**Reply to Referee #1**

GENERAL COMMENTS

The presented dataset stores high quality soil physical data. The description of measurement methods and models applied to compute soil hydraulic parameters by fitting the moisture retention and hydraulic conductivity are detailed and clear. Structure of the manuscript is logical. The main strength of the database is the data on unsaturated hydraulic conductivity. This way the presented work and dataset will attain international interest.
The data could be easily accessed. Organization of the six data tables within the dataset is logical, the tables can be merged by the Sample_ID column.

Dear referee #1,
Thank you very much for your positive assessment and the thoughtful suggestions for a revision of our manuscript. We will address these line by line in the following.

A paragraph could be added about data quality check under materials and methods, because that could strengthen that the dataset was rigorously checked and the way the check was performed can be very informative for the readers and serve as a guideline.

You are perfectly right that such a quality check paragraph is a useful addition. It got lost during our initial internal revisions. We will add a respective paragraph before 2.4 to the manuscript describing the quality assessment of the data in more detail.

A final data check would be useful to secure that all data is correct. The detailed review can be found under SPECIFIC COMMENTS.

The data has been checked several times, but we will certainly perform another final check-up.

SPECIFIC COMMENTS

L24-25, L55, L78, L79, L82, L96 and entire text, please specify if you refer to soil profiles or soil samples, the word “data sets” is not enough specific.
We generally refer to soil samples throughout the manuscript. This will be specified more clearly. L24: We will add “sample-based SHP”, L47: We will add the sentence: “Such data collections are commonly based on individual soil samples from various profiles.”, For the examples, we will try to extract the requested differentiation from the cited literature.

L97: … basic soil properties such as soil texture … or something similar
Thank you for spotting this. We will amend the manuscript as suggested.

L101-102: please add reference or some examples for the two level texture information, because it is not widely used.
We thank the reviewer for this hint and will add the precise definition (particle sizes) of both the texture classes and the subclasses in the revised manuscript.

L127: … mixed average soil sample … is it correct?
Yes, the formulation was misleading. DISTURBED samples (originating from the undisturbed ones or having been sampled alongside the undisturbed samples) have been analyzed. In some cases, the disturbed reference samples have been referring to several undisturbed ring

samples. In such cases, the data were averaged and attributed to all rings. We will amend the formulation accordingly.

L134-149: all is clearly described, just a table providing an overview about the methods would be very informative, because for the readers it is a very valuable information what method was used for which soil property. Please add information about the measurement method of N and S, as well – because those are also included in the BasicProp.csv file. Please consider if the method used by soiltexture package can have limitations. Some other methods exist, which might result in a more accurate conversion to USDA silt and sand content. It is possible that in your case there would not be significant difference between different methods, but for other cases there might be. Readers might follow the procedure you published, so it worth to mention other methods, e.g.: Nemes et al (1999) https://doi.org/10.1016/S0016-7061(99)00014-2.
Thank you for your suggestion. We have discussed a more detailed table of all methods during the preparation. We will provide the table and to specify the methods. Please see the answer above for the texture class conversion.
We agree with the raised concerns about the log-linear interpolation in the "soiltexture" R-package. We will revise the conversion method according to Nemes et al. (1999) https://doi.org/10.1016/S0016-7061(99)00014-2 and Minasny and McBratney (2001) https://doi.org/10.1071/SR00065. We will revisit the data and use a more sophisticated method if possible.

L150: Before "2.4 Fitting models to measured data" subsection could you please add a separate subsection on how quality of the data was secured? Could you shortly describe what rules were applied during checking the data?
Thank you for your suggestion. And again, this has been discussed and will be included during the revisions.

L181-182: please add reference and equation used to compute parameter Ks of the PDI model.
The calculation of Ks was done as described by Peters et al. (2023), https://doi.org/10.5194/hess-27-1565-2023. We will make this clearer in the revised manuscript. Since this calculation procedure is rather complicated, we would like to restrain from a repetition of the procedure in this paper.

L184-186, Table 1: please add meaning of VGM and PDI to have the table self explanatory.
We will explain the abbreviations in the caption.

