

Hydrol. Earth Syst. Sci. Discuss., referee comment RC1
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Comment on hess-2021-426

Jan Hopmans (Referee)

Referee comment on "It rains and then? Numerical challenges with the 1D Richards equation in kilometer-resolution land surface modelling" by Daniel Regenass et al., Hydrol. Earth Syst. Sci. Discuss., <https://doi.org/10.5194/hess-2021-426-RC1>, 2021

Initially, when accepting to review this manuscript, I was very interested to learn about more recent advances in numerical modeling. However, it took me some time to realize that the manuscript assumes knowledge at the landscape scale, and is seeking to describe LS modeling to the km scale, at much higher spatial and temporal resolution. This reviewer's expertise is in soil and vadose zone hydrology which simulates subsurface water flow using the Richards equation at the cm (m) and hour (minute) scales.

I do fully understand the inherent complexities when taking the landscape scale as the benchmark and using those experiences to address unsaturated water flow at much higher spatial and temporal resolutions. However, over the past few decades, the soil/vadose zone hydrology field has largely advanced, and has developed computer simulation algorithms that can address these high resolutions with satisfactory computer times including multidimensional flow at increasing space (time) scales (more than cm/minute scales).

It was therefore surprising to learn that the authors have largely neglected to reference that work, and ignored those more recent developments of the past 10-20 years in the soils and vadose zone hydrology literature. Instead, this manuscript makes simplistic assumptions that are no longer necessary, such as considering multidimensionality through an empirical sink term, and simple boundary conditions such as zero flux lower boundary and a nondynamic infiltration term.

Just for the author's information, I list hereby just a few references that they could read (from a much larger list of additional references), and these are:

Recent Developments and Applications of the HYDRUS Computer Software Packages

Jiří Šimůnek, Martinus Th. van Genuchten, Miroslav Šejna, at
<https://access.onlinelibrary.wiley.com/doi/full/10.2136/vzj2016.04.0033>

Adaptive Grid Refinement in Numerical Models for Water Flow and Chemical Transport in Soil: A Review R. S. Mansell, Liwang Ma, L. R. Ahuja, S. A. Bloom,

<https://doi.org/10.2136/vzj2002.2220> at:
<https://access.onlinelibrary.wiley.com/doi/abs/10.2136/vzj2002.2220>

Sustainability of irrigated agriculture in the San Joaquin Valley, California

Gerrit Schoups, Jan W. Hopmans, Chuck A. Young, Jasper A. Vrugt, Wesley W. Wallender, Ken K. Tanji, and Sorab Panday at:
<https://www.pnas.org/content/102/43/15352>

And

Modeling Soil Processes: Review, Key Challenges, and New Perspectives

Vereecken,* A. Schnepf, J.W. Hopmans, M. Javaux, D. Or, T. Roose, et al. Modeling Soil Processes: Review, Key Challenges, and New Perspectives. Vereecken,* A. Schnepf, J.W. Hopmans, M. Javaux, D. Or, T. Roose et al. 2016. at:
<https://access.onlinelibrary.wiley.com/doi/epdf/10.2136/vzj2015.09.0131>