

Dear Professor Frolking,

Thank you for your review. Please find below your comments in black font. Our reply is provided in blue font.

Steve Frolking:

This manuscript presents a new public data set of global peatland depths, compiled from published literature, national or regional datasets, and some unpublished data. This is an important new data set for global carbon cycle assessments and earth system modeling activities. ESSD is an appropriate journal outlet. The paper is very well written.

I have no major questions/issues with the manuscript. All of my comments and questions below are minor ones.

Thank you for your positive assessment of our manuscript.

Line 60: 'often contain errors' seems a bit harsh for a ubiquitous problem. maybe just 'can contain errors'?

True, there were a few of the compilations that did not have errors (shown in Table 1), changed to 'can contain errors'.

Line 61: 'outdated measurements': I don't know what this means.

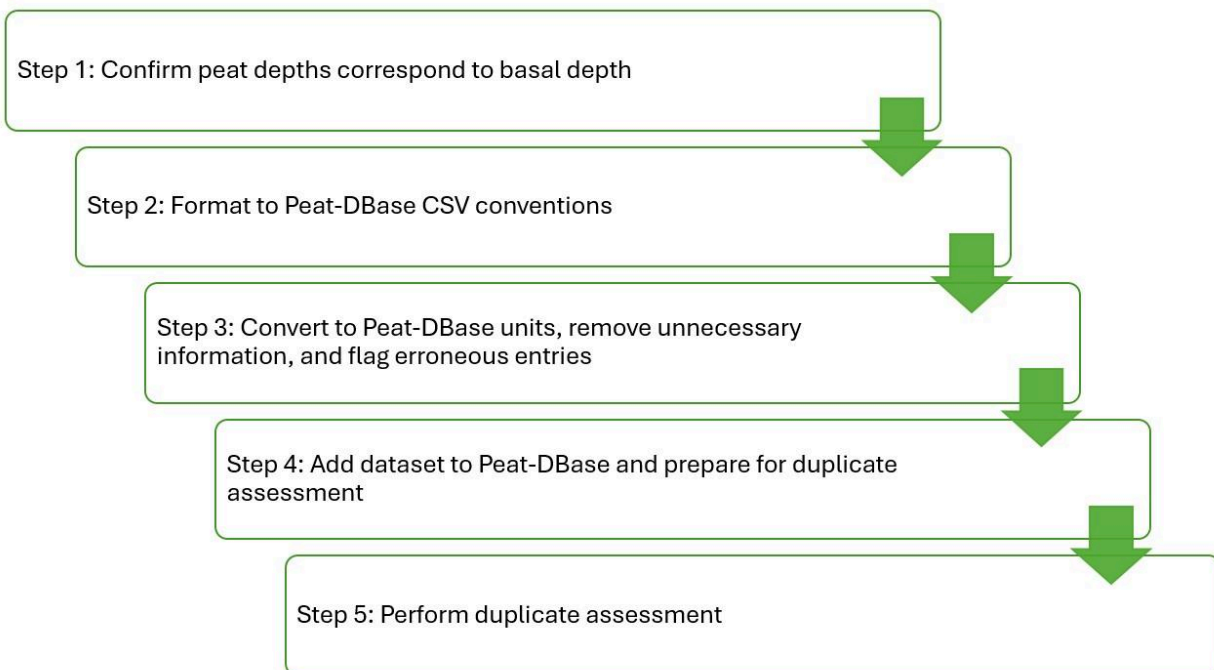
Our comment here refers to the fact that a peatland can be measured as an intact peatland and then later experience disturbance either natural or anthropogenic in which case the peat depth may have then changed dramatically. We have reworded this for clarity (new text in italics), "Current peatland compilations assembled for individual studies (e.g. Gorham et al., 2012; Treat et al., 2019; Hugelius et al., 2020) can contain errors, duplicates, outdated observations (*whereby a peatland has experienced natural or anthropogenic disturbance since measurement*), among other issues."

Line 68: Not sure if this is necessary, but it might be worth noting that most land-surface models need peat depth data for initiation as they do not simulate the multiple millennia needed to accumulate the peat, and the peat stocks are not necessarily in equilibrium. They cannot be 'spun up' to an equilibrium state.

