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Interactive comment on "Factors controlling *Carex brevicuspis* leaf litter decomposition and its contribution to surface soil organic carbon pool at different water levels" *by* Lianlian Zhu et al.

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Comment 1.1 General comments Zhu et al. not only identified the major factor controlling leaf litter decomposition as water level, but also revealed its working approach in natural freshwater wetlands. The systematic and scientifically sound design delivered new insights into wetland leaf litter decomposition processes and consequences. I recommend to be accepted after revision. Response 1.1 We appreciate the positive evaluations from the reviewer on our work and are grateful for the reviewer for recognizing the potential impact of our work. Comment 1.2 Specific comments Abstract: L25-27: The key rate values should be added. Response 1.2 Thank you very much for your detailed suggestion. L25-27 has been changed to: The percentage litter dry weight loss and the instantaneous litter dry weight decomposition rate were the highest at +25 cm water level (61.8%, 0.01307d-1), followed by the 0 cm water level (49.8%, 0.00908 d-1), and the lowest at -25 cm water level(32.4%, 0.00527 d-1). See line 25-27 in the revised manuscript. Comment 1.3 L33: Change "strengthen" to "increase". Response 1.3 Changed as suggested, Thank you! Comment 1.4 L35: Change "influences" to "influenced". Response 1.4 Changed as suggested, Thank you! Comment 1.5 L36: Change "affects" to "and affected". Response 1.5 Changed as suggested, Thank you! Comment 1.6 Introduction: L40: Change "25" to "25%". Response 1.6 Changed as suggested, Thank you! Comment 1.7 L66-69: Move to M & M. Response 1.7 Thank you for the suggestion. We have moved "Dongting Lake (28°30'–30°20' N, 111°40'–113°10' E) is the second largest freshwater lake in China. It is connected to the Yangtze River via tributaries. Dongting Lake wetlands are characterized by large seasonal fluctuations in water level ($\leq$ 15 m) and are completely flooded during June–October and exposed during November–May (Chen et al., 2016)." to "Materials and methods" section as suggested. Please see L82-L85. Comment 1.8 L71: Species is not a vegetation Response 1.8 Thank you for the reminder. This sentence has been rephrased as "Carex brevicuspis is a dominant species in the Dongting Lake wetland". Please see L69. Comment 1.9 L82: Unclear. "decomposition controls differs"? Response 1.9 We are sorry for the ambiguity. It means that the intrinsic control factors are different at different water levels. This sentence has been rephrased as "the intrinsic factors that control litter decomposition rate at three water levels are different" to avoid confusing. Please see L78-79. Comment 1.10 L100: Move "which is . . ." to L91. Response 1.10 Thank you for the comment. This sentence has been moved to line 88-89 in the revised manuscript as suggested. Comment 1.11 L101: What's the source of the belowground water? Response 1.11 We are very sorry for our negligence of detailed description about the belowground water. The belowground water is extracted from the well in the experiment site by the water pump. We have added this information in M&M part. Please see L99-100. Comment

