KINETIC HETEROGENITY OF SOIL ORGANIC MATTER AT THE GLOBAL SCALE

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Soil organic matter (SOM) represents the largest actively-cycling terrestrial reserviour of carbon and, as such, it is imperative that we quantify the kinetic heterogeneity of SOM and the mechanisms that keep C in soils. The timescales over which SOM pools are cycled are critical constraints on the strength and direction of the SOM feedback to the global carbon cycle.

Radiocarbon is our primary means for estimating timescales of SOM cycling, including mean age and rates of transfer from one SOM pool to another. Previous meta-analyses of soil radiocarbon data demonstrated the different controls on shallow versus deep soil organic matter age (Mathieu et al., 2015) and that Earth surface models may underestimate the mean system age of SOM leading to an overestimation of the soil carbon sequestration potential (He et al., 2017). However, these studies focused primarily on whole-soil radiocarbon content, and it is clear that additional information can be obtained by considering data from descrete soil pools.

When combined with soil models, pool-based data provides added constraints on the rates and drivers of SOM change. Yet, our ability to consider detailed SOM pool strucutres in global-scale assessments is limited by the disperate methods used to isolate soil pools. The International Soil Radiocarbon Database (ISRaD) allows for synthesis and comparison of soil radiocarbon and associated measurements across a diversity of soil pools, providing an opportunity to systematically compare soil fractionation methods and to expand our interpretation of fundamentally different SOM architectures to the global scale. At present, ISRaD includes over 3700 observations of soil pools and over 8700 total radiocarbon measurements. We provide an overview of the soil pool categorization used in ISRaD and discuss preliminary findings from this synthesis effort.

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