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Evaluating the distribution and mineralization of soil organic carbon pool in relation to soil geochemistry under different land use in volcanic soil

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Land use through its control on vegetation and fertilization can impact on soil geochemistry which in turn also
influences the stabilization of soil organic carbon (SOC). Here, we assess soil organic carbon pools following a
fractionation method by Zimmermann et al. (2007), and analyse the fate of SOC with a process-based soil genesis
model, SoilGen2. We hypothesized that geochemical properties influenced the distribution of SOC and these
properties can be applied in a model context to modify the decay rate of soil carbon pool. A set of volcanic soils
data from Mt.Tangkuban Perahu and Mt. Burangrang in Indonesia covering different land uses (primary forest,
pine forest, and agriculture) from Holocene age was used in this study. In the model, calibration was done
sequentially including (i) weathering of amorphous and primary minerals, and (ii) decay of soil organic carbon.
These processes are represented by various process parameters, and each simulation was run on a 8-10k year
time scale. Our SOC fractionation study showed that the dominant SOC pool was located in sand-aggregate
fractions and was higher with agricultural land use. This pool was positively correlated to pH, exchangeable Ca,
aluminum-oxalate extraction (Alo), and amorphous materials. This result is also in line with a better performance
in the SOC model by applying geochemically-modified rates. Our calibrated model shows the advantage of
including geochemical rate modifier in the volcanic soils. Further, the SOC levels will also be investigated under
different climate projection using SoilGen model.