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Interactive comment on “Field measurements of trace gases emitted by prescribed fires in southeastern US pine forests using an open-path FTIR system” by S. K. Akagi et al.

Anonymous Referee #2

Received and published: 5 September 2013

General comments:

The paper "Field measurements of trace gases emitted by prescribed fires in southeastern U.S. pine forests using an open-path FTIR system" by Akagi et al. presents a set of open-path FTIR measurements of fire chemistry that are part of a comprehensive measurement campaign of three prescribed fires. The data are valuable for understanding fire chemistry and the impacts on human health, and will be useful for comparison to future field campaigns and for modeling studies. The paper should undergo some reorganization, clarification, and redundancy reduction before publication. The discussion of trends in emission factors of some compounds between the early

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Discussion Paper



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Comment

and late periods is not robust (highlighted in specific comments), and should be revised and the statistical significance more clearly shown. With these adjustments, the paper makes a strong enough contribution to the field to merit publication.

Specific comments:

P18490 L15 - clarify the meaning of actively in "actively located individual residual smoldering combustion fuel elements"

L25 - Clarify what is meant by platform differences. This is a significant point in the abstract, but the meaning is unclear.

L27 - Delete "also" from this sentence.

P18491 L12 - The "beneficial role(s) that fire plays in fire-adapted ecosystems" should be stated explicitly in this sentence.

P18492 L10 - Define "actively located".

P18494 L1 - How often were the ambient emission spectra collected? Was the frequency high enough to account for the effect of changes in the ambient temperature over the measurement procedure?

P18495 L12 - The acronym for excess mixing ratios (EMRs) should be defined in section 2.1 where the procedure is described, not in the beginning of 2.3.

P18495 L25 - What could the potential consequences of this be for the accuracy of your results? "For NH₃ and CH₃COOH, for unknown reasons, there was a large positive intercept in the plots versus CO so the intercept was not forced."

P18496 L8 - Define "SNR".

P18498 Sec2.5 - The first paragraph of the "Three-pronged sampling approach" section is almost entirely of results and should be moved to section 3.

P18498,L25 - P18499,L3 - The point of these sentences should be clarified. The jus-

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tification is not clear for why the stated expectation was not met. This belongs in the results section.

Sec2.5.1-3 - These whole subsections could be moved to the results sections. Or, the information about the fire, strategy, and meteorology could be retained in section 2, but results regarding the MCE should be moved to the results. I suggest the former.

P18501, L9 - The EF results in Table 1 should be presented more in the text before the discussion that occurs following L9. It seems the contents of Sec 3.1 and 3.2 are mixed here. If discussing the difference between early and late, Table 2 should be introduced earlier. The 3.1 section needs to be much more clearly organized to clearly present the results of the study (MCE, EF, and ER) and to discuss the early/late differences. The heading "initial emissions" does not match the content of this paragraph.

P18501, L15 - explain what is meant by other platforms.

P18502, L9-12 - The reason that the different instruments should sample different fuel types was not clear to me in the preceding text. Please explicitly state this in this section or with the information in section 2.5. It is unclear whether the discussion of measurement losses is the explanation for the trend presented in L12, or if the fuel type argument is a different one. Please clarify. This paragraph should be split into two or more based on topic.

P18503, L14 - What is meant by "significant" here? If not statistically significant, please reword to indicate the specific meaning.

P18503, L21 - Is this statement supported: "we see higher EF for some smoldering compounds like methane and methanol late in the fire associated with lower MCE"? The trend for CH4 EF between early and late are not consistent for each site. Are the differences statistically significant for CH4 and methanol? Any modifications to the text should also be reflected in the introduction and conclusion.

P18504, L5 - Please postulate why the "late" OP-FTIR samples deviate from the ap-

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Comment

parent EF vs MCE trend observed for other cases. The deviant late OP-FTIR measurements do not support this statement: " consistent relationship between the EF obtained and the flaming to smoldering ratio each instrument can sample."

P18504, L16 - Your definition of MCE is not the same as dCO/dCO₂. Are you presenting the dCO/dCO₂ in parenthesis or after the commas. Be explicit, consistent, and clear. Could just present MCE?

P18505, L2 - Which emission factors from this work are within the natural variability? All the species listed in table 1 except for NH₃? How is the natural variability of an EF determined? Please add relevant citation.

P18507, L25 - I find the terminology normalized excess mixing ratios (dX/dCO) confusing because it is equivalent to your defined molar emission ratios (dX/dY), which were not referred to as normalized excess mixing ratios. Shouldn't this published dX/dCO be referred to as a published molar emission ratio (ER) or (PER)?

Sec 3.4. I would consider moving the first three paragraphs of this section to the end of the introduction.

Conclusion - Should be shortened by removing redundant portions that restate results.

Table 1. Define "NMOC" in table header or footnote. The table heading should be changed to more clearly reflect which data are MCE and which are EF. You could have the MCE in bold for example and make that clear in the table heading. The heading should either consistently use acronyms MCE and EF or the full names, not this mix. Same comments for Table 2.

Figure 6. The standard deviation is very difficult to see in this figure. Please change the scale to make it clear which differences (especially between early and late OP-FTIOR) are significant.

Figure 7. The correlation coefficient or R² should be shown for the fit to support that stated strong negative correlation.

Table A2, Table4 and P18507-8 text. Please be consistent and either use 'estimated' or 'calculated', but not both.

Table S1, supplemental file Why are some numeric cells italicized? If there is a meaning please define, otherwise format uniformly.

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Comment

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