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Geoscientific Model Development Discussions

Interactive comment on "IPA (V1): A framework for agent-based modelling of soil water movement" *by* Benjamin Mewes and Andreas H. Schumann

Anonymous Referee #2

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Review of the Manuscript [Manuscript # GMD-2017-318]: "IPA (V1): A framework for agent-based modelling of soil water movement" By Benjamin Mewes, Andreas H. Schumann General Comments

The manuscript presents a novel model concept by using an agent-based model to describe soil water movement in layered soils. The authors present in a very clear way how agents could be understood and how they can be set into play with each other within a given framework (here: a layered soil). Thus, they rather present a modelling-concept than a specific modelling software. Generally, it is an interesting and intriguing approach to describe soil water movement from a different perspective than other soil water transport models, which surely is of interest to many scientists working in the fields of quantitative water sciences. To the best of my knowledge there is no publi-

cation demonstrating such an application in relation to soil water movement, therefore, the approach presented in this paper is novel and will be a valuable contribution to the geo-scientific community. From my perspective as a non-native speaker, the paper is well written and I could follow the model description easily. Nevertheless, with regard to possible applications there are two points I would like to be discussed prior to publication:

- We know that soil water movement is strongly driven by heterogeneities within soils. One keyword would be "macro-pores". The actual discussion turns partly around possible ways to integrate macro-pore- driven soil water processes into the existing modelling frameworks. The proposed agent-based modelling approach would be a good candidate for developing such a representation. In addition, I find that the reasons why scientists should chose the proposed approach over other existing approaches are not satisfying: The proposed advantage of the agent-based model "Agent-based models allow a deeper analysis of system behaviour, the relation between dynamic components and last but not least, the ability to model unforeseen dynamics in certain model cases. (Page 2, line 6)" is not fully convincing. Even simple 1-D approaches could be analyzed with a focus on variable system properties or time-tagged rainfall input. Hence, I recommend to include the problem of predicting the effect of macro-pores into the introduction & discussion section and to propose an idea how the agent-based approach could improve the representation of such lateral soil heterogeneities.

- Another point is the cpu-time, which is needed for the application of the approach. It is not mentioned, how much effort and computer-power is needed to run the presented conceptual representations of a soil. For a possible use of the modelling approach for the simulation of observed time-series of soil-water storages (e.g. lysimeter data), this would be an important decision-criteria during model-selection. The chosen example time-series to analyze and characterize the agent-based model (e.g. 20 runs for the "starting-point-analysis") indicate to me that the time needed to run the model is comparably high. Hence, I think it should be clearly stated if e.g. an uncertainty anal-

ysis of model parameters using Monte-Carlo-schemes or other approaches would be possible. Especially for soil-systems, where seasonal dynamics (climate, vegetation) change the system, an advanced analysis of modelling output might be necessary.

- Page 7, eq. 7: R^2, as a statistical criteria to evaluate predictive qualities of models is very common and thus needs no extra explanation. The whole paragraph could be deleted.

Overall, I recommend publication after minor revisions.

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