

# ***Interactive comment on “Long-term Brown Carbon and Smoke Tracer Observations in Bogotá, Colombia: Association to Medium-Range Transport of Biomass Burning Plumes” by Juan Manuel Rincón-Riveros et al.***

## **Anonymous Referee #2**

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This paper investigates the contribution of biomass burning from distant locations to air quality in Bogota Colombia based on an extensive data set of aerosol light absorption at multiple wavelengths. Most data reported are from a measurement site upwind and at higher elevation than the city. Filter measurements of smoke tracers are also used to support the analysis, along with satellite-based fire counts and air mass back trajectories. Overall the paper is a nice contribution to an understudied location and appropriate for publication in this journal. The results are interesting and the analysis very thorough, however, some components are confusing and should be clarified.

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I agree with the other two reviewers that the sensitivity of the reported results to the choice of AAE for BC (AAE=1) and for BrC (AAE=2) should be assessed. A value of BrC AAE of 2 seems especially arbitrary. It is not clear to me why the authors utilized this analysis method at all since it adds unnecessary complexity and ambiguity; more related to this question follows below.

Why was 470 and 880 nm light absorption data used in the fractional biomass burning calculation? Explicitly state the reason. Eg, why not 370 and 950 nm, respectively? Similarly, why was 880 nm used for eBC, not 950 nm? Why not use all the wavelength data in some way, instead of just selecting a few wavelengths from the measurements (more on this below)?

Why does one even need to calculate a BC and BrC concentration, instead of just using the absorption coefficient? For example, simply using the absorption measured at a high wavelength as a tracer for BC and Abs measured at a low wavelength (e.g., 370, or if too noisy, 470 nm) as a tracer for BrC, after the Abs by BC at that wavelength is removed. This can be done by assuming a BC AAE of some value, such as 1. This seems like a much more transparent way to apportion BC and BrC from the multi-wavelength Aeth data and it eliminates the need to assume a characteristic BrC AAE. It also simplifies an uncertainty analysis on the sensitivity of the results to only the value of BC AAE. It would be interesting to see a correlation between the BrC mass inferred by the method in this paper and the BrC abs at some wavelength (eg, 370 nm).

Instead of picking a specific wavelength for BrC why not use all the Abs vs wavelength data. That is, fit the data with an AAE using all the wavelength and then use the fit to predict BrC AAE (data AAE-1) and then determine light absorption at some low wavelength with fit AAE-1.

Light absorption data are based on PM1, chemical composition and mass on PM2.5. PM1 was chosen to reduce possible influence of dust light absorption on the inferred BrC mass. The authors could test if there is any correlation between dust (eg, Ca<sub>2</sub>)

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and BrC.

Line 236-237: This line is unclear, suddenly there is a discussion that changes from eBC to EC. How does this data prove eBC is EC. Why not just say that eBC is from urban traffic and industrial emissions? Also, why is EC only assumed to be from these two sources?

Line 248-249, first line after heading 3.1. This line is unclear. Is the eBC, BrC and fire counts data (Fig 3b) from the hill top site and the PM<sub>2.5</sub> mass (Fig 3a) from the urban air quality stations in the city? That means that Fig 3a has data from two different sites? This complicates the comparison and the discussion that follows this line. More clarity is needed here. Please specify on the plots in Fig 3 what site the data is from.

Line 282, typo change that to local emissions, to, than to local emissions.

Line 289-290 states, ... However, optical methods are not always quantitative methods to determine BB aerosol loading. What is this statement based on?

Line 314. Is this true; the Monserrate site (also called at times, the hill top site) maybe a fairly close distance to the urban center, but it is decoupled from the city at times due to its higher elevation and changes in BL height. This mixing of the hill top site with the urban site throughout the paper leads to confusion. Often the term monitoring site is also use, which is apparently the Monserrate site, not the urban air quality sites? I suggest being more specific and consistent throughout the paper on what the sites are called.

Last line of Conclusions. What is the 13% based on, mass ratio of eBC and BrC. This is then not an optical ratio and should be noted, it may also depend on how BrC was determined (AAE=2). Again, calculating mass concentrations of BC and BrC from the absorption data just leads to confusion and more uncertainty, in my view.

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