Geophysical Research Abstracts
Vol. 17, EGU2015-14895, 2015
EGU General Assembly 2015
© Author(s) 2015. CC Attribution 3.0 License.

From the pore scale to the core scale: How to model the spatial interactions in soils?

Patricia Garnier (1), Valerie Pot (1), Oivier Monga (2), Claire Chenu (1), Laurent Vieuble-Gonod (1), Laure Vogel (1), Naoise Nunan (3), Wilfried Otten (4), and Philippe Baveye (1)

(1) INRA, UMR ECOSYS, F-78 850 Thiverval Grignon, France, (2) IRD, UMI UMMISCO, Yaoundé, Cameroun, (3) CNRS, IMR IEES, 94010 Creteil, France, (4) SIMBIOS, University of Abertay, Dundee, UK

Recently, innovative modeling tools have been developed to describe the physico-chemical processes occurring in soil pores at scales directly relevant to microorganisms. Modelling efforts have attempted to understand how microbial processes such as decomposition or competition among species are affected by diffusion in 2-D or 3-D environments. Most of these models use a virtual representative pore network that can have the same features as soil pores with regular lattice grid. The most recent and innovative of these models use real images of soil structure from binarized 3D images. These models are able to simulate microbial degradation although microorganisms and organic matter are placed at different locations in the pore space. Then, the encounter of nutrients and microorganisms is achieved through the implementation of the diffusion process of the soluble substrates in the connected water-filled space. The high computational demand of this type of approach restricts its applicability to small-scale systems, typically in the order of micrometers or millimeters. The numerical techniques used to solve the equations include the lattice Boltzmann method, algorithmic methods and finite element methods. Most of these models have not yet been tested with experimental data because of the difficulties of investigating such small scales. On the other hand, many experimental results developed at the core scale have showed the importance of soil microbial habitat and especially how physical characteristics (pore sizes, connectivity) control the decomposition of organic substrates via their accessibility by microorganisms. The general question we have now to answer is whether information on the spatial heterogeneity of soils at the microscale can be used to predict the processes observed at the macroscale in soils