

Reviewer #1

Fang et al., in their article "Litter decomposition enhances volatile organic compound emissions from a freshwater wetland: insights from a year-round in situ field experiment", present results from year-round VOC fluxes in a freshwater wetland located in southeastern Anhui Province in China for three different treatments: no litter addition, 1.4kg litter, and 2.8kg litter.

The manuscript is clear and the arguments easy to follow. The presentation of the results is clear, and they are discussed appropriately. I only found minor issues, which I trust the authors will be able to address. Therefore, I recommend accepting the manuscript with minor corrections.

Reply: Thank you for the helpful comments and providing us the opportunity to revise the manuscript. We have carefully addressed the comments in point-by-point form as shown below.

Minor comments:

- ll. 128-131: An important element that is missing from the manuscript is an indication of naturally occurring litter. How much is it in treatment A? Are the authors able to give an estimate?

Reply: Thanks for the comments. In fact, in treatment A, the *Phragmites Australis* above the roots were removed and no plant litter was added. This treatment was used to compare the wetland-air exchange of VOCs under no plant litter decomposition.

Moreover, as for naturally occurring litter, you pointed out an interesting question, which was also in our previous consideration. However, we finally have not included the estimations and discussion on this part in our manuscript for two reasons as below: First, in addition to *Phragmites Australis*, there are several other plants that live in the wetland. These plants have different growth cycles and could be also affected by the current global warming trend, which poses a challenge for estimating naturally occurring litter. It is therefore unfortunate that we are currently unable to provide such an estimate.

Second, the objectives of this study are to investigate the wetland-air exchange of VOCs and the impacts of plant litter decomposition. Using 11 in-situ field experiments in the wetland, we obtained the results that allow us to achieve above aims. Estimating naturally occurring litter is quite interesting and meaningful work but is obviously outside the scope of the present study. Anyway, you have made a valuable suggestion that we will consider it in our next work.

- ll. 134-136: Could the authors elaborate on when the *Phragmites Australis* above the roots were cleared in relation to the first samples being taken? In addition, could the authors briefly mention why roots were/could not be cleared up?

Reply: Thank you for the comments.

1) The *Phragmites Australis* above the roots were removed on December 21, 2021, eighteen days before the first formal sampling on January 9, 2022.

2) When we conducted the in-situ field experiments, the roots of *Phragmites Australis* were not removed. On the one hand, as mentioned in the original manuscript, we have, as far as possible, not made much significant intervention in the wetland ecosystem. More importantly, this is more likely to follow the process of plants' natural apoptosis, during which the roots remain in the wetland soil.

In the revised manuscript, we also added above information as follows:

“only Phragmites australis above the roots were cleared up on December 21, 2021, eighteen days before the first formal sampling (January 9, 2022). As showed in Fig. 1 (b), the roots were kept in the nine boxes and this is more likely to follow the process of plants' natural apoptosis, during which the roots remain in the wetland soil.” (Line 137-141)

- ll. 213-214 (and Fig. S3): I wonder if Fig. S3 is necessary and if the authors should not instead refer to the literature to back their statement about this positive feedback loop. In addition, in Fig. S3 'arise' is the only intransitive verb and should be replace by 'increase', for instance, to be consistent with the two other (transitive) verbs.

Reply: Thank you. As reviewer suggested, we have deleted Fig. S3 in supplement.

- ll. 227-230: The authors only state that the 'technique used here failed to fully characterize higher molecular weight species, such as monoterpenes and lower molecular weight species, such as methanol'. Could the authors be more specific in relation to the limitations of the method? Does it have to do with the sampling? Also,

do the authors mean 'higher molecular weight species, such as sesquiterpenes' as they include at least two monoterpenes in their results (Table S1).

