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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Determination of empirical parameters for root water uptake models" *by* M. A. dos Santos et al.

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Reply to "Interactive comment on "Determination of empirical parameters for root water uptake models" " by Referee#3

In response to the Anonymous Referee #3 :

We are thankful for your critical reading, constructive questions and suggestions. In the following we address your major comments. The response to the minor comments can be found in the supplement.

i) Regarding the discussion of the empirical models, we hope that the modifications (suggested by the referees) made in the revised manuscript will improve the discussion

and understanding.

ii) For most applications transpiration is more relevant than uptake distribution. For specific applications in which average water content in soil layers is of interest, root water uptake distribution can play a major role. Indeed, fitting the models with local uptake and transpiration simultaneously, and using a proper weighting scheme, might lead to more reliable results. Nevertheless, fitting the models to root water uptake only also provided good predictions of relative transpiration (by the models that showed good performance on predicting RWU) as shown by the statistical indices of Fig. 9, suggesting that using RWU only for such a task is quite sufficient. Conversely, using transpiration for such a task can lead to wrong predictions of RWU uptake distribution. We could use some simulated scenarios to show this.

iii) It is correct that those models that use matric flux potential are mathematically closer to the reference model, an advantage for the comparison, and this should be emphasized. A short discussion about this will be placed in the text.

iv)" One of the critical points concerning the Feddes stress response function in combination with the Jarivs (1989) compensation approach, the authors mention, is that the models fail to predict compensation under wet conditions, where alpha is 1 for different matric potentials. The modification using martic flux potential with distinct critical point (M_c) will perform alike. This is ok but should be discussed". A critical comparison between the models is made from line 23, page 14 to line 2, page 15. We will address this fact also.

v) Regarding the fact the "Model PM mixes stress reduction described by pressure head and compensation calculation based on matric flux potential". Conceptually the two models distributes RWU over depth by taking into account root length density and a hydraulic function to account for the effects of soil water in partitioning RWU. Any hydraulic function could be used, however the matric flux potential property seems a good alternative since it integrates both effects of soil hydraulic conductivity and soil

pressure head. This will define S_p in the model. The actual local uptake can then be obtained by applying a stress response function α of any type, and for PM $\alpha = \alpha(h)$ is used. Thus, the fact that PM mingles M and h is not conceptually unreasonable.

vi) Using variable boundary conditions would provide more information content of the "measurements" as you comment as compared to the used constant boundary condition. We will comment this limitation of the work, however the applied scenarios included distinct hydraulic conditions, submitting the models to a wide range of conditions.

vii) Indeed, it is important to discuss about other existing physical models. We will include a discussion about the models you suggested. We will also discuss the limitations of the De Jong van Lier et al. [2013] model and emphasize that this work deals with only reduction of RWU/transpiration due to soil water stress.

viii) Although considering daily variation of T_p during the day would give more detail about the predictions, the simulations performed did provide important features to strictly analyze De Jong van Lier et al. [2013] model as shown in section 4.1. In most applications root water uptake models are performed with no variation of T_p.

ix) We will consider your suggestion about the title, as it was suggested by N. Jarvis in RC1 comment.

References

Q De Jong van Lier, J C van Dam, A Durigon, M. A. Santos, and K Metselaar. Modeling water potentials and flows in the soil-plant system comparing hydraulic resistances and transpiration reduction functions. Vadose Zone Journal, 12(3), 2013.

N J Jarvis. A simple empirical model of root water uptake. Journal of Hydrology, 107(1): 57–72, 1989.

Please also note the supplement to this comment:

http://www.hydrol-earth-syst-sci-discuss.net/hess-2016-59/hess-2016-59-AC3-supplement.pdf

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