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Biogeosciences
Discussions

Interactive comment on "Effects of precipitation on soil respiration and its temperature/moisture sensitivity in three subtropical forests in Southern China" *by* H. Jiang et al.

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Responses to review1 comments

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âĂŤ- General comments âĂŤ

1. This manuscript describes the effects of a precipitation manipulation experiment, conducted in three subtropical forests in southern China, on soil respiration (SR). Manipulative experiments are extremely valuable, given the large SR carbon flux and potential for climate-induced changes, and relatively few such data have been reported.

The ms is reasonably well written and generally clear.

Response: We thank this reviewer for the positive comments and constructive suggestions. We have undertaken a careful revision of our manuscript based on the comments. The point-by-point responses are detailed below. We hope that these changes are adequate to address the reviewer's concerns.

2. There are a number of significant problems, however. First, the authors adopt a pretty simplistic analysis (e.g. a fixed-Q10 temperature model) that really seems inadequate for use in a study specifically looking at how SR sensitivities may change with seasons and precipitation. (This is a somewhat ironic, given the authors' inaccurate criticism of the state of ecosystem models.) I'm also concerned that some of their results follow trivially from these models. At the very least, they need to show residual plots and justify their choices.

Response: We adopted the fixed-Q10 temperature model in this study because this fixed-Q10 temperature model has been commonly used to calculate soil and ecosystem respiration from local to global scales (e.g. Cox et al., 2000; Bond-Lamberty and Thompson, 2010). Previous work at the Dinghushan Nature Reserve has also adopted this model to estimate soil respiration (Tang et al., 2006; Huang et al., 2011; Deng et al., 2012). One of the aims of this study was to determine whether this fixed-Q10 temperature model would produce misleading conclusions. There were many manipulated experiments using this model to test whether temperature sensitivity varied with temperature (e.g. Luo et al., 2001; Zhou et al., 2006) or moisture (e.g. Harper et al., 2005; Suseela et al., 2012). Thus, we analyzed the change of the fixed-Q10 temperature model under different seasons and precipitation treatments. We found that temperature and moisture sensitivities in the fixed-Q10 temperature model indeed varied with soil moisture or seasonal variations, which in turn would provide evidence for the researches in the future to explore using a 'better' model that allows for varying temperature and moisture sensitivities. We have added the residual plots in the revision (see Fig. A2-A5 below).

3. Second, as noted above, the authors are quite inaccurate in describing some issues in the introduction and discussion (specifically regarding SR temperature and moisture sensitivity; see comments below).

Response: We have carefully considered the comment and incorporated them into this revision. Mainly, in the introduction section, we acknowledged more previous work that many empirical models use a variable Q10 (page 4, line 1-3, 23-26). In practices, however, the Q10 model still remains the most widely used one (e.g. Cox et al., 2000; Bond-Lamberty and Thompson, 2010). In the discussion section, we cited some earlier references to support our results (page16, line23-25). We thank this reviewer for the comments and hope this revision provided a better description of the SR temperature and moisture sensitivity.

4. Finally, some of the tables and figures are unclear and overlap.

Response: We re-defined and corrected the parameters in the equations (Table 3, A1 and A2 below), and added actual model fit and residual plots (Fig. A2-A5). We hope that the tables and figures are clear now.

5. In summary, this is a potentially interesting ms, but needs some significant revisions in many areas. I would encourage the authors to explore using a 'better' model that, at the very least, allows for varying SR temperature sensitivity.

Response: Again, we thank the reviewer for positive comments. We have carefully considered all the comments and incorporated them into this revision. For the soil respiration model, we used fixed-Q10 temperature model as one of the aims was to determine whether this model would produce misleading conclusions. Similar approaches have been used in many manipulated experiments (e.g. Luo et al., 2001; Zhou et al., 2006; Harper et al., 2005; Suseela et al., 2012). Thus, we analyzed the change of this fixed-Q10 temperature model under different seasons and precipitation treatments. We found that soil temperature and soil moisture sensitivities in this fixed-Q10 temperature model indeed varied with soil moisture or seasonal variations, which in

turn would provide evidence for the researches in the future to explore using a better model that allows for varying soil temperature and soil moisture sensitivities.