Reply: Thank you for carefully reviewing our manuscript. As you pointed out, the higher molecular weight species were sesquiterpenes rather than monoterpenes. In the updated version, we have modified this. Moreover, the method limitations for higher molecular weight species such as sesquiterpenes and lower molecular weight species such as methanol were described as below:

“Previous studies reported the release of significant amounts of sesquiterpenes and methanol during the decomposition of litter (Gray et al., 2010; Faiola et al., 2014). However, due to wall loss, the canister sampling method used here failed to fully capture sesquiterpenes (Helmig et al., 2004; Frazier et al., 2022). In addition, the lower molecular weight species (< C₂) such as methanol could not be characterized by a pre-concentrator coupled with the GC-MSD technique.” (Line 239-244)

References

- Helmig, D., Bocquet, F., Pollmann, J., Reверmann, T., 2004. Analytical techniques for sesquiterpene emission rate studies in vegetation enclosure experiments. *Atmos. Environ.* 38, 557-572. <https://doi.org/10.1016/j.atmosenv.2003.10.012>.
- Frazier, G., McGlynn, D.F., Barry, L.E., Lerdau, M., Pusede, S.E., Isaacman-VanWertz, G., 2022. Composition, concentration, and oxidant reactivity of sesquiterpenes in the southeastern U.S. *Environ. Sci.: Atmos.* 2, 1208-1220. <https://doi.org/10.1039/d2ea00059h>.

- 1. 232: The authors lead the discussion of seasonal pattern with a figure in the supplement material (Fig. S4). If the figure is important, it should be part of the main text. Also, I wonder if Fig. S4 is absolutely necessary given that the authors should be able to support their conclusions with Fig. 3 from the main text (mentioned later in this section), as well as with Fig. 5.

Reply: Thank you for the suggestions. We agreed with your comments and deleted Fig. S4 as you suggested.

- Conclusions: I would like to again mention that it would be interesting and important for context to give the reader some information about the amount of litter naturally occurring at the wetland, potential changes in litter amount throughout the seasons, and how litter amounts are expected to change in a warming climate? Is more or less litter, expected to be found in the wetland? This information might also be included in the introduction and the discussion sections of the manuscript.

Reply: Thanks. As replied to the comments above, on the one hand we are currently unable to estimate the amount of litter naturally occurring in the wetland; On the other hand, estimating naturally occurring litter is beyond the scope of this manuscript. We greatly appreciate your valuable comments and suggestions. In the revised manuscript, we added some sentences on plant litter naturally occurring in wetland in the **Introduction**, which were also provided as follows:

“Plant litter includes dead plants and dead plant material detached from living plants, the amount of which is significantly affected by climate (Cornwell et al., 2008). Future

global warming could alter the growth cycle of plants and accelerate plant litter breakdown, potentially leading to more litter BVOC emission.” (Line 69-73)

Reference

Cornwell W.K., Cornelissen J.H., Amatangelo K., Dorrepaal E., Eviner V.T., Godoy O., Hobbie S.E., Hoorens B., Kurokawa H., Pérez-Harguindeguy N., Queded H.M., Santiago L.S., Wardle D.A., Wright I.J., Aerts R., Allison S.D., van Bodegom P., Brovkin V., Chatain A., Callaghan T.V., Díaz S., Garnier E., Gurvich D.E., Kazakou E., Klein J.A., Read J., Reich P.B., Soudzilovskaia N.A., Vaieretti M.V., Westoby M., 2008. Plant species traits are the predominant control on litter decomposition rates within biomes worldwide. *Ecol Lett.* 11, 1065-1071.
<https://doi.org/10.1111/j.1461-0248.2008.01219.x>.

- Text S1: The authors seem to describe their laboratory blanks, but then mention that 'only when no targeted VOC were detected' the canisters were used for sampling. It is a little confusing. Why is only 10% of the evacuated canisters then analysed? Or have all the canisters been analysed earlier at some point for this project?

Reply: Thanks. Before sampling, the canisters must be cleaned to remove any possible residual contaminants. To check whether the canisters were really clean, we refilled the cleaned canisters with high pure N₂ and analyzed them by GC-MSD in the same way as the samples. We have agreed with you that all cleaned canisters should be checked, but this process is laborious, time-consuming and can be unnecessary. Because based on our 16 years of experience in VOC laboratory analysis, the canister cleaning method

we reported in the manuscript is reliable and no targeted VOC species are measured in the cleaned canisters. Thus, in the later experiments, we randomly selected 10% of the cleaned canisters for further check before sampling. If targeted VOCs are detected in any of the selected cleaned canisters, all cleaned canisters will be re-cleaned and inspected. This method for verification of canister cleanliness is also recommended by US EPA (https://www.epa.gov/sites/default/files/2019-12/documents/to-15a_vocs.pdf).

