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Hydrol. Earth Syst. Sci. Discuss., referee comment RC1
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Comment on hess-2021-633

Anonymous Referee #1

Referee comment on "Mixed formulation for an easy and robust numerical computation of sorptivity" by Laurent Lassabatere et al., Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2021-633-RC1, 2022

Manuscript: hess-2021-633

Title: Mixed formulation for an easy and robust numerical computation of sorptivity

Dear editor and authors. I read carefully the manuscript. The article is quite interesting and is well written and organized. The authors propose a new mixed formulation that scales sorptivity. The topic is relevant and gives valuable information about sorptivity. This hydraulic property is a key parameter, and there is a lack of information about it, especially in terms of the dependency with the soil water content. For these reasons, the manuscript fits into the journal's scope and would be relevant to the readers of Hydrology and Earth Systems Science. Additionally, this manuscript complements very well the previous study of Lassabatere et al. (2021), published in this journal. However, there is one major concern that must be addressed before publication. Soil sorptivity is a function of the initial and final soil water content. Since sorptivity is an expression of the capillarity forces, the highest value corresponds to the dry condition ($h=-\infty$) and decreases as the soil water content increases (in dry condition, the capillary forces domains the process, while near saturation there is no expression of capillarity). The authors included in the manuscript the Figures 1 and 2 in order to show an example of the of the mixed formulations. In these figures, the y axis corresponds to the sorptivity (estimated with the new mixed formulation function) and the x axis corresponds to the soil water content or water pressure head (h). The behavior of this function is the opposite to the expected one. This issue should be addressed in the manuscript. Additionally, the inclusion of hypothesis and objective will improve the manuscript. Also, it would be very interesting to include some figures with the sorptivity values as function of soil water content and water pressure head, calculated with the new mixed formulation. Below, I mention more detailed comments. I'm not English native speaker, then I will not correct language issues.

Detailed comments:

L 12-13: the first two sentences are exactly the same than the two first sentences of Lassabatere et al. (2021). Please modify.

L 20: Equation (1): Please add more information about this equation. I couldn't find the same expression in Parlange (1975).

L 21: initial and final water contents of the soil or the water source? More detailed information about the relationship between sorptivity and water content is needed.

L 24: I couldn't find the same expression in Ross et al. (1996). Please give more detail about the construction of this equation.

L 240-246: Please use these ideas to built hypothesis and objectives, and include them in the Introduction section.

L 363-371: this is not a conclusion. The inclusion of an explicit hypothesis will improve this section.