 2020

Review of AMT-2020-277: Wrana et al., "Retrieval of stratospheric aerosol size distribution parameters using SAGE-III/ISS extinction measurements at three wavelengths"

Summary: Variability of the natural stratospheric aerosol (SA) layer properties relevant to climate and chemistry remains an important field of active research. Wrana et al., present an approach to remotely monitor two properties of the SA particle size distribution using solar occultation measurements like those furnished by the SAGE III/ISS mission. The article reads well, clearly presents the problem and their approach to a solution. It certainly is among the first to apply such an approach to the new SAGE III/ISS data set. However, it is not clear in what way this work is different in princi-

ple from previous publications that have retrieved mono-modal lognormal size distribution properties from multi-wavelength aerosol extinction coefficient measurements , such as Wang et al., 1994 (doi: 10.1029/JD094iD06p08435) or Bingen et al.. 2004 (doi:10.1029/2003JD003518). The article is worthy of publication once the truly 'novel' portions are clearly defined and substantiated.

Comments:

1. Article should include reference to Wang et al., (doi: 10.1029/JD094iD06p08435) who used multi-wavelength SAGE II aerosol extinction to retrieve SA parameters using single-mode lognormal & modified gamma representations.

2. Abstract, first sentence: It is not clear to me what is 'novel' about this approach in view of previously published work.

3. The assumption of composition is understandable in view of the stated research goal to support the investigation of the impact of volcanic eruptions on climate and atmospheric chemistry. However, analysis should be done regarding errors in composition, specifically biomass burning events that have occurred during the first three years of SAGE III/ISS operations. It would be interesting to see when the 'validity-check' with the Angstrom exponent fails. Maybe it is an indicator of a situation of improper composition assumptions.

4. Given that the focus is volcanic eruptions, the authors should examine the case of bimodal size distributions or cases that are more representative of time following an eruption. The conditions of June 2017 were fairly unperturbed with respect to stratospheric aerosols.

5. The authors have a sound approach to choosing wavelengths for the retrieval, paying attention to the quality of the SAGE III/ISS data. However, the relative uncertainties shown in Table 1 are twice as large at 1543nm compared to those at 1021nm. There should be a discussion of how the 'increased information content' available at 1543nm

vs. 1021nm out-weighs the increased uncertainty.

6. Line 148: "...while avoiding potential problems..."

7. In the left panel of Fig. 2 and Fig. 3, how do you reconcile the multiple solutions near the coordinate (0.13, 2)? The narrowest distribution oscillates across several slightly wider distributions.

8. Lines 165-169 mention limiting the width to sigma < 2 to cover cases in general and cites previous work showing values not exceeding 1.9. However, given the limitations of the Mie kernels, it is not clear how the previous work would not have a similar limitation as this current work. That is, does the previous work invoke a similar assumption/limitation on the distribution width?

9. Line 235: "which" instead of "wich"

10. Line 338: "aerosol" instead of "aerol"

11. Line 350 mentions "both validation methods suggest", but it is not clear to me what method other than the Angstrom exponent computation is used for 'validation.'

Interactive comment on Atmos. Meas. Tech. Discuss., doi:10.5194/amt-2020-277, 2020.