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Biogeosciences
Discussions

Interactive comment on "Modeling rhizosphere carbon and nitrogen cycling in Eucalyptus plantation soil" *by* Rafael V. Valadares et al.

Rafael V. Valadares et al.

rafaelvvaladares@hotmail.com

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Dear reviewer,

We appreciated your attention and helpful criticisms.

Sincerely yours,

Authors

Rafael V. Valadares

Soil Department

Universidade Federal de Viçosa

36570-900 Viçosa, MG, Brazil

E-mail: rafaelvvaladares@hotmail.com

Tel: +55 (31) 99253 7720

Answers to anonymous reviewer's comments

1. Comment from Referees: "The authors apply the MCNiP model to Eucalyptus plantations to estimate the importance of rhizosphere processes to N nutrition in these systems. The inclusion of a plant component to the model is an important development in addition to the other microbial limitations that the authors integrated. The authors use a variety of data sources to validate the model. However, the results presented do little beyond validating the model and there is little discussion of the larger importance of this work. In addition, the main message of this manuscript is unclear given the lack of structure in the paper as well as the numerous language errors throughout."

Author's response: Once more, we thank the gentle comments regarding our work. In fact, at the end of the work, we presented the question of the biological importance. We showed this question since the beginning of the paper, in the abstract and introduction, for instance. This question is important considering its environmental impact and also justifies part of our study. That is the main reason to present it in the same paper of the model description. It was also one of the main motivations for elaborating this model for genus Eucalyptus. About the structure, we presented a theoretical and mathematical model with its validation, sensitivity analysis, and biological importance. It is a very common structure in this kind of work. Many thanks for this comment.

Author's changes in the manuscript: We will submit the paper to a rigorous language review.

2. Comment from Referees:"In addition to the assumptions highlighted by the first reviewer, I am also troubled by the apparent assumption that thicker roots drive a greater

rhizosphere stimulation. This assumption is in direct contrast to what was parameterized in the original MCNiP model."

Author's response: Our model uses the root diameter to simulate the rhizosphere process considering the percentage of root length ratio per diameter. Around 88 % of the root length belong to those roots with a diameter lower than 1 mm (graphic available in the attached version). Thus, if we divide the rhizosphere N supply output, the highest supply still comes from roots with a diameter lower than 1 mm. This assumption was done with base in relevant papers about Eucalyptus roots, cited in the present paper (Baldwin and Stewart, 1987; Mello et al., 1998). Therefore, the highest contribution to the rhizosphere process comes from roots with diameter <= 1 mm because of the higher length and, consequently, rhizosphere volume and rhizodeposition flux. Thus, when we say in the sensitivity analysis that there is a higher supply until 3 mm, we are just doing a simple sum of the contribution of the rhizosphere from the root classes of 0-1 mm plus 1-2 mm and 2-3 mm - the total supply of the active rhizosphere system.

Author's changes in the manuscript: None.

3. Comment from Referees: "There are numerous language errors and typos throughout the manuscript. The list below does not include all of these errors. Abstract: Line 13: change "for instance" to including Line 19: Missing and before SOM formation."

Author's response: About the line 13, in this case, "for instance" was used as an example, which is correct. About the line 19, it is not clear the sense of the suggestion.

Author's changes in the manuscript: None.

4. Comment from Referees: Page 2 Line 1: The authors use i.e. many times to add another clause to the sentence. This should be put in parentheses with (i.e., N mineralization). Or edit these sentences to include it in the sentence structure.

Author's response: Thanks. The correction will be made in the final version.

Author's changes in the manuscript: The correction will be made in the final version.

5. Comment from Referees: "Page 2 Line 7: Replace high with higher."

Author's response: The correction will be made in the final version.

Author's changes in the manuscript: The correction will be made in the final version.

6. Comment from Referees: "Page 2 line 14: Rhizosphere is spelled incorrectly."

Author's response: The correction will be made in the final version.

Author's changes in the manuscript: The correction will be made in the final version.

7. Comment from Referees: "Page 2 line 19: This value of 1/3 cited for Finzi et al. 2015 is incorrect. In the top 30cm of soils, it only approaches 25% when the rhizosphere influence is assumed to be high." Author's response: We were based on the following sentence from Finzi et al. (2015) abstract: "Then, using a numerical model that combines rhizosphere effect sizes with fine root morphology and depth distributions, we show that root-accelerated mineralization and priming can account for up to one-third of the total C and N mineralized in temperate forest soils."

Author's response: After your suggestion, we read the paper again and also saw that the value of 25 % is the correct. Thanks for the valuable suggestion. We will correct it in the final version. It's somehow interesting because we are preparing other paper with scenarios simulation and this value (proportion) it is very close to those from some of four main forests plantations.

Author's changes in the manuscript: The correction will be made in the final version.

8. Comment from Referees: Page 2 line 31: Schimel and Weintraub, as well as the Allison reference, did not develop the model to look at rhizosphere processes. Also, the model is MCNiP not MSNiP. This error is repeated throughout.

Author's response: Since we are developing an organism-oriented model, it is not a problem to mention the advances of these authors. The main changes, in terms of representation, is the availability of growth resources for microorganisms, when we

compare the bulk soil with rhizosphere soil. Thus, advances are, in a sense, shared for the representation of any subsystem of the whole soil system. In mechanistic models, it is always good to take into account the phenomena in question in the highest degree of importance. Regarding the name of the model, in fact, during the review process, we substituted the letter C for S. Thank you for the valuable observation.

Author's changes in the manuscript: The name MCNiP will be corrected in the final version.

9. Comment from Referees: Page 4 line 18: Cite Finzi et al. 2015 as well

Author's response: The citation will be included in the final version.

Author's changes in the manuscript: The citation will be included in the final version.

