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Reply on RC2

Sastrika Anindita et al.

Author comment on "Tropical Andosol organic carbon quality and degradability in relation to soil geochemistry as affected by land use" by Sastrika Anindita et al., SOIL Discuss., https://doi.org/10.5194/soil-2022-13-AC2, 2022

Thank you for the comments and suggestions. Our responses are listed below in the same order as the referee's comments.

- **Regarding the parent materials between sites:** Testing the similarity of parent materials is an interesting point but was problematic to evaluate because not all the samples have C horizons, so the signal of the parent material is obscured. Before our study, previous studies reported the age in our study area for 1 m depth approximately between 8000 – 10000 years (Utami et al., 2019, https://doi.org/10.1016/j.catena.2018.09.024; Chartres and Van Reuler, https://doi.org/10.1111/j.1365-2389.1985.tb00322.x). Thus, we did not expect inhomogeneous parent materials in our study area. Detailed information and soil properties on the six sites can be found in our recent publication (Anindita et al., 2022, https://doi.org/10.1016/j.geoderma.2022.115963). We have taken and analysed replicate (duplo) samples for each layer. Based on that study we found sufficient grounds to indeed assume that the parent materials in our study are similar. The area might receive various types of tephra from nearby or at distance and redistribute by wind, but the estimated mineral content (by quantitative X-ray diffraction) was found to be comparable between all sites, except NF. Also, a comparison of weathering degree and total oxide composition of the site revealed a close likeliness of all soils, except again the NF site. As explained in the current manuscript, the NF site is considered an exception because it is located within the 1.5 km distance from the crater, with the presence of new ejecta on the top of soil. Accordingly, for most observations (SOC fractions, C-mineralization data), the effect of land-use conversion in the current manuscript **was based on a comparison between the pine forest sites and the agricultural sites only, with comparable parent materials.** The history and management of land were therefore concluded to have effects on the differences of soil properties between sites. We understand that the inclusion of the NF forest site data could have been misleading and **we will carefully rescan the entire manuscript for unambiguous phrasing on this matter. If this is found necessary by the editor,** we will also add data from our previous research, such as (i) weathering index: $SiO_2/(Al_2O_3 + Fe_2O_3 + TiO_2)$ and (K+Ca)/Ti, and (ii) estimated mineral amount, (iii) texture, (iv) %volcanic glass, (v) code for soil classification**.** However, such would imply a direct repetition of previously published information, for which we would need to ask reproduction permission from the published of Geoderma, Elsevier.

- **Regarding the Zimmermann-fractionation method and weak sonication energy level:** We agree with the referee that the “Zimmermann-fractionation” most likely yields

composite soil fractions, as would in fact most soil fractionation methods. However, aggregate stability is indeed particularly strong in Andosols and **we share the referee's scepticism on the ability of the applied 22 J ml^{-1} ultrasonication step to sufficiently disrupt sand-sized soil aggregates.** As a consequence, the currently isolated S+A fraction (sand + aggregates > 63µm; after ultrasonication) would possibly also contain a substantial part of the silt+clay associated OC (s+c). After rechecking we can indeed acknowledge the presence of undisrupted microaggregates in our S+A fractions and **we would follow the referee's advice to further subdivide it into >63µm sized occluded-POM and silt+clay associated OM**. For this, a stronger mode of soil dispersion followed by wet sieving at 63µm and analysis of the resulting two-size fractions would be needed. We also now tested the successfulness of this procedure by subjecting the S+A fractions of three of the soil samples to 400 J ml^{-1} ultrasonication and this led to full dispersion of >63µm aggregates (other tests at 200 J ml^{-1} proved insufficient). In these three test samples, the %of SOC of the S+A OC lowered by 8-31% vs. the original S+A OC estimate. **If the editor agrees,** we propose to thus further subdivide the S+A fraction into a sand + occluded-POM fraction and into s+c OC for all soils (3 replicates x 6 sites x 3 depths). The amount of C in the latter fraction could be added to the already separated s+c. **Relevant discussion parts will be revised accordingly** with these updated S+A 400 J ml^{-1} and s+c OC data.