

Interactive comment on “Comparison of several wood smoke markers and source apportionment methods for wood burning particulate mass” by et al.

Anonymous Referee #3

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This paper uses a method developed in an earlier publication [Sandradewi et al. 2008, Env. Sci. & Tech. V.42(9)] that uses the differences in the wavelength dependent absorption properties of carbonaceous aerosol produced by (1) fossil fuel combustion and (2) biomass burning combustion (specifically hard and soft wood) to determine the relative contribution of each to total particulate mass using a seven channel (wavelength) aethalometer. The method requires the use of an aerosol mass spectrometer (AMS) and a seven wavelength aethalometer at 880 nm to determine the organic mass and black carbon mass. These measurements are needed to find the coefficients required to convert the derived absorption measurements of particulates generated by fossil fuel burning and woodburning, respectively, into equivalent masses. Aethalome-

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ter data are corrected for loading and scattering artifacts. The use of differences in the spectral absorption of light absorbing carbon to identify different sources is of high importance in the study of carbonaceous aerosols.

In this paper, the method is reviewed and results at several field sites are compared to other known markers for wood smoke (levoglucosan, mannosan, and fine potassium) to qualitatively validate the results.

My primary concerns with this paper are the constants used by the authors, upon which the partitioning calculations are based, that were taken from literature values and previous studies. These constants represent average values obtained from large numbers of measurements and have uncertainties associated with them. While I understand the need to use these constants, I think a discussion of the uncertainties associated with their use, as well as a propagation of the associated uncertainties through the calculations is required. These assumed constants/factors include;

1.)Efficiency of total particulate mass from the AMS compared to the non-refractory particles actually measured: 0.5 and 0.7 (pg 8096)

2.)Absorption exponents: 1.1 for traffic and 1.86 for woodburning. In the ES&T paper there was mention that the woodburning exponent had more of a range, but was not mentioned quantitatively here. (pg 8098-8099)

3.)Additional assumed constants, such as the OM/OC ratio of 1.4 as one example, are implicit in the 14C calculations, but not explicitly mentioned in this paper, however they contain associated uncertainties that should be propagated.

The author acknowledges that these uncertainties exist, however does not provide any estimate of the resulting uncertainty in the final calculations. Error bars should be placed on the points in figure 1, 3, and 4.

Secondary concerns: - except for the comparison between the levoglucosan and the mannosan measurements and the derived EC and OC from woodburning, much of this

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paper repeats information available in the ES&T paper, specifically the comparison between the aethalometer model and the 14C results. This paper contains additional data taken from other sites, which is valuable; however less attention to validating the aethalometer method and more attention to the significance of the measurements themselves would make this a stronger paper. As it stands, the take home message that I get is: a previously published method for isolating biomass burning carbon from fossil fuel carbon correlates somewhat with other known markers for biomass burning.

Specifically, more discussion or clarification on what is new in this paper, the significance of the measurements, and the associated uncertainties in the final calculations, is required prior to publication.

Lastly, I agree with the other reviewer comments regarding the use of the 14C method to both calibrate and validate the aethalometer model.

Technical concerns: Pg 8095, line 1: dust is also a source of fine potassium and should be accounted for or mentioned.

Pg 8095, line 25-26: the time code is confusing. 0600 to 1400 local time or GMT, rather than "6 14 h", will clarify that it is time of day that is being given and not number of hours.

Pg 8099 line 11: need a reference for the statement "Levoglucon is the most abundant anhydrosugar measured in woodsmoke aerosol.";

Pg 8100, line 4: "absorption coefficients" should be "absorption exponents";

Pg 8100, line 6: cannot understand what the author is trying to say "...contribution to BC respectively EC.";

Pg 8101, "Levoglucon, a widely proposed organic tracer for wood smoke, has the highest concentration..."; this has already been stated, but still needs a reference or to be omitted.

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