

Characterizing SOM leveraging extraction bias and controlling for distortion effects

K. M. ROSCIOLI¹, Y. SHEN², T. L. FILLMORE¹,
M. M. TFAILY¹, R. ZHAO¹, N. TOLIC¹, B. J. ANDERSON²,
C. R. ANDERTON¹, N. J. HESS¹, L. PAŠA-TOLIĆ¹
AND E. W. ROBINSON^{1*}

¹Environmental Molecular Sciences Laboratory, Pacific Northwest National Laboratory, Richland, WA
(*correspondence: robby@pnl.gov)

²Biological Sciences Division, Pacific Northwest National Laboratory, Richland, WA

Characterizing SOM dynamics

Better understanding the dynamics of soil organic matter (SOM) plays a central role to climate modeling, carbon sequestration, microbial community, fate and transport of carbon, mineral SOM interactions, rhizosphere, and many other EMSL and EMSL User research efforts. In support of these research efforts and as a DOE National User facility, we are developing a suite of SOM characterization capabilities. Key to this effort is leveraging the biases inherent to different workflows and controlling distortion effects.

Historically, leveraging analysis biases was accomplished by matching extraction and detection biases with the target compounds of interest to a specific study. With the current trend towards more holistic or systems level investigations, we have found that multiple extraction and detection methods are needed to obtain a sufficiently inclusive representative characterization of SOM. We are developing a multi-stage extraction and fractionation process which can be readily tailored to specific scientific objectives. This includes extending analysis methods to provide a spatial characterization of SOM. Such spatial characterization is particularly useful to study potential spatial effects on SOM such as spatially dependent interactions with roots and mineral composition diversity.

The control of distortion effects is based on the use of standard additions, or spikes, of control compounds and in some cases the use of stable isotopically labeled compounds to characterize the temporal and chemical stability of a broad range of chemical classes through extraction, fractionation, and detection processes. Studies include time course, background, and carry-over measurements. We plan to present our bias and distortion findings for a sub-set of the methodologies developed and provide examples from alkaline, solvent, and critical fluid based extractions.