- Figure S2: I fail to understand the blue columns in this figure. I understand the numbers, but I don't understand their relation to the blue columns and if the blue columns have the same x-axis as the green bars. This should be made more understandable.

Reply: Sorry for that. Based on your comments, we have revised the Fig. S2 in the updated version.

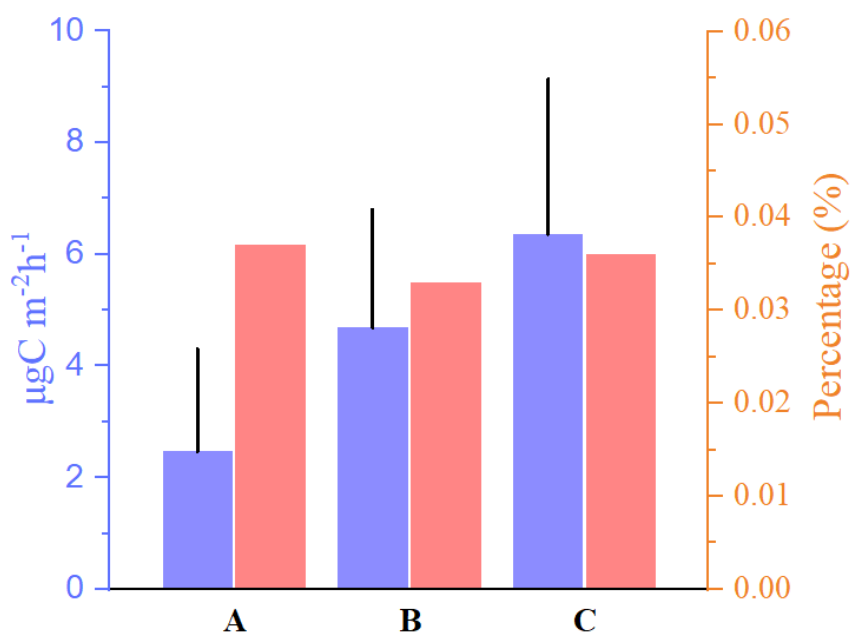


Fig. S2. The carbon fluxes contributed by VOCs in the three treatments. Error bar was

the standard error. Red column represents the percentage of VOC-driven carbon in total calculated carbon (VOCs, CO₂ and CH₄).

Technical/language comments:

- 1. 245-247: Should the sentence end with 'in all three treatments' or 'in the three treatments'?

Reply: Thanks. We revised as “in all three treatments”.

“in all three treatments” (Line 260)

- 1. 324: I would not use the turn of phrase 'ranked No. 1 contributor', which seems a little clunky compared to 'contributed most' or 'was the main contributor'.

Reply: Thank you. Revised as suggested.

“contributed most” (Line 338)

- 11. 417 and 427: The conclusions include twice the acronym TVOC, which has not been defined.

Reply: Thanks. We revised this in the manuscript.

“the net fluxes of total volatile organic compounds (TVOCs)” (Line 430)

- 1. 430: While 'increasement' can be found in a dictionary, it is obsolete and can be replaced by 'increase'.

Reply: Revised as suggested.

“increase” (Line 443)

- l. 735: '11 campaigns': I would think that all the measurements in this study form a campaign, not each individual sampling time.

Reply: Thank you. We agreed with you and modified “11 campaigns” as “11 samplings”.

“11 samplings” (Line 101-102, 731)

- Table S1: I noticed some small inconsistencies in the number of digits reported in this Table (e.g. sometimes ± 0.1 and sometimes ± 0.10).

Reply: Thanks. Based on your comments, we have revised the number of digits and kept it consistent in the Table S1.