

Atmos. Chem. Phys. Discuss., referee comment RC1  
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## Comment on acp-2021-742

Anonymous Referee #1

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Referee comment on "Measurement report: Observations of long-lived volatile organic compounds from the 2019–2020 Australian wildfires during the COALA campaign" by Asher P. Mouat et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2021-742-RC1>, 2021

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### General comments

The authors present a set of 21 emission factors (EFs) for longer-lived VOCs measured using a Proton-Transfer-Reaction Time-Of-Flight Mass Spectrometer (PTR-TOF-MS) during an opportunistically sampled wildfire plume strike.

This may be the first deployment of PTR-TOF-MS in Australian temperate forest wildfire smoke, however the need to restrict the analysis to the least reactive species due to the age of the plume (~8h) reduces the number of reported species to 21 (down from 150 identified species) and therefore the added value of using this instrumentation is lost, with relatively few (9) new species quantified for the ecosystem.

The authors use the ratio of maleic anhydride to furan to assess OH oxidation in the plume and the ratio of (cis-2-butenediol + furanone)/furan to assess NO<sub>3</sub> oxidation. The use of (cis-2-butenediol + furanone)/furan as an indicator is new but is confounded by the fact that the oxidation products are emitted by the fire itself.

The manuscript then includes a comparison with EFs reported by a selected number of other studies.

As it is, the manuscript is a reasonably well presented data paper, but the lack of a discussion means that it falls outside of the scope of ACP. As the paper is short, I recommend adding a discussion of the findings in a revised version.

Specific comments/questions

Introduction:

Lines 27-28: There are other references to include to support this statement, including some studies that have a focus on Australia

Lines 35-36: "In 2019/2020, Australia experienced its worst wildfire season on record..." Could you expand on this? And add references? There are so many papers describing this event. Anything about the blanketing smoke would seem relevant in the context of this manuscript.

Line 37: "remained poorly constrained in air quality models". Please add references.

Lines 37-38: "CTMs often use EFs for temperate forests based on measurements in North America" Akagi et al 2013 and Burling et al 2011 are examples of measurements of EFs in North American temperate forests, not of CTMs using them. Do you have examples of CTMs using North American values in an Australian context and getting poor results as asserted on line 37?

Section 2:

Lines 85-86: Was the instrument calibrated after the event as well? Was there much drift in between?

Line 94: Please add a table (in the supplementary info) of all the reported species, what m/z they were measured at, whether they were contained in the calibration cylinders and an indication of uncertainty for each

General comment: A campaign such as COALA would have had access to O<sub>3</sub> and NO<sub>x</sub>

measurements. Could you add these species to the figures in section 3?

Section 3:

Figures 2 and 3: Please explain that m/z 85 is the sum of cis-2-butenediol and furanone in the caption

Line 146: winds from the north? aren't the fires to the south of the site? Can you clarify?

Section 4:

This section needs clarification.

Line 158: "when passing over the active fires ~25 km to the south, near Canberra"

25 km to the south of what? There are no trajectories going over Canberra in Figure 1.

Line 160: "the intensity of the fires near Canberra" Again, none of the trajectories go over the fires near Canberra. I can see how different fires have been sampled (blueish colour right on the coast, yellowish colour a little inland).

Line 163: 25km seems too small a distance

Section 5:

Line 182: The use of standard linear regression is not appropriate here. Use something appropriate like reduced major axis regression.

Line 194: "allow us to report ERs for..." Are these ERs tabulated anywhere? It would be nice to see them, maybe in the supplementary info

Table 1: Add the m/z at which the species were measured. Also, isn't Furanone the sum of furanone and cis-2-butenediol?

General comments on Section 5:

Considering that Permar et al report potential uncertainties of up to a factor of 2 (see Figures 2 and 5 of their paper) and that similar uncertainties apply to this study (one plume sampled) and most of the other studies that are included in the comparison, it seems likely that any 'discrepancies' of up to a factor of 2, 3 or even 4 are actually not significant. The only species that then warrant commenting upon are MVK+MACR, acetonitrile, propene, potentially methyl methacrylate?

Can you calculate the 'modified combustion efficiency' of the plume sampled?

The manuscript needs a discussion section. EFs were measured, they are in rough agreement with other EFs. So what? What makes this more than a data paper? Much of the east coast of Australia was blanketed in smoke for weeks, do your findings shed any light on anything related to this? The species you report on are 'longer-lived' – what are their potential impact on downwind chemistry? Did you see anything interesting in ozone or particulates when the sun rose on the second day? Could you use your oxidation indicators to 'wind back the clock' and determine EFs for more species? As it stands, this manuscript would be better off published elsewhere.

Corrections

Line 42: delete 'in': "higher than those in measured ..."

Line 61: replace 'select' with 'selected'

Line 66: insert "the" in "30 km to **the** northwest"

Line 83: "assist pump"? Wouldn't it be clearer to say something like "air was pulled through the inlet at a flow rate of 3 SLPM for a residence time of 2.5s and the PTR-TOF-MS sampled at X flow rate from this bypass flow"?

Line 184: Replace 'the' with 'that'? "We find the using only the freshest..."