Atmos. Chem. Phys. Discuss.,
https://doi.org/10.5194/acp-2018-49-RC3, 2018

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Light absorption of brown carbon in eastern China based on 3-year multi-wavelength aerosol optical property observations at the SORPES station and an improved Absorption Ångstrom exponent segregation method" *by* Jiaping Wang et al.

D. Liu (Referee)

dantong.liu@manchester.ac.uk

Received and published: 5 March 2018

This study provides an improved approach on deriving the brown carbon absorption from AE31 measurement, and highlights the importance in using the proper AAE to extrapolate the BC absorption from longer to shorter wavelength. If the technical part of this study could be more convincible, then it could be considered for publication. I would suggest to improve the technical part by considering the following points.

1.The issue of deriving the coating content from OC/EC measurement is not just from the uncertain OM/OC ratio, but also that many of the OM may not contain BC, i.e. externally mixed, the OC/EC method would tend to largely overestimate the coating associated with BC. You could use some external results to estimate this.

2. The crucial results here are from the AE31. How it has been corrected is important. It is a challenge to get the proper result from this instrument (especially at shorter wavelength). Though this may have been done in your previous publications, but it's worthy to mention here, e.g. how you get the multiple scattering and scattering correction, and how you have corrected these at different wavelength, and these may substantially affect the derived AAE because these corrections rely on the AAE as well.

3. The BC core size is not constant, the BC from open biomass burning or domestic solid fuel burning has a larger core than from traffic (Schwarz et al., 2008) (Liu et al., 2014). As you have already raised, the larger core will have a lower AAE. Some external data could be used to make more constrains for biomass burning BC.

4. The ideal approach would be combing with the SP2 measurement, such as a similar study (Liu et al., 2015), however the advantage of this study is the long-term measurement using the less-cost instrumentation, and different contributions such as open biomass burning or residential burning occurred in different months, which is interesting. If by somehow, this study could benefit by constraining some of the inputs from the existing information and doing sensitivity test.

Other comments: -It is better to show the location of the experimental site and the surrounding major emissions.

-Equation 4 and 5 could be merged into one, it would be useful to show the Rs-1 in time series or monthly variation.

-Please give the refractive index you used for BC, clear coatings and brown coatings in the main plot legends.

-the Cl-/EC, as an indicator of coal combustion, needs more reference

-would you be able to derive the MAE of brown carbon at different months, which will be very interesting. It looks the higher Babs/K+ ratio possibly means the Dec. BrC had a higher absorption efficiency maybe?

Schwarz, J., Gao, R., Spackman, J., Watts, L., Thomson, D., Fahey, D., Ryerson, T., Peischl, J., Holloway, J., and Trainer, M.: Measurement of the mixing state, mass, and optical size of individual black carbon particles in urban and biomass burning emissions, Geophys. Res. Lett., 35, 2008.

Liu, D., Allan, J., Young, D., Coe, H., Beddows, D., Fleming, Z., Flynn, M., Gallagher, M., Harrison, R., and Lee, J.: Size distribution, mixing state and source apportionment of black carbon aerosol in London during wintertime, Atmos. Chem. Phys., 14, 10061-10084, 2014.

Liu, D., Taylor, J. W., Young, D. E., Flynn, M. J., Coe, H., and Allan, J. D.: The effect of complex black carbon microphysics on the determination of the optical properties of brown carbon, Geophys. Res. Lett., 42, 613-619, 2015.

Interactive comment on Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2018-49, 2018.