

REVIEW

GENERAL

The paper presents analyses of aerosol optical properties measured at the ATTO site in Amazonia during several years. The authors have measured scattering and absorption coefficients, refractory BC (rBC), aerosol chemical composition as well as several supporting parameters. The wavelength dependence of absorption was used for estimating the contributions of black and brown carbon to light absorption, contributions of geographical source areas were estimated using transport analyses, mass absorption coefficients (MAC) by comparing independent absorption and rBC measurements. All this is important and valuable. The paper is mainly well written so I can recommend its publication after some clarifications and revision.

The main point that bothers me is the way the contribution of brown carbon is calculated. It is the core of the paper so it should be presented clearly. I'll show the problem in the detailed comments.

Another point that I miss is the size distributions of rBC. They were measured with the SP2 and used for MAC calculations but not shown anywhere. Why? The geometric mean diameters and geometric standard deviations of BC are useful and valuable as such for modeling purposes. Did they vary seasonally and with source areas? The size distribution can also give hints of whether part of the BC remained undetected which would definitely affect the calculated MAC values, another important point in this paper. There should be some uncertainty analysis of the MAC.

How about coatings? They can be obtained from the SP2 but not presented, why? It would be valuable for the analysis of absorption enhancement.

DETAILED COMMENTS

L112 "(Womack et al., ref needed)." Write the ref.

L221-227. I assume you corrected also the Aurora 3000 data for truncation, did you?

L234 "... instrument is able to provide absorption coefficients with a time resolution of 5 min."
The time resolution of the MAAP can be set not only to 5 min. Reword the sentence.

L 303-304 "... . The 8-channel SP2 rBC mass measurement was underestimated by a factor of 5 % ..."
How was this 5% obtained?

Another thing is, how could you estimate missing BC if it were outside the size range detected by the SP2? In biomass burning smoke BC could be attached to larger particles as well.

L356-372, calculation of BrC. There is a problem here. I rewrite the equations and show it.

$$WDA = \dot{a}_{abs370-950} - \dot{a}_{abs660-950} \quad (3)$$

$$BC\dot{a}_{abs370-950} = \dot{a}_{abs660-950} + WDA \quad (4)$$

$$BC\sigma_{ap370} = \sigma_{ap950} \times \left(\frac{370}{950}\right)^{-BC\dot{a}_{abs370-950}} \quad (5)$$

$$BrC\sigma_{ap370} = \sigma_{ap370} - BC\sigma_{ap370} \quad (6)$$

Insert (3) to (4)

$$\Rightarrow BC\dot{a}_{abs370-950} = \dot{a}_{abs660-950} + WDA = \dot{a}_{abs660-950} + \dot{a}_{abs370-950} - \dot{a}_{abs660-950} = \dot{a}_{abs370-950}$$

Insert the result to (5)

$$\Rightarrow BC\sigma_{ap370} = \sigma_{ap950} \times \left(\frac{370}{950}\right)^{-BC\dot{a}_{abs370-950}} = \sigma_{ap950} \times \left(\frac{370}{950}\right)^{-\dot{a}_{abs370-950}} = \sigma_{ap370}$$

where the last step comes from applying (1) on line 342.

Insert finally the result to (6) and you get that $BrC\sigma_{ap370} = 0$.

This cannot be the idea, BrC being always zero. Rewrite the equations.

Further on the same issue. On L361-362 it is written " Calculated BC WDA thresholds, presented in Fig. S5, were compared to the ambient data in order to retrieve the BrC contribution to light absorption. "

What do you mean by thresholds? Do you mean that if WDA is larger than a threshold then this is due to BrC? This is not clear at all. Looking at Fig S5 does not explain me, what these thresholds might be. And what is the reasoning for claiming that exceeding a threshold for WDA is due to BrC?

This is much too descriptive way to explain how you calculated BrC. Give more details so that other people can us the same method and evaluate it. Recently many people have started using the so-called "Aethalometer model" (Sandradewi et al., 2008) and it would be good if the model presented in this work could be compared with it.

L373-377, still about the same issue. How did you get the uncertainties? Give formulas. Writing that

" The relative overestimation of the BrC contribution obtained by using different BC core sizes and different refractive indices in the Mie model calculations can be found in Table S2." is simply too qualitative an not understandable. People have to be able to reproduce the result.

L472-473 " Rizzo et al. (2013), however, pointed out that this relationship is only evident for surface and volume mean diameters and was not clearly valid between \dot{a}_{sca} and count mean diameters. "

Also Virkkula et al.: ACP, 11, 4445–4468, 2011 found the same.

L568 -> Where do you get the equivalent potential temperature from? Model, I assume, present in methods then.

L672 Do you have a clear definition for "BC-only regime"?