

Hydrol. Earth Syst. Sci. Discuss., referee comment RC1
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Comment on hess-2022-153

Anonymous Referee #1

Referee comment on "A robust upwind mixed hybrid finite element method for transport in variably saturated porous media" by Anis Younes et al., Hydrol. Earth Syst. Sci. Discuss., <https://doi.org/10.5194/hess-2022-153-RC1>, 2022

This paper deals with 2D numerical simulations for a coupled system arising in flow and transport in heterogeneous media. The mathematical model under consideration is the flow and transport in variably saturated porous media using Richard's equation. A numerical scheme is developed for the discretization of this system by combining a mixed finite element method and a new upwind scheme for the convective term. 2D numerical results are presented to see the performance of the scheme for two tests for numerical simulation of contaminant transport into a variably saturated porous medium. The obtained results are satisfactory.

The subject is of interest and of current events. The authors made an interesting contribution for a difficult problem. The paper is well written and the results are of current interest. I deeply recommend the publication of this article.

The authors should clarify the following points:

- '{ }' notation should be defined to avoid confusion.
- The time discretization, the strategy used for the choice of the time step, the resolution of the nonlinear system and the linear systems should be specified.
- To ensure reproducibility of the results of the two tests presented, all necessary data including discretization and solvers etc. should be specified.

- It would also be interesting to give information about the environment in which the simulations were performed and the CPU times for each simulation.

- Can you comment on the extension of this approach to the 3D problem?