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Interactive comment on "OH reactivity from different tree species: Investigating the missing reactivity in a boreal forest" *by* Arnaud P. Praplan et al.

Anonymous Referee #2

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This manuscript is an important contribution to our knowledge about the emission of BVOCs from vegetation, particularly from boreal forest, and its implication for OH reactivity, considering current gaps in our knowledge in this research area. In particular, this work highlights some important aspects related to difficulties in OH reactivity evaluation, and its dependence on both environmental conditions and methodological limitations. My comments are mostly about the way the results are presented and discussed. While the methodological aspects are generally described in detail, in few cases important aspects should be clarified. There are a number of language flaws that should be corrected. Specific comments are listed below.

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Specific comments:

Line 11: why “even though”?

Introduction: While you emphasize the importance of accounting for OH reactivity by its effects on the lifetime of VOCs oxidants in the atmosphere, there are additional central reasons why OH reactivity and BVOCs composition are important. Among these you can mention photochemical air-pollution and secondary aerosol formation.

Line 29-35: This paragraph use extensively “OH reactivity” which you define on line 111. It will be good to provide a brief explanation/definition before you discuss it here.

Line 31: Can you provide reference/s to support this statement?

Line 42: remove extra “)”.

Line 50: “contradictory” – the use of this word seems inappropriate taking into account the rest of the paragraph.

Line 57: What do you mean by “important” trees? Can you make this point clearer?

Line 83: It’s not a comparison between the “changes in biomass” and other uncertainties; you probably refer to the effect emanating from the former on OH reactivity. While this assumption seems reasonable can you indicate to what extent (e.g., in percentage) this effect could affect your results?

Lines 141-142: Can you explain why you didn’t use C3H8 for the calibration as described by Parplan et al. (2019) and Shina et al. (2008)?

Line 147: Are the values in Eq. 3 referring to the calibration factors? Please indicate their meaning in the text.

Line 148: To what extent humidity can affect your results in addition to (/relative to) the dilution effect?

Line 152: “Other correction factors need to be applied. . .” – Do you mean other than

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the presence of NOX and O3? If so, why did you write “However” in the next sentence?

Lines 152-153: Is this because NOX and O3 are assumed to be effectively removed by the HPZA-7000?

Line 164: “OH levels” – do you mean the effect on RH levels?

Line 168: “t o” should be “to”.

Line 180: Eq. 8, please indicate clearly what is the meaning of the (calibration?) values.

Lines 187-188: Please provide a reference to support this estimation.

Results and discussion: In this section you present 4 figures and 2 tables, but you only once refer to Fig. 5 and Table 1 and 2. Please try to refer the reader to each of these from the text.

Lines 209-2013: I suggest making this paragraph shorter and generally avoid summarizing or discussing the results prior presenting the results themselves.

Table 1 caption: Acronyms - “Te” is not consistent with RH if the latter refers to measurements in the enclosure.

Line 214: Can you support it by statistical analysis?

Line 235: GLVs was already defined before.

Line 236: “as well” appears twice.

Lines 245-247: Can you elaborate on why the fact that stress in your case was not driven by elevated temperature indicates that some of these (missing OHRE) are not terpenoids or oxidized volatile organic compounds?

Line 249: What do you mean by "follows qualitatively"? If you imply for correlation, can you calculate the Pearson correlation coefficient and present it to support this notion?

Lines 253-255: What about aldehydes? How it compares with the findings by Hakola et al. (2017) about aldehyde emissions from Spruce?

Lines 255-257: Does the higher emission of sesquiterpenes at the expense of GLVs under the different conditions can be supported by statistical analysis? Can you use regression to identify which of the parameters (temperature, radiation, precipitation) shows higher association with the emissions rate of the various VOCs?

Line 259: Why “However?

Lines 280-281: Can you indicate to what extent the constant blank subtraction could have affected your results?

Line 282: “quantitatively” - Qualitatively? Can you calculate the Pearson correlation coefficient for all three species?

Line 300: Please indicate the regression you have used to evaluate R. Did you try exponential regression (as is implied by Fig. 5)?

Lines 301-303: Can you provide more information about the nature of the stress and the cause for the low TOHRE?

Line 305: Why not referring to Table 2?

Line 312: What do you mean by "good correlation with temperature"?

Line 316: "In a few cases was even slightly reduced." – this seems reasonable to me. I just want to make sure you have used exponential regression type for temperature.

Lines 321-323: A very general sentence - can you specify which factors ("other factors") and elaborate on that?

Line 332: "stress-induced" - Please specify stress type as much as possible.

Lines 337-338: Can you provide an explanation for that?

Line 341: "highest" - Looks like a contradiction with the rest of the sentence.

References

Hakola, H., Tarvainen, V., Praplan, A. P., Jaars, K., Hemmilä, M., Kulmala, M., Bäck, J., and Hellén, H.: Terpenoid and carbonyl emissions from Norway spruce in Finland during the growing season, Atmos. Chem. Phys., 17, 3357–3370, https://doi.org/10.5194/acp-17-3357-2017, 2017.

Praplan, A. P., Tykkä, T., Chen, D., Boy, M., Taipale, D., Vakkari, V., Zhou, P., Petäjä, T., and Hellén, H.: Long-term total OH reactivity measurements in a boreal forest, Atmos. Chem. Phys., 19, 14431–14453, https://doi.org/10.5194/acp-19-14431-2019, 2019.

Sinha, V., Williams, J., Crowley, J. N., and Lelieveld, J.: The Comparative Reactivity Method – a new tool to measure total OH Reactivity in ambient air, Atmos. Chem. Phys., 8, 2213–2227, https://doi.org/10.5194/acp-8-2213-2008, 2008.

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