Geophysical Research Abstracts
Vol. 19, EGU2017-13089, 2017
EGU General Assembly 2017

Soil organic matter stability as indicated by compound-specific radiocarbon analyses

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Carbon storage in soils is increasingly recognized as a key ecosystem function, and molecular-level analyses could be a valuable potential indicator of this storage potential. In this framework, radiocarbon constitutes a powerful tool for unraveling soil carbon dynamics on both decadal as well as centennial and millennial timescales. In this study, we look at the radiocarbon signature of specific compounds (fatty acids and n-alkanes) in two forested ecosystems (temperate and pre-alpine) with the aim of attaining a better understanding of soil organic carbon stability on a molecular level. Radiocarbon dating of the fatty acids and n-alkanes has been coupled to abundance data of these compounds and additionally lignin phenols. We hypothesize that potentially, these long-chain apolar compounds could be a representative indicator of the mineral-bound soil organic carbon pool. These well-studied sites are part of the Long-Term Forest Ecosystem Research (LWF) program of the Swiss Federal Institute for Forest, Snow and Landscape research (WSL). Therefore, a wide suite of ancillary climatic and textural data is available for these sites. Initial results show a wide range of ages in the specific compounds which constitute a much larger range than the ages indicated by the density fractions done on the same samples. Overall, this study explores the use of molecular-level indicators to study soil organic matter dynamics, which could help assess the overall potential vulnerability of soil carbon in various ecosystems.