Hydrol. Earth Syst. Sci. Discuss.,
https://doi.org/10.5194/hess-2019-132-RC3, 2019

Hydrology and Earth System Sciences
Discussions

Interactive comment on "Simulating preferential soil water flow and tracer transport using the Lagrangian Soil Water and Solute Transport Model" *by* Alexander Sternagel et al.

Anonymous Referee #3

Received and published: 8 May 2019

A Lagrangian modelling method developed in Zehe and Jackisch (2016) have been extended to simulate solute mixing in soils with macropores which act as preferential flow pathway. It was tried to check validity and applicability of the extended model for replication of field data and solute transport processes. The topic is of significant importance for geoscientists and hydrogeologists, considering the challenges of using existing models for simulation of mixing in heterogeneous soils with micropores which have been discussed sufficiently in the introduction section of the paper. The proposed model needs a specific parameters describing the characteristics of the pore scale structure of the soil such as dimension of macropores. A strategy for extending the modelling method has been described smoothly and appropriate level of details have

been presented. However, it should have been verified using simple benchmark examples to check reliability of the method before any effort for its validation with field data.

Major comments: 1) The modelling strategy have been proposed to overcome challenges related to dual domain models, however, there no quantitative comparison between the dual domain methods proposed in Seven and Germann, (1981) or Nezhad et all (2010), and the model proposed by authors in this manuscript. A further analyses is required to compare the results achieved from the extended work and the original LAST model as well as results that can be achieved via dual domain theory. These quantitative comparisons are required, particularly, for clarification of discussions in lines 25-30 if the page 12.

2) Some new parameters have been introduced in the new model, which may not be physically measurable such as dimension of the micropores and considering the authors effort for simulation of field data, it has not been proposed/specified how values of these parameters can be identified.

3) Discussion regarding computational efficiency of the proposed model has not been presented sufficiently, and for example in page 13 line 39 duration of simulation has been presented without identifying which machine have been used and also duration of simulation with other possible model have not been compared. With our such complete comparisons, discussions on efficiency of the method would not add any scientific knowledge to the readers.

4) Some of the results presented in the paper are obvious and do not need complex modelling methods to be implemented. For example discussions presented in page 12 lines 15-20, can be achieved using other methods and perhaps developing proposed model was not required to understand these. Perhaps if authors compare their results with other results achieved using other methods which capture the effects of macropores, more valuable finding will be presented. Authors should make the results section

more focused on the capacity of new strategy used for modelling micropores and their interactions with soil matrix.

Minor comments: 1) Simulation domains have not been explained sufficiently in the text, and mainly some figures have been presented which are not enough to understand the problem being simulated.

2) A complete description of boundary conditions and initial conditions for simulation domains are required.

3) discussion on time step in page 6 lines 20-25 is vague and needs to be clarified. It will be helpful that author visualise the discussion and king it more understandable.

)If I understood correctly LAST model is the same as the model developed by Zehe and Jackisch (2016). I suggested that author call it as their model or the model developed by Zehe and Jackisch (2016), i.e., rewrite lines 9-11, I suggest "Our LAST-Model (Lagrangian Soil Water and Solute Transport) developed by Zehe and Jackisch (2016) relies on the movement of water particles carrying a solute mass through the soil matrix and macropores. We advance this model by two main extensions: a)..."

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2019-132, 2019.