

# ***Interactive comment on “Responses of two nonlinear microbial models to warming or increased carbon input” by Y. P. Wang et al.***

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Responses to review by Dr Thomas Wutzler

Many thanks for the constructive comments. We have responded to all points raised by the reviewer. All line numbers are those of the manuscript with tracked changes (attached as supplemental material in pdf).

1 General comments

(A1) The background on the model differences is quite short (p. 14654 L 11ff). The notion of either substrate or enzyme to be rate limiting is to my opinion misleading.

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Kinetics in both models depends on the same two properties. The difference is where the non-linearity is placed, and the range of applicability based on concentrations of the enzyme and substrate (see Tang 2015 GDD). Response: Agreed and modified. See L192-198. The paper by Tang (2015) is now cited (see L139).

(A2) The authors take caution with interpretation and often display differences without evaluating them. In the discussion I miss some expert judgement on what is more likely. E.g. An increase in soil carbon stocks with warming given the same inputs is unlikely at the soil column scale (p. 14666 L23). Response: An increase in soil carbon under warming was also simulated by Frey et al (2013) (Their figure 3, last set of blue and red bars), and Hagerty et al. (2014) (their Figure 4 with increasing turnover and constant MGE) and Li et al. (2014) (their Figure 2 with varied CUE). It depends on the value of minimum soil carbon temperature. If minimum soil carbon temperature is lower than the mean soil temperature before warming, any warming will result in an increase in soil carbon, as explained in Section 3.2. We also added some text to make this clearer (see L355-376). Biologically the response of soil carbon increase to warming can result from the decrease in soil decomposition by microbial biomass. Mathematically soil carbon will always decrease with warming for both models if  $a=0$  (or the fraction carbon input to soil is zero, and see our eqns B6 and B7). No change is made here.

(A3) In Appendix A: In what way correspond the eigenvectors to the three carbon pools. This needs a bit more explanation. Response: Agreed and added. See L815-825. (A4) I checked the equations in the main. I like the approach with the non-dimensionalization of Appendix C. However, I was not able to follow step C5 to C6. Response: C5 is an approximation of a function  $(C_b)$  using a second-order Taylor expansion (a reference is now given). To clarify the derivation, we added a new equation (C6). Abramowitz, M. and Stegun, I. A. (Eds.). Handbook of Mathematical Functions with Formulas, Graphs, and Mathematical Tables, 9th printing. New York: Dover, p. 880, 1972.

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## 2 Specific comments

(A5) My other comments are mainly technical corrections. (p. 14654 L1 8):  $F < 0$ ? Mathematically  $F \neq 0$ , reasonably  $F > 0$  Response: Agreed. It should be  $F_{npp} > 0$ . See L204. (A6) (p. 14654 L 20): two typos  $\alpha$  versus a Response: Agreed and changed a to  $\alpha$ . See L206. (A7) (p. 14660 L1): repetition of t50. Response: Do not understand. But we put t0.5 into brackets now. See L322.

(A8) (p. 14662 L1): please clarify that laboratory parameters were used, and that no calibration was performed. Response: Yes, we tuned the values of two parameters listed in Table 1 (values obtained from this study (Column 2, source: this study)). This is now stated explicitly. See L404-405.

(A9) (p. 14666 L5): good summary in Table 2. The discussion following line 10 is difficult to read. Maybe state the main difference and then explain in detail. Response: Agreed. We have revised the text to state more explicitly which responses by which model. See L506-515.

(A10) (p. 14666 L23): The authors are take caution and often display differences without evaluating them. In the discussion I miss some expert judgement on what is more likely. E.g. I think an increase in soil carbon stocks with warming given the same inputs is unlikely at the soil column scale. Response: See our response to A2.

(A11) (p. 14671 L1): The relationship of the eigenvalues and the three pools need to be explained in more detail. Response: See the revised explanation. See L817-820.

(A12) (p. 14672 L19): What is the “third element of eigenvectors” Response: State more explicitly now. See L817-818 and L821.

(A13) (p. 14675 L18): Need more space after comma between variables. In this form it is hard to distinguish. Several commas are missing. Response: Agreed and revised. Three commas are missing from typesetting. They have all been added now. See L880.

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Please also note the supplement to this comment:

<http://www.biogeosciences-discuss.net/12/C8246/2015/bgd-12-C8246-2015-supplement.pdf>

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Interactive comment on Biogeosciences Discuss., 12, 14647, 2015.

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