

## ***Interactive comment on “The organic carbon pool of permafrost regions on the Qinghai–Xizang (Tibetan) Plateau” by C. Mu et al.***

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This study provides the first comprehensive estimate of shallow and deep soil organic carbon (SOC) stocks in the Qinghai–Xizang (Tibetan) Plateau (QXP). The authors synthesize existing field data for near surface soils (0–1 m depth) and provides new field data for deeper deposits (1–25 m depth). This constitutes a timely contribution of data from a region that has previously been under-sampled. There are however aspects of the SOC upscaling which need more work and the dataset for deep SOC stocks needs to be more carefully described. I would also recommend that the manuscript is carefully proof-read and edited with regards to the English language.

General comments:

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I would strongly recommend that the authors calculate basic confidence intervals or uncertainty ranges for their estimates. Hugelius (2012, *Global Biogeochemical Cycles*) exemplifies how simple confidence intervals can be calculated. Note that it is likely not realistic to report the stock estimates with two decimals for a Pg given the uncertainties associated with estimates like this.

The authors have chosen to upscale point observations from soil pits and boreholes using a generalized vegetation map. It would be beneficial with some discussion and justification of this choice. How do the authors expect that the identified vegetation classes and their properties interact with the pedogenic processes that cause accumulation of SOC in soils?

A major strength of the paper is the new data from 11 deep boreholes which are used to estimate SOC stocks down to 25 m. Are all these 11 boreholes exactly 25 m deep? Looking at the data in Figure 2 it seems like ca. 5-6 sites has data extending below 10 m depth? This type of deep borehole data is very valuable and it would be very valuable if the authors provided more detail on individual boreholes, possibly as an online supplement? Data on C%, bulk density, ice-content and texture from such boreholes would be very valuable to the wider scientific community.

The authors have upscaled deep SOC stocks from eleven boreholes, mainly located along the railway, to the entire QXP. How likely is it that the entire non-forested section of the QXP is actually covered by 25 m thick unconsolidated sediments? If the authors maintain this claim, it needs to be justified with references to studies of Quaternary deposits in the region. I would expect that the deeper deposits only extend to some fraction of the QXP.

Specific comments:

P5016 line 8-9: Note that this direct comparison of fraction SOC below 3 m is not applicable since the Tarnocai et al. (2009, *Global Biogeochemical Cycles*) estimate only includes selected deep deposits and makes no attempt to include deep deposits

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outside the yedoma region and deltas.

P5016 line 18: This is an oversimplification. The previously frozen SOC becomes available for mineralization. Whether or not this leads to greenhouse gas release depends on multiple environmental factors.

P5017 line 21-22: I would not advise you to apply such a generalized statement for all deep permafrost deposits. The genesis and age of deep deposits is very different in different locations. Many deposits are epigenetic, which implies that they were permafrost-free for some time prior to permafrost aggradation.

P5018 line15: It is not essential that vegetation is used. It is one of several viable options for upscaling.

P5020, equation 1: Note that if the BD was calculated based on initial frozen core volume, the ice content should not be subtracted again in the formula. It is already accounted for by the lower sample BD when ice melts and water evaporates in the drying of the sample.

P5021 line 6: Please report the standard deviations of these mean values. This applies whenever means are reported in the paper.

P5021 line13: “depth of 6 cm” This is likely a mistake and should be 6 m?

P5021 equation 2: The authors may consider is this function could be applicable to upscaling their deep SOC stocks (with uncertainty ranges) to those parts of the QXP where they expect deep deposits to occur. This may replace the simple thematic upscaling currently used. There is however the complicating factor that some individual cores show an increase with depth rather than a decrease. This may reflect different Quaternary deposits?

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Interactive comment on The Cryosphere Discuss., 8, 5015, 2014.

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