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► To cite this version:

Sophie Leguédois, Nicolas Marilleau, Christophe Cambier, Yvan Capowiez, Jérôme Cortet, et al.. A 3D multi-scale virtual structure to model and simulate concurrent processes of soil evolution. 4. International Congress Eurosoil 2012 - Soil Science for the Benefit of Mankind and Environment, Jul 2012, Bari, Italy. n.p., 2012, 4th International Congress. Eurosoil 2012. Soil Science for the Benefit of Mankind and Environment. Fiera del Levante, Bari Italy, 2-6 July 2012. hal-01190362

HAL Id: hal-01190362

<https://hal.science/hal-01190362>

Submitted on 3 Jun 2020

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S04.05a -5

A 3D MULTI-SCALE VIRTUAL STRUCTURE TO MODEL AND SIMULATE CONCURRENT PROCESSES OF SOIL EVOLUTION

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The evolution of soil structure is one main feature of pedogenesis. Biological processes such as faunal or root bioturbation influence the structure of the soil ecosystem. However the soil biological activity is also largely impacted by the spatial organisation of soil (aggregation, pore connectivity). Simulation-based approach is an interesting way to explore the interactions between an evolving soil structure and bioturbation activity as well as to assess the sustainability of soil systems. Our main objective is to develop a 3D multi-scale model to represent the evolution of soil structure. It is a generic soil structure allowing calibration on various measured data (mineral and organic size distribution, bulk density...) and the choice of the constituting elements (mineral and organic matters, pores, nutrients...). Virtual processes can be introduced in this structure to model soil functioning. Our applied case study concerns soil rehabilitation by soil construction (constructed Technosol). Firstly, this work deals with the representativeness of an existing structure model: the APSF (Arborescent-Pore-Solid-Fractal). It is a discrete pattern-based soil design. The preliminary exploration analysis shows that the calibration of the APSF on size distributions and bulk densities is very sensitive. Comparison with measured data on pore network could allow a better assessment of the parameters. Secondly, we integrated the APSF into a multi-agent system (MAS) in order to model the interactions of soil structure with anecic earthworms. We will present the developed model based on SWORM (Simulated Worm) as well as its first results. Hints to model root growth in MAS are also presented.