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

Anonymous Referee #1

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The authors present an applied study modelling the soil nitrogen feedbacks to plant rhizodeposition. The subject is relevant to the audience of the journal, as nutrient constraints on SOM stocks and plant growth, especially in tropical soils, have high leverage on our understanding of global CN cycles.

However, I cannot judge the soundness of the paper due to lacking information and confusion of units in the model description.

Without reading the cited publication informations are lacking: - on the evaluation data (what does one data point represent: a different plot, a different treatment, a time series? ...) - lack of information how the the model was calibrated (just the one standard parameterization, or some parameters adjusted, once for all the data or different parameters by dataset or observation, ...)

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There are unit errors in the model description E.g. in 21 the units of right and left hand side do not match.

There is confusion between rates (amounts be per hour) and pure amounts (here concentrations per g Soil).

In eq. 16 and 17, it is checked whether a rate is smaller than an amount (Uc < DOC). This makes sense in a model integration using a time step integration of 1hour, but nevertheless is a category mistake. The model description needs to be better separated from the time integration of the model.

It is very hard for the reader to always need to locate all the abbreviations in the tables S1 and S2. I recommend repeating the the abbreviations in the sections, where they are used for the first time. Because of these confusions and abbreviations, I did not check all the equations.

The formulation of uptake (eq. 13, 14) is awkward. The uptake of DOC is proportional to biomass measured in carbon units (BCm) , while the uptake of DON is proportional to biomass measured in nitrogen units. I suggest computing the uptake of N to be stoichiometric with C using the CN-ratio of the DON. If microbial uptake is deliberaty described differential in C and N, I would at least make it proportional to microbial biomass measured in the same units.

N-Immobilization (eq. 19) is computed only by microbial demand. There is no upper limit of the immobilization rate, hence microbial growth is never limited by total N. Is this reasonable assumption for this site?

The transfer of Kpr*DOC(i) (+ Kpr* flux terms) from DOC to SOC needs more justification (Table S3). If the other flux terms were zero, the DOC would quickly go to zero because tranfering all to SOC. I strongly suggest a formulation of the form: DOC(i+1) = DOC(i) + ... and thinking of some alternative to the term: -Kpr DOC(i), e.g. if Kpr limits uptake, I suggest using Kpr in the uptake equation instead.

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Table S3: Again to avoid unit confusion, the multiplication with time (1hr) should be noted explicitly, or better a differential formulation (dX/time = input_rate_X - output_rate_X) should be adopted. Please, also report amounts consistently either per gram or per cm3.

It did not become clear to me how the 3-PG estimate of C flux allocated to roots/rhizodeposition is translated to inputs to the soil. Eq. 7 does depend only on root propoerties. If only root properties estimates by 3-PG are used, it should be checked that the sum of rhizodeposition as computed by the full model (eq. 7) is consistent, i.e. equals, the 3-PG C allocation flux to roots.

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