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# *Interactive comment on* "Global change effects on decomposition processes in tidal wetlands: implications from a global survey using standardized litter" *by* Peter Mueller et al.

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General comments

This paper discusses the control that the soil matrix exerts on the decomposition of organic matter in tidal wetlands. Their large carbon stocks and sensitivity to global change make this a highly relevant topic for scientists and policy makers alike. The paper is well-written and easy to read, while presenting novel data with important conclusions on the relation between decomposition and global change. The usage of a standardised method over a wide range of tidal systems allows for a generalisation to the global scale, making this paper relevant to the broad readership of Biogeosciences.



The explorative nature of the experiment also introduced some unavoidable methodological weaknesses. Many of the environmental parameters which are discussed in relation to decomposition are often strongly correlated with tidal regime (i.e. soil temperature, salinity, nutrient status, microbial biomass, and redox status), or latitude (i.e. nutrient limitation, vegetation type). In its current version, the manuscript does not always acknowledge the potentially spurious relation between these factors. While this does not invalidate the main conclusions I would recommend to consider non-causality more carefully when attributing effects to specific environmental parameters

The current description of the data-analysis does not describe how the authors have ascertained themselves that underlying assumptions of the statistical tests used were not violated. Where applicable, tests of heterogeneity, normality, and independence should be included, or other tests considered. For example a linear fitting is performed between k and S with temperature, without mentioning testing for residual patterns to uncover non-linearity. As the authors note the relation between decomposition and single parameters are often not linear (L221), in which case the result of a linear model is unreliable.

Lastly, I would like to add that the strength if the TBI lays in its standardisation. I would therefore recommend to mention the S/k calculated with the standard approach alongside with the re-scaled values calculated with the more aggressive extraction method. This would allow for easy comparison with other data such as the TBI-values from mangroves mentioned in the methods paper. See also below.

specific comments

L79 and L83-L84 seem largely redundant to me

L85-L86 'OM decomposition' is somewhat ambitious as it is not clear whether this refers to decomposition rate (k) or extend (S), please revise.

L117 Although this should have been more explicit in the TBI method paper (Keuskamp

et al, 2013), the k estimated by TBI is not exactly equivalent to the classical litter bag experiment as it describes the decomposition rate of the hydrolysable fraction and is not calculated over the entire mass. We have therefore adapted k1 to indicate that this is the k of the most labile fraction, as opposed to k2 which refers to the decomposition rate of the recalcitrant fraction. to the To avoid confusion this should be made explicit here.

L120 The recalcitrant fraction is also decomposable, albeit a lot slower

L127 ' thereby improving our process-level understanding on how global warming affects carbon turnover' Not sure what this means exactly

L137 I am somewhat surprised that the oxidation of organic matter would be limited by the supply of SO4 in brackish tidal wetlands. Wouldn't the constant flushing with water replenish SO4 to saturating levels in brackish/salt water systems?

L154 '(i.e. dwarf vs. fringe phenotypes)' Aren't these also Rhizophora vs Avicennia? In that case phenotypes would not be the appropriate description. These mangroves belong to different genera, each with their own properties (soil oxygenation, phenolic compound production, N-content) that are known to influence decomposition.

L154 'Relative elevation' as relative to what? mean lower tide, mean mean tide? please specify

L169-170 Decomposition rates depend on soil temperature rather than on air temperature. Others have shown (e.g Piccolo et al. 1993, Reckless et al. 2011) that in tidal wetlands, the soil temperature is strongly determined by inundation regime in which case the accuweather temperature are not an accurate reflection of the decomposition environment. Moreover, inundation regime and temperature effects would be confounded. Could it be shown accuweather estimated temperatures vs measured temperatures so that the reader can see for themselves whether the accuweather approximation suffices?



L176 Pepsico, to my knowledge the bags are produced by Lipton, which is a Unilever brand.

L180 Were the reference bags dried at 70oC prior to mass determination?

L198-L200 It could well be that the method described is a more accurate operationalisation of the labile (non-hydrolysable) fraction. Redefining the labile fraction and the consequential shift in S, and rescaling of k, may however lead to misunderstandings when the results of this study are used in comparisons with other TBI experiments. I would therefore suggest to provide the TBI S/k values calculated according to protocol alongside the obtained S/k values obtained by the revised protocol.

L220-L250 Would you be able to indicate whether potential violations of the assumptions underlying the statistical tests were assessed? For example, were the residuals of the ANOVA procedure tested for normality / homogeneity of variance?

L250 It is critical to this conclusion that air temperature is a good proxy of soil temperature (see earlier remark). The interaction between temperature effect and tidal position reinforces the suspicion that this is not the case.

L314 As also noted in L313, the absence of a temperature effect is very unusual. Could the authors rule out the possibility that this is due to a mismatch between soil and air temperature?

L332 I would recommend discussing potential confounding of temperature effects with other changes in decomposition matrix(e.g. nutrient availability, redox status, vegetation, salinity). With respect to k, such reservations are made in L323/L329, but are absent here.

L351 Can this be generalised to continuously submerged parts of the soil? The TBI is at a relatively low depth, where tidal pumping may cause increased influx of oxygen during tidal subsidence. Especially in tannin-rich mangrove systems, temporal oxygenation may make a large difference by allowing breakdown of phenolic compoounds (see also

Freeman et al, 2001)

L445 In mangrove TBI experiments that I have conducted S values have always been positive, and I am somewhat puzzled by the large difference. Negative S values could also be caused by loss of recalcitrant particles as I have observed when using teabags in open water. Did you have any indications that this has taken place here?

Technical corrections L74 Earth? Not sure if this should be with a capital E L77 Separate SRL from citations L94-98 This sentence is very hard to read. Split. L346 add 'in' before 'tidal wetlands'

References

M.C. Piccolo, G.M.E. Perillo, G.R. Daborn, Soil Temperature Variations on a Tidal Flat in Minas Basin, Bay of Fundy, Canada, Estuarine, Coastal and Shelf Science, Volume 36, Issue 4, 1993, Pages 345-357, ISSN 0272-7714, https://doi.org/10.1006/ecss.1993.1021.

Klaus Ricklefs, Klaus Heinrich Vanselow, Analysis of temperature variability and determination of apparent thermal diffusivity in sandy intertidal sediments at the German North Sea coast, Estuarine, Coastal and Shelf Science, Volume 108, 2012, Pages 7-15, ISSN 0272-7714, https://doi.org/10.1016/j.ecss.2011.09.015.

Freeman, C., Ostle, N., & Kang, H. (2001). An enzymic "latch" on a global carbon store. Nature, 409(6817), 149–149. http://doi.org 10.1038/35051650

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