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Biogeosciences Discussions

Interactive comment on "Modification of the RothC model to simulate soil C mineralization of exogenous organic matter" *by* Claudio Mondini et al.

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We would like to thank the Referee #1 for her/his valuable and pertinent comments to the manuscript. Please find below our response to the comments.

Comments from Anonymous Referee #1:

This could be a very good paper and the modification to RothC for organic amendments are very important, but I think adding three extra compartments to the model is not the best initial approach to take. The RothC model already allows for two types of material to enter the soil the first being "plant material" and the second "organic amendments". While the standard version of the model only allows for farmyard manure, there

is no reason why the authors, like Falloon (2001), should not have changed the proportions entering the DPM, RPM, and HUM pools to better model other types of organic amendment. By adding three extra compartments, will lead to a lower RMSE, due to increasing the number of pools, but this means increasing the number of parameters needed by the model, and making it far more complicated. The authors should have initially used the approach used by Falloon, and for each different organic amendment they should have started by changing the default parameters for FYM from DPM 49%, RPM 49% and Hum 2%, to obtain more suitable proportions entering the DPM, RPM and Hum pools. This will give a lower RSME, and will also keep the model simple, but if by changing the proportion of organic amendment entering the DPM, RPM, and Hum pools, the model still does not give accurate predictions, the authors could then consider adding one or more extra pools. So while the modification to RothC for organic amendments are very important, I do not think the authors have chosen the best approach.

Answer:

We agree with the Referee's comment in that it perfectly describes the procedure we have followed in the modification of the model. As a matter of fact, in the initial stage of the study we tried to fit the respiratory curves of incubated soil by only modifying the partitioning factors of DPM, RPPM and HUM of added EOM and leaving unchanged the standard decomposition rates of the model (i.e. 10, 0.3 and 0.02 y-1 for DPM, RPM and HUM, respectively), as suggested by the Referee and carried out by Falloon (2001). This was performed trying to balance model simplicity and accuracy. Unfortunately, results of the optimization performed by changing only EOM pools partitioning factors were not satisfactory for most of the cases. As an example mean RMSE for household waste compost for different soils and incubation conditions was 20.0%, while for bioethanol residue it was 29.9%. Therefore, we further modified the model by introducing the possibility to vary the decomposition rate of EOM pools. As reported in the manuscript this model configuration allowed for a more accurate predictions of

respiratory curves (mean RMSE 4.5%). The above procedure followed to modify the model has already been reported in the current manuscript at the beginning of section "4.3 Model Optimization", LL 357 - 366. In the text we made reference to the work of Peltre et al. (2012), but the approach selected by these authors (i.e. changing only the partitioning factors of EOM pools) is the same as for Falloon (2001). We have now added reference to the latter in the manuscript. We have also added some sentences in the introduction section supporting the improvement in terms of simulation accuracy of an approach considering EOM specific decomposition rates.

Sentences added to the manuscript:

1 Introduction

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This model behaviour contrasts with the large variability in the decomposition rate of different EOMs and the evidence that model predictions can be improved by identification of EOM specific decomposition rate, as demonstrated by Mueller et al. (2003) with the DAISY model. Similarly to RothC, the original DAISY model involves two pools of added EOM with decomposition rates that are constant for a wide range of added organic materials. Muller et al. (2003) showed that adjusting the decomposition rates for each EOM significantly increased the model capacity to predict C mineralization in amended soils.

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