1.12 L105: How to arrange the 15 litterbags (10 cm × 15 cm) within each soil cores (40 cm diameter)? Response 1.12 We are very sorry for our negligence. Litter bags were laid flat on the surface of the soil. Each litter bag was not filled, and there are a little overlap between the litter bags where there is no litter. Please see L104-105. Comment 1.13 L170: Multiple regression method should be added. Response 1.13 Thank you for the suggestion. We have added the following sentence in the statistical analyses section. The intrinsic litter decomposition rate-limiting factors were analyzed by stepwise regression method in a multiple regression model. Please see L174-175. Comment 1.14 L198-201, Table 1: Why not choose the same variables in every regression model? Please explain or give the methodology basis. Response 1.14 We are very sorry for our negligence. Stepwise regression is used to calculate the regression model, the variables were the result of Stepwise regression model filtering, so the variables were different. The regression model methodology has been added in section 2.6, in L174-175. Comment 1.15 Figure 1: The full words of S, L and D should be added in the caption. Response 1.15 Thank you for the detailed suggestion. The following paragraph has been added in the Figure 1 caption. L represents litter which was distributed on the soil surface in 15 litter bags to observe the effects of leaf litter input on soil carbon pool; S represents soil which was designated the litter removal control; D represents decomposition which was distributed on the soil surface in 15 litter bags to monitor the litter decomposition rate and process. Please see L454-458. Comment 1.16 L227: K-value should be kept consistent with k occurred in M & M. Response 1.16 We are very sorry for our negligence. K-value in L227 in the original manuscript has been changed to the instantaneous litter dry mass decay rate (k) that was kept consistent with k occurred in M & M. Please see L229-230. Comment 1.17 L230: Please specify which results. Response 1.17 These results are that the percentage litter dry weight loss and the decomposition rate increased with water level supported our first hypothesis. "Hence, the percentage litter dry weight loss and the decomposition rate increased with water level. These results supported our first hypothesis." has been rephrased as following: "Hence, the percentage litter dry weight

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loss and the decomposition rate increased with water level, which supported our first hypothesis." Please see L232-233. Comment 1.18 L232-233, 244-245: Not always the truth. Water will inhibit most decomposition as well for lack of oxygen. Response 1.18 We are sorry for the ambiguity. The purpose of quoting this sentence is to show that there are existing studies supporting the results in our study, and to provide a scientific and reasonable explanation for my research results. The sentences have been changed to: Related research showed that the wetland water level strongly affects litter leaching and microbial decomposition (Peltoniemi et al., 2012). Molles et al (1995) also found that compared with the terrestrial environment, in wetland, water promotes litter leaching and microbial metabolism, thereby accelerating litter decomposition. Moreover, water infiltration into litter also increases relative leaching loss (Molles et al., 1995). Please see L234-238. Comment 1.19 L251-259: It's more interesting to discuss why the same litter subject to various water levels were mainly controlled by different factor? Response 1.19 Thank you for the suggestion. This is mainly because that in different water levels, the rates of N lost were different. At the 0 cm and +25 cm water level, N is rapidly lost and the L/N ratio significantly increases. Thus, L/N is the main internal limiting factor at the 0 cm and +25 cm water level. Please see L261-263. Comment 1.20 L279-280? Any references? Response 1.20 References (Gao et al., 2016;Chen et al., 2018) have been added in the text. Please see L286-287. Comment 1.21 L285-286: Repeated from Abstract. Response 1.21 We are sorry for the mistake. The conclusion has been rephrased as "In this study, we quantified the contribution of leaf litter decomposition on soil surface organic carbon pools (S-SOCPs) under different water level conditions. Appropriate flooding (+25 cm water level treatment in our study) can significantly promote the decomposition of litters and contributed about 13.75% organic carbon to S-SOCPs. Under waterlogging condition (0 cm water level), litter decomposition, which mainly controlled by microbial activity, contributed 4.73% organic carbon to S-SOCP. However, under relatively drought condition (-25 cm water level treatment in our study), litter decomposition only contribute about 2.51% organic carbon to S-SOCP, which is largely ascribe to the slower decomposition rate and soil carbon lost by metabolism of the microbes (i.e. actinomycete). We also found that lignin and/or lignin/N content were intrinsic factors controlling litter decomposition rate in Carex brevicuspis. In Dongting Lake floodplain, the groundwater decline which was caused by the climate change and human disturbance would slowdown the return rate of organic carbon from leaf litter to soil, and facilitate the S-SOCP loss." Please see L291-302. Comment 1.22 L291-293: Beyond the support of this study. Response 1.22 We accept this comment and this part had been deleted. Our conclusion has been rephrased as follows: Appropriate flooding can promote the decomposition of litters. The flooding can break the limit of lignin in the decomposition of litters. The flooding state is more conducive to the input of litter carbon into the soil, and the main input form may be DOC. The references in the responses were listed as follows: Chen, H. Y., Zou, J. Y., Cui, J., Nie, M., and Fang, C. M.: Wetland drying increases the temperature sensitivity of soil respiration, Soil Biology & Biochemistry, 120, 24-27, 10.1016/j.soilbio.2018.01.035, 2018. Gao, J. Q., Feng, J., Zhang, X. W., Yu, F. H., Xu, X. L., and Kuzyakov, Y.: Drying-rewetting cycles alter carbon and nitrogen mineralization in litter-amended alpine wetland soil, Catena, 145, 285-290, 10.1016/j.catena.2016.06.026, 2016.

