Geophysical Research Abstracts
Vol. 21, EGU2019-10802, 2019
EGU General Assembly 2019

Upscaling CUE adaptation with the SESAM model

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Soil microbial carbon use efficiency (CUE) is strongly affected by the stoichiometry, i.e. elemental ratios, of the consumed substrate. This substrate stoichiometry again is controlled by trade-offs in enzyme production to degrade organic matter fractions of different stoichiometry. The necessary process detail of modelling microbial community dynamics or extracellular enzyme pools makes it difficult to integrate models of this CUE control in larger scale models and model-data-integration studies.

Therefore, we developed the Soil Enzyme Steady Allocation Model (SESAM) that simplifies short-term scale processes of enzyme dynamics by the quasi steady state assumption of enzyme pools. As a result, SESAM captures only processes with a time scale of months to decades, which poses challenges for model data integration with temporally finer resolved observations. SESAM represents organismic processes and community adaptation to substrate stoichiometry on an upscaled level with fewer, lumped parameters. Hence, we discuss selected use cases and strategies to integrate SESAM into ecosystem models and model-data integration studies.