Individual Based Modelling of Microbial Activity to Study Mineralization and Nitrification Process in Soil

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Soil organic matter plays an important role in the development and functioning of terrestrial ecosystems. Microorganisms are the first colonisers of the soil, and they are mainly responsible for certain steps of the carbon and nitrogen cycling. Depending on temperature, oxygen, pH and available substrate among other variables, they choose the appropriate metabolic pathways to achieve their requirements to synthesize biomass for their growth and viability. In recent years there has been an increase in modelling and simulation studies on the transformation of carbon and nitrogen in soils, to deal with the C and N dynamics in soil ecosystems. These models cover the diverse parts or components of these processes, and describe the effects of different factors affecting them [1,6-8].

A computer code based on a modelling methodology that shares the philosophy of other individual-based models was developed by Ginovart and co-authors to study bacterial cultures [2]. This simulator called INDISIM (INDividual DIScrete SIMulations) was developed to deal with several systems in which bacterial activity is one of the fundamental part of the system [3,4]. In order to deal with microbial activity in Soil Organic Matter we are working with INDISIM-SOM [5]. The microbial activity in soils is modelled using it by setting up rules of behaviour for each microorganism of the system: motion, cellular cycle, uptake, different metabolic pathways and viability. An organic matter medium occupying a two dimensional spatial grid and subject to periodic boundary conditions

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has been considered. In each spatial cell we control the amount of different types of organic compounds identified by: resistant and labil organic C and N, and mineral compounds like N-NO3-, N-NH4+and CO2, among others. The evolution of the microbial system over a period of time is controlled through the time steps programme. Some parameters related to soil organic matter and microbial activity such as growth rates of microbial biomass, metabolic quotient, N mineralised and C/N rate are studied. The qualitative agreement of the simulation results with experimental data of short-term dynamics of C and N enables us to evaluate the assumptions made in the model. Some of the lastest and novel results achieved with INDISIM-SOM will be presented in order to compare the different dynamics of some parameters corresponding to two kind of soils.

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