Dear Dr. Bauters,

Thank you very much for evaluating the revised version of our manuscript ("Continental-scale controls on soil organic carbon across sub-Saharan Africa", soil-2020-69). We are pleased that you and the referee are overall satisfied with the changes we made.

We addressed the minor comment from the referee. Please find below the change we made to address this comment.

Sincerely, on the behalf of all authors,
Sophie von Fromm

Point-by-Point response

Reviewer1:

Lines 29-30: On this read through the manuscript, I find the I strongly disagree with the following sentence: "The similarities between the two regions suggest that SOC content in highly weathered soils is not primarily related to long-term soil development, but to common geochemical and climatic properties". I would argue that long-term soil development determines (or at least strongly influences) common geochemical properties. Soil development is expressed in soil properties. The findings of this paper do not indicate that long term soil development has no influence on organic C: in fact, quite the opposite, since exchangeable ions and reactive metal phases accumulate over time as soils develop. Is the point rather that the same geochemical factors dominate in tropical and temperate regions? If so, better to say that directly.

Answer1: Thank you for pointing this out in the abstract. We made the following changes to the abstract to address the issue raised.

Line 15 to 29: "Soil organic carbon (SOC) stabilization and destabilization has been studied intensively. Yet, the factors which control SOC content across scales remain unclear. Earlier studies demonstrated that soil texture and geochemistry strongly affect SOC content. However, those findings primarily rely on data from temperate regions where soil mineralogy, weathering status and climatic conditions generally differ from tropical and sub-tropical regions. We investigated soil properties and climate variables influencing SOC concentrations across sub-Saharan Africa. A total of 1,601 samples were analyzed, collected from two depths (0–20 cm and 20–50 cm) from 17 countries as part of the Africa Soil Information Service project (AfSIS). The data set spans from arid to humid climates and includes soils with a wide range of pH values, weathering status, soil texture, exchangeable cations, extractable metals and land cover types. The most important SOC predictors were identified by linear mixed-effects models, regression trees and random forest models. Our results indicate that geochemical properties, mainly oxalate-extractable metals (Al and Fe) and exchangeable Ca, are equally important compared to climatic variables (mean annual temperature and aridity index). Together, they explain approximately two thirds of SOC variation across sub-Saharan Africa. Oxalate-extractable metals were most important in wet regions with acidic and highly weathered soils, whereas exchangeable Ca was more important in alkaline and less weathered soils in drier regions. In contrast, land cover and soil texture were not significant SOC predictors on this large scale. Our findings indicate that key factors controlling SOC across sub-Saharan Africa are broadly similar to those in temperate regions, despite differences in soil development history."