Please also note the supplement to this comment:
https://bg.copernicus.org/preprints/bg-2020-266/bg-2020-266-AC1-supplement.pdf

Interactive comment on Biogeosciences Discuss., https://doi.org/10.5194/bg-2020-266, 2020.

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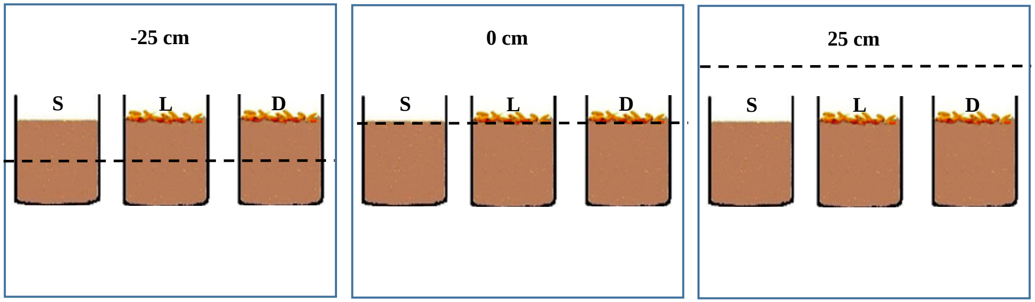

Fig. 1. Figure 1: Schematic diagram of the experimental setup. The dotted line represents the water level. L represents litter which was distributed on the soil surface in 15 litter bags to observe the effect

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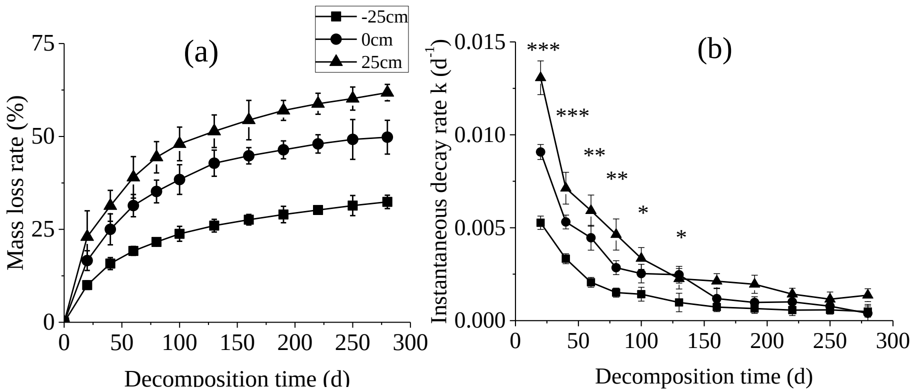

Fig. 2. Figure 2: Percentage litter dry weight loss and decomposition rate during C. brevicuspis decomposition at three water levels (-25 cm, 0 cm, and +25 cm). *, **, and *** represent significant difference