âĂŢ Specific comments âĂŢ

1. Page 15668, line 12: "modification of"

Response: Corrected.

2. P. 15669, l. 2: "rising temperature"

Response: Corrected.

3. P. 15669, l. 15-: this really isn't true. Many ecosystem and global models use a variable Q10, typically following Lloyd Taylor (1994), in which Q10 falls as temperature rises; we know that the 'intrinsic' (Davidson Janssens 2006) sensitivity acts this way from basic biokinetics.

Response: We agreed that there were many empirical models developed to relate field measured soil respiration to soil temperature (e.g. Davidson et al., 2000; Jia et al., 2006), and many studies indicated a variable Q10 value with temperature and the 'intrinsic' sensitivity acting this way from basic bio-kinetics (Lloyd Taylor, 1994; Luo et al., 2001; Davidson Janssens 2006). In this revision, we revised the sentences to acknowledge this fact (page 4, line 1-3, 23-26). In practices, however, the Q10 model still remains the most widely used one (e.g. Cox et al., 2000; Bond-Lamberty and Thompson, 2010). In addition, one of the aims in this study was to determine whether soil temperature and moisture sensitivities in the fixed-Q10 temperature model varied with soil moisture, but not with temperature, which has not been well tested under precipitation manipulation experiments.

4. P. 15673, l. 5: what distance? From the ground? Between pipes?

Response: The distance is the pipes from the soil surface, which was added in the revision.

5. P. 15673, l. 19-20: I'm unclear what this means (measured three times per collar) and why it was done. Doesn't this contradict the next sentence, that soil respiration was calculated as the mean of five measurements?

Response: In order to ensure the measuring stability of the instrument, soil respiration was measured three times for each soil collar. Soil respiration in a collar was calculated as the mean of three time measurements. On this basis, soil respiration in a treatment plot was calculated as the mean of five collar measurements.

6. P. 15674, l. 9: "cores"

Response: Corrected.

7. P. 15675, l. 7: give version of SAS used

Response: We added the version (Version 9.1) of SAS software in the revision.

8. P. 15676, l. 25-: it would be good (and I think is necessary) to show residual plots of the model fits. Were the constant-Q10 and linear SM models free of bias?

Response: We have added actual model fit and residual plots in the revision (see Fig. A1-5 below). The constant-Q10 and linear SM models fit the data relatively well and were free of bias.

9. P. 15681, l. 7-11: this is much older than Davidson and Janssens; see for example Orchard and Cook (1983, doi 10.1016/0038-0717(83)90010-X) or Boddy (1983, 10.1016/0038-0717(83)90042-1), both in SBB

Response: In this revision, we added several earlier studies and revised the sentences to acknowledge the result (page14, line27-29).

10. P. 15681, l. 14-16: doesn't this (negative relationship) follow trivially from your choice of a linear SM-SR model? Again, showing actual model fit and residuals would greatly help

Response: The negative relationship of moisture sensitivity with soil moisture followed trivially from the mixed model using R=(α+βM)exp(γT) (see Table. 5 and Fig. 3 below). Our results indicted that the negative relationship also followed trivially from the linear SM-SR model using R=a+cM (see Table. 4 and Fig. A7 below).

11. P. 15689, Table 1: what exactly is being tested here? Are these mean annual values?

Response: There were soil respiration rate, soil temperature, and soil moisture being tested in Table 1 (see Statistical Analysis section). Soil respiration and soil temperature were calculated as the means of five collar measurements in a plot. Soil moisture was calculated as the mean of five measurements at random locations in a plot. In the table 2, there were mean annual values of soil temperature, soil moisture, soil respiration, fine root biomass and soil microbial biomass under different precipitation treatments.

12. P. 15691, Table 3: what equation do these parameters refer to? Provide it in caption, or refer to a numbered equation in the text. Also reorder a-b-c if possible

Response: We re-defined and corrected all the equation and parameter meanings in the revision (see Table 3, A1 and A2). Now we believed that the equations and the parameters are clear.

13. P. 15696, Figure 3: doesn't this duplicate data presented in Table 3?

Response: We have removed the figure 3 to "Supporting information", and now it is numbered as Fig. A6 in the revision.

Interactive comment on Biogeosciences Discuss., 9, 15667, 2012.