

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

Anis Younes et al.

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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

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**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.