

# ***Interactive comment on “Deriving Brown Carbon from Multi-Wavelength Absorption Measurements: Method and Application to AERONET and Surface Observations” by Xuan Wang et al.***

## **Anonymous Referee #3**

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This work provides an observational constraint for brown carbon aerosols (BrC), which absorb solar radiation, and thus have an important implication for climate. Based on the previous study for quantifying the brown carbon aerosol absorption, authors used observed absorption angstrom exponents at a pair of wavelengths at AERONET sites to reduce associated uncertainties. I believe that this dataset adds up to the observations of BrC absorptions, which are very sparse globally and thus it will be valuable to evaluate the estimated contributions of BrC to aerosol absorption and radiative forcing. However, the observed quantity derived from the combination of various observations needs additional clarification and the details are listed as follows.

P4, L23 - Authors need to estimate the associated uncertainty with the assumption

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of spherical BC in their method. For example, Kahnert and Devasthale et al. (2011) estimated the difference of SSA up to 0.05 between spherical vs. aggregate shapes of BC (Figure 5 in their paper).

P5, L21-24 - Please elaborate how you obtain 4% uncertainty.

Figure 2 - It would be recommended to remove the dust contribution as shown in Section 3.

P7, L14-15 - Several papers showed that BrC absorption at 675 nm is significant (Alexander et al., 2008; Chung et al., 2012). So I am wondering if you assume an absorption at 879 nm as BC absorption alone, then how would your results differ. Or at least, you may need to discuss those previous papers and the possible effect on your estimates.

P7, L19 - Why did you use GFED3 for 2011 and earlier? If there is no reason for this, you better use GFED4 for the entire period consistently.

P9, L8-9 - Jethva and Torres (2011) and Ahn et al. (2014) conducted an evaluation of AOD alone, not AAOD. Jethva et al. (2014) did an SSA evaluation and showed that OMI SSA are higher than AERONET SSA. For example, about 50% of total samples showed the difference of 0.03 or higher and 25% showed 0.05 or higher differences. This is a considerable discrepancy between two datasets and may have a huge impact on your estimates. For example, if AERONET SSA is 0.94 and OMI is 0.97, then the estimated AAODs using AERONET versus OMI data differ by 100%. So BrC AAE using OMI and AERONET AAOD together may cause too high uncertainty. Please consider a bias correction for OMI or simply drop out OMI data in your calculation.

minor corrections,

P2, L28: Forrister et al., (2015) -> Forrister et al. (2015) P7, L15: 675 m -> 675 nm

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