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Up-scaling spatial heterogeneity of microbial turnover in soil using a stochastic approach

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Rates of microbial processes in soils show considerable spatial and temporal variability emerging from small-scale microbial-physicochemical interactions. Complexity and variability of microbial processes might be captured as stochastic system behaviour, which provides a way to upscale small-scale dynamics. To test this approach, we modeled pesticide degradation in a soil pedon as a test case. A spatially explicit approach (based on partial differential equations) is compared to a stochastic approach (based on stochastic ordinary differential equations). Scenario simulations for multiple realizations of different spatial distributions of microbes at the mm-scale are performed using the spatially explicit model. These simulation results are then used as reference data to which the stochastic model is fitted via approximate Bayesian computation for identification of parameters controlling the stochastic dynamics of the state variables. The use of multiple different summary statistics allows to analyze and evaluate limitations of the stochastic model with respect to upscaling. We will present the modeling framework and show first results.