

## ***Interactive comment on “Individual- and stand-level Stem CO<sub>2</sub> efflux in a subtropical *Schima superba* plantation” by L. W. Zhu et al.***

**L. W. Zhu et al.**

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Dear Editor and Reviewer:

Firstly, we thank you for your helpful comments and suggestions. Following are our responses to reviewer's comments to our manuscript.

General Comments: This manuscript investigates seasonal and vertical patterns of stem respiration in a subtropical forest. Overall this seems like a useful and well-conducted study. The methods appear to be robust and there are some interesting results. There are a couple of areas that use some reorganization. The introduction and discussion could be improved through better use of the literature. In the introduction there are too many examples of one study being used to draw a broad conclusion,

while in the discussion there are too many references that are not fully relevant. Additionally, the manuscript could benefit from review by a native English speaker; there are a number of spelling and grammar issues.

Response: Firstly, the language mistakes have been corrected carefully such as spelling errors. Besides, the spelling and grammar errors of this manuscript also will be checked by copy-editing system of this Journal (BG Language Copy-Editing Service) as long as we submit the revised manuscript. We have shortened and improved the discussion and removed some references which are not fully relevant (the followings were removed: Lines 11-19 in Page 3298, Lines 1-14 and 22-25 in Page 3299, Lines 7-13 and 26-29 in Page 3300, Lines 6-7 and Lines 14-16 in Page 3301, Lines 5-7, 10-13 in Page 3302. Page and line number is one in discussion paper.). The introduction has been improved by reorganizing some references (For example, Lines 13-17 in Page 3291 were removed. Line 10 in Page 3291 was extended. The changed details were not stated here, but in the revised manuscript they were improved).

Response to the detailed comments:

1.Comment: Abstract Line 8: The term “scaling scalar” is a little awkward. Just “: : the scalar: :” would be better.

Response: We wanted to express “the unit for calculating the stand-level respiration”. The “the scaling scalar” has been changed to “the scalar” in the revised manuscript as suggested.

2.Comment: Lines 13-15: It is not clear (until reading farther into the paper) why the values here are (or could be) underestimated, since it is not stated here that these values are calculated based on assuming that the respiration at breast height is representative of the entire stem.

Response: A sentence has been added to the section of abstract: “based on the measurement data at 1.3-m height of the stem” (Line15 in Page 3290). However, we

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assume it was underestimated. In the future the measurements at the different heights might be made. So in this paper the sentence “which was underestimated due to the vertical variation of stem CO<sub>2</sub> efflux along the stem” was removed.

3.Comment: Line 16: The temperature response is determined at the tree scale, rather than stand scale.

Response: . Yes, the temperature response is determined based on the data of all sample trees. We deleted the adverbial phrase “on the stand scale”

4.Comment: Introduction While the introduction is generally well organized (in terms of what topics are covered), much of the background material is not well supported or referenced. Surely there is more than one study that determined the proportion of ecosystem carbon used in stem respiration (lines 0-2, page 3291). More than one study should be referenced in order to conclude that foliage respiration has no seasonal trend or that stem respiration does not vary interannually (lines 13-17, page 3291).

Response: We have reorganized the literatures to support our study (Line 21 in Page 3290 was revised. Some references were added into Lines 22-26 in Page 3290, Line 6 in Page 3291 and Line 3 in Page 3292. Lines 3-6 in Page 3291, Lines 13-17 in Page 3291 were removed. Line 10 in Page 3291 was extended. ). We did not make discussions about the foliage respiration and interannual variation, so the statements of foliage respiration and interannual variation have been removed.

5.Comment: Line 9-11, page 3291: Seems like a stretch to say that it is hard to estimate stand stem volume.

Response: We have been added some statements explaining why it was difficult to measure surface area and volume in the section of introduction. “due to the different structure of tree species” and “The surface area and volume were generally estimated using the allometric equations with diameter and tree height (Chambers et al., 2004; Kim et al., 2007; Robertson et al., 2010)” have been added to the section of introduc-

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tion.

6.Comment: Line 15, page 3291: “annual” should be “interannual”.

Response: Actually we had not discussed the “interannual” variation, so this sentence has been removed.

7.Comment: Lines 0-3, page 3292: I am leery of using the argument that something should be measured, simply because it hasn't been measured before. It would be informative to suggest why subtropical forests might have a different, or more complex respiration response than boreal or tropical forests. Something to address why this is interesting or useful research to undertake in this particular type or forest (or if it is suggested that the results are independent of forest type, how do the measurements contribute to more fundamental understanding of stem respiration).

Response: Because in the subtropical zone there is rich rainfall and high temperature, which results in strong energy exchange, it is essential to understand stem respiration of this forest type for the forest ecosystem carbon loss. Such reason has been added to the section of introduction (Line 6 in Page 3292). There were great differences in stem respiration among the tree species (shown in the section of Discussion in Page 3303). So the diversity of tree species in the different forest type might result in complex respiration response.

8.Comment: Materials and methods What is the size of the study plot (the area in which the trees in Figure 1 were measured)?

Response: The area of the study plot has been added to the section of site description (Line 18 in Page 3292).

9.Comment: I don't think it is mentioned, but I assume the chambers were ensured to be airtight?

Response: Yes, the chambers were airtight (this was shown in Line 6 of Page 3293 in the revised manuscript).

