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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Biomass burning emissions and potential air quality impacts of volatile organic compounds and other trace gases from temperate fuels common in the United States" *by* J. B. Gilman et al.

Anonymous Referee #1

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General comments

The paper "Biomass burning emissions and potential air quality impacts of volatile organic compounds and other trace gases from temperate fuels common in the United States" by Gilman et al. reports emission ratios (ERs; vs. CO) of more than 200 gases obtained in laboratory burns of different fuels from different regions in the US (SW, SE, N). Measured ERs are used to characterize OH reactivities and SOA formation potentials (SOAP) of gaseous biomass burning (BB) emissions. The paper also includes a

validation of the sampling method (discrete "grab" sampling vs. continuous monitoring) and exemplary results from ambient air measurements (BB vs. urban vs. biogenic).

The paper is well written and the subject of the study is within the scope of ACP. One aspect merits special attention though. If I have understood this correctly, the data presented in Table 2 are the same (ERs instead of EFs) as already given by Yokelson et al. 2013 (doi:10.5194/acp-13-89-2013, Supplement, http://www.atmos-chem-phys.net/13/89/2013/acp-13-89-2013-supplement.zip). The data are analyzed in a different context though (OH reactivity, SOAP), which is new. The former work also briefly touches upon methodical aspects (discrete sampling vs. continuous monitoring) conveying the same message as in the present work.

I personally think that the manuscript conveys information in a concise and useful way even though a significant part of it is not truly new. I thus recommend publication with minor revisions as specified below. My reviewer colleague and the Editor should, however, evaluate the aspect pointed out above.

Specific comments

Title:

"temperate fuels": Fuels cannot be temperate. Reformulate.

Table 1

As previously indicated to me by reviewers, "MS" should be used as an abbreviation for "mass spectrometry" and not for "mass spectrometer". In other words, the term "MS" refers to the method and not to the instrument itself. When referring to the instrument, the phrase "MS instrument" (e.g. PIT-MS instrument) should be used.

The term "sampling limitations" is incorrect. Other compounds are sampled but they are not or detected.

The use of the unit "a.m.u." is deprecated. m/z is a dimensionless quantity obtained by

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dividing the mass number of an ion by its charge number.

“Protonated molecular mass”->“protonated molecule” “mass fragment”->“fragment ion” “protonated ion”->“protonated molecule” “deprotonated ion” ->“deprotonated molecule”

It is incorrect to use the term “identification” when using PTR-MS, PIT-MS, NI-PT-CIMS. These methods are not capable of identifying ions. Use “detection of the protonated molecule”, “detection of deprotonated molecule”.

“Infrared Spectrometer”-> “Infrared Spectroscopy”. Use the term spectroscopy when referring to optical methods.

For details on MS nomenclature see: Murray et al., Definitions of terms relating to mass spectrometry (IUPAC Recommendations 2013), Pure Appl. Chem. 85(7),1515–1609, 2013.

Table 2

Does it make sense to report four significant digits after the decimal point?

Would it make sense to also report median ERs?

Alkenes (Saturated, ..) -> Alkenes (Unsaturated,..)

HCN and HNCO are inorganic compounds.

Indicate in the table (e.g. asterisk or similar) which species have been calibrated and which have not!

Table 3

Change unit in the VOC vs. CO (ppb/ppm)?!

Figure 1, caption

“select gases”-> “selected gases”

Text

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21716, 9: Health effects due to exposure to HNCO at relevant levels have not been demonstrated. Use “potentially harmful” instead of “harmful” for this compound.

21716,19-27; 21717,1-10: The tutorial on tropospheric gas-phase chemistry is excessive in length and not strictly relevant for this work. I suggest shorting this paragraph and introducing the concept of OH reactivity here.

21717,11-27: The tutorial on SOA and SOA formation is excessive in length and not strictly relevant for this work. I suggest shorting this paragraph and introducing the concept of SOA formation potential here.

21718, 14: revise number of inorganic gases (HCN, HNCO)

21718, 17:” spectrometer (GC-MS)”-> “spectrometry (GC-MS) instrument”

21719, 3: “cursory”. I have never seen a cursory analysis by Bob Yokelson!

21719, 9: “SOA potential”->“SOA formation potential” (I know the term “SOA potential” has been used previously but I still think it is incorrect).

27119, 1: Heading: use “2 Methods” instead of “2 Experimental”; analysis methods should also be given here (see below)

21720, 24-27: “spectrometer”->“spectrometry instrument”

21722, 5: Why was an ozone scrubber used? Briefly describe and discuss CO2 and H2O scrubbing (large CO2 concentrations in BB samples, loss of water-soluble analytes?)

21722, 13: “atomic mass units”; use of this unit is deprecated

21722, 19: How did the experimenters decide when to take the sample? Did they follow CO and CO2 on-line and manually activate the sampler based on their experience? Describe.

27125: The Results and Discussion section contains lots of methodical information

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(e.g. how to calculate MCE, degree of unsaturation, emitted molar mass, OH reactivity, SOA formation potential.). The methods of data analysis should also be included in chapter 2.

27128: It is crucial to take the sample at the right time. Briefly discuss this aspect.

21730, 2: revise number of inorganic gases (HCN, HNCO)

21730, 16: “degree of unsaturation”. In mass spectrometry, the use of the term “ring and double bond equivalent” (RDB, or RDBE) is recommended (see Murray et al., 2013 - see above).

21732: The authors use the term “molar mass emitted” but many gases were not measured (e.g. N2, H2, N2O, SO2,. . .). It should be stated more clearly that the given percentages refer to the molar mass that was measured. Give an estimate of the percentage of non-measured gaseous species.

21733, 27-28 and 21734, 1-14: Introduce concept of OH reactivity in chapter 1 and give methodical details in chapter 2. Only present results here.

21736, 6-22: Introduce concept of SOA formation potential in chapter 1 and give methodical details in chapter 2. Only present results here.

21738, 9-14: This statement should go elsewhere.

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 21713, 2015.