



Agent-based models to address the spatial complexity of biological and physical interactions in soils

G. Beurier (1), C. Cambier (2), N. Marilleau (3), E. Perrier (4), and R. Duponnois (5)

(1) Gregory Beurier LIRMM CNRS Univ Montpellier, France, beurier@lirmm.fr, (2) Christophe Cambier, Paris 6 University, France, cambier@ird.fr, (3) Nicolas Marilleau, IRD, Bondy, France, nicolas.marilleau@ird.fr, (4) Edith Perrier, IRD, Paris, France, edith.perrier@ird.fr, (5) Robin Duponnois, IRD, Dakar, Sénégal, Robin.Duponnois@ird.sn

We developed a new computer approach to represent the interactions between soil microorganisms and soil structure in various contexts, namely the decomposition of organic matter by soil bacterial communities, the modification of soil structure due to earthworms dynamics, or phosphorous uptake by mycorrhizae in the rhizosphere. In this presentation, we show how to handle individualized entities evolving in a heterogeneous spatial medium to simulate complex phenomena occurring in soils as the emergence of a set of local behaviours. The consumption of resources by biological organisms can be modelled by an offer versus demand discrete dynamical process. We focus on the effect of spatial organisations on observed phenomena, and we introduce explicit representations of tri-dimensional multiscale soil porous structures. These modelling concepts are illustrated by several applicative examples where simple assumptions about local behavioural rules and medium properties have been made by soil scientists, then implemented and explored.