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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Chemical characteristics of brown carbon in atmospheric particles at a suburban site near Guangzhou, China" *by* Yi Ming Qin et al.

Anonymous Referee #2

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Using a combination of light-absorption measurements (7-wavelength Aethalometer) and chemical-speciation measurements (HR-ToF-AMS) performed in Guangzhou, Qin et al. report 1) contributions of brown carbon to aerosol light absorption, 2) temporal variability of brown-carbon absorption, and 3) correlations between brown-carbon absorption and OA constituents. The manuscript is well written and the topic (sources and speciation of brown carbon) is timely. I believe that this manuscript is suitable for publication in ACP after the following comments are addressed:

General comments:

I believe that the observations could be interrogated further to gain more insight on BrC

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sources and optical properties of the various components:

1. How do the diurnal cycles of b_BrC compare to b_BC? This comparison could shed light on how similar the sources of BC and BrC are, and also on the relative contributions of primary versus secondary OA to BrC.

2. As the authors allude to in the Abstract and the Introduction, the light-absorption properties of different BrC species exhibit different wavelength dependence. The data presented in this manuscript could be utilized to further investigate/highlight this. Specifically, I suggest:

a) Extending the analysis in section 2 to present not only MAC values, but also AAE values of the different BrC components.

b) Extending the analysis in section 3 to present the correlations with N-containing ions at longer wavelengths as well, and discuss any differences between different wavelengths.

Specific comments:

Line 6: I see what the authors are trying to say, but the statement that absorption "increases the atmospheric energy budget" is not accurate. The atmosphere does not store energy, but re-emits it back as IR radiation to space. Absorption increases the average temperature of the atmosphere.

Line 7-8: Do you mean 20%-50% of the total aerosol warming (i.e. positive forcing)?

Line 10: Several studies have shown that BrC absorption in the long-visible wavelengths is not negligible (e.g.1–3)

Line 24-27: The authors state that they deal with the effect of coating on AAE in another manuscript, but this should be discussed here as well because it is central to the observations, especially that the average AAE value of 1.43 is at the edge of what has been argued to be just coated BC or BC+BrC.

Line 137-140: The authors reference Lack and Langridge (2013) for the uncertainty in the AAE attribution method, but this is not adequate. The uncertainty should be addressed in this manuscript as well.

References:

(1) Alexander, D. T. L., Crozier, P. a, and Anderson, J. R. (2008) Brown carbon spheres in East Asian outflow and their optical properties. Science 321, 833–6.

(2) Hoffer, A., Tóth, Á., Pósfai, M., Chung, C. E., and Gelencsér, A. (2017) Brown carbon absorption in the red and near-infrared spectral region. Atmos. Meas. Tech. 10, 2353–2359.

(3) Saleh, R., Cheng, Z., and Atwi, K. (2018) The Brown–Black Continuum of Light-Absorbing Combustion Aerosols. Environ. Sci. Technol. Lett. 5, 508–513.

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