EGUsphere, referee comment RC2
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Comment on egusphere-2022-359

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Referee comment on "Simulating long-term responses of soil organic matter turnover to substrate stoichiometry by abstracting fast and small-scale microbial processes: the Soil Enzyme Steady Allocation Model (SESAM; v3.0)" by Thomas Wutzler et al., EGUsphere, https://doi.org/10.5194/egusphere-2022-359-RC2, 2022

General: The study presents an upscaling of a short-term (enzyme turnover time) SEAM model of C and N dynamics in soil to a decadal scale. This is done by one of the valid procedures - the simplification of short-term model equations, while retaining discussed microbial mechanisms. The study shows that the performed modification of the model equations did not change long-term effects of those mechanisms in specific scenarios, and the SESAM model is interesting for further studiyng the effects of these mechanisms on regional scale.

The authors mention having already tried implementing SESAM into a land model and that this trial initiated several reformulations of model aspects. It would be interesting to know which kind of aspects were revealed necessary to reformulate.

The basis of the model in adapting microbial consumption of SOM driven by their stoichiometry and resulting CUE as emergent property of microbial community is a very senseful approach and a valuable result. While it looks questionable whether the stoichiometrically excess C should indeed go into respiration overflow, this mechanism is worth testing.

Minor questions:

p.2 l.20: it would be good somewhere in the beginning to explain in a few words what is “banking mechanism” same as done for “N priming”.

p.5 l.10 "..SEAM required model parameters for enzyme turnover.'' You could make it more clear - that SESAM now requires only one instead of two enzyme parameters in SEAM, if this is what you mean.

p.7 l.24: "with scenario of varying initial C/N ratio with otherwise very low rate of L input" not very clear what is meant here by "otherwise".

p.10 Figure 3: the legend covers the figure

p.11 Figure 4: what do numbers 50,70,90 in the legend mean? is it C/N ratio if yes, why is it so high?

p.13 l.6: "The mostly concave functions of decomposition according to Michaelis-Menten kinetics yield a lower flux of the average input compared to the average of the fluxes on varying input. Hence, we expected slightly higher decomposition rates and lower stocks with the average litter input scenario." Not very clear how the averaging of inputs should cause 'higher decomposition'.

p.14 l.12: "While the relative changes in SOM pools are so small that are very hard to directly measure, changes can potentially be detected by a changing C/N ratio of the total SOM". What result of SESAM model one can expect in the scenario of no litter input on decadal scale for C/N of the pools and C stock?

p.15 l.27: here for the first time "conserving CUE" is used. The CUE was discussed as an emergent property of the model. How to interpret "conserving"? Does it mean optimal for survival?

Typos:

p.2 l.19: an model

p.2 l.30: " allows exploring consequences soil microbial stoichiometry for SOM cycling" sentence is not consistent

p.3 l.4: “several SOM by several pools”

p.6 l.1: “..production and turnover or organic matter” did you miss the word “enzyme” to “production and turnover”? What “or organic matter” refers to?

p.6 l.14: contrained

p.7. l.5: input of input

p.7 l.23: “gm2yr−1” divide by meter

p.14 l.8: SUM

p.15 l.3: because its range it rather