Hydrology and Earth System Sciences Discussions

Interactive Comment

Interactive comment on "Implementing small scale processes at the soil-plant interface – the role of root architectures for calculating root water uptake profiles" *by* C. L. Schneider et al.

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Received and published: 15 November 2009

General reply

Thanks to Jan W. Hopmans for his fruitful short comment and the introductory laud. We added an extra paragraph to the beginning of section 2 explaining that our exercise consist of comparing two different model approaches where the second was again divided in two different scenarios.

Reply to Specific comments (comments are italic, response in standard script)

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In order for me to understand of what was presented, I had to re-read this manuscript various times. I therefore strongly suggest that the authors include an introductory paragraph to section 2 (p. 4237) that explains that the manuscript makes a comparison between 2 model approachs. Approach 1 uses the fully 3D Richards equation solver coupled with the Feddes reduction function to simulate soil water stress effects on root water uptake. Approach 2 uses the fully 3D Richards equation only to provide for the macroscopic soil water potential, which is coupled to the microscopic radial soil water flow and aRoot water transport models.

We changed the text as follows:
"Within this study we make a comparison between two model approaches for root water uptake. One approach uses a full 3D Richards Equation (see Section 2.1) coupled to the classical root length density approach combined with the Feddes reduction function (Section 2.4) to simulate soil water stress effects on root water uptake. The other approach again uses the 3D Richards Equation to model the bulk soil water ïňĆow combined with a smaller scale water uptake model called aRoot (Section 2.2). This aRoot model was divided into two scenarios of different root hydraulic parameterizations.“

Possibly, the organization of section 2 could be changed for that purpose.

We changed the beginning of section 2, where we decided to keep the organization of the subsections. We renamed the section formerly labeled by the "Feddes approach" to the "RLD approach" since this naming is less misleading.

I also like to point out that Simunek and Hopmans recently published a paper that shows how the macroscopic approach can be adopted to allow for compensated root water uptake as well. See: Simunek, J., and J.W. Hopmans. 2008. Modeling compensated root water and nutrient uptake. Ecological Modeling. doi:10.1016/j.ecolmodel.2008.11.004.

Thanks for this hint. For including a compensational effect into the Feddes model there is another paper published by Li et al. (2001). However this paper is also based on distributing the water uptake (either uncompensated or compensated) along the RLD. As I had a look to the designated paper of Simunek and Hopmans (2008), it seems that for the uncompensated and compensated case a similar approach was used, relying (in two dimensions) on the spatial root distribution function $b(x,z,t)$ (page 511 of their paper). The finding of our model study is while RLD profiles were similar amongst the 50 realisations, the water uptake behaviour was different. This is somehow questioning the use of RLD as a single parameter for distributing the root water uptake ability of plants within the soil.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 6, 4233, 2009.

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