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Interactive comment on “Global distribution of soil organic carbon, based on the Harmonized World Soil Database – Part 1: Masses and frequency distribution of SOC stocks for the tropics, permafrost regions, wetlands, and the world” by M. Köchy et al.

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General Comments

This manuscript provides an interesting examination of different databases that can contribute to the calculation of global soil organic carbon (SOC). The challenges of estimating the extent and characteristics of both wetlands and permafrost areas are

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known, but the comparison of databases that attempt to address these issues nicely illustrates the current situation. The authors give particular emphasis to the issue of bulk density (BD), which is a problem that deserves greater attention.

Although much of the manuscript's content has merit, the effective communication is hindered by the text's organization. A major factor for obscuring the message is the appearance of five different points within the writing: 1) effect on SOC stock estimates from 'correcting' HWSD values for BD, 2) comparison of different databases' estimation of soil depths, 3) comparison of different databases' estimation of permafrost and wetland extents, 4) comparison of different databases' classification of wetland types, and 5) summing of global SOC stocks by latitude and wetland type. Clearly these points are related, but addressing them all in a coherent and focused matter will require careful crafting.

Specific Comments

1. An apparent contradiction for the writing organization is the classification of this paper as a "review," but the text contains a methods section that does not describe the process for reviewing. Instead, this section describes a method for adjusting the BD in the HWSD. One possible solution for addressing this and my general concern about the paper's organization would be to use an outline similar to the following:

I. Intro – setup of the problem, definition of key terms, and a clear statement of purpose

II. Comparison of different databases' estimation of BD

A. add modified HWSD as an additional item of comparison

III. Comparison of different databases' estimation of soil depth

IV. Comparison of different databases' estimation of permafrost and wetland extents

A. sub-discussion on the different wetland classifications used and impact on re-

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sults

V. Summarize/compile SOC mass (summed stocks) following predefined lines of data sources by wetland category and spatially on a map. Then compare the final results of these different calculation pathways.

2. Terms and abbreviations need to be used consistently, e.g. 0.5 arc minute v. 0.5', harmonization v. harmonisation (both acceptable spellings, choose one), SOC stocks v. organic C stocks v. organic carbon stocks.

3. P 326, L 3-6 – This needs elaborated on. Specifically, what constitutes ‘relevant’?

4. P 332, L 8 – Is it really fair to say that the SOC stock is not underestimated with a reference soil depth of 100 cm? There are several studies showing notable amounts of SOC below 1 m (e.g. Richter and Markewitz, 1995, among others). Both in this manuscript and the published literature the qualifier of “SOC stock in the upper 1 m” is often used, which is an important distinction for what is actually being estimated.

Also, later in the manuscript estimations of SOC for depths below 1 m are discussed. The subsequent breakdown of soil depths by soil type is interesting, but I suspect there is a disconnect between the definitions of sampling depth, soil depth, and the depth at which organic carbon can be found. Consideration of these issues should be part of this discussion.

5. P 332, L 19-22 – These sentences appear contradictory. If WISE and HWSD give the same soil depth for 80% of the area and WISE gives less soil depth for the remaining 19%, how does it work out that in total WISE gives greater depth?

6. P 333, L 4-6 – Provide the original HWSD 1.1 Pg C calculation as a baseline.

7. P 333, L 16 – Should “mean” be inserted before “BD”?

8. P 333, L 24-27 – The difference between 2476 Pg and 1062 Pg (1414 Pg or more than 50%) does not sound “small,” but the intended comparison is probably with the

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1061 Pg of the modified HWSO 1.1 calculation. Please clarify.

9. The comparisons of numbers are often difficult to follow. Better organization could help this, but the text at times needs to be more clear about to which number a new calculation is being compared. Tables may be helpful for this.

10. P 336, L 18-20 describes the importance of the spatial mapping's quality for frozen high-latitude soils, but only the attribute accuracy is identified as important for the global carbon mass. The area of an applied attribute is a major multiplier in any calculation of total mass. Some balance is needed to communicate that both spatial and attribute accuracy is important, but different aspects are more of a problem for the current mapping of SOC in certain land use types.

11. P 337, L 1-2 – It appears that the CAMP map is not identifying a separate region, but a unique delineation encompassing many of the same areas as the others. If that is the case, then “a third permafrost region” should be changed to “a third permafrost extent.”

12. P 339, L 19 – Is this calculation really based on an “intersection” of the two databases or the ‘union’ of the two? An intersection would be a conservative estimate, but a union seems likely to be closer to reality.

13. P 341, L 5 – It would be interesting to have the Pg SOC estimation based on the 3.3 Mm^2 area for comparison with the Pg SOC based on the 10 Mm^2 area.

14. P 341, L 20-22 – Which source are these numbers from?

15. P 342, L 13 – Is this total C or organic C?

16. P 344, L 11-14 – There are many possible references that explore this point specifically; a few of the more recent ones should be cited here.

17. P 345, L 10-12 – This statement is not really true for this manuscript, especially considering the focus was on wetland and permafrost areas. The data was broken

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down by wetland type and by latitude ranges, but not by land-use/land-cover classes in general.

18. P 345, L 20-27 – These last sentences seem to extend beyond the scope of this manuscript.

Technical Corrections

P 329, L 14 - delete “underlying”

P 330, L 4 - insert commas around “in an international context”

P 330, L 4 - replace “which” with “where”

P 333, L 5 - insert “is used” after “SOC mass”

P 333, L 12 - replace “to the BD of” with “of BD for”

P 334, L 25 - replace “1-2 m” with “0-2 m”

P 335, L 24 - add “, respectively” at end of sentence

P 335, L 25 - soil C stocks are different from SOC stocks, but this sentence appears to be a generalization related to the preceding text’s discussion on SOC stocks. Please correct for consistency and clarity.

P 336, L 3 - insert “, respectively,” after “22%”

P 336, L 22 - insert “a” before “13.1 Mm^2 soil area”

P 336, L 25 - insert a comma before “which” OR replace “which” with “that”

P 336, L 25 - insert “the” before “snow-adjusted”

P 336, L 27-28 - replace “(19.5 Mm^2 pixel area (Fig. 2))” with “(19.5 Mm^2 pixel area, Fig. 2)”

P 337, L 3 - replace “which comprises 12 categories” with “which is comprised of 12

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categories”; apply this to all uses of the word “comprise”

P 337, L 6 - replace “area of the HWSD” with “area within the HWSD identified area”
(if meaning is still correct)

P 339, L 14 - delete “category” before “mire, bog, fen category”

P 340, L 15 - please add the units for numbers in this line

P 341, L 14 - delete “the spatial extent”

P 342, L 14 - add a comma after “subsurface”

P 344, L 8 - replace “were” with “would be”

P 344, L 22 - insert a semi-colon after “digitally”

P 344, L 26 - replace “be benefitted” with “benefit”

P 345, L 18 - insert “the calculation of” before “SOC”

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