Geoscientific

Model Development

Discussions

**[GMDD]**

Interactive

comment

# *Interactive comment on* "Jena Soil Model: a microbial soil organic carbon model integrated with nitrogen and phosphorus processes" *by* Lin Yu et al.

### Anonymous Referee #1

Received and published: 27 October 2019

Yu et al reported the development and evaluation of the microbially-explicit SOM BGC model Jena Soil Model at a temperate beech forest stand. The model was found able to reasonably reproduce the measured profile of SOM stocks and radiocarbon. It also explained why microbial residue plays an important role in SOM cycling. Further, the nutrient dynamics resulting from plant-microbial interactions simulated by the model appeared reasonable, although important nitrification-denitrification dynamics are missing. Overall, I found the paper interesting and generally well written. I think the paper will become a good read provided the authors address the following comments.

In section 2.3, subsection model protocol and calibration. I followed the authors without

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any problem on the model initialization, however, it is unclear how the 200 years are aligned with the time. Did the model pretend to start from 1850? Also the 14C of litter input in last 60 years was mentioned to match the observed 14CO2 atmospheric pulse, how was this done exactly? Further, I think the inorganic P pool from Yang et al. (2013) is closer to contemporary (say year 2000) than 1850. Was this criterion appropriate? I have no answer to this last question myself, and we also struggled when doing the P cycle in our TBM. Nonetheless, I would like to know more about the authors' opinion on this.

Another question is how the SOM 14C profile is initialized? It is not very clear from current description.

In the model formulation, I saw nitrate was part of the N dynamics. However, I did not see any description of other N related biogeochemistry. My impression is that the model does not have a nitrification-denitrification process. Is this why no abiotic ammonium adsorption is considered in the model?

Further, the model predicted a number of interesting features, such as the importance of microbial residue, and that root input will result in different depolymerization dynamics. Given one purpose of modeling is to inform new empirical experiments, I think the authors can make the paper more interesting by explicitly asking what new experiments will help constrain their model.

Finally, I think the English of the paper should be further improved. I collected some of these problems below, but I recommend the authors do a more thorough check.

Other comments:

P1 Line 3, remove the redundant "potential" from "predict potential future climate feedbacks".

P1 Line 14, remove "of" from "ample of".

P1 Line 17, replace "major nutrients" with "macronutrients".

P1 Line 24, replace "reproduce the response" with "reproduce the ecosystem response".

P2 Line 1, replace "their representation" with "their poor representation".

P2 Line 2, please be specific about what "plant uptake".

P2, Line 5, remove "the" from "In these models, the nutrient".

P2, Line 7, expand "the CENTURY approach" into "the sufficiency of the CENUTRY approach".

P2, Line 8, remove "the representation of".

P2, Line 10, "one other important limitation" is awkward, please consider revision. And replace "most of the current SOM" with "most current SOM".

P2, Line 20, the sentence reads a little bit awkward, please consider revision.

P2, Line 30, remove "this" from "this competition". Also, the sentence seems incomplete, even though it is syntactically correct.

P2, Line 33, remove "for representing them".

P3, Line 2. "kinetic" should be "kinetics".

P3, line 6, replace "cycle process" with "cycling process".

P3, line 13, remove "and was"

P3, line 17, replace "a maximum" with "the maximum".

P3, line 18, add "while" before "the mathematical".

P3, line 19, replace "of the QUINCY" with "QUINCY".

P3, Line 20, replace "can be" with "can either be".

P4, line, 24, "a loam topsoil" should be "a loamy topsoil".

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P4, line 27, is the unit "g/kg" meaning "g C/kg soil"?

P5, line 3, replace "the observations" with "observations".

P5, line 19, replace "we assumed increased" with "we increased".

P6, line 5, replace "the model experiments" with "model experiments".

P6, line 18, Table S4 should be "S2".

P7, line 10-11, the sentence is hard to understand due to unclear definition of organic P and stocks. Does this mean include all P from all organic SOM pools? Nor the definition of stocks is clear. Please define them clearly.

P7, line 14, perhaps Fig. 7 and Fig. 3 should be swapped, so the paper's logical flow is more continuous.

P8, line 24, remove "the fact"

P8, line 27-34, I think "actual enzyme allocation" is not a proper name here because you don't know what is happening in reality. Perhaps a better name is needed.

P9, line 9, maybe "resistant" should be replaced with a more appropriate word.

P10, line 23, replace "The fact that" with "that".

P11, line 13, perhaps "N&P" should be replaced with "N and P" for it to be consistent with the writing style of the paper. Similar changes should be made in other places.

P11, line 13, "resulted" should be "resultant".

Fig 5, some red annotation of depth overlapped with the y-stick label.

For all figures, some annotation text should use large font size, because they may become unreadable when included in the published version.

2019.