Review of:
"Light absorption of brown carbon aerosol in the PRD region of China" by Yuan et al.

This paper characterizes the Absorption Ångström exponent (AAE) values of aerosols at urban and rural site in the PRD region of China based on the measurements using a three-wavelength photoacoustic spectrometer and reports the AAE values for pure black carbon (BC) and contributions of light absorption by brown carbon (BrC). This manuscript includes sufficient originality, and the topic seems to fit the journal. I recommend publication to ACP after the points below have been addressed.

Major comments:

1) The evaluation of accuracy for the measurement of absorption coefficients is critically important in this study. Therefore, more detailed information on the calibration procedure and uncertainties for the measurements of absorption coefficients at each wavelength should be added. What kind of particles did you use for calibrations? How the theoretical value of 1 was determined? If the authors used similar methods with those used in the previous studies (e.g., Arnott et al. 2010, Nakayama et al. 2015), it would also be better to refer them.
2) It is also unclear what do the values of error in the laser powers and slopes in Table 1 mean and how did you decide these values. In addition, it is amazing that the all values for Rural_fall and Tunnel is same in Table 1. How many times did you calibrate the instrument?
3) If you used the soot particles for calibration, the systematic uncertainties of the calibration factors for scattering measurements also influence to the determination of calibration factors for the absorption measurements. The estimated systematic uncertainties of the calibration factors for absorption measurements at each wavelength are needed to be taken into account to estimate the uncertainties for AAE and AAE_{BC}, as well as for the light absorption and contributions of BrC. In addition to the systematic uncertainties, influence of drift of the signals in 30 min should also be added in eq. (5).
4) In section 3.2 and 3.3, the authors reported that the linear relation between AAE and r_org/bc was obtained for all cases. However, I think the linear relation between AAE and r_org/(bc+org) may be expected, if a simple mixing rule is assumed.
5) The plot between AAE and OC/EC was used in Utry et al. (2014). I recommend to adding some information and discussion in the introduction and discussion sections.
6) In section 3.2, the authors reported the difference in AAE_BC values at SZ site and those at HS site and pointed out the difference of sources (fuel combustion and biomass burning) as a source of the difference of AAE_BC. Although it is interesting findings, more detailed

discussion on the relationship between source (size, shape, and mixing state of BC) and AAE_BC value should be added.

7) In section 3.4, the authors reported that “BrC could play a more important role under polluted condition”. I recommend to adding some discussions on the source of BrC in SZ site in winter. It seems to be nice to calculate the AAE values for BrC for the discussion of the source of BrC.

Minor comments:

1) Page 28454, lines 12-13 and page 28466 lines 17-18
   I think it better to revised the sentence from “.. AAE values … at 405 nm, and … at 532 nm” to “.. AAE values … between 405-781 nm, and … between 532-781 nm”.
2) Page 28459, lines 12-13
   Are these detection limit values for 2min data?
3) Page 28461, lines 20-22
   Please add the uncertainties and their definition.
4) Page 28466 line 16
   “the absorption of pure BC”=> “the AAE of pure BC” ?

References

Arnott, W. P, et al., Nitrogen Dioxide and Kerosene-Fla.me Soot Calibration of Photoacoustic Instruments for Measurement of Light Absorption by Aerosols, *Rev. Sci. Instrum.*, **71**, 4545–4552, 2000.

Nakayama, T. et al., “Characterization of a three wavelength photoacoustic soot spectrometer (PASS-3) and photoacoustic extinctiometer (PAX)”, *J. Meteorol. Soc. Jpn.*, **93**, 285–308, 2015.

Utry, N. et al., Correlations between absorption Angström exponent (AAE) of wintertime ambient urban aerosol and its physical and chemical properties, *Atmos. Environ.*, **91**, 52-59, 2014.