SOIL Discuss., referee comment RC2
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Comment on soil-2021-73

Anonymous Referee #2

Referee comment on "Additional soil organic carbon storage potential in global croplands" by José Padarian et al., SOIL Discuss., https://doi.org/10.5194/soil-2021-73-RC2, 2021

Using a quantile CNN model, the authors assessed the potential of soil carbon accrual in global soils.

Frankly, I have carefully read the comments by the other reviewer. I have to say I stand with her/him. Here, I only focused on some technical aspects which should be addressed before publication of the manuscript.

The quantile approach relies on a strong assumption that SOC will be same under similar soil forming factors. If SOC values are different, it much be induced by management. But the problem is that we would never find two soils with the same forming factors. Numerous factors (e.g., climate seasonality) regulate SOC dynamics and thus SOC stock at a typical site. At the same site, SOC would also experience temporal changes. In this study, only very few potential predictor variables of SOC were considered. Other variables such as soil parent material, land use history, climate variability are not included. More importantly, the approach adopts another strong assumption of steady state. If the soil is not at the steady state, the approach will be invalid, because a mediate soil (50% quantile) may experience SOC loss. The SOC would be an overestimation of the real 50% quantile, and vise versa.

The manuscript paid little attention to the potential uncertainties in the relevant estimations. Two major uncertainties I think should be explicitly tested are: the approach used to estimate BD and prediction uncertainty by the quantile CNN model.

I found that the method section is very fragmentary. Here, I just gave some examples. To my knowledge, BD has been reported for some soil profiles, why was BD estimated using

a pedotransfer function? Could you please test the credibility of the BD estimates which are vital for estimating SOC stock? In page 3, a bootstrapping routine was mentioned. The reader cannot find anything descriptions on the purpose of this routine. To predict SOC stock? The author very briefly desribed future climate projections. As the SOC estimates were conducted at the global scale, I believe historical climate records are required to run the GCMs. How were the climate projections used in their models for predicting SOC stocks?