L190-193: would be informative to add 4.1-4.3 tables from 2023-012_Hohenbrink-et-al_Data-Description.pdf file here.
Thank you for your suggestion. We have discussed this question already and found the technical description alongside the data more suitable. However, we will consider a condensed version of the tables for more clarity here.

L194: It might worth to consider to create a metadata .xml file following the INSPIRE metadata guidelines (ISO 19115 and ISO 19139) and add it to the dataset.
We are aware of the different metadata guidelines and fully support the notion to emphasise their implementations. So far, we found an xml file somewhat repetitive to the tabled metadata. But we will consider your suggestion and revise for better compliance with the standards.

L216-219 and Figure 2. : please consider to provide this information according to USDA texture classes (based on the USDA sand, silt and clay fractions), because that is internationally used, the German texture classes are not widely known out of Germany. I see that for Figure 3. it might not make sense to use the USDA standard because than you might have only three fractions and Figures 4 and 5 is easier to interpret if meaning of texture classes can be read from Figure 3.
Since we have done the reclassification and provide the USDA texture classes, it is very easy to use this reference and to switch the classification background. We will check this and include a statement in the figure description.

L241: circles on Figure 4 are hardly visible, maybe Figure 4 could be edited somehow to let easier distinguish between circle, triangle and square.
You are certainly challenging the capabilities of plotting so many data points without any aggregation obscuring the main point of the figure… Since all plotted values have been quality checked and since their origin does not really make a huge difference in the figure's interpretation, we have ended up with this hard to discern version. However, we will follow your suggestion (in line with referee #2) and try our best to find a new version of these plots.

L244: Please shortly add why number of dewpoint measurements ranges between 1 and 8.
We will revise the statement as follows: "Since the matric head results of the dewpoint measurements can only be assessed after each reading, the number of measurements for single samples ranges between 1 and 8 (with a median of 3) to cover the drying branch towards pF 6."

L263: … range for coarser texture classes … Do you agree?
No. Here we were not precise enough. We will rephrase the two sentences as follows: "The hydraulic conductivity curves described by VGM (Figure 5b) vary over a wide range and can hardly be grouped by texture classes. In contrast, those of the PDI model (Figure 5d) are more closely related to texture and span a much narrower range for each texture class. The reason for this behavior is that the conductivity curves must be extrapolated in the wet as well as in the dry moisture range and in the new PDI model formulation (Peters et al., 2021; 2023) this extrapolation is done on a physical basis."

L268-271: if th_1_8, th_2_5 and th_4_2 columns of Param table were computed with PDI model, please add "_PDI" as last characters to those column names.
Thank you for pointing to this. We will check the specific references and amend the document accordingly.

L272-273: please add very short explanation for why filed capacity and wilting point vary widely within texture classes. This is obvious for experts in soil physics but not that trivial for researchers from other environmental fields.
We will do so.

L308: please consider e.g. the work of Twarakavi et al. (2010) (https://doi.org/10.1029/2009WR007939 ) - or possible other papers in this topic – and rephrase the sentence accordingly.
Thank you for suggesting this citation and challenging our sloppy formulation. We will reconsider this argument and provide references.

L311: Do authors plan to add soil depth, chemical soil properties - e.g. pH or calcium-carbonate content - or taxonomical information to the dataset in the future? If soil depth is available it might be easy to add to the BasicProp.csv table, it could be an important data column.
This is true and will be done for soil depth. We will discuss what more we can include with sufficient degree of confidence. This issue arises with different standards for some of the analyses in the different labs. For the data we report, this has been checked and harmonised.

Result of checking the database:
there is a negative theta value in RetMeas.csv, please check and revise/correct.
there is a negative value for S in BasicProp.csv, please check and revise/correct.
Sum of USDA sand and silt and clay is 99.9 and 100.1 for some samples, it might worth to correct them to sum up to 100.
Thank you for pointing to these issues. We will carefully check the data again.

Dear referee #1,
Thank you again for your suggestions. We hope that we could address all concerns and will use your advice for a substantial revision of our manuscript and a check of the data.

Kind regards,
Tobias Hohenbrink, Conrad Jackisch, Wolfgang Durner, Kai Germer, Sascha Iden, Janis Kreiselmeier, Frederic Leuther, Johanna Metzger, Mahyar Naseri, and Andre Peters