

Interactive comment on “Interactions among temperature, moisture, and oxygen concentrations in controlling decomposition rates” by Carlos A. Sierra et al.

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Received and published: 12 November 2016

This paper reports a relatively simple factorial experiment of soil respiration response of moisture, temperature and oxygen. This is an important topic if we are to accurately model respiration of soils in temporally and spatially variable environments. One might think that these relationships have been well constrained already but when trying to find specific examples in the literature it is not easy to find many examples. A simplification of the DAMM model is used to explore data. A nice addition is inclusion of an oxygen treatment to distinguish between the role of water in controlling oxygen supply and carbon diffusion. The paper is easy to read and follow and I generally have few comments. I am not really expert in modelling side of soil carbon dynamics and will

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limit my comments here.

Specific comments 1. While a high C content soil was supposedly selected to avoid carbon limitation during the incubation this does not mean that the labile fraction of C would not be depleted. This is important as it is possible for depletion of labile C occurs faster at higher temperatures. The authors can check whether this might have occurred by examining the timeline of CO₂ production – if carbon supply was not limiting then respiration rates should be linear and not reach a plateau. Do authors have this information? Currently reporting only the total CO₂ after 35 days.

2. Alternatively, a rise in rate through time would indicate adaptation and/or microbial growth during the incubation. Are the authors confident during the 35 days that microbial adaptation to constant moisture, temperature and oxygen conditions has not occurred? If this does occur then the model fitting data between different microbial populations. The authors need to acknowledge these possibilities and present some information or rationalisation to overcome them.

3. What was the temperature range in the field that the soils are exposed to?

4. What bulk density was the soil packed to in the cores? Do these represent what might be observed in the field?

5. Pg 3 8 is 'fallowed' meant to be 'followed'?

6. Pg 4 ln 5-10 Include abbreviations O, Ko, W in text

7. Pg 4 ln 23 There were only two temperatures used so that statement respiration did not decrease at higher temperatures should strictly be singular “at the higher temperature”.

8. What are the error bars on fig 2? Fig2 I also printed this out in black and white and it was very difficult to see what line was what, symbol could be changed and a dashed line used.

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9. Figure 2 and 3 this not really my area and I think a little more description of what these graphs mean would be useful.

10. Figure 4 is it reasonable to make prediction of a full curve of temperature response based two temperatures? And furthermore make prediction above and below the temperature measured? Similarly a very steep curve is predicted for the oxygen content response between two end points.

11. Pg 7 In 5. I disagree with the statement of increases in temperature being almost always associated with decreases in soil moisture is really a matter of temporal scale of interest. For example between seasons this is certainly possible wet and cold vs hot and dry and this would allow microbes time to adapt. But increases in temperature diurnally can also occur. It would be unusual for a soil to cycle by 5 to 10 C during a 24 hour period where moisture content would be steady and there is less time for adaptation.

12. Pg 9 Conclusions and discussion. That the authors did not find a decline in respiration at a single higher temperature (35C) but this does not mean that MMRT or similar functions are not important in moderating microbial responses in soil. The authors only had two temperatures 25 and 35 C. For the respiration rate to be lower at 35C than 25 C would require the temperature optimum (temperature at which the respiration rate is maximal) to be closer to 25C than 35C. If a temperature optimum for soil respiration was near or greater than 35 C there would be no observed decline in respiration in comparison to the rate at 25C. If I have my logic correct then there is no support for the argument in the conclusions that scale in this case matter with respect to extrapolating MMRT from enzymes to soil systems.

Interactive comment on Biogeosciences Discuss., doi:10.5194/bg-2016-474, 2016.