How lysimetric facility can contribute to monitor Technosols dynamics.

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How lysimetric monitoring of Technosols can contribute to understand the dynamics of the porosity of soils

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Working Session
Soil conservation and habilitation to improve water management in urban areas

The dynamic of water in soils is mainly controlled by a set of hydraulic properties that are characteristic of each type of soil and that reflect the architecture – more generally defined as soil structure - of such a specific porous medium. Structural changes are induced by external factors (*e.g.* climate, biology, human action) and are the result of pedogenetic processes that modify the solid phase and redistribute ions and particles. Consequently, changes in the poral volume and in the size and the connectivity of soil pores are observed that significantly influence regulating ecosystem services that can be provided. The temporal and spatial dynamics of these properties is complex to highlight and poorly studied, especially as the soil processes in natural soils are slow at human timescales.

To question this crucial issue, we chose to focus our study on the dynamics of Technosols porosity as a result of seasonal climatic variations, vegetation and early pedogenic evolution – which kinetic is known to be much faster - (Lin, 2011; Séré et al., 2012). Our purpose is then to develop an original approach to characterize, in a continuous way, the evolution of soil's structure. To do so, a natural soil and SUITMAs - from a Luvisol to a Spolic Garbic Technosol (Histic) -, within an anthropization gradient, have been studied. They have been studied under two treatments (with or without vegetation) in monitored 2 m^3 lysimetric columns over a 3 to 6 years' time sequence. Water balances have been performed as well as the monitoring of water transfer at different depths. Experimental data have been compared to a modelling approach that relied on the use of Hydrus 1D (Simunek et al., 2008).

The results exhibit contrasted hydraulic behaviors that are mainly correlated to the age of the soils and the level of human influence. Only cyclic variations – for example on the amount of water that is stored (Figure) - were visible on natural and slightly anthropogenic soils that were attributed to seasonal factors (*e.g.* climate and vegetation). In addition to that cyclic changes, more drastic acyclic evolutions were observed on the Technosols that demonstrated their significant settlement and an evolution of the porosity due to their early pedogenesis (Figure). An inverse modelling approach led to the estimation of hydraulic parameters that confirmed that findings by highlighting an evolution of poral architecture with time.

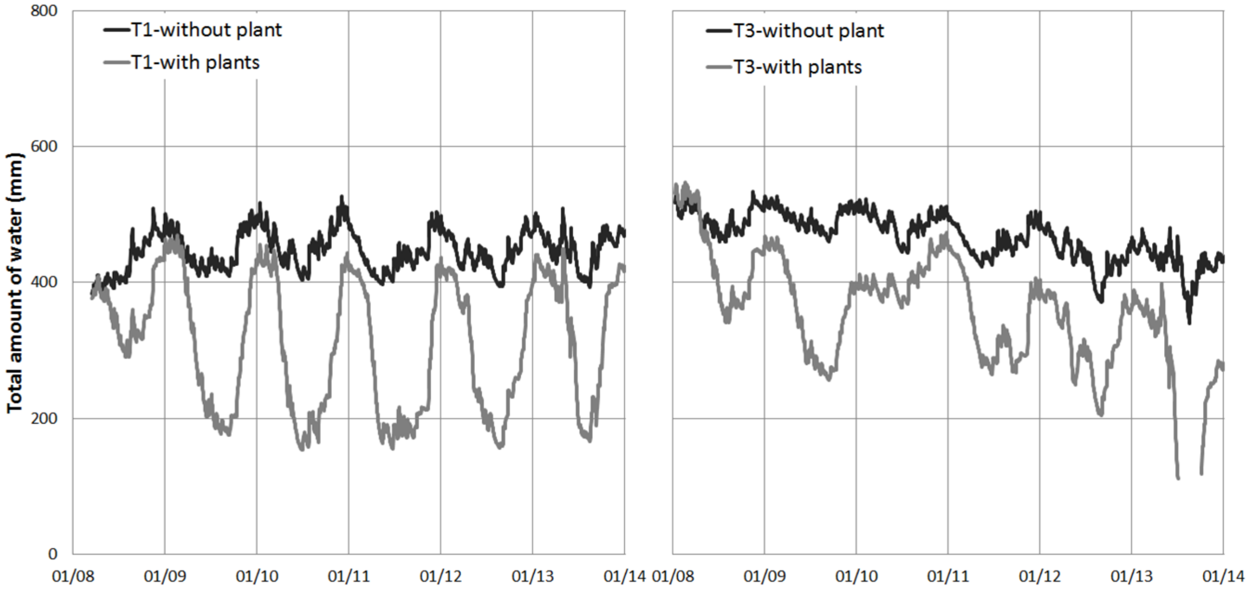

Figure: Evolution over 6 years of the amount of water stored in T1 (Luvisol) and T3 (Technosol) with and without vegetation

References

Lin H. 2011. Three Principles of Soil Change and Pedogenesis in Time and Space. Soil science society of America, 75, 2049–2070

Séré G, Ouvrard S, Magnenet V, Pey B, Morel JL, Schwartz C (2012) Predictability of the evolution of the soil structure using water flow modeling for a constructed technosol. Vadose Zone Journal 11:0-0.

Šimunek, J., Sejna, M., Saito, H., Sakai, M. et van Genuchten, M., 2008, The HYDRUS-1D software package for simulating one-dimensional movement of water, heat, and multiple solutes in variably saturated media. Department of Environmental Sciences University of California Riverside, Riverside, California.