

Interactive comment on “Comparison of root water uptake models in simulating CO₂ and H₂O fluxes and growth of wheat” by Thuy Huu Nguyen et al.

Anonymous Referee #2

Received and published: 7 July 2020

General Comments

This study compares two crop and root growth models with measured data that were previously published. The models differ mainly in their representation of root water uptake. One uses the standard approach (Feddes), the other considers the flow process in the roots (but not to the roots) and is hence more mechanistic. The paper is fairly well written. It is a valuable contribution to soil/crop science, but would benefit from a few extensions and corrections, as outlined below.

It is a severe shortcoming of the measurements that the field plots do not involve replications. Replicates would be very desirable to enable assessing the variability, but their omission should not prevent the manuscript from being published. It should be frankly stated that and why there were no replicates (too expensive?). The experiment should

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be described better (e.g., the plot size is not given).

In model-measurement comparisons, it is good practice to present the measured data with standard deviations or errors and the modeled data as lines; if uncertainty is considered, with uncertainty bands. This is not always the case here (Figure 3 no, figure 4 yes; why?)

The paper should give a few more details about the calibration of the soil-crop model. The role of Penman's ETP should be discussed.

The Conclusions section should be improved. The first paragraph is misplaced. I would like to hear a bit more about the rhizosphere conductivity under drought and see the work (at least one paper) of Andrea Carminati cited in this context. Model testing is important but how could the model be improved? Is it not a severe shortcoming that the drop in root length density in the topsoil is neglected? And, similarly, the increased root growth under drought stress? How could this be represented better in the model? What models are already out there that are capable of handling such situations?

Does the fact that P1 receives less water but is exposed to the same weather situation in regard to all other weather variables (e.g., air humidity) as P2-P3 might have biased (in the sense of an artifact) the reaction of crops in the field as compared to the simulations?

Detailed comments

line 41 function of

44 correct: are lost

46 make clear that you use the terms water potential and hydraulic potential coherently. Better, define it for the readers from different fields. There is a problem because traditionally for plant scientists water potential does not contain the gravitational component, for soil scientists it does. What is root zone water potential? Is it the hydraulic or matric potential in the rhizosphere? probably not.

58 computation of

228 In both models, delete "for each model"

235, 240 in a given layer

238 delete "sufficient"

239 I recommend deleting "which is based on a mechanistic description of water flow in the coupled soil-plant system," because you are her in the technical part.

252 delete "the"

287 UTC is more confusing than local time

292 better "characterizes the difference" or "is a measure for the difference"

297 "are uncertain"

304 seminal roots

310 units missing

311 threshold (index)

316 better reverse: kplant explicitly simulated by. . .

317 we present and discuss the results of the sensitivity analysis

324 in fair agreement (at best)

358 Grammar: this should not be emphasized too much Content: This cannot be emphasized too much because it shows a clear and important shortcoming of your modeling approach and gives a point of leverage for the next step of improvement.

366 better: transpiration rates simulated by the Fe/Co model or simply transpiration rates by the Fe/Co model

376 less dry

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379 "from" end of May

404 I do not understand how you define adequate. I would rather write fair.

407 Pg is not defined. For the reader, it is better to write it out.

443 the sheltered plot with the silty soil (the field is the same - according to figure 1) if this is not true add the field borders in figure 1

444 comma before based

445 delete "in the measurements" (perhaps: observed in the field)

446 and elsewhere see above 443

450 must have causes not considered in the model ("other causes that" is wrong here)

455 The sensitivity analysis is, frankly speaking, a bit boring (sorry). It destroys the flow of the paper and feels like a "lost part". The reader should be left off the hook after Figure 9, but (recommendation) after a better discussion of what he or she can learn from all that.

479 are lower than those of old cultivars (not were)

481 indicates that

490 potential

495 more mechanistic, then you can drop the quotation marks

496 no comma

549 How were x_j and w_j determined? Should it not read $LAI(x_j)$?

554 "thus there was no Gaussian integration over time degree" - this cannot be understood

559 better write "grass reference evapotranspiration (FAO, give the reference)"

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561 reference needed

565 How were surface resistance and aerodynamic resistance calculated?

578 verb missing matric potential, not matrix potential matric potential head should have a unit, here m

Please make clear in the whole paper if you talk about the soil matric potential or soil hydraulic potential. Otherwise it is confusing. Here, for example, I feel that you mean soil matric potential. Actually I would avoid using the expression soil water potential.

Figures All figure captions should be formulated more carefully and with more empathy for the reader.

Figure 1 Indicate what kind of rock.

Figure 7 You should try to explain the systematic deviation in the deeper soil layers. 998: The should be better described in the text.

Figure 6,8 Rephrase the confusing caption. You should start with a statement about what the reader can see. Include the top graphs in the enumeration. Ψ_{leaf} and P_g should be defined in the caption (as RWU).

Figure 10 should be deleted

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., <https://doi.org/10.5194/hess-2020-180>, 2020.

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