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10.Comment: Lines 12-21, page 3294: Here and in the corresponding parts of the discussion, I think two issues are being combined: 1) the best way to scale respiration to the stand and 2) what part of the stem tissue contributes most to the total stem respiration.

Response: Because one is the cause and the other is the effect. If volume is the best scalar, it can be thought that stem respiration was derived from the xylem of stem. If surface area is the best unit for scaling to the stand level, phloem was thought to be respiratory source. So we discuss in combination of these two issues.

11.Comment: Line 24, page 3295: What is “under-branch height”? Height to crown base?

Response: Yes, “under-branch height” means the height from ground to crown base (shown in Line 23 of Page 3295).

12.Comment: It would be helpful to see the tree volume equations.

Response: Taper function was used to estimate stem volume. The tree volume equation has been added to the section of calculation (Line 23 of Page 3295).

13.Comment: I would strongly recommend adding a section describing the statistical analysis performed on the data. It is very hard to tell from the (later) results text what kind of stats were done.

Response: The description of statistical analysis has been to the section of Materials and Methods (Page 3296).

14.Comment: Results One thing that is not totally clear to me in the results is how the upper (2m) stem respiration measurements were used. Do these results only appear in Table 2, and all the rest of the tree and stand averages are based only on the breast height measurements?

Response: In our study, Tree-scale stem respiration was estimated based on the as-

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sumption that stem respiration was constant along the stem. The vertical variation of stem respiration along the stem was not used. It only could make us understand stem respiration was over- or underestimated. In the future, we may study the vertical variation in detail.

15.Comment: Lines 14-15, page 3296: Is Figure 4 accurate? It looks like (a) shows a non-significant relationship, while (b) is significant.

Response: Yes, it is right. We have conducted a correlation analysis in SPSS and found stem respiration per surface area is positively correlated with diameter in Fig4(a) ( $P < 0.05$ ). But stem respiration per stem volume is not correlated with DBH-1 in Fig4(b) ( $P > 0.05$ ).

16.Comment: Line 20, page 3296: Temperature shows a strong diurnal pattern, but stem respiration does not appear to.

Response: There was a variation in stem respiration or temperature on the daily scale. They showed “S” diurnal pattern. This sentence has been changed to “As shown in Fig.6 that both  $E_s$  and stem temperature ( $T_s$ ) presented a daily dynamic.”.

17.Comment: Discussion The clarity of the discussion could really improve if it were shortened. There is a lot of extra information that doesn't really seem necessary to put the study in context, and is not very well integrated with the results. The discussion shouldn't just be a long list of results from other studies, with an occasional sentence about the present study.

Response: The discussion has been shortened, especially in the section of the effect of stem temperature on stem respiration. Some references which were not relevant have been removed (Lines 1-14 and 22-25 in Page 3299, Lines 7-13 and 26-29 in Page 3300). In the end of discussion a conclusion is added.

18.Comment: There are several sections that seem like they could be cut: Lines 0-14, page 3299: The issue of growth vs. maintenance respiration is beyond the scope of this

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study Lines 15-26, page 3299: Most of these studies do not provide any information on the effect of stem temperature on respiration, and many of them do not include total stem respiration, so they don't seem very useful to discuss here.

Response: Yes, the reviewer's suggestion is correct. The paragraph has been removed. Although we thought this could be indicated by our analysis, they were not involved in the section of results.

19.Comment: Lines 17-21, page 3302: Elaborating on this analysis would be very informative. It is not clear what kind of analysis this 85.9% value results from. Also, I am confused how temperature can explain so much of the variation, when E23 is so different between the two seasons.

Response: The result about the comparison of E23 between two months has been removed. Instead of the comparison of E23, the daily means of stem respiration between the two seasons were examined. 85% explanation of temperature on stem respiration was calculated based on the means of stem temperature and respiration of all sample trees. It might be due to the great difference in the temperature and respiration between the two seasons resulting in so high explanation. The statistical analysis description has been added to the section of Materials and Methods to support the results.

20.Comment: It would be great to have a conclusion paragraph or section to summarize what this study has contributed to the understanding of stem respiration, and what kinds of future studies are needed (what is still unknown).

Response: In the end of discussion, a conclusion has been added.

21.Comment: Figures Y-axes for different panels within a figure should be the same (as much as possible) to facilitate comparisons.

Response: Y-axes in all Figures have been corrected to one with the same panels.

22.Comment: In Figure 5 and 7, should there be a break in the August data? If not, why do the ticks switch from being at 20:00, 4:00 and 12:00 to 23:00, 7:00 and 15:00?

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Response: X-axes have been corrected to be one for consecutive several days. The figures were made for consecutive several days in order to be understandable.

23.Comment: Figure 6: With so much scatter (variation between trees) it might be better to analyze this relationship at the tree level, or include a variable which explains the tree to tree variability.

Response: There was great difference in stem respiration between trees. It will be different when the individuals are analyzed. However, we only want to know the general relationship between stem respiration and temperature in this forest. In the future, the difference in stem respiration and its response to environmental factors between the individuals may be analyzed.

24.Comment: Table 2: Are these values averaged across August and December? Why not keep them separate and look for seasonal changes in the height patterns?

Response: Yes, they are values averaged across August and December. Because we just want to know if there was the vertical variation in stem respiration along the stem and we do not apply it for calculating the tree-scale respiration.

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Interactive comment on Biogeosciences Discuss., 9, 3289, 2012.

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9, C2283–C2290, 2012

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