Poster #1-2

Comparison of Microbial Parameters Parameterized based on Short-term and Long- term Incubation

Siyang Jian[1*], Jianwei Li[1], Gangsheng Wang[2,3] and Melanie Mayes[3]

[1] Tennessee State University, Nashville, TN;
[2] University of Oklahoma, Norman, OK;
[3] Environmental Sciences Division and Climate Change Science Institute, Oak Ridge National Laboratory, Oak Ridge, TN

Contact: sjian@my.tnstate.edu and jli2@tnstate.edu

BER Program: TES
Project: Student Travel Award

In the Microbial-Enzyme Decomposition (MEND) model, five microbial parameters relevant to microbial uptake, growth, maintenance and dormancy are critical to model performance but are usually parameterized based on short-term measurements. These parameters include the initial active fraction of microbes (r_0), maximum specific growth rate (V_g), a ratio (α) between maximum specific maintenance rate (V_{mt}) to the sum of V_{mt} and V_g, half saturation constant of dissolved organic carbon uptake (KD) and true growth yield (Y_g). To assess how model projection of soil C stock vary with parameterizations based on measurements over different time scales, this study compared modelled soil responses to 5ºC warming by implementing best-fit parameters calibrated based on soil incubation datasets over 144 hours and 729 days (referred to as short-term or ST parameters, and long-term or LT parameters). Results showed that all five best-fit ST parameters were higher by 7.7~420% than LT parameters. Under 5ºC warming, model projected significant steady-state SOC loss (-15.4±0.1%) and minor SOC gain (2.1±0.2%) using ST and LT parameters, respectively. Compared to meta-analysis synthesis, LT parameters projected more realistic SOC response to long-term warming. MEND analytic steady state solution demonstrated that the relative change of SOC under warming depended upon Y_g only, so the overestimate of SOC losses to warming using ST parameters were attributed to higher best-fit Y_g. This study suggests that to improve the accuracy of long-term SOC projections, parametrization of microbial relevant processes particularly true growth yield, should be achieved relying upon measurements over long time scale.