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Radiocarbon as a tool to assess organic matter vulnerability across different regions in Swiss soils

Soil organic matter (SOM) forms the largest terrestrial reservoir of carbon outside of sedimentary rocks and it provides the fundamental reservoir for nutrients that sustains vegetation and the microbial communities. With ongoing changes in land-use and climate, SOM is also subject to change, with potentially major consequences for soil as a resource and for global biogeochemical cycles. Radiocarbon is a powerful tool for assessing SOM dynamics and is increasingly used in studies of carbon turnover. The overall goal of this present study aims to assess the controls on organic matter stability and vulnerability in soils across Switzerland. Focusing on range of Swiss soil types that span climatic, topographic and geological gradients, we examine lateral variability in ^{14}C over plot (decimeter to meter) to regional scales, vertical variability from surface to deeper soil horizons, and temporal variability by comparing present-day with archived (legacy) samples. Preliminary results reveal large differences in SOM ^{14}C age across small lateral and vertical distances within soil systems, with the magnitude of these variations dependent on relief and soil type. Radiocarbon data are compared with elemental composition (C, N) of the material, as well as ^{13}C data in order to examine relationships with SOM composition. Ultimately, studies of bulk variability will be followed up with analyses of SOM sub-fractions, and will involve ^{14}C measurements on specific fractions including at the molecular level. Investigating ^{14}C variability over various space and time domains will shed light on the scales of processes that dictate the composition and vulnerability of SOM, and provide valuable constraints on models of SOM turnover.