

Hydrol. Earth Syst. Sci. Discuss., author comment AC2
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Reply on RC1

Anis Younes et al.

Author 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-AC2>, 2022

RC1: 'Comment on hess-2022-153', Anonymous Referee #1, 07 Jul 2022 reply

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.

Answer: We thank the Reviewer for his/her positive appraisal of our work. As detailed below, all comments are accounted for in the new revision.

The authors should clarify the following points:

- '{ }' notation should be defined to avoid confusion.

Answer: The symbol designates the contribution from the adjacent element . This has been specified in the revised version.

- 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.

Answer: Done in the revised manuscript.

- To ensure reproducibility of the results of the two tests presented, all necessary data including discretization and solvers etc. should be specified.

Answer: We agree and add all data in the revised version.

- It would also be interesting to give information about the environment in which the

simulations were performed and the CPU times for each simulation.

Answer: We agree and add information about the environment for the simulations and CPU times.

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

Answer: The scheme can be seen as a combination of the upwind edge/face centred Finite Volume (FV) method with the lumped formulation of the hybrid MFE method and, as such, it can be easily extended to 3D problems.