Review on 'Differences in aerosol absorption Ångström exponents between correction algorithms for particle soot absorption photometer measured on South African Highveld' by J. Backman et al.

General comment

The article investigates differences in the absorption Angström exponents due to different corrections for artefacts of three wavelength Particle Soot Absorption Photometers. The absorption Angström exponent is a key parameter for such studies. The article is of scientific relevance, since the interest in spectral absorption coefficients for source apportionment is growing.

The article is well written and understandable. The reviewer suggests the article for publication in Atmospheric Measurement Techniques after addressing a few comments.

Specific comments

Equation 1: 'C' is not explained. Another often used definition of the Ångström exponent is:

$$\ln\left(\frac{\sigma(\lambda_1)}{\sigma(\lambda_2)}\right) = -AE \cdot \ln\left(\frac{\lambda_1}{\lambda_2}\right)$$

$$\Leftrightarrow \ln(\sigma(\lambda_1)) - \ln(\sigma(\lambda_2)) = -AE \cdot (\ln(\lambda_1) - \ln(\lambda_2))$$

$$\Leftrightarrow \ln(\sigma(\lambda_1)) = -AE \cdot \ln(\lambda_1) + AE \cdot \ln(\lambda_2) + \ln(\sigma(\lambda_2))$$

If λ_2 is considered to be a constant base wavelength, the term $AE \cdot \ln(\lambda_2) + \ln(\sigma(\lambda_2))$ can be associated with the term C. But since AE is part of that term, the definition as shown in Equation 1 could be misleading, since C is not a constant.

Page 9736, line 8: typo, singular "absorb"

Section 3.1:
The MAAP suffers from a scattering artefact as shown in Fig. 12 in Petzold et al. (2005) and Fig 12 in Müller et al. (2011b). Was the scattering artefact considered in the data evaluation? Is the scattering artefact relevant in cases of high single scattering albedos?

Reviewer comment to core-shell particle model: Page 9748, line 16 to end of section:
In Fig. 1 in Ma et al. (2012) it was shown, that the hemispheric backscattering fraction can provide information if particles are mixed internally, externally, or even if a core-shell model is more appropriate. For a core-shell mixing the hemispheric backscattering is larger than for the other mixing states. For a larger hemispheric backscattering typically the asymmetry parameter also is larger. In Mueller et al. (2013) it is shown, that the scattering artefact of filter based

absorption photometer depends on the asymmetry parameter. In summary it can be stated that the mixing state has influence on the basic corrections of filter-based absorption photometers and also on the derived absorption Angström exponents. Additionally there are the effects described in Gyawali et al. (2009) and Lack and Cappa (2010).

The reviewer knows, that is difficult to distinguish between instrumental correction functions and uncertainties in the aerosol properties due to the unknown mixing state.

Differences in absorption Angström exponents for different aerosol are shown in Figure 5 a,b. Could the author estimate to what degree the differences are due to the properties of the aerosol type or due to uncertainties of PSAP corrections (having in mind that correction could depend on aerosol type).

Line 9750, line 25: typo "an aerosol"

Line 9751, lines 10&11: check sentence

Line 9752, line 7: no blank in "V20 10"

Line 9752 , line 25, typo in "differences"

Running title: Typo in 'PASP'

Literature:

Ma et al., A new method to determine the mixing state of light absorbing carbonaceous using the measured aerosol optical properties and number size distributions, Atmospheric Chemistry and Physics, 12, 2381-2397, 2012.