Model-data comparison of soil organic oatter cycling: soil core scale

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Soil organic matter (SOM) cycling is usually modeled as a donor controlled process, most often by first order kinetics. However, evidence of contradition of this donor-paradigm is appearing. One alternative hypothesis is that microbiological consumers of SOM play an important role and need to be taken into account more explicitely. Here we link SOM cycling to the modeling of microbial growth kinetics. We set up a suite of alternative models of microbial growth. Explicitly modelling the cycling of a label across carbon pools allowed to compare the model outputs to data of a soil priming experiment. The experimental data was taken from U. Hamer, & B. Marschner (2002 Journal of Plant Nutrition and Soil Science 165(3)), who incubated several 14C labelled substrates at 20°C in a model system that consisted of sand mixed with lignin for 26 days. Data streams of time series total respiration, respiration from labelled amendment and prior information on model parameters were used to determine the posterior probability density function of the model parameters of each of the model variants and to calculate Bayes-Factors, the ratios of the likelihood of the different model variants. This kind of data and Bayesian analysis is usable to compare model structures adapted to processes that determine the dynamics at this scale: co-limitation of depolymerization of older soil organic matter by both substrate and decomposers, prefererrential substrate usage, activation and deactivation and predation of microbes, and usage of both assimilated carbon and carbon of internal pools for maintenance and growth respiration.