Atmos. Meas. Tech. Discuss.,
doi:10.5194/amt-2019-342-AC1, 2020


Atmospheric Measurement Techniques Discussions



# *Interactive comment on* "Issues related to the retrieval of stratospheric aerosol particle size information based on optical measurements" *by* Christian von Savigny and Christoph Hoffmann

**Christian von Savigny and Christoph Hoffmann**

csavigny@physik.uni-greifswald.de

Received and published: 3 February 2020

## Reply to the comment by Alexei Rozanov

**Comment:** Dear Christian and Christoph,
In your paper you show very interesting results illustrating that a weaker sensitivity of the solar occultation measurements to smaller particles is expected to lead to the overestimation of the mode radius and underestimation of the particle number density if a coarse mode is present but not considered in the retrieval. However, you tend to overgeneralize your conclusions. As shown by Malinina et al. (2019), not mentioned in your paper by the way, the sensitivity of the limb measurements to



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Discussion paper

smaller particles is very different to that of solar occultation. For this reason I disagree with a blind extension of your findings to the limb geometry as you do, e.g. by writing "Stratospheric aerosol particle size retrievals from satellite limb-scatter measurements can be expected to be affected by similar issues as the occultation and lidar retrievals described here. " To my opinion this statement is unjustified and should be removed.

**Reply: Dear Alexei,**
**we weakened the statement by replacing "can be expected to be" by "may be". However, we don't fully agree with this comment. We agree that there are differences in sensitivities between occultation and limb-scatter measurements, but we see no reason, why limb-scatter measurements should not in principle also be affected by the problem discussed in the paper.**

**We now also cite and briefly discuss the paper by Malinina et al. (2019).**

**Comment:** Furthermore, with the last sentence of the abstract "The results question the overall significance of stratospheric aerosol size retrievals based on optical satellite or lidar measurements, as long as the actual aerosol particle size distribution is not well known." you provide a misleading message to the scientific community. First, based on the results of your paper you can only talk about solar occultation measurements and must not generalize your conclusions to all optical satellite methods, second a known bias in the retrieval products is not yet a reason to question the significance of the retrieval/measurements in general.

**Reply: We agree in part that the statement can be misinterpreted. We agree that we only investigated the effects for lidar and occultation measurements and not for limb-scatter measurements. Still, there is no reason why retrievals based on limb-scatter measurements should not be affected by this problem. We changed**

**this sentence and now only make a statement about lidar and occultation measurements. The sentence now reads:**

**"The results indicate that stratospheric aerosol size retrievals based on occultation or lidar measurements have to be interpreted with caution, as long as the actual aerosol particle size distribution is not well known.“**

**Comment:** One more technical issue is in the first paragraph of the “Methotology” section “Aerosol particle size information can in principle be obtained based on measurements of (a) the spectral dependence of the aerosol extinction or scattering coefficients (e.g., Yue and Deepak, 1983; Bingen et al., 2003), (b) the scattering phase function (e.g., Gumbel et al., 2001; Renard et al., 2008), or (c) the polarization of the radiation scattered by aerosols (e.g., McLinden et al., 1999).” Here you seem to forget that in limb retrievals the spectral dependence of the radiance rather than that of the extinction or scattering coefficient is used (Malinina et al., 2018).

**Reply: We agree with this comment. We had implicitly included limb-scatter measurements in point (a), which is certainly not entirely correct. We now added limb-scatter measurements explicitly as new point (b).**

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Interactive comment on Atmos. Meas. Tech. Discuss., doi:10.5194/amt-2019-342, 2019.



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