Comments on “C-PEAT’s Global Peatland Carbon Database (v.2025)”

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General comments

In this manuscript, the authors present a peatland chronology (depths, calibrated und uncalibrated ages) and biogeochemical (bulk density, C and N contents) database (Global Peatland Carbon Database, GD) created by the PAGES’ C-PEAT working group. The database contains data from 267 cores across the globe with a majority of data from high latitudes and can be downloaded free of charge from the PANGAEA repository and used free of charge by interested parties.

This is a to date unique contribution to the datasets available on peatlands; I am not aware of a similar datasets with uncalibrated ages with age errors and biogeochemical data for such a number of cores that covers peatlands from all latitudes. Such data are useful to calibrate and test both local long-term process models and peatland modules in earth system and dynamic vegetation models. The ability to use other calibration models to estimate peat ages is an important and necessary feature. For this reason, I think that the GD is an important and new contribution to peatland research.

I have tested downloading the data using the R script from Ransby, Riemann-Campe, and Sanderson (2025) mentioned in the manuscript. Except for one error in the scripts that I could correct myself (see comment below), this all worked fine, the dataset is complete and mostly in a usable format. I have comments on some limitations in the script and the metadata documentation that could prevent usage of the GD or lead to erroneous usage of the GD that I list below. I did not test the Python script since I do not use Python.

The description of methods and metadata in the manuscript is generally of good quality. Besides some technical comments, my main point is that I do not fully understand the analysis of the representativity of the GD because of the lack of a — in my point of view — sensible reference population for which the GD should be representative. I would expect that an analysis of the representativity of the GD would compare the dataset to a population is expected to be representative for. For exampe, while I think that the climate envelope and climate region analyses are sensible to give the reader an overview on climate conditions at the sampling locations, an analysis of the representativity of the GD would mean to compare the distribution of climate conditions to that of a reference population. For instance, one could perform the climate analysis using all grid points covered by peatlands according to some current peatland distribution map like PEATMAP (Xu et al. 2017, 2018) and test whether the sampling distribution is similar to the population distribution (globally or within specific strata). Similar analyses would be expected for the geochemical data. I also do not understand why we would be interested to compare the USDA-NRCS NCSS to the GD because the differences of peat to mineral soil are widely known. Finally, I think that (if I correctly understood the data compilation) the analysis displays circular reasoning when the authors argue that “the central tendencies and data ranges presented therein are in line with previously published datasets (e.g., Loisel et al. 2014).” because Loisel et al. (2014) is part of the GD.

I want to emphasize that I fully understand that these analyses of the reprsentativity of the GD would demand lots of work (and may have their own limitations, for example because we lack a systematic inventory of peat geochemistry independent of the data in the GD) and I do not think they must be included in the manuscript, even though they are of couse an important feature for potential users of the dataset. If this was my work, I would expand the representativity analysis of climate conditions, as described above, but drop the comparison to the USDA-NRCS NCSS.

Other than that, I would like to thank the authors for providing such a useful dataset to all those interested to analyze peatland accumulation and C and N dynamics.

Specific comments

1. In the R scripts provided by Ransby, Riemann-Campe, and Sanderson (2025), one gets an error when loading `"Data/dataset_IDs_by_events_2025-10-28.txt"`. This happens at l. 8 in `02_geochemistry_data.R` and `03_cal_age_data.R`. The reason is that the code that writes this file in `01_download_all.R` always pastes the current date into the file name which obviously won't be 2025-10-28.
2. Just as suggestion: The R script provided by Ransby, Riemann-Campe, and Sanderson (2025) would be more useful if it would also include code to prepare the uncalibrated age data. I think this is important because usage of the data will in many cases require applying new calibration models with updated calibration curves and with the possibility to obtain the Markov Chain Monte Carlo draws for proper error propagation, for example for the computation of aCAR or tests of peatland models.
3. For what is shown in the figures in the manuscript, many of them have a poor resolution. For example, Figure 7 does not allow to clearly distinguish sampling points from each other and from regions with yellow filling.
4. l. 39: "soil-c": Typo.
5. Figure 2: Possible language errors by the software used to create the figure are still highlighted.
6. l. 129: "C density (kgC/m2)." This definition seems to contrast with the definition used elsewhere in the manuscript, for example Table 2 (`Density, organic carbon`), Table 5.
7. l. 132: "multiple ages and C measurements along a peat profile can also be used to estimate temporal changes in aCAR (e.g., Yu et al. 2010), though this technique has methodological limits; see below (Young et al. 2019, 2021)." Actually, it is perfectly fine to compute temporal changes in aCAR in this way. The problem is not that the approach has methodological limits, but if aCAR is misinterpreted as net C balance (NCB) of the peatland — as rightly described a few sentences below in the manuscript — which is the point of Young et al. (2019) and Young et al. (2021).
8. l. 140: "Aggregating a large number of core site data for which multiple age determinations and C measurements are available can help alleviate the issue; indeed, secondary decomposition can be seen as site-specific "noise" that is subdued in a synthesis product." I think that this statement is only true if the secondary decomposition is a process random in space in time, but do we know that this is the case? If there are large-scale changes in land use, this may lead to population-level changes in NCB. But perhaps I misunderstood what the authors wanted to say.
9. l. 194: "international protocols and standards". Can the authors please name and cite the protocols and standards relevant for the GD and to what part of the meta(data) they apply to?
10. Figure 5: The caption says that the global peatland area is shown in black, but it seems to be shown in green.
11. Units are not always displayed correctly in the text. For example, l. 39 has "gC/m2/yr", but this should be "$g_C/m^2/yr$" or "$g_C\ m^{-2}\ yr^{-1}$".

