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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Biomass burning impact on $PM_{2.5}$ over the southeastern US during 2007: integrating chemically speciated FRM filter measurements, MODIS fire counts and PMF analysis" *by* X. Zhang et al.

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"I'm concerned with IC analysis (HPAEC-PAD) of levoglucosan. Chromatographic peaks of levoglucosan and arabitol were not separated by CarboPac PA-1 column. The authors calculated arabitol concentration by dividing mannitol concentration by 1.5, assuming that mannitol level is 1.5 times higher than arabitol (Bauer 2008). However, this conversion factor (1.5) was determined for PM10 sampled in Vienna (Bauer 2008) and therefore cannot be used as uniform coefficient. Moreover, concentrations of arabitol and mannitol are variable and depend on type of PM source (Medeiros 2008). I think

that these aspects are very important for the present study."

We agree with the reviewer that this adds uncertainty to the levoglucosan measurement, as we have acknowledged in the paper (page 7042, line 29) and recognize that in the future the anion exchange column (MA1) is more appropriate since it separates levoglucosan and arabitol. This issue was also raised by Referee #2, who concluded the added uncertainty is likely not large. We also note that the associated uncertainty is not expected to be substantial in the winter, but can be important in the summer. For example, we calculate that the fraction of arabitol peak area to the total "levoglucosan + arabitol" peak area is only 2.6% in winter but 24.2% in summer. Meanwhile, as also noted by Referee #2, this method was validated by an intercomparison between levoglucosan measured by HPAEC-PAD versus GC-MS, which shows good agreement (slope of 1.09 and R2 of 0.92) between the two independent methods (Sect. 2.2). Moreover, a number of concentration ratios such as levoglucosan to PM2.5, K+ to levoglucosan in PMF factor 1, obtained from this study compare well with other studies where levoglucosan was measured by methods without this limitation (Sect. 3.3.3).

Statements have been added in the revised manuscript in the experimental section (Sect. 2.2) to elaborate the measurement uncertainty and also in the discussions (Sect. 3.1.2) regarding levoglucosan concentrations in summer.

"The authors noticed that there is no correlation between two major tracers of biomass burning emissions such as potassium ion (K+) and levoglucosan. Does this mean that the potassium ion should not be considered as biomass-burning tracer since it can be emitted by other sources?"

Potassium has been extensively used as biomass burning tracer in source apportionment studies, however, laboratory and field studies, including this work, show that biomass burning is not an exclusive source for potassium. Here we show that during periods when biomass-burning emissions are low (eg, during the summer, as confirmed by satellite fire count data), other sources of potassium can become important

and potassium should not be used to assess biomass-burning emissions. However, during periods of more extensive burning, as in the colder winter months, we show that potassium is a reasonable tracer, likely because in these cases biomass-burning emissions dominate over all other sources.

"Paragraph 2.2.UV-VIS light absorption spectra were required to determine the link between “brown carbon” and biomass burning. It would be advantageous if authors could include more details about this experiment (e.g. used standard, procedure of “abs” quantification, etc.)"

The UV-Vis light absorption measurement method and the results discussing the sources of brown carbon are the topic of another paper recently published in ACPD (Hecobian et al., 2010). We defer a more detailed description to that publication, however, more details related to light absorption measurement have been added in the revised manuscript (Sect. 2.2). Regarding the question of calibration of the absorption method, as with all measurements of the ambient organic aerosol, there are no standards available. The procedure for making an absorption measurement is to define the zero as that of the solvent (e.g., water blank) and the max as the dark spectra (light source blocked). The measurement of solvent containing solute falls between these values. Saturation of our optics was generally not an issue except for filter samples collected in strong fire plumes, and indicated by absorption greater than 1. In these few cases the filter extract was diluted a known amount and the absorption spectra was re-measured.

"Paragraph 3.1. It is not necessary to separate 12 month into four seasons (winter, spring, summer and fall) as well as each season into free month (see Tables 2 and 3). I think it is well known."

We feel it is worthwhile to explicitly state which months were included in each season so that there is no ambiguity in the resulting statistical analysis segregated by season.

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 7037, 2010.