

Hydrol. Earth Syst. Sci. Discuss., referee comment RC3
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Comment on hess-2022-173

Anonymous Referee #3

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-RC3>, 2022

The author proposes an adaptation to the new analytical relation presented by de Rooij (2021) to describe the water retention curve in a full matric head range. The analytical expression was tested on 21 soil samples taken from UNSODA database.

The evaluation of this manuscript is based on the following questions:

- Is it a novel work based on a reliable scientific technique?
- Is it clearly structured and well-written?
- Are the experimental design and analysis of data adequate and appropriate to the investigation?

Generally speaking, I would like to state that HESS is a high-ranked Journal and should receive novel, robust, scientifically-sound applications based on big data. This technical note does not fit in HESS for the following reasons:

- A new, or an adaptation of a new, analytical expression should be tested on ad-hoc water retention measurements to resolve the data fitting in the dry region. The soil sampling should cover all texture classes. The author took only 21 soil samples from the UNSODA. This number is not sufficient to draw strong conclusions. Moreover, the new expression should be compared to the existing expressions (van Genuchten, Brooks and Corey, Kosugi, to mention a few) by considering performance indexes like RMSE, R², KGE and especially AIC (that penalizes the performance if the number of

parameters is too high).

- The parameter fitting optimizes five water retention curve parameters on six to fourteen data pairs (Fig. 5) which are unable to provide basic information on the water retention curve. The author should show the uncertainty bands around the optimized curve and other performance indicators. I would be curious to see the parameter cross-correlation for each soil sample in Supplemental Material. What are the parameter ranges?
- This technical note resolves the fitting only for the water retention function by ignoring the hydraulic conductivity function that represents an essential prerequisite to solve the Richards equation in process-oriented hydrological models
- The author should convince the readers the advantage in using this equation and the disadvantage in using the most widespread equations. The three above mentioned analytical relations (and others) provide a closed-form expression for the hydraulic conductivity curve and for this reason are widely used by the hydrology community
- The RMSE is calculated on soil water content data (line 219)? If so, the RMSE values (the author should report the units) in Table 1 are dramatically high. In line 276, the author states that maximum allowed RMSE is 0.1 but in Table 1 I see many values higher than 0.1
- The text is too long for a technical note. There are too many figures that can be moved in Supplemental Material. The title should be concise and line numbering should be continuous for all lines. Figures must be improved consistently (enlarge fontsize, add grid, clarify axis titles by adding symbols and units)

This technical note should be rejected in this present form. I suggest to revise it thoroughly and re-submit