

Interactive comment on “Massive carbon addition to an organic-rich Andosol did not increase the topsoil but the subsoil carbon stock” by Antonia Zieger et al.

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Anonymous Referee 4 Received and published: 3 December 2017

Dear reviewer 4,

we thank you for taking the time to provide us with your feedback on our manuscript. We carefully considered your comments. Our responses and suggestions for possible changes are given below each comment. We upload the revised manuscript at the end of the discussion together with changes suggested by other reviewers.

The manuscript answers the specific question of how much organic carbon (OC) can

Interactive comment

be stored in a specific type of soil (Andosol), giving experimental support to the theory of a finite OC accumulation potential of soils due to the limited binding capacities of minerals. I found the manuscript well written and well organized. Even though the experimental site was not designed from the beginning for this trial, I agree with the authors saying that it is rare to have such a long history of treatments, and this is particularly valuable when studying carbon dynamics in soil.

My bigger concern regards the bulk density (BD) values reported in table 1 and the way they were assessed. As reported in equation 1, BD is of a pivotal importance in assessing the total amount of OC in the soil (Mg/ha), so I think it should be specified with more details how the sampling was carried out, which volume of soil was considered, which corer and so on. Ten sampling points don't represent a huge number, but for BD just 2 were used, which is really low for such a big area.

Author response: We agree that the BD is of pivotal importance. We add the standard error in Table 1. The bulk density was determined at two profiles per site (all horizons). For each horizon, five replicates were sampled with 100 cm³ corers, oven-dried at 105°C for 24 hours and weighted. We think that the number of bulk density measurements are sufficient, because the standard error was very small (with <0.01 g cm⁻³). We add those details in the revised manuscript.

This observation arises because the BD values reported in table one are really low even for andosols (< 0.4 Mg/m³), which causes a relatively low amount of OC per hectare considering the relevant percentage that OC reaches in that soil (up to 21

Author response: We add some references supporting BD values below 0.5 g cm⁻³ in Andosols. Especially aluandic Andosols feature often such low BD values. We also add some sentences to Section 4.4 to compare the OC stock of this Andosol with values from other soils.

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Basile-Doelsch, I., R. Amundson, W.E.E. Stone, D. Borschneck, J. Y. Bottero, S. Moustier, F. Masin, and F. Colin. "Mineral Control of Carbon Pools in a Volcanic Soil Horizon." *Geoderma* 137, no. 3–4 (2007): 477–489. <https://doi.org/10.1016/j.geoderma.2006.10.006>.

Marin-Spiotta, Erika, Oliver A. Chadwick, Marc Kramer, and Mariah S. Carbone. "Carbon Delivery to Deep Mineral Horizons in Hawaiian Rain Forest Soils." *Journal of Geophysical Research: Biogeosciences* 116, no. G3 (2011): n/a–n/a. <https://doi.org/10.1029/2010JG001587>.

Tonneijck, Femke H., B. Jansen, K. G. J. Nierop, Jacobus M. Verstraten, Jan Sevink, and L. de Lange. "Towards Understanding of Carbon Stocks and Stabilization in Volcanic Ash Soils in Natural Andean Ecosystems of Northern Ecuador." *European Journal of Soil Science* 61, no. 3 (2010): 392–405. <https://doi.org/10.1111/j.1365-2389.2010.01241.x>.

I would also stress this fact more in the discussion chapter, section 4.4: the low BD is likely due to a low content of minerals, which can be "easily" saturated with OC at least in the upper layers. Please provide also some more info about the way in which sawdust was distributed over the years, specifying to which degree can the soil treated with sawdust considered homogeneous within the 3 hectares of the trial.

Author response: Yes, the smaller content of mineral phases in the topsoil might cause the smaller sorption capacity but probably the smaller mineral content itself is just a result of the strong sorption of organic matter by highly reactive mineral phases. The sawdust was distributed approximately evenly over the site by hand. We add this information to the Materials and Methods section.

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Some technical notes:

P1– L3: please add a reference at the end of the first sentence (storage of organic carbon in soils)

P4 - L11: please use the same decimals (1-16 o 0.9 – 16.0 Mg ha⁻¹ year⁻¹)

P6 – L9: standard deviation (not derivation)

Author response: Thank you for pointing this out. We change the manuscript accordingly.

Interactive comment on Biogeosciences Discuss., <https://doi.org/10.5194/bg-2017-386>, 2017.

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