Yes, this was an important motivating factor in initiating our study. The text as is does mention the requirement for data for model initialization, i.e. "First, advancing peatland representation in land surface models (Wu et al., 2016; Bechtold et al., 2019s; Apers et al., 2022) requires accurate, extensive data for initialization and evaluation, especially as these models are integrated into Earth system models."

In Fig. 1, step 1 is to 'confirm basal depths'. To me this implies confirm that the values are correct (how?) but maybe it means 'confirm reported peat depths are basal'? Also, step 3 includes 'remove unnecessary information', which makes sense. In the best of all possible data worlds, it would be easy to align Peat-DBase data with other data sets (e.g., one of basal ages, or one of age-depth profiles). The burden of creating this best-of-all-possible-worlds shouldn't fall on you, but it seems to me that it must be something you have thought about. Would any of this 'unnecessary data' be useful in this regard? Would that introduce uncertainties that you don't want to (and shouldn't be expected to) have to manage? Could this be discussed in the 'future work' section, perhaps identified as 'future work for the community to move the field forward', not specifically as future work for Peat-DBase and this manuscript's authors.

"Confirm basal depths" has now been expanded for clarity to be "Confirm peat depths correspond to basal depth" and updated in Figure 1:



Indeed, as we have continued development of Peat-DBase, we have begun bringing in this 'other' information as we feel it could be valuable especially as the dataset could be used for estimating important quantities like global peatland carbon stores. At present, all new sites include extensive information beyond peat depth (including allowing non-basal depth measurements) like organic carbon and bulk density measurements and we are working to add in information for sites already in the database. We have added some information about the expansion to Peat-DBase that we are presently undertaking (Line 245 in original MS, new text in *italics*): "Future versions will incorporate data on current peatland status to address this limitation. ... Peat-DBase will also be expanded to include organic carbon content and bulk density data for the soil cores, as well as characteristic information about the sampling site such as hydrological status, soil water pH, vegetation present, etc. "

Line 125: are some of the peat depth data in the ocean from Treat et al. 2019, which included coastal shelf peatland data from the last glacial? If so, these are not in error, just not relevant for Peat-Dbase. Also, there is not universal agreement on where the land ocean boundary is, and it certainly depends on spatial resolution.

Thank you for this comment. Of the 614 points for Treat et al. (2017; 2019), 5 were flagged as being in the water. These were located tens of kilometres from the nearest land point. We have added a postscript to Table 1 explaining: "Five of the cores in Treat et al. (2019) were excluded due to being located in the present-day ocean. These sites were not in error, but were collected to characterize peatlands across the last glacial cycle when the sites were subaerial."

Table 2. 'depth_cm': is that reported to any particular significant figure? nearest integer cm?

We recorded the values as presented in the original sources. We have changed that line in Table 2 to, "Basal peat depth measurement in centimetres *with precision as recorded in the original source*".

Table 2 and elsewhere: for the sample duplication flag, one data sample is the 'first instance'. How is this selected/determined: earliest published, first that you acquired, first that you entered, ...? It likely doesn't matter in terms of the database, but it would be good to explain what you mean by 'first instance' as priority in time is an important currency in academic publication.

The determination of the 'first instance' is based on several factors. We have added the following description to the text discussing Table 2 for clarity:

"Detected duplicates were sorted by precision and source. For rounded duplicates, the point with the greatest decimal precision was designated as the first instance. For exact duplicates, points were sorted alphabetically by dataset name (e.g., Gorham et al. (2012) before Hugelius et al. (2020)). When datasets were added incrementally, previous duplicate assessments were retained, and newly added data were compared only against existing first instances and unduplicated records. Consequently, first instance designation reflects both the sorting criteria and the temporal sequence of data acquisition, which followed the order datasets were obtained (except datasets with publication restrictions, which were added last in their acquisition order)."

Fig. 3 caption: Bin sizes are 3° in longitude; how many in latitude?

This comment has prompted us to more accurately record the bins sizes. The caption now reads: "Bin sizes are *approximately 2.88° in longitude and 2.5° in latitude*."

