Atmospheric
Chemistry
and Physics
Discussions

Interactive comment on "**Emissions of trace gases from Australian temperate forest fires: emission factors and dependence on modified combustion efficiency**" *by* **Elise-Andrée Guérette et al.**

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Received and published: 6 November 2017

The reviewer thanks the authors for submitting their article entitled "Emissions of trace gases from Australian temperate forest fires: emission factors and dependence on modified combustion efficiency" to Atmospheric Chemistry and Physics for potential publication in this journal. In this article, the authors undertake trace gas measurements from nine prescribed fires in South-Eastern Australia (seven in NSW and two in Victoria). In this study, the main focus is on VOC measurements as well as trace gas emissions such as CO_2, CO and CH_4 that support analysis behind the measurements (i.e. they enable MCE to be calculated, for example). The authors use a combination of

open-path FTIR, SIFT-MS and White Cell spectroscopy as tools to quantify trace gas species. Within this field, state-of-the-art (at least from a North American perspective) has been advanced by authors such as R. J. Yokelson et al. and S. K. Akagi et al. which the authors of the current manuscript have cited. The opinion of the reviewer is that the current study presented by the authors is a timely addition to the literature. The authors demonstrate that ecosystem specific EFs should be used for VOC emissions accounting in Australia and also demonstrate that some VOC species differ significantly from those measured in North America. On these grounds I find the current contribution useful, and furthermore recommend publication after minor revisions and attending to some technical issues.

Whilst the reviewer is not an expert in VOC measurement and chemistry, Figure 3 demonstrates some nice results showing excellent agreement between ethene mixing ratios quantified with SIFT-MS and White cell FTIR spectroscopy. This gives the reviewer some confidence that the instrumentation used in this study is quantitatively reliable.

The manuscript is currently in fairly good shape; however, an accepted manuscript would have to attend to a few matters.

Title: The reviewer has a preference for titles that indicate the outcome. This would help to promote the findings of this paper and get more people to read it. Something in the title that indicates the recommendation of ecosystem-specific VOC emissions may help.

Abstract: Line 8. "... compare with Australian savanna". This is presumably due to a paucity of data in Australia. May help to indicate why comparison was done with a different biome.

Line 9. "... disagree by a factor of two or more". May help to indicate which VOCs differ by that amount.

Introduction: Line 15. "... carbon monoxide and aerosol". Probably reads better as ... particulate matter. Line 19. May help to be careful regarding the comment "... lower due to rapid regrowth". If there was a change in fire regime e.g. fire frequency then the rapid regrowth would not occur. Net C emissions would increase.

Line 15. "... pyro-convective lofting". I believe the authors have missed two papers here. Please consult:

de Laat, A. T. J., D. C. S. Zweers, R. Boers, and O. N. E. Tuinder (2012), A solar escalator: Observational evidence of the self-lifting of smokeand aerosols by absorption of solar radiation in the February 2009 Australian Black Saturday plume, J. Geophys. Res., 117, D04204,doi:10.1029/2011JD017016.

Siddaway, J. M., and S. V. Petelina (2011), Transport and evolution of the 2009 Australian Black Saturday bushﬁre smoke in the lowerstratosphere observed by OSIRIS on Odin, J. Geophys. Res., 116, D06203, doi:10.1029/2010JD015162

Line 23. "... weather conditions that are conducive to pollution build up". What conditions are these - a stable atmosphere? More detail required.

Line 15. Page 3. "... highly cited compilations". This phrase should not appear in a scientific article. It appears a bit like a sales job.

Methods. Line 30. Presumably bark litter was present too? Line 32. "... canopy species" then "... overstorey species". Choose one term and stick with it.

Section 2.2. Line 16. "... forest road ": looks like a firebreak to me.

Section 2.3.1. I'm not sure what the phrase "co-adding scans" means?

Section 2.3.2 Line 23. Is the dilution ratio measured or assumed? If measured, how was this done?

Figure 3. Can't see the vertical errors bars < 10 ppm. Have they been calculated? Also, how were these uncertainties calculated? This information should go into the

Figure caption.

Section 2.4. Line 8. Orthogonal regression. Please check this terminology. Greg Ayers refers to this as restricted major axis regression. It may help to cite this paper too - it's in Atmospheric Environment from memory.

Page 8. Lines 3-4. RE selection of reference species. Not really sure what the chemical reasoning is for these selections? Is this just a matter of choosing a reference species that correlates with your results, or is there some more fundamental reasoning sitting behind this?

Section 2.5 Page 8. Line 19. molar mass not molecular mass. Page 9. Line 18. "... uncertainties in quadrature". Are you able to shed more light on what this technique does?

Section 2.6. Line 20. The first part of this sentence mentions MCE then it moves to combustion efficiency. I think it should be the other way round? Define combustion efficiency and then define MCE as an approxmation.

Section 3.2. Page 13. Line 6-7. RE uncertainties. It may help to bring this information forward i.e. uncertainties calculated according to Paton-Walsh. The first mention of uncertainties in the methods may be a good locus for this information.

Section 3.3. Line 9. The p-value. Not sure what test was done to obtain this p-value?

Table 3. The table caption is not self-contained for the reader. How are the +/- values calculated? What test was done for the p-values? Putting some of this detail in the Table caption may help.

Section 4.1. Page 17. Lines 17-18. "... not only a product of combustion". Are there any quantitative insights regarding non-combustion emissions?

Section 4.2. Lines 29-30. "... wild or prescribed fires, or between measurement platforms". Just wondering whether you have a physical explanation for why wild versus

prescribed MCEs are similar.

Table 4. Last row. Smoke < 20 min. Not sure what this fire type relates too? Further details may help.

Section 4.3. Line 17. I think you mean Table 5?

Line 23. "... two to ten times more acetonitrile and pyrrole". Just a two-fold suggestion here. What is the role of these compounds in atmospheric chemistry and why, perhaps, you got the differences you did compared to Northern American fires.

Table 5. The last column needs to be tidied up a bit. There are question marks and undefined acronyms. Not sure what MACR and MVK relate to for example. Also, you have the use of MM (molecular mass) and MW (molecular weight) in the manuscript. Stick to one term.

Section 5. Page 23. Line 2. "... impacts plume chemistry". In what ways? Some discussion of these impacts in the discussion may round it out a bit more - at least in terms of impact.

Supplementary Information Supporting Data. These aspects of the submission look satisfactory.

Thanks again to the authors for a timely submission regarding VOC emissions from temperate forest fires. The reviewer wishes the authors good luck with the re-submission of this paper to ACP.

Reviewed by: N. Surawski, Sydney, Australia.

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