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Advancing process-based microbial C model using C dynamics data with controlled inputs in Chinese Cropland

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Accurate estimate of C inputs to soils is important to improve the prediction of changes in global soil organic carbon (SOC) and SOC transformations in a microbial C cycle. In cropland crop yield are well documented and can be used to estimated C inputs accurately, thus processes in SOC biochemical cycle become critical to predict changes in SOC. We modeled the time series data of SOC stock and crop yield of multiple long-term agricultural trials that represent a range of climate, soil texture and agricultural management (e.g. fertilization and rotation) in China. The soil organic carbon (SOC) model comprised physical size and density fractions, where adsorption to minerals and occlusion in soil aggregates are considered as SOC stabilization mechanisms. Physical fractions contents in the model define soil aggregation state and thus a feedback with C stabilization due to spatial restrictions for microbial attack of occluded SOC.

The inverse modeling was done with Nelder-Mead optimization algorithm to estimate the reaction rates of SOC transformations in different physical fractions and carbon use efficiency as a density-dependent function or community-level regulation parameters.

The current modeling study with data of long-term SOC dynamics at known SOC inputs and texture allows us to improve the model constraints for estimating biological parameters of microbial decomposition for stable and labile organic matter in physical fractions. Further modeling results may inform us on unknown details of soil biochemical processes.