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Discussions

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Comment on hess-2022-173

Anonymous Referee #2

Referee comment on "Technical note: A sigmoidal soil water retention curve without asymptote that is robust when dry-range data are unreliable" by Gerrit Huibert de Rooij, Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2022-173-RC2, 2022

de Rooij's submission aims primarily at presenting some adjustments to a previously developed sigmoid-logarithmic soil-water retention function (WRF) and evaluates the new parametric relationship in terms of better describing the dry range of WRF. Specifically, this technical note is an extension of previous works by Prof. de Rooij's group on the subject and deals with a slightly different parameterization of de Rooij et al.'s (2021) WRF which places greater emphasis on the role exerted by the "alpha" parameter of the sigmoid component of this analytical relation.
The text reads well and is properly organized, although some parts of Sections #2 and #3 seem too wordy for a technical note. The figures and tables are satisfactory, but I suggest improving the readability of Figs. #2, #3, and #5 (and subsequent) by enlarging a bit more the fonts of the numbers.
I have some criticisms and concerns that offer to the author for possible revision of the original submission. As a comment to the editor in charge, I shall make my opinion clearer below that the topic of this manuscript might be of scant interest to the HESS readership. Therefore, this paper should not be accepted in its current form, requires major revisions, or should be rejected altogether.

1) The author should, first of all, explain well and in detail to the reader why he feels the need to present this parametric analysis only on the analytical expression of the water retention function. Nowadays, it is quite clear that the real advantage of using a relatively simple or more comprehensive closed-form WRF is to infer the hydraulic conductivity function (HCF). I believe it might be worth putting one's attention to only a better (one expects) analytical description of the measured water retention data-points whether one employs the WRF for a certain scope (e.g. to get a better estimation of the water content at the condition of field capacity, or to better compute the integral of WRF).

2) P.3, L.60. On the subject of "hydraulic equilibrium" and relevant constraints on the soil hydraulic parameters, the author can find useful inputs if the review paper by Assouline and Or (2013).

3) P.4, L.80. Here one should warn the reader that the reported range of the “alpha” parameter depends on the parametric relation used to describe the WRF.

4) P.5, L.106. Strictly speaking, if the first derivative is zero, this is a necessary, yet not sufficient, condition for a minimum (or a maximum). In a view of the detailed parametric evaluation carried out in this article, one should also discuss the likely presence of relative minima and global minimum.

5) P.9, Section 3, L.206. I believe the author emphasizes too much the role that the various soil textural classes exert on WRF. Of course, soil texture is important, but other soil characteristics play a role in determining the shape of the WRF and often also have dominant effects, such as the oven-dry soil bulk density, the organic carbon content, and soil aggregate composition and aggregate-size distribution.

6) This comment is somehow linked to the previous point -5-. Some water retention data-points used in this technical note (especially those shown in Fig.8) seem better described by a bimodal (or multi-modal) water retention relationship. Firstly, coarse-textured soils can have a bimodal retention behavior as happens in the cases of some volcanic soils (e.g. Romano et al., 2011). It should also be considered whether other parametric relations, perhaps even simpler (e.g. just a simply bimodal relation linked somehow to the final matric pressure head Hd) than those proposed in this article, can give equally satisfactory or even better results.

7) As a final comment and allowing for HESS’s aims and scope, if I were a reader of this journal, I would probably find this article of little use. This is definitely not because the analytical developments are not interesting, but mainly because I think it is more effective here to discuss a functional evaluation rather than a parametric one (see, for example, the paper by Iden et al, 2021). This article can be more profitably submitted to a soil physics journal.

Reference cited.

Assouline, S., D. Or, 2013. Conceptual and parametric representation of soil hydraulic properties: A review. Vadose Zone J., 12, doi:10.2136/vzj2013.07.0121.

Iden, S.C., J.R. Blöcher, E. Diamantopoulos, W. Durner, 2021. Capillary, film, and vapor flow in transient bare soil evaporation (1): Identifiability analysis of hydraulic conductivity in the medium to dry moisture range. Water Resour. Res., 57, e2020WR028513.

Romano, N., P. Nasta, G. Severino, J.W. Hopmans, 2011. Using bimodal log-normal functions to describe soil hydraulic properties. Soil Sci. Soc. Am. J. 75:468-480.