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Atmospheric Measurement Techniques Discussions

Interactive comment on "A new approach for measuring the UV-Vis optical properties of ambient aerosols" *by* Nir Bluvshtein et al.

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We would like to thank the Reviewer for his/her helpful remarks. Below, please find our detailed point by point replies to the comments made by the Reviewer.

Page 6, line 24-26. The use of a power law for the alpha_abs seems specifically designed to capture brown carbon. What would the appropriate spectral dependence be for black carbon if that were the only absorbing component, and would the power low represent black carbon well in that situation?

Pure black carbon was shown (Moosmuller et al., 2011) to have a distinct power law behavior of absorption with AAE of 1. However, there is no inherent limitation in the presented approach that would prevent fitting of a power low with AAE of 1 or any other AAE that would represent a combination of internally or externally mixed BC and BrC

as long as the total absorption behavior dose not significantly differ from a power (or exponential) behavior in the selected wavelength range.

Page 9, section 3.1 and Figure 5. A few questions / comments.

1) The relative errors are large in extinction due to absorption (and in imaginary refractive index) and small in extinction due to scattering and in total extinction (and real refractive index). One would guess that large errors in absorption would translate directly into large errors in SSA, which is directly proportional to absorption, yet errors in SSA are much smaller. Some explanation is warranted. The SSA is directly related to extinction and also to either the scattering or the absorption in a straightforward way that depends on how you choose to calculate it. The errors on SSA are also related in the same way. The closer the SSA is to a value of 1 the more its errors are related to the errors in the scattering. The closer the SSA is to a value of 0 the more its errors are related to the errors in the absorption. An example for the following "true" values: Ext = 100, Abs = 5 (Sca = 95, SSA = 0.95) and with errors of +-5% on Ext and +-500% on Abs. The errors on the Sca and on the SSA would be about +-25%. for the following "true" values: Ext = 100, Abs = 50 (Sca = 50, SSA = 0.5) and with errors of +-5% on Ext and +-500% on Abs. The errors on the Sca and on the SSA would follow the errors on the Abs, namely about +-500%.

2) Relative errors are given with no indication of the sign of the errors. Does this analysis reveal any systematic deviation, or are the errors simply distributed about zero?

The distribution of errors around zero is strongly related to the instrumental wavelengths used, to the wavelength range chosen for the extrapolation and to the wavelength range presented (300-400 nm, 400-500 nm etc.). In our analysis errors in some presented wavelength ranges were skewed to negative error and some to positive. Because of the subjective nature of the error distribution we chose to preset its absolute value and not its direction.

3) If I understand this procedure correctly, the measured values are assigned to the correct value in the synthetic data for the purpose of testing the retrieval. Please correct if I have misunderstood. What would be the effect and / or additional error in the retrieval if measurement uncertainty were considered (i.e., measurements assigned to values different from the synthetic data according to the measurement uncertainty distribution)?

The errors in the retrieval already include the random errors; these were applied to the synthetic data points before the retrieval procedure. In section 2.4.1 the sentence: "An additional error was assigned randomly out of a normal distribution with $\pm$2% (1 standard deviation)" was changed to: "An additional error was assigned to each calculated αext, αsca and αabs at the instrumental wavelengths, randomly out of a normal distribution with $\pm$2% (1 standard deviation)".

Page 10, line 6-7: Wouldn't one expect agreement between the measurement and retrievals at the single wavelength to which the aerosol absorption is constrained in the retrieval? Suggest adding the phrase "as expected" or equivalent to indicate this.

The sentence was revised to: "The good agreement between measured and retrieved SSA is an indication that the broadband extinction retrieval procedure has little to no error at the wavelength at which the aerosol absorption is constrained."

Moosmuller, H., Chakrabarty, R. K., Ehlers, K. M., and Arnott, W. P.: Absorption angstrom coefficient, brown carbon, and aerosols: Basic concepts, bulk matter, and spherical particles, Atmos. Chem. Phys., 11, 1217-1225, 2011.

Please also note the supplement to this comment:
http://www.atmos-meas-tech-discuss.net/amt-2016-66/amt-2016-66-AC5-supplement.pdf

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