

## ***Interactive comment on “Development and Analysis of Soil Water Infiltration Global Database” by Mehdi Rahmati et al.***

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Title of Paper: Development and Analysis of Soil Water Infiltration Global Database  
Authors: Mehdi Rahmati et al.

We thank the reviewers and editor for their valuable comments to improve this manuscript. As far as possible the comments have been addressed in the revised version of the manuscript. Revised version of Manuscript (tracked and cleaned) + supplement are attached. Following are the replies for specific comments.

Comments from Prof. Jan Hopmans Comment: “Through a global survey of availability

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of soil infiltration data, the main authors of this manuscript developed a general accessible global data base of some 5000+ infiltration data sets, with all those who submitted data recognized through co-authorship. The database includes additional supplemental data such as soil texture, SOM, bulk density, saturated hydraulic conductivity, EC and pH, and landuse, if available. All data were digitized, and subsequently fitted through analytical 1D or 3D analytical solutions, providing for fitted values of sorptivity (S) and saturated conductivity (Ksat). Subsequently, the paper analyzed and compared measured with fitted Ksat values, and used principal component analysis (PCA) to analyze and discuss possible relationships between soil properties with S and/or Ksat. However, as also stated by the authors, the performed analyses are limited and much more could have been done, but that was not their objective. Moreover, the authors emphasize the many uncertainties associated with the various measurements and model assumptions. Despite that, the manuscript highlights the potential uses of this database for future research, as well as the need to expand the database, as various world regions are under-represented. In all, this reviewer was impressed with the commitment of the main authors to provide such an accessible global soil infiltration database.”

Response: Authors thank Prof. Dr. Jan Hopmans for giving such a positive feedback on this huge effort that has been made to collect these data.

Comment: “My main other comments are: 1. for those many readers that are likely not well-versed in soil infiltration, its limitations in measurement and modeling, it would be best if a literature reference was provided. I could give an example of that, but ask the authors to contact me, if they are interested.”

Response: Actually, different methodologies to measure soil infiltration and their formulation and limitations are already provided in a supplement file. We had missed to refer the readers to this file. Couple of lines is added at the end of Introduction section to cover this. Several references are also provided.

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Comment: 2. Indeed, the main discussion is on data uncertainty, for example on the discrepancies between independently measured and fitted Ksat values, and the lack of correlation with soil texture. The authors provide various reasons, including the scale of measurement and differences between field-measured and lab-measured infiltration data. However, I would pose that much of that is related to the lack of including soil structural information, such as macro porosity quantification or other possible soil attributes. I think that this manuscript deserves such discussion, so readers are aware. Moreover, it could inspire others to collect such information when conducting additional soil infiltration measurements, and can include this in the database in the future.”

Response: This comment is discussing about the structure effect on soil infiltration that is addressed in manuscript. Please see lines 399-407.

Comments from Prof. Attila Nemes Comment: “The authors present a 5000+ sized international data collection of soil infiltration measurements and related meta-information. I congratulate the authors for pooling these data into a great database and providing an initial exploration of the data collection. It is exemplary that such amount of data was openly contributed and made available to the community with no limitations. In my view, the lack of pooled field-based soil hydraulic data constituted a large knowledge gap for a long time now. I have a few questions about methodology and a number of small comments on the text, but I think this database and its documentation yield great service to the international soil community. I look forward to seeing the final version and further analyses performed on this data set.”

Response: Authors are grateful to Prof. Dr. Attila Nemes for his positive feedback. Such a positive feedback from him as a pioneer in supplying this kind of huge databases is unique and outstanding. We found the comments very useful.

Comment: “I have three questions about methodology or its documentation. Particle-size distribution (PSD): It is not surprising that the authors did not find much correlation between PSD and Ksat/S. Yet, I find it important to be clear about the way soil texture

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data were handled. Internationally, there are typically more than one PSD standards followed (e.g. USDA/FAO vs. IUSS), yet there appears to be only USDA/FAO conform data reported. Yet other systems may not even be possible to convert/interpolate, due to working with a fraction other than <2mm. Please add necessary information on how non-USDA/FAO-conform PSD data were handled. Were those rejected? Interpolated in any ways? Is raw data available? (L269-284, and Table 4).

