Geophysical Research Abstracts
Vol. 17, EGU2015-6326, 2015
EGU General Assembly 2015

Predicting the long-term fate of buried organic carbon in colluvial soils

Zhengang Wang (1), Kristof Van Oost (1), and Gerard Govers (2)

(1) UC Louvain, Louvain-la-neuve, Belgium (zhengang.wang@uclouvain.be), (2) Department of Earth and Environmental Sciences, K.U.Leuven, Heverlee, Belgium

A significant part of the soil organic carbon (SOC) that is eroded in uplands is deposited and buried in colluvial settings. Understanding the fate of this deposited soil organic carbon is of key importance for the understanding of the role of (accelerated) erosion in the global C cycle: the residence time of the deposited carbon will determine if, and for how long, accelerated erosion due to human disturbance will induce sequestration of SOC from the atmosphere to the soil. Experimental studies may provide useful information, but, given the time scale under consideration, the response of the colluvial SOC can only be simulated using numerical models which need careful calibration using field data. In this study, we present a depth explicit SOC model (ICBM-DE) including soil profile evolution due to sedimentation to simulate the long-term C dynamics in colluvial soils. The SOC profile predicted by our model is in good agreement with field observations. The C burial efficiency (the ratio of current C content of the buried sediments to the original C content at the time of sedimentation) of deposited sediments exponentially decreases with time and gradually reached an equilibrium value. This equilibrium C burial efficiency is positively correlated with the sedimentation rate. The sedimentation rate is crucial for the long-term dynamics of the deposited SOC as it controls the time that buried sediments spend at a given soil depth, thereby determining its temporal evolution of C input and decomposition rate during the burial process: C input and decomposition rate vary with depth due to the vertical variation of root distribution and soil environmental factors such as (but not limited to) humidity, temperature and aeration. The model demonstrates that, for the profiles studied, it takes ca. 300 yr for the buried SOC to lose half of its C load. It would also take centuries for the SOC accumulated in colluvial soils over the past decades due to soil redistribution under mechanized agriculture to be released to the atmosphere after the application of soil conservation measures such as conservation tillage.