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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Aerosol optical properties and trace gas emissions by PAX and OP-FTIR for laboratory-simulated western US wildfires during FIREX" *by* Vanessa Selimovic et al.

Anonymous Referee #1

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This paper reported emission factors (EFs) of trace gases and optical properties of aerosol particles during combustion of canopy, litter, duff, dead wood in US and some other fuels in the laboratory. The data obtained in this study are valuable to evaluate the impact of biomass burning on climate and atmospheric environment. However, improvement of the discussion will be necessary before considering the publication in ACP.

General comments

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Discussion paper

Discussion on the relation between the EF for gaseous species and aerosol optical properties is not enough. Especially, optical properties of BrC should depend on chemical compositions of particles and may be indirectly related to the relative EF of gaseous compounds. I recommend adding discussions on this point.

Specific comments

1) Page 5, lines 36-39

Scrubber and diffusion dryer were used in this study. Information on the removal efficiency of light absorbing gases and the particle losses should be added.

2) Page 6, lines 15-24

“The emission ratios to CO2 were then used to derive EFs calculated by the carbon mass balance method (CMB), which assumes all of the burned carbon is volatilized and that all of the major carbon-containing species have been measured” “Our estimate of total carbon in this paper includes these three species and all the rest of the C-containing emissions measured by the OP-FTIR and the PAXs.”

These two sentences are confusing. Did the authors include BC in the estimation of total carbon?

3) Page 7, lines 15-19

The authors assume the AAE for BC to be 1 to estimate EF abs405 for BrC. However, this assumption is not necessarily correct (e.g., Lack et al. 2010). In addition, the authors assume that the lensing effect was negligible. However, it is strongly depend on the relative amount of OC to BC, as well as combustion conditions. Is it reasonably to estimate that OC (or BrC) did not coat BC even when OC/BC ratio was very high under low MCE conditions? Discussion on the effect of these assumption (and uncertainties) on the uncertainties in EF abs405 for BrC and EF BC should be added.

4) Page 9, line 20-21

“The lab-measured EFs for these OP-FTIR species and the data for many NMOG species measured by MS and FIREX data in general can thus be used to generate representative EFs or other data for real wildfires.”

Because the data of MS was not presented, I recommend avoiding the discussion based on MS data.

5) Page 9, lines 23-32

Because I cannot access to the in preparation papers (Koss et al. and Sekimoto et al.), we (readers) cannot check reasonability of the suggestions.

6) Page 9, lines 43-44

“However, for both vegetation types we observed an enhancement in NOx emissions from the litter and canopy components,..”

Figure 4 shows EF for NOx from litter and canopy were smaller with “Douglas Fir (Mixed)”.

7) Page 10, lines 16-18

“As mentioned previously, we measured absorption and scattering coefficients directly at 401 and 870 nm. For the first 31 stack fires, which includes most of the studied fuel types, we have both 401 and 870 nm data. For the remaining 44 stack fires, we only report data at 870 nm as we used our 401 nm PAX for intercomparison studies that will be reported elsewhere.”

Same information was given many times (introduction section and experimental section). I recommend avoiding duplicate contents.

8) Page 10, lines 23-24

“Table 3 does not reveal a strong ecosystem dependence among coniferous ecosystems tested for optical properties, but does indicate that chaparral fire aerosol is rela-

tively more absorbing and that there are significant contributions of absorption by BrC at 401 nm among all ecosystems."

The description may be incorrect. Table 3 indicates that EF Babs 870 and EF Babs 401 for chaparral fire aerosols were not necessarily greater than those for Lodgepole Pine and Ponderosa Pine aerosols.

9) Table 4

Because lab. average EF for BC would be calculated from average EF Babs by multiplying a constant factor, I think that the relative uncertainties for them should be same. Why are the ratios 0.53/0.58 and 3.20/5.16 different?

Why did the authors choose different types of function (linear and power law) for EF for Babs401 and EF for Babs401(BrC) for the equation to estimate EF from MCE?

Fitting uncertainties (or reasonability) for each equation should also be added. For example, no clear relations between EF Babs 401 and MCE and between EF Babs401(BrC) and MCE are observed in Fig. 8.

10) Figure 8

I recommend adding error bars.

11) Same terms should be used throughout the text.

For example, EFabs 401, EF_{abs}401, and EF Babs 401 are used for EF for Babs at 401 nm.

References

Lack, D. A. and Cappa, C. D.: Impact of brown and clear carbon on light absorption enhancement, single scatter albedo and absorption wavelength dependence of black carbon, Atmos. Chem. Phys., 10, 4207–4220, doi:10.5194/acp-10-4207-2010, 2010.

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