Field capacity (FC) although available only for a limited number of cases: This is another example where international standards do not match – there are at least 5 matric potentials at which FC is approximated. Is there information on what definition was reported, and was there any opportunity to standardize – or at least provide metadata - if reported at different matric potentials? Other properties, for example BD, Ksat or saturated water content: Is there any information on their methodology? Core method vs. clod method? Field or lab Ksat (constant vs. falling head?) or fitted? Sensory or gravimetric? If such information is not available, I recommend that it is stated that those were not collected or provided. I expect that methodology on Ksat will especially be of interest.

I think the above should at least be commented on in the paper – or described where possible – to help avoid misinterpretations or the lack of information may hinder the database’s use in any other ways.”

Response: The reviewer is right by this comment/question. This is what that some of our co-authors also had warned us about the mixture of different standards in measuring or calculating soil properties. Actually, no conversion has been made and only raw data are reported in database. We simply assumed that all soil properties, more specifically soil texture, are measured by routine USDA methodology. However, we have supplied the reference for all data (if available) to enable people to retrieve more information if needed. This is discussed through the manuscript to warn the readers being aware of this issue. Please refer to lines 457-465.

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Comment: Minor comments, editorials: L215: made on samples of. . . L290: Sparse coverage? L301: Since this is often the same for other large data collections, I suggest replacing the end of the sentence as: (Fig 2), which makes SWIG a valuable data source for comprehensive studies.” L302-303: Rephrase to make it an independent sentence. (Skip ‘because’ and perhaps add that it would still be desirable to know about those soils. L332: With 22%, grasslands are the second most frequently represented land use type. L336: replace ‘striking’ with ‘noticeable’ or something similar. Alternatively: “Data show that the upper and lower. . .” L349-350: Does this lumping originate from the cited paper? If not, please explain. L356: Please spell out what is meant by ‘this’ L358: replace ‘rejected’ with ‘excluded’. . . were excluded from the presented study. The same in L359. L363: the  $\ln$  L365-366: restructure sentence: . . .R2 values higher than 0.9 and 0.99 were obtained in 94 and 68% of the cases respectively.” L368: from the analysis L379: from the SWIG L387: replace ‘striking’ with a more objective sounding term. It was observed. . . or something similar. L388-392: It would be useful to add a sentence or two here, summarizing what exactly constitute the problem. (e.g. sample size vs. representative elementary volume, sample excluding cracks or biopores, imperfection of sampling, etc.) L397: was performed L412: that the examined basic soil properties. . . L416: replace ‘done’ with ‘implemented’ L417: does not provide adequate means to estimate  $K_s$  L421: databases L425: errors L427: difficult, since the required L27-428: The uncertainty and variability related to the applied measurement technique . . . may be assessed as information on the applied techniques is available. L430: a strong effort has been made. . . L431: . . .any probable error of this nature. L435-438: Merge this para with the previous under the same umbrella with soil hydraulic properties. It is a very similar thought. L440-441: Do you refer to measurement scale here? How about assumptions about initial conditions, 1D vs 3D flow, etc.. .? Acknowledge those other potential sources of uncertainty. L443: please provide reference(s) L444-454: First, the quality of text in this section should be improved in general. Second, I think it would be better to present these cases more in a general context, perhaps even with 2-3 references. L475-476: . . .climate models,

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texture is not the main controlling factor. L476: the SWIG database References: Das Gupta should be Dasgupta. Please correct it in the relevant tables as well Figure 1: I don’t think the scale is necessary for a World map, especially since part of the map is distorted.

Response: done

Comment: Figures 3 and 4: There is a concern of visibility in these two figures. Also, there is very little difference that the reader can comprehend between the respective panels. They are not discussed too much either. I suggest that these two figures are removed, or some alternate way of presenting the relevant data is found. Figures 5-6: What do the multiple points with the same color represent within a texture class? They appear too few (especially in Figure 5) to be individual samples.

Response: Figure 3 and 4 are removed now. Nothing more except the soil texture they show. By this coloring figure we were trying to illustrate that which texture class is relevant to which component and which soil properties.

Please also note the supplement to this comment:

<https://www.earth-syst-sci-data-discuss.net/essd-2018-11/essd-2018-11-AC1-supplement.zip>

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