Dear Reviewer #2,

Thank you for your review. We post your comments in black font and our reply in blue.

Anonymous Referee #2:

Skye et al., present a timely examination of global peat depths, based on the synthesis of 25 regional/global prior syntheses. The paper presents the motivation, analysis, results, and discussion well and I have no major issues with the current manuscript. I have several minor comments, mostly focused on how to deal with the definition of "peat" and the measurement of peat depth in a "meta-synthesis" such as this paper.

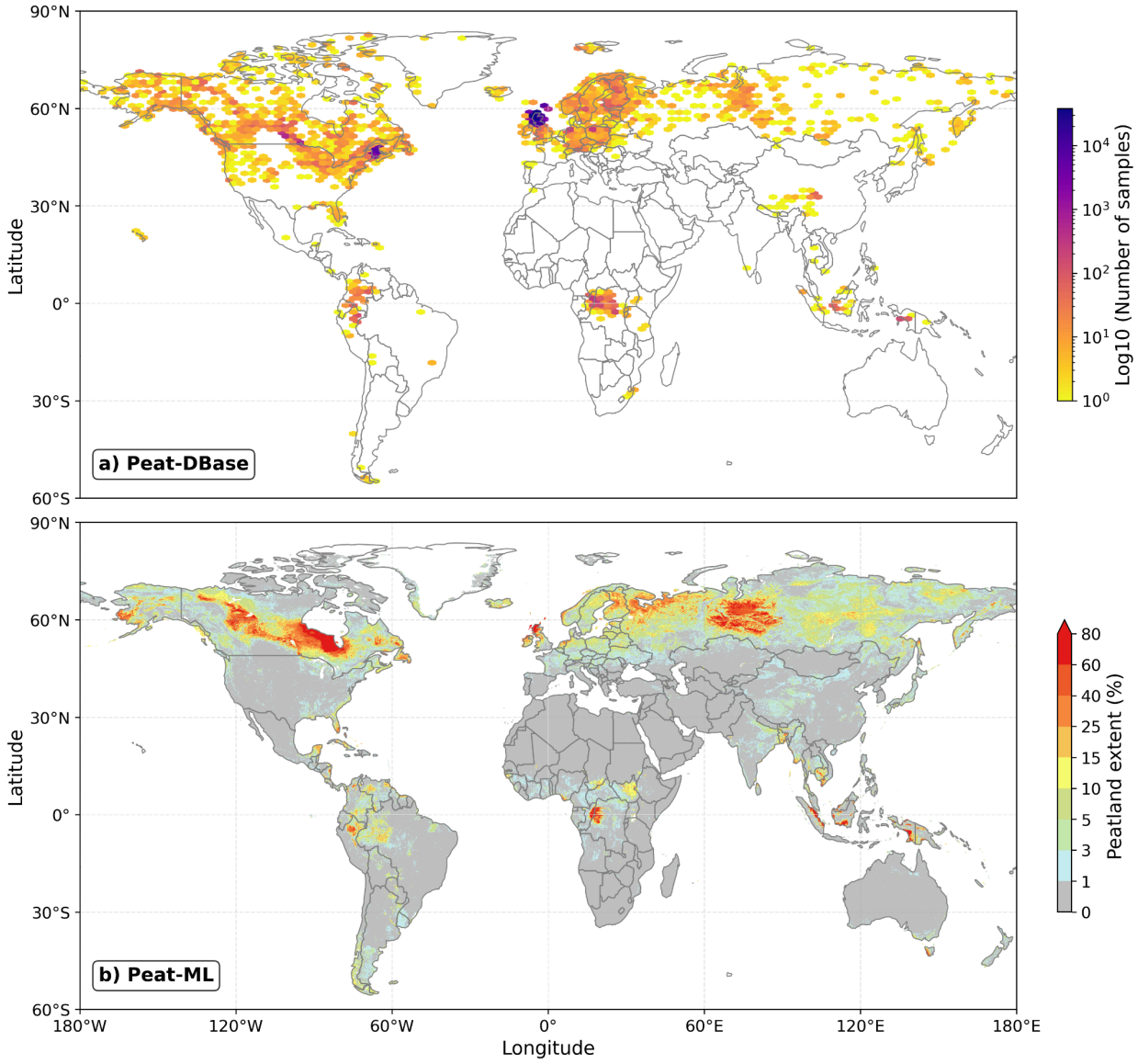
Thank you for your positive assessment of the work.

In definitions of peat that include lower OM%, it is often more difficult to characterize when "basal peat" is reached as opposed to mineral soils. I agree with the author's decision to include everything described as peat by the primary source, but I think that should be explicitly stated early on in Sec. 3.1.

We have edited the start of Section 3.1 to be, '... *To select studies we relied on the authors' identification of what constitutes peatlands or peat soils and their determination of the basal peat depth*.'

Additionally, while I appreciate the inclusion of non-peat mineral soils into the database to highlight regions where peat is not found, I think one of the recent maps of peat area should be included in the main text figures. This helps to visually highlight peat-rich regions that are currently under-sampled better than simply listing a few examples in the text.

