Geophysical Research Abstracts,
Vol. 11, EGU2009-3406-2, 2009
EGU General Assembly 2009

Square meter scale new moulding method to study the temporal evolution of the soil surface micro-topography and its impact on the runoff dynamics

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Micro-topography, in interaction with the global slope, directs and triggers the runoff. By concentring the surface water fluxes, it can promote the development of eroded pathways, while, by delimiting depressions where water accumulates, it can favour sedimentation.

If we want to study this, it is necessary to isolate, among all the different processes that interact with the runoff, the impact of the micro-topography only. Therefore we developed a fast and cheap in-situ moulding method (+/- 50 euros/m2) that combines alginic acid, gypsium and a lacquer. It creates stable, and impermeable artificial micro-topographies that reproduce real fields situations and that can be submitted to various laboratory rain and erosion simulations. Both surface of a specific soil and its artificial reproduction have been measured with a laser scanner in order to assess the quality of the moulding method, analyzing: the surface heights, the surface storage, the spatial correlation (semi-variogram and bivariate entropy), the connectivity properties (N-direct connectivity, Euler number, percolation probability, connectivity function and relative surface connection function) and the runoff dynamics.

Since real soil micro-topographies evolve with their exposure to rain events, we made several moulds of a small bare field plot during a rain season and analyze the evolution of the above cited properties, especially the runoff dynamics.

This cheap technique already provides important metrics of runoff triggering to be integrated in hillslope runoff-erosion models. It could allow one, in the future, to create a collection of micro-topographical reproductions to study the combined actions of the rain and the agriculture practices on the micro-topographical properties. Under laboratory conditions, the spatial variation of water velocity could be studied on those artificial micro-topographies to better model the erosion-deposition processes.