

Hydrol. Earth Syst. Sci. Discuss., referee comment RC4
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Comment on hess-2021-340

Anonymous Referee #2

Referee comment on "Evaporation front and its motion" by Jiří Mls, Hydrol. Earth Syst. Sci. Discuss., <https://doi.org/10.5194/hess-2021-340-RC4>, 2021

The process of evaporation under confinement (i.e., within a porous medium) is encountered in a number of important industrial, environmental and agricultural applications. Examples include the evaporation of water from soil, water evaporation within building materials, while when considering a more general view of the "evaporation process" we could mention the process of drying-out during CO₂ sequestration in aquifers (a process occurring at higher than atmospheric pressures).

Therefore, it is essential to enhance our understanding of the particular process at multiple length scales (microscopic, mesoscopic, macroscopic).

The current study focuses on the macroscopic description of the evaporation front. The study provides an elaborate mathematical formulation of the water evaporation front and how it moves within a porous medium. Therefore, it contributes in enhancing our understanding of the particular problem under discussion.

However, the following issues need to be considered by the author:

- While, in general, the manuscript is well-written, during reading you often get the feeling that important information is missing between the different steps presented in the study. Maybe the author could provide some additional details, which may be too obvious for the author; however, they may not be that obvious for the interested reader.

- It is not clear to me why the author has selected to limit the testing of the developed theory to some unpublished experimental data that are "...not sufficiently documented..." (as stated in line 203), instead of using some other published experimental data that have available all the required information. In that case the author would have the opportunity to examine if the proposed theory has accounted correctly for all the phenomena that are involved or some additional mechanism may be possibly missing. For example, M. Prat (Int. J. Heat Mass Transf., 50, 1455-1468, 2007) has indicated that accounting for film flows results in predicting more accurate the liquid saturation within a porous medium during evaporation. Otherwise, the provided numerical example is simply a mathematical exercise.

- The possible effect of film flows on the definition of the evaporation front has not been discussed in the current study. The evaporation front in the presence of film flows has been discussed by Yiotis and coworkers, as well by Prat and coworkers (e.g. see the related references in the aforementioned ref of Prat).

In addition, the following issues should also be considered:

- The quality of the figures needs to be improved (e.g., font-sizes in x-, y-axes needs to be increased)
- All symbols should be clearly defined at the point where they are first introduced in the manuscript (e.g., density porosity in Eq. 3).
- All equations should be numbered consistently (about half of the equations are not numbered).
- In order for someone to be able to reproduce the simulations discussed in the current study, it is essential that all the parameters used in the study should be provided either in the text or preferably collected in a Table (Mualem and van Genuchten parameters, Diffusion coefficients, etc.)
- In lines 76-78 the author mentions that "we do not consider the temperature distribution and heat flow balance...". Does the author consider completely isothermal conditions? This issue should be stated clearly. Does this particular assumption apply to all experimental conditions and different porous media? If not, which are the restrictions/limitations for using this assumption?
- In lines 293-295 the author presents 3 cases for c_f and c_e . Additional details should be provided on how these values were selected (temperature, pressure conditions etc.) and what is the source of these values.
- The doi reported for Sakai et al. (2011) corresponds to a "Correction" to a previous paper by those authors. The author might want to include the original paper as well in the reference list.