Line 213: 'enhanced growth, stagnation, or erosion' -- I think that 'loss' (i.e., from 'excess' decomposition, not erosion) should be added to this list.

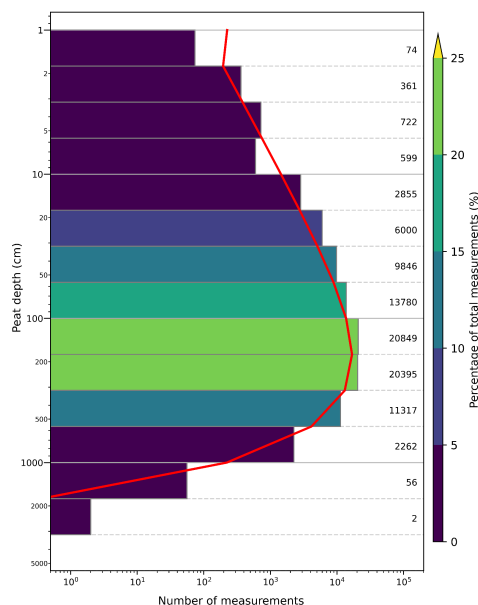
Indeed, now reads: “However, peat depth does not correlate linearly with age, as peatlands undergo variable accumulation rates influenced by changing climatic and hydrologic conditions, including periods of enhanced growth, loss, stagnation, or erosion”.

Fig. 4 caption: it would be useful to add binning sizes (50 cm?, 1° latitude?)

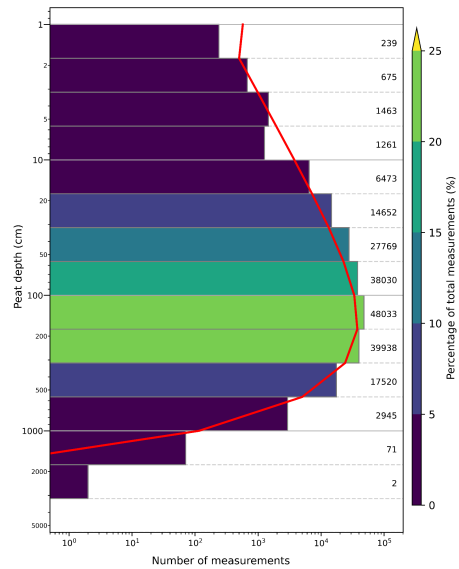
Yes, we have now added to the caption, “Data has been binned by 2° in latitude and 50 cm of depth.”

Fig. 5: The color scale is not too helpful here, at least for me, as the x-axis is number of measurements. I think it would be helpful to label the bar at the top ‘zero depth’, since it doesn’t really work on the vertical log scale (I initially mis-interpreted this as the sum of all other data, but, of course, it didn’t add up). In the caption: I don’t understand why a focus on depth distributions leads you to remove data points labeled as drained or modified. Particularly since you cannot make this assessment for all data. Nonetheless, if you maintain this, I suggest adding an ‘n = NN’ in parentheses for number excluded.

We have revised the figure to make it more useful. We removed all non-peat cores (WoSIS and zero depth cores from peat-focused studies). We then adjusted the colour scale to emphasize the distribution better. We have also kept out the ‘drained/modified’ cores as their depths could be highly modified from ‘natural’ cores. We have modified the caption “... As this plot focuses on depth distributions, we removed data points noted as drained or modified (n=110 924). At present, this information is only available for the observations derived from the NatureScot dataset \citep{scotland_peatdepth2025}. Figure A1 is a version of this plot with those measurements included.” We include this revised figure in the main text:



and this new figure (with drained/modified samples) added to the appendix:



More generally on the drainage/disturbance question: you say in the captions to Figs. 4 & 5 that drainage information is only available for the NatureScot dataset. How is that noted in the Peat-DBase (it is not mentioned in Table 2)? Others may also want to make the exclusion that you did.

In Table 2, the column 'site_condition' contains the information needed to exclude the drained/disturbed sites.. At present the information is only available for NatureScot but we are working to expand it on other sites in future versions of Peat-DBase.

-Steve Frolking