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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Technical Note: Simple analytical relationships between Ångström coefficients of aerosol extinction, scattering, absorption, and single scattering albedo" *by* H. Moosmüller and R. K. Chakrabarty

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We'd like to thank Anonymous Referee #3 for the detailed comments and are responding to them as follows:

C1) In equations 1b and 1c you give two different ways of getting the AC. Why wouldn't you also mention that it can also be obtained from multiple-wavelength data by taking logarithms on scattering (or absorption or extinction) and the wavelengths and fitting a line; the slope gives the AC.

Ad C1) The referee is completely correct, we have discussed this in our recent paper (Moosmüller et al., 2011), but failed to do so here. Therefore, we've added a brief statement to that extent.

C2) P19217, L3: "... SSCA (v) ..."; P19217, L4: "... SSA (ω) ..."; P19217, L11: "... SSA $\omega(\lambda)$ ...". P19217, L11, "... SSA $\omega(\lambda)$ ...". Why don't you use just ω and v, you have defined both of them already earlier.

Ad C2) Done

C3) I feel that section 3 "Generalization to two-wavelength Ångström coefficients" is somewhat unconnected to the rest of the paper, all equations before and after it are clear without it. And what is the physical meaning of a two-wavelength SSA? You write that it is a weighted average of the SSAs at the two wavelengths. Weighted by what? To me it seems just a mathematical construction, you could just as well define an n-wavelength SSA but what would it mean? Please clarify this a bit. Also in the same section you write about the symmetries (P19218, L4-9). What would these mean in practice, what is the purpose of discussing these symmetries?

Ad C3) We only partly agree with the referee on this. While "all equations before and after section 3 are clear without this section, it is absolutely unclear how to apply them, if the extremely common two-wavelength Ångström coefficients are used. To make this application possible within the previously introduced mathematical framework, we introduce the two-wavelength SSA, which justifiably can be called "just a mathematical construction" and discuss the mathematical properties of this two-wavelength SSA including its symmetries. While, we share the concerns of referee #3 about the "mathematical construction", we know of no simpler and clearer way of doing this and have left this section unchanged.

C4) P19218, L10-12: "Using Eqs. (3a, b), as definitions of two-wavelength SSA and SSCA, Eqs. (2h), (4d), and (5) can be used for two-wavelength Ångström coefficients by replacing all occurrences of (λ) with (λ1,λ2)." Well, if the AC has been calculated

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from 3 or more wavelengths by fitting a line to logarithmized data, how then?

Ad C4) The referee correctly points out that our equations that include the SSA have only be given for single- or two-wavelength ACs. This is due to the mathematical complexity of appropriately attributing the influence of the SSA at different wavelengths for linear and non-linear fits. However, the single-wavelength equations still give a good approximation for most such cases. A discussion has been added to the end of section 1.

C5) You are creating here new nomenclature so I suggest you once more think through the symbols. SSCAAC is quite a long symbol for one quantity. Have you considered using α for AC, like a few other authors, and using a subscript for the various versions of AC? Then you would have shorter symbols, for instance αv for SSCAAC and $\alpha\omega$ for SSAAC. At least I would consider this more compact.

Ad C5) The referee is quite correct that we could have used different and possibly more compact nomenclature. However, our goal was to keep the nomenclature consistent with our previous related publications (i.e., Moosmüller et al., 2009 and Moosmüller et al., 2011) and no changes have been made.

C6) And still about terminology: I did a simple opinion poll using scholar.google: Ångström exponent: 2190 hits Ångström coefficient: 783 hits Ångström parameter: 331 hits There seems to be no consensus – which is in line with so many of the symbols used in aerosol optics. I am for the ”exponent”.

Ad C6) Nice detective work! Using our nomenclature “exponent” seems to be more confusion as its abbreviation “E” can be confused with the abbreviation “E” of “extinction”. Again, we are trying to stay consistent with our previous publications and no changes have been made.

References:

Moosmüller, H., R. K. Chakrabarty, and W. P. Arnott (2009). Aerosol Light Absorption

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Moosmüller, H., R. K. Chakrabarty, K. M. Ehlers, and W. P. Arnott (2011). Absorption Ångström Coefficient, Brown Carbon, and Aerosols: Basic Concepts, Bulk Matter, and Spherical Particles. Atm. Chem. Phys., 11, 1217-1225.

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