Geophysical Research Abstracts
Vol. 16, EGU2014-16105, 2014
EGU General Assembly 2014

The influence of woody thickening on SOM dynamics along a precipitation gradient in West Africa

Gustavo Saiz (1,2), Michael Bird (2), Christopher Wurster (2), Philippa Ascough (3), Elmar Veenendaal (4), Klaus Butterbach-Bahl (1), Franziska Schrodt (5), Tomas Domingues (6), Ted Feldpausch (7), Victor Braojos (1), Jonathan Lloyd (2,8)

(1) IMK-IFU, Karlsruhe Institute of Technology, Garmisch-Partenkirchen, Germany, (2) School of Earth and Environmental Sciences James Cook University, Cairns, Australia, (3) AMS Laboratory, Scottish Universities Environmental Research Centre, East Kilbride, UK, (4) Nature Conservation and Plant Ecology Group, Wageningen University, The Netherlands, (5) Max Plank Institute for Biogeochemistry, Jena, Germany, (6) School of GeoSciences, University of Edinburgh, UK, (7) College of Life and Environmental Sciences. University of Exeter, UK, (8) Department of Life Sciences, Imperial College London, UK

We made use of the carbon isotopic composition of soil organic matter (SOM) in bulk and fractionated samples to assess the influence of C_3/C_4 vegetation on SOM dynamics in semi-natural tropical ecosystems sampled along a precipitation gradient in West Africa. The non-linear nature of the relationship between δ^{13}C and SOC content observed across the latitudinal gradient strongly suggests that in addition to the inherent differences in the input rates and turnover times of tree and grass-derived carbon, the broad range of edaphic characteristics may have a major effect in both the physical protection of particulate organic carbon and the chemical stabilization of ^{13}C enriched microbial metabolites.

The stable carbon isotopic composition of SOM with depth indicated that there was a larger proliferation in woody vegetation with increasing precipitation, with such trend being also heavily dependent on the characteristics of the soils. An unbiased assessment of the potential impact of tropical vegetation thickening on SOM dynamics is characteristically difficult given the confounding effects posed by the interaction of varying climatic and edaphic factors. Therefore, in order to minimize the impact of those factors, we selected two neighboring transitional ecosystems (a closed savanna woodland and a semideciduous dry forest) occurring in soils of comparable characteristics. Both sites showed varying degrees of δ^{13}C enrichment with depth in bulk and fractionated SOM. Moreover, radiocarbon analyses of sand-size aggregates ($>$53 μm HF) yielded relatively short MRT, which shows highly dynamic SOM processes even in fairly deep locations. Interestingly, the most stable SOM fraction associated to silt and clay ($<$53 μm Min) showed shorter MRT in the open savanna woodland than in the pure C_3 stand. Our results strongly suggest that both ecosystems are undergoing a rapid transition from open woodlands to dense canopy structures. However, such vegetation thickening varied in intensity in each site and posed contrasting effects on their SOM dynamics. This study further demonstrates that C_4-derived SOM decomposes faster than that derived from woody biomass in mixed C_3/C_4 environments, and highlights the far-reaching implications that vegetation thickening pose on the stability of deep SOC.