12. Table 2, table 3, table 4: It would be good if there was a textual description that explains what each parameter means. Table 2 has a column that provides descriptions for each parameter, but these are missing for many parameters and could be more detailed for others. For example, was `DEPTH, sediment/rock [m]` measured from the peat surface (beneath the moss layer) or from the moss surface (or were both methods used depending on the dataset)? Table 3 does not have such a column and I do not understand, for example, what the parameter `Age model` represents, or how `Age, error` differs from `Age, uncertainty`. Such explanations are necessary because the individual datasets in the GD vary with respect to how values are encoded as parameters and therefore one can only combine different datasets if the parameters are unambiguously defined.
13. Table 3: It seems that the units shown in brackets are sometimes omitted or wrong. For example, ± is no measurement unit, but is displayed as measurement unit of `Fraction modern carbon, error`. Such information are necessary because the individual datasets in the GD vary with respect to how values are encoded as parameters and therefore one can only combine different datasets if the parameters units are unambiguously defined.
14. Table 3: There seem to be some parameters in the downloaded data not listed in the table. For example, some datasets have parameters `Age [a] (years ago)`, `Age [a AD/CE] (#0 = below detection, Age, 210Pb)`, or `Age dated [ka] (converted age)`.
15. l. 226: “These ancillary data include entries such as the main peat type. Age determination datasets provide raw age control data such as radiocarbon (14C), Lead-210 or tephra chronostratigraphy”. Does the GD contain taw data on ^{210}Pb or tephra chronostratigraphy data? I could not find any such raw data (e.g., for ^{210}Pb total ^{210}Pb activities, ^{226}Ra activities or ^{137}Cs activities)?
16. l. 229: “… including their upper and lower limits …”: How are these limits defined? Are these the max/min age values of Markoc Chain Monte Carlo draws from the posterior distributions representing the age-depth models (which would be rather unstable depending on Monte Carlo errors) or some quantiles (e.g. 5% and 95%) or does the definition differ between datasets?
17. l. 279: “Temporal coverage of the peat cores varies over time, with the number of basal ages steadily increasing throughout the Holocene (Fig. 6a).”. This sentence may be misleading. Since Fig. 6 (a) shows the cumulative number of basal ages (counted from older to younger times), it does not show that the number of basal ages steadily increases throughout the same time period. In fact, more basal records seem to be added from 12000 to 11000 yr BP than from 11000 to 10000 yr BP.
18. l. 334: “a total of 267 peat depths …”. This may be a typo? There are 267 cores, but with more than one peat sample per core.
19. l. 347: “Organic matter density values (OMD; n = 4016) are available for 20 sites …”. Is there a distinction between “core” and “site”?
20. l. 351: “… C content based on OM measurements, …” Could the authors please explain how C% was estimated based on OM content?
21. l. 356: “Total carbon content (TC%) values range from 0.0 to 100%, …” How is a TC% of 100% possible for peat?
22. l. 366: “Overall, the central tendencies and data ranges presented therein are in line with previously published datasets (e.g., Loisel et al. 2014).” Is this worth mentioning? If I understand correctly, Loisel et al. (2014) is part of the GD?
23. Figure 8: The caption mentions “IQT”. Could you please provide the unabbreviated term and define what it means?
24. Figure 9: What do the shaded regions represent?
25. Figure 9: The x axis title, axis labels or unit seems to be wrong because they suggest a mean soil organic carbon density of ca. 1.05 g cm^{-3} for peat while Table 5 suggests that the mean organic carbon density is ca. 0.06 g cm^{-3}.
26. Table 6: Some of the parameters are listed without units (e.g., Bulk density (oven dry)). If you decide to keep this table, could you please add units for all parameters?

References

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