We have now added Peat-ML (Melton et al. 2022) to Figure 3 to allow easier comparison.



Other Minor Comments:

Line 85 – “Peat study data…” This sentence is somewhat awkwardly phrased.

We have restructured it to ‘Peat study data were accepted into Peat-DBase provided the measurements were taken down to the basal depth indicated by mineral soil or bedrock\footnote{Future versions of Peat-DBase will allow peat data that does not reach the basal depth through the use of appropriate flags indicating that fact.}. Any coring or sampling method was allowed that could accurately determine this basal depth.’

Line 91 – While you discuss limitations of the dataset elsewhere, I would rephrase this sentence “until they meet a non-peat layer and cannot go any further” as probes can still penetrate non-peat sediments without meeting refusal. This is especially true of very humified, lower

organic % peats which often grade into organic-rich mineral soils (i.e. humic silt sediments) found in more temperate regions.

This is a good point. We have added, ‘Probing, involves the use of metal poles which are inserted into the peat until they meet a non-peat layer and cannot go any further \citep[e.g. Oakfield probes;][]{Magnan2024-dz,Householder2012-sh,Crezee2022-sx}. *We note probing has higher uncertainty for estimating peat depths as there is no visual confirmation of the interface between the peat and the underlying substrate*.’

Line 100 – Where there any systematic methods used for searching the literature for peat depths?

There was no structured approach to the search beyond checking common databases such as Google Scholar and UVic libraries for literature with applicable key words. Results of these searches were broadly prioritised based on whether the titles or abstracts suggested the collection/assemblage of a significant amount of peat cores (e.g. Treat et al. (2019), Hugelius et al. (2020), Crezee et al. (2020), etc.). Literature with potentially large amounts of data were prioritised as it helped to reduce data processing time and, in the instances where the data was assembled from other sources (e.g.. Treat et al. (2019), Hugelius et al. (2020)), they already contained the data from other literature that appeared in searches.

Figure 2a – I’m not sure why the mineral soils are plotted for the Congo region but not elsewhere? Are those wetland soils that have a mineral substrate? i.e. hydric soils?

The mineral soil cores in other peat study data papers are all plotted, however plotting small grid points like this on a global scale leads to over plotting and obscures the data points. We experimented with smaller points but it makes it harder to see the data in other regions. These points in the Crezee et al. dataset appear to be cores taken in villages or at least were recorded as non-peat points, e.g.

Figure 3 – You discuss comparisons with PEATMAP in the main text (line 183). Could you add the peat map as a background to your figure on Peat-DBase data density? This would be the most “major” revision I would recommend.

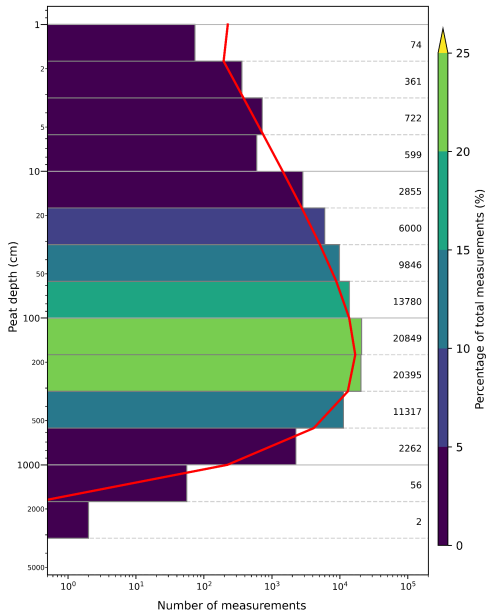
We agree with this suggestion being helpful to a reader and have added the Peat-ML map (Melton et al. 2022) to Figure 3 as shown earlier.

Line 200 – While I agree that the source data is biased to the northern hemisphere, the overall total land area coverage of tropical peatlands is also lower than boreal peatland coverage.

We agree, tropical peatlands have smaller extent than those in the boreal. However, even accounting for that, we are biased to the high-latitudes as our tropical peatland cores are heavily clustered leaving many areas of the tropics missing data.

Figure 5 – The color bar scale should be reduced, as currently there is not much variation in the color for each bin.

Thank you, based on this comment and those of Steve Frolking we have revised Figure 5 to be:



251 – This is a minor comment, but I might put this paragraph first as I think it's the most pressing issue to resolve in future versions of the dataset.

We agree that uncertainty around definitions is a pressing issue, but prefer our present wording. Given how much peatland area is now under anthropogenic pressure (e.g. Fluet-Choinard et al. (2023)), we feel that understanding whether the core is from a pristine or degraded/modified peatland is important as these changes could drastically change the peat depth.

285 – If one of the major goals was to highlight under sampled regions, then I would definitely add one of the recent peat-map areas to the map in Figure 3 as there is currently not a great way for the reader to judge visually which peat-rich areas are under sampled.

We have addressed this now with our revised Figure 3 shown above.

References cited:

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