

Biogeosciences Discuss., referee comment RC3
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Comment on bg-2022-189

Anonymous Referee #3

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-RC3>, 2022

This paper examines patterns of initial decomposition rate and stabilization factor over a flooding gradient and depth profile in a tidal marsh. The focus on decomposition over an elevation gradient and belowground, where the greatest contribution by plants to blue C accumulation occurs, represents an important contribution to the literature. Further, the use of standard substrate to control for litter quality allows for a focus on abiotic drivers of decay. Overall, this is a good paper that, with some clarifications to the methods and stats and additional interpretation of results, will add valuable insights to decomposition processes in tidal marshes that are especially vulnerable to climate change.

Specific comments and questions:

L60-61: clarify by explaining what their proposed mechanism is for how the lack of oxygen inhibits warming effects.

L63: reiterate that the use of a standard substrate is needed to understand warming effects.

L70: is the first hypothesis expected regardless of soil depth?

Site description – Figure 1 is difficult to see, and the zones are not clearly defined in the text. It would be helpful to explain how the zones are oriented relative to the open water, with the pioneer zone along the shoreline and the high marsh farthest inland. Also, how is "pioneer zone" defined?

Experimental design – How was the soil warming established and verified along the soil depth gradient? Was there uniform warming of the soil column or did it vary with depth? It would be nice to see a graph of these data. Did you confirm treatment conditions of +1.5 and +3 degrees warming? Why was the average soil temperature from -10 and -60 cm used as opposed to looking at temperature along the soil depth gradient at the same intervals at which decomposition and soil reduction were measured?

Decomposition – why was this examined across two different periods (June-Sept vs. May-July) in the two years? It is not surprising that ambient temperatures were cooler in year 2 (late spring/early summer) than in year 1 (late summer), which may have contributed to the larger effect sizes of warming in year 2 compared to year 1. Address why these time periods were selected, and later discuss how this could have affected results.

Statistics – This section is lacking details and does not fully track with the results presented. Were years compared statistically or tested separately? Why or why not? How were the effect sizes determined and analyzed, and why was this only examined in year 2? How was soil reduction analyzed?

For the discussion and methodological considerations, how much could leaching be contributing to the results and different findings for k and S along the flooding gradient? How did the PVC influence the hydrology or connectivity of the tea bags with their surroundings? Was the temperature gradient verified within those PVC pipes? It would also be useful to revisit the importance of litter quality, as well as species-specific differences in decay with species turnover along the elevation gradient. While this study was designed to avoid plant influences, brief discussion of how it could affect these patterns, and how shifts in community composition with sea-level rise is another climate change driver to be considered that, if species differ in their contributions to blue C, could have implications for marsh resilience.

Technical comments:

L13: clarify “plant production”

L15: suggest “entire intertidal flooding gradient”

L17: delete “of” before “(k)”

L54: delete “probably”

L59: offset "and thus strongly reducing" with commas

L69: what is short- and mid-term warming effects? Is this in reference to projected warming of +1.5 vs. 3 degrees?

L71: combine sentences so that it reads "...soil, and (2) that warming..."

L77: "has operated" instead of "operates"

L79: change comma after climate to semicolon

L148: should this be "appear to be consistent"?

L150: this is unclear. What do you mean by "refer the significant interaction"?

L152: clarify that the relationship is "with increasing soil depth"

L192: change to "a large" instead of "an"

L209: add a comma after the citation

L248: "known"