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Geoscientific Model Development Discussions

Interactive comment on "Comparing microbial and chemical approaches for modelling soil organic carbon decomposition using the DecoChem v1.0 and DecoBio v1.0 models" *by* G. Xenakis and M. Williams

Anonymous Referee #2

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General comments:

Firstly, I'd like to thank the two authors for their presenting of an interesting work. Through the numerical comparison of two decomposition models that are based on different conceptual models, they highlighted that the conventional turnover time based linear SOM models are inefficient in incorporating the priming effects and the acclimation effects, which are critical for improving the simulation of carbon-climate feedbacks. The study is well designed and is reported quite clearly. Although I have a concern needs authors' clarification before the paper goes to final acceptance.

I went through their code quickly and found they used the first order forward Euler scheme. This makes me concern about the robustness of the paper's results. The forward Euler method has its pitfalls, especially when applied to nonlinear models that has unstable or near unstable component. Also, it converges relatively slowly. Since the code is written in Fortran and there are quite robust numerical solvers written in Fortran, I would suggest the authors to confirm their results are robust.

In addition, I think the linear chemical model can be solved analytically. If possible, I would recommend the authors to use the analytical solutions for the sensitivity analysis. That will be much more robust.

Specific comments:

Abstracts: I would suggest the authors spell out 'numerical experiments' explicitly, because I have found myself got confused between 'numerical experiments' and actual 'observational experiments' when reading the abstract. Especially, the author also mentioned 'experimental warming', which apparently referred to actual field experiments.

P35, L12. Soils are likely a sink of atmospheric CO2 of approximately 0.4 Pg C(. . .) I think the authors misspelled the unit here. Author, would you mind providing the reference for your quote?

P39: Eq. (5), did you use Einstein's summation convention? Similar problems are with Eq. (7), Eq. (11), and Eq. (12).

P39, Eq. 6: I think the equation is different from what was used in Blagodatsky et al. (2011), could you check that?

P45, L8. I would suggest replacing 'variable climate' with 'variable temperature' because you never included other climate variables.

P45, L11: 'Slow organic carbon stocks . . .', It is a little bit confusing here, you may want to put it explicitly what made the slow organic carbon stocks 10% larger.

P47, I think it is better to make words like ‘when litter was increased’ and ‘increasing litter inputs’ more transparent. How much was the increase? Although you mentioned in the designation of the sensitivity study, putting the increase into exact numbers here won’t lengthen your explanation much but the paper is much more readable.

P48, L12: Again, please use numbers to show how much extra glucose you added.

P52, L3-4: ‘The sustained increased in microbial biomass . . .’ I think you were saying ‘the sustained increase in microbial biomass’. Also, readers would be happy to see your assertion here is numerically robust.

Interactive comment on Geosci. Model Dev. Discuss., 7, 33, 2014.