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## ***Interactive comment on “Oscillatory behavior of two nonlinear microbial models of soil carbon decomposition” by Y. P. Wang et al.***

### **Anonymous Referee #2**

Received and published: 29 January 2014

Dear Authors,

The analyses you use to compare conventional and non-linear soil decomposition models is intriguing and well-timed given the growth in development of microbially-explicit non-linear soil carbon cycling models. Your analysis suggested that non-linear models are more sensitive to change in soil carbon inputs than occurs in nature. This made me wonder how environmental biotic and abiotic factors (e.g. seasonality, change in substrate composition and/or decomposer community, priming effects, etc.) would modulate the sensitivity observed in this highly sensitive model system. Although this was briefly touched upon in the discussion, I think that the authors could have expanded upon this substantially. I realize that models by their nature must simplify the systems they are trying to capture, but a deeper reflection on the ability of non-linear relative

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to linear models to deal with these types of factors would have been interesting. As also pointed out in the comment of S.D. Allison, I am curious to explore how would the oscillatory behavior change with more heterogeneous soil conditions?

I would have liked to see more citations referencing studies connecting warming to empirically observed effects on soil carbon/microbial community/substrate effects; several times in the paper there were statements that I felt were not backed up with references or could have been more thoroughly discussed (e.g. "For example, it is well known that a system of nonlinear ordinary differential equations, such as a nonlinear soil model, can become unstable in response to a small perturbation to its initial pool sizes or inputs and can have multiple equilibria (Drazin, 1992), although there is presently no evidence that soil carbon dynamics exhibits such characteristics over interannual to decadal timescales." Citation for latter half of the statement? Also, what is the citation for: "The shifted microbial community toward more fungi and less bacteria under warming than control is expected to decrease carbon use efficiency." Missing references occurred throughout the paper and grammar could be strengthened).

A more comprehensive interpretation of how linear and non-linear models could be used to interpret why NPP and soil carbon accumulation are or are not decoupled from each other in different ecosystems would be a great addition to the paper. Further, I think that the paper could be improved by more discussion regarding what empirical observations and/or additional processes would be useful in parameterizing/improving non-linear, microbially explicit models.

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Interactive comment on Biogeosciences Discuss., 10, 19661, 2013.

**BGD**

10, C8316–C8317, 2014

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