Biogeosciences Discussions

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Reply on RC2

Michael Staudt et al.

Author comment on "Growth and actual leaf temperature modulate CO_2 responsiveness of monoterpene emissions from holm oak in opposite ways" by Michael Staudt et al., Biogeosciences Discuss., https://doi.org/10.5194/bg-2022-142-AC2, 2022

Dear referee 2

Thanks you very much for your compliments on our study and the efforts to carefully read and review our manuscript and the inspiring comments. I will soon start revising the manuscript. In the meantime, I would like to address some of the points you raised in your comments:

Referee 2 Comments:

Growth and actual leaf temperature modulate CO2 -responsiveness of monoterpene emissions from Holm oak in opposite ways

The manuscript describes a greenhouse experiment where the effects of elevated CO2 and growth temperature on holm oak leaf scale monoterpene emission rates are assessed. This is very relevant research topic already for decades, and the authors manage to scrutinize the experiment in a way that they can eventually conclude novel and interesting results.

The monoterpene emission responses to elevated CO2 and temperature were decoupled. Clear differences between cool- and warm-grown plants could be seen, the latter being more sensitive to CO2 inhibition. Contrasting this, a lower actual measurement temperature seemed to lead to larger CO2 inhibition compared to measurements at higher (35C) temperatures. This is rather surprising when the temperature difference is only 5C. The authors explain this with the leaf energy balance, similarly as has been shown for isoprene. Still, some explanations of the seemingly rather small temperature difference should be interesting for readers. In contrast, growth CO2 had no significant effect on emission CO2 sensitivity, although it promoted plant growth and the leaf's emission factor.

The methods are well designed and elegantly used. Several different normalisation methods are used for assessing the uncertainties related to plant chemotype, growth conditions and measurement conditions. Finally, the obtained non-linear responses are used to upscale the short term impacts to annual emission dynamics using the MEGAN algorithm.

Overall, the ms represents an elegant experiment and is well compiled. It could be revised by removing some of the speculations and using the figures more directly to show the reader the main results, this would lead to significant shortening and clarifications of the

main messages.

Answer: Thank you very much for these very positive words. I will consider all advices during my revision. However, it would be helpful for me if the reviewer could clarify the meaning of "the more direct use of figures..." and also which speculative conclusions she/he thinks should be removed.

Some linguistic errors and typos should be corrected, and a few other aspects could be clarified in the manuscript:

- how old were the measured leaves, were they of same age? what part of the canopy?

Answer: All leaves were mature leaves of the current year. The age of the leaves in months is not known. For practical reasons, leaves were selected that were not too small and were at the end of the shoots so that they could be accommodated in the LiCOR leaf chamber and covered the entire chamber surface.

- how tall were the saplings?

Answer: the height of the saplings ranged between 15 and 70 cm.

- what was their rooting size?

Answer: The size of roots or any measure requiring the harvest of the plants were (unfortunately) not made at the end of the experiment.

- emission measurements: how many adsorbent tubes per CO2 level and leaf?

Answer: Only one VOC sample per CO2 level so that the VOC sampling phase and consequently the duration of the entire CO2 ramping was not too long. Overall, we had very few sample losses due to errors in the GC-MS analysis. In contrast, we lost entire CO2 ramping series because the leaf was injured or even detached (the petiole of Q ilex leaves is very short).

- was the humidity of incoming air controlled?

Answer: The humidity of the incoming air was not controlled (H2O-scrubber was not used). Mean relative humidity during CO2-ramping was 43 +/- 5 and 32 +/- 6 at 30°C and 35°C respectively.

- Supplementary table 1 has remnants of non-english origin (mars)

Answer: thanks for this hint, I will correct it.

- Figure 5 is an overview of the correlation network, but is does not really clarify the results and is almost impossible to read. I recommend removing it. However, I was missing a multivariate analysis where the combined effects of temperature and CO2 levels could have been assessed.

Answer: I agree that the figure is not easy to read even though it shows only the main connections. However, besides showing the key correlations, it can help readers understanding the experimental protocol. Therefore, I suggest keeping the figure as supplementary material in supplement 2 (near the corresponding matrices of Pearson correlation). The scatter plots shown in Figs 1 and 3, which can be extended, plus more detailed descriptions of the Pearson results in the text should be sufficient. In addition, I will improve the coloration of the matrices towards a kind of heat map, thus providing a

more easy readable overview of the correlation networks.

Regarding multivariate analyses I will check what I am able to do and whether the outputs are instructive.

Thank you again for your kind review. I look forward to your feedback.

With kind regards,

Michael Staudt