Simulating biological dynamics using partial differential equations: application to decomposition of organic matter in 3D soil structure

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Abstract: The majority of carbon in the atmosphere is in the form of soil or- ganic matter. And its degradation by microfauna leads to the remineralization of carbon as carbon dioxide. The microbial activity causes a reduction of soil carbon and increases atmospheric carbon. However, most models of organic matter does not explicitly take into account this reality. We try to answer these questions by developing and validating a model describing the action of microorganisms on degradation of organic matter. We use simulation domain as the pores in the soil modeled by a network of balls. The model is solved numerically in the balls by the finite element method with the solver of par- tial differential equations Freefem3d. We compare the results of the numerical with experimental data on the mineralization of soil carbon. The numerical experiments are performed for a same soil relatively wet and relatively dry.