

Biogeosciences Discuss., referee comment RC2  
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## **Comment on bg-2022-189**

Inge Althuizen (Referee)

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Referee comment on "Warming accelerates belowground litter turnover in salt marshes – insights from a Tea Bag Index study" by Hao Tang et al., Biogeosciences Discuss., <https://doi.org/10.5194/bg-2022-189-RC2>, 2022

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The manuscript presents a study of belowground decomposition processes in salt marshes in response to climate warming, which are underexplored. The experiment has a novel experimental design that makes use of two warming treatments along a flooding gradient, where decomposition rates and stabilization factor were assessed throughout the soil profile using a standardized litter bag method (tea bag index; TBI). In addition, soil redox index was measured along this gradient to deduce whether changes in hydrology and redox conditions affect decomposition.

The study design has multiple aspects and gives interesting new insights to decomposition processes in this system and the manuscript is in general well written, though there are some sections that need further clarification. I also have more substantial comments regarding the methodology and performed analyses that I will detail below.

Since the experiment was performed in salt marshes, leaching could play a large role in mass loss due to high soil moisture/inundation and might influence the findings, see for example (Gessner et al. 2010, Lind et al. 2022, Marley et al. 2019). While the authors do state that they used a tidal wetland-adapted TBI protocol, I would like to see details on what adjustments this protocol has for the  $k$  and  $S$  calculations within the manuscript and whether this takes into account leaching. In addition, it might be good to raise and discuss this point already in the introduction.

I also wondered whether the use of PVC tubes could influence the conditions in which the decomposition experiment was performed, as the solid pipes might prevent water flow and could potentially also hinder the warming treatment used. Could the authors address this point. Potentially assess whether the temperature treatment was affected by the use of solid PVC tubes?

This also leads me to another point that I would like clarification on being the temperature monitoring. The authors only provide a mean temperature during the deployment time for the different zones. Which leaves me to wonder whether temperature was also monitored in the various treatments, to check whether treatments were effective. I could also not find at which depth temperature was monitored, only 1 depth or throughout soil profile? Could the authors provide a figure with the temperatures for the different zones and treatments throughout the deployment times to give a better representation of the treatments used?

The description of the statistical analyses is different from the results you present. From the results I deduce that you have performed separate analyses of warming and zone and their interaction for the different years (between subject), excluding the effect of depth.

Then there is separate analysis of the effect of depth, depth\*zone and depth\*zone\*warming (within subject). In the statistical analyses section these are lumped together and it is not clear that the analyses were performed for each year separately. Furthermore, it is not clear to me why these analyses are split and what the authors mean with the indication "between subject" and "within-subject"? The "within subject" analysis would still need warming and zone included as separate factors to account for their effect.

Furthermore, there is no mention of analysis done to produce figure 5 and it is hardly discussed in the results. Lacking this information it is hard to properly assess the results.

Personally, I think Figure 5 gives a much better look into how the different factors influence decomposition rate  $k$  and  $S$ . I think expanding on this analysis would improve the manuscript as it sheds more light what factors/conditions affect decomposition in salt marshes. This could also be a way Figure 3 and 4 could then potentially be moved to supplementary material.

I also wondered why the authors did not use the measured soil reduction index in their analysis, as they as they discuss the influence of redox a lot in the discussion, but have not directly tested these links in their analysis. Why not use reduction index as predictor of  $k$  and  $S$ ?

Specific comments

line 68. What do the authors mean with short- and mid-term warming?

Line 96 Can the authors also indicate the location of the different warming treatments. And were these treatments randomly assigned?

Line 132. Not clear if it is 1 PVC stick per zone or whether there is replication? The transect in the next line adds to my confusion. Figure 6 legend states "n = 6 observations per zone, deployed over four consecutive deployment campaigns (July-October)". Clarify in methods.

Figure 3 Hard to read this figure as the error bars of the different treatments are overlapping. Please adjust figure so it is possible to discern the different treatments per soil depth.

Line 114 Incubation period different in 2018 and 2019, June-Sept vs May-July. Why? This does explain why temperatures were higher in 2018 as it is later in the season.

Line 150-153 It is not clear to me what the authors are trying to say. Clarify

Figure 3c Why high marsh higher k in +1.5 vs +3.0 treatment?

Why k higher in warming treatments in 2019 vs 2018? Bigger difference in temperature?

Technical corrections:

Line 49 "in" question

Line 50. Do the authors mean labor intensive instead of efficient? Constructing a lot of litter bags is labor intensive in my opinion.

Line 54 rephrase: represents a widely used standardized litter bag approach

Line 68 replace “over” with “for”. Over implies the incubation time was either 1 or 2 years, but there were separate 3-month incubations in each year.

Line 81 Can the authors use a more widely known standard like meter above sea level for to indicate elevation instead of NHN?

Line 132 “.” After citation

Line 132 remove “from pioneer.... High marsh.”

Line 248 known

## References

Mark O. Gessner, Christopher M. Swan, Christian K. Dang, Brendan G. McKie, Richard D. Bardgett, Diana H. Wall, Stephan Hättenschwiler, Diversity meets decomposition, *Trends in Ecology & Evolution*, Volume 25, Issue 6, 2010, Pages 372-380, ISSN 0169-5347, <https://doi.org/10.1016/j.tree.2010.01.010>

Lind, L., Harbicht, A., Bergman, E., Edwartz, J., & Eckstein, R. L. (2022). Effects of initial leaching for estimates of mass loss and microbial decomposition—Call for an increased nuance. *Ecology and Evolution*, 12, e91118. <https://doi.org/10.1002/ece3.9118>

Marley, A. C. R. G., Smeaton, C., & Austin, W. E. N. (2019). An assessment of the Tea Bag Index method as a proxy for organic matter decomposition in intertidal environments. *Journal of Geophysical Research: Biogeosciences*, 124. <https://doi.org/10.1029/2018JG004957>