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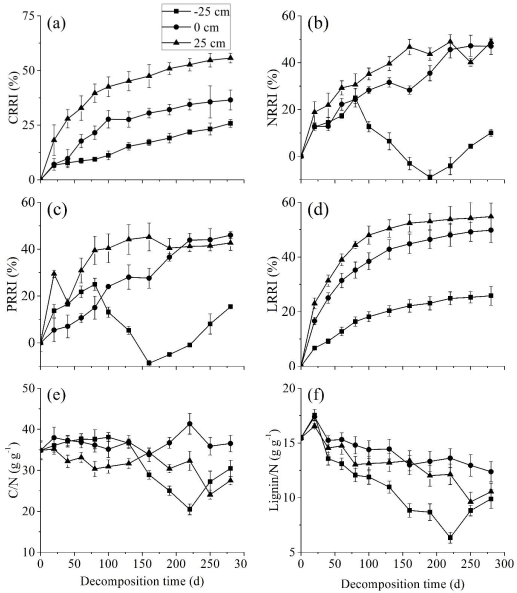

Fig. 3. Figure 3: Percentage (mean ± SE) of carbon relative release index (CRRI), nitrogen relative release index (NRRI), phosphorus relative release index (PRRI), lignin relative release index (LRRI), C/N ra

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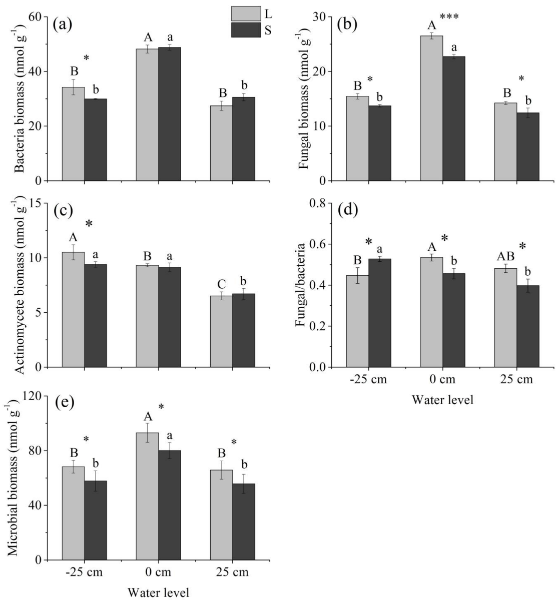

Fig. 4. Figure 4: Microbial community structure under litter input and litter removal at three water levels. Different uppercase letters among vertical bars indicate significant differences among the three wa

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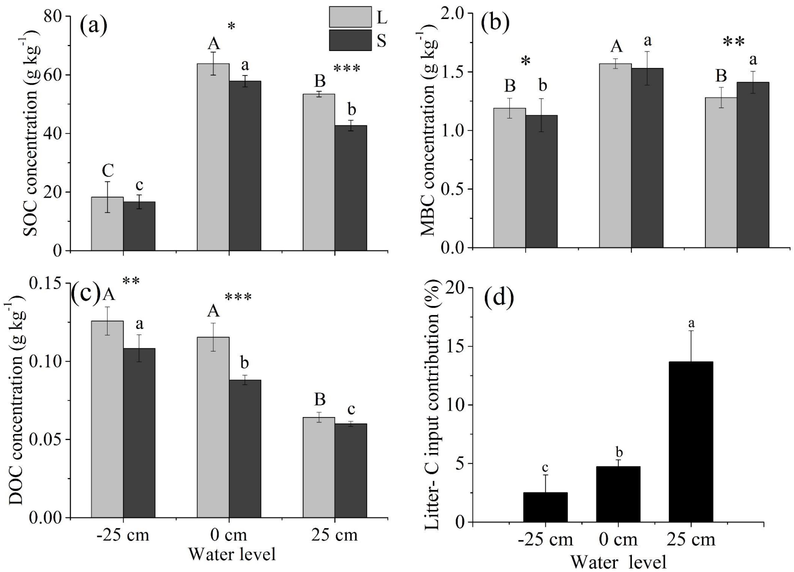

Fig. 5. Figure 5: Concentrations of SOC (A), MBC (B), DOC (C) between the litter input (L) and litter removal (S) groups and the litter-C input contribution (D) under three water levels at the end of the expe

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