

NONLINEAR DYNAMIC SOIL AGGREGATION MODEL

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Soil aggregation-mediated biological interactions on micro-scale give rise to macro-patterns of soil regimes. This crucial phenomenon is an interesting case of self-organization in complex systems. In the present study we developed a physically-based mathematical model of soil aggregation considering major known biological feedbacks with soil physical parameters. According to our previous experimental studies, organic matter affinity to water is an important property affecting soil structure. Therefore, organic matter wettability is taken as principle distinction between organic matter types in our model. The mathematical model is formulated as a system of non-linear ordinary differential equations, including reaction kinetics equations for biological and coagulation/adsorption/adhesion processes and Smoluchowski-type equations for aggregation. For parametrization of the model fast algorithm of numerical solution for such type of equations is suggested. The present dynamic soil aggregation model is being developed to include spatial distribution and transport of water, heat and chemical substances, so it can be used to model properties of the soil profile.

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