10. Comment from Referees: Page 4 Line 26: Replace of with on.

Author's response: It will be corrected in the final version of the article.

Author's changes in the manuscript: It will be corrected in the final version of the article.

11. Comment from Referees: Page 5 Line 34: The second half of this sentence is confusing and unclear.

Author's response: It will be improved to the final version of the article.

Author's changes in the manuscript: It will be improved to the final version of the article.

12. Comment from Referees: Page 6 Line 4: The lack of feedback between plant growth and rhizosphere stimulation of N mineralization is key process that is missing in this model.

Author's response: This type of refinement is timely, but it should be the focus of an article focused on growth modeling. Our team is already working on it.

Author's changes in the manuscript: None.

13. Comment from Referees: Page 8 Line 8: "it was used data". Same for Line 18.

Author's response: It will be corrected in the final version of the article.

Author's changes in the manuscript: It will be corrected in the final version of the article.

14. Comment from Referees: Page 11: This text is unclear but it appears that the model is parametrized to have greater rhizosphere volumes when root diameter is larger. This directly contrasts the assumption in Finzi et al. 2015 that fine low diameter roots are more active and thus have a greater rhizosphere effect.

Author's response: Our model uses the root diameter to simulate the rhizosphere process considering the percentage of root length ratio per diameter. Around 88 % of the root length belong to those roots with a diameter lower than 1 mm (graphic available in the attached version). Thus, if we divide the rhizosphere N supply output, the highest supply still comes from roots with a diameter lower than 1 mm. This assumption was done with base in relevant papers about Eucalyptus roots, cited in the present paper (Baldwin and Stewart, 1987; Mello et al., 1998). Therefore, the highest contribution to the rhizosphere process comes from roots with diameter <= 1 mm because of the higher length and, consequently, rhizosphere volume and rhizodeposition flux. Thus, when we say in the sensitivity analysis that there is a higher supply until 3 mm, we are just doing a simple sum of the contribution of the rhizosphere from the root classes of 0-1 mm plus 1-2 mm and 2-3 mm - the total supply of the active rhizosphere system.

Author's changes in the manuscript: The results are consistent with data from field experiments.

15. Comment from Referees: The results section is mainly validation and does not address key ecological questions nor does it attempt to scale these results up.

Author's response: We thank the comment. But the reviewer should consider that the fundamental question is the priming effect and the mathematical representation of the rhizosphere system with respect to C and N. We did it! And, more importantly, we

consider biological logic by representing the effect of the availability of biotic and abiotic growth factors. This question is the basis of all work and was, within the possibilities, represented.

We have reviewed numerous articles on this subject and are aware of our contribution. We gave ecosystem scale when considering the plant in this system, which we have seen to be rare in this type of work. In addition, we devote an entire section to the biological importance of this phenomenon.

Author's changes in the manuscript: None.

16. Comment from Referees: Table 1. There are no units for the parameter variables. Same for Table 2.

Author's response: Thanks. We will correct it in the final version.

Author's changes in the manuscript: Thanks. We will correct it in the final version.

17. Comment from Referees: Figure 7 caption should say kinetic.

Author's response: Thanks. We will correct it in the final version.

Author's changes in the manuscript: Thanks. We will correct it in the final version.

18. Comment from Referees: Figure 9 caption on instead of in.

Author's response: Thanks. We will correct it in the final version.

Author's changes in the manuscript: We will correct it in the final version.

19. Comment from Referees: Table S1: Why do some variables have dashes instead of values?

Author's response: Some variables are user-defined and others are model outputs.

Author's changes in the manuscript: none.

20. Comment from Referees: Conclusions: These abruptly are presented at the end

of the text with little context to gauge whether they were supported. In addition, the discussion does not highlight the importance of the work.

Author's response: The proposition of this model in itself justifies the article and is already helping in the understanding of results of measurements of SOC in Brazil, with a view to assisting in the management of forest residues and nitrogen fertilization. Discussions about scenario simulation are quite interesting and will be covered in another article. In any case, scenario simulations should not overshadow the proposition of the model that gives rise to them. Finally, the presentation of biological importance was proposed as a means of showing the reader the direct importance of the work.

Author's changes in the manuscript: none.

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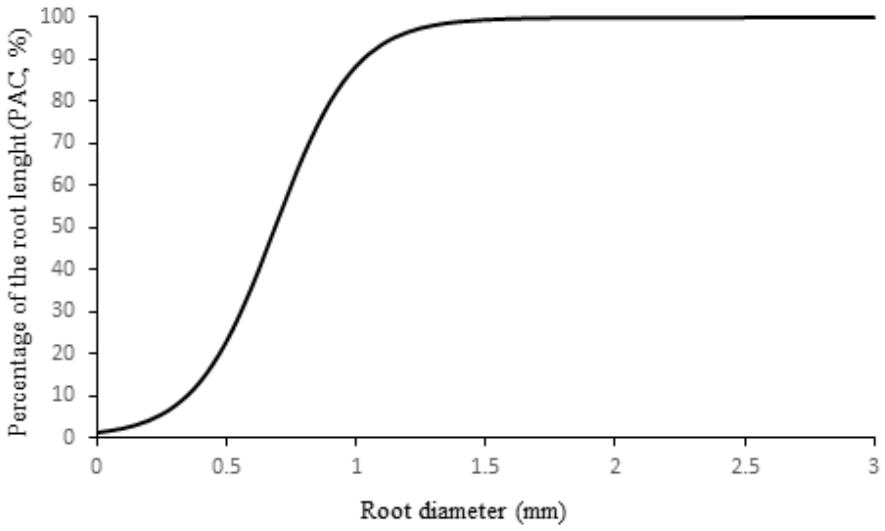

Fig. 1. Percentage of the total root length per root diameter