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Structural stability of soil crusts. Consequences for soil erodibility assessment

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Erosion and sediment transport processes depend on the soil surface properties. Because of water flow and other processes (climate, agricultural practices, biological activity, etc.), the properties of the soil surface can undergo significant changes that affect erosion. As a consequence, understanding of the transport processes and improvement in soil erosion prediction involve a better assessment of soil surface characteristics. Structural stability has been used to evaluate the sensitivity of soils to erosion. This methodology reproduces the processes responsible for particle and fragment production, the initial step leading to erosion. Structural stability measurements are usually carried out on soil materials sampled inside the plough layer. Since the material at the soil surface, i.e. the soil interacting with the overland flow, is usually discarded at sampling, structural stability measurements do not assess the properties of the most relevant material.

The goal of this study was to evaluate the range of structural stability for a given soil placed under different conditions. First, soil aggregates were placed under a laboratory rainfall simulator to produce a coherent layer and a sediment layer (two ubiquitous states of the soil surface). Second, the samples were sprayed with deionised water or nutrients (to stimulate biological activity) and incubated in a climatic chamber. A set of structural stability measurements was done over a 20-days period.

Results show the material at the soil surface can have a sensitivity to erosion very different from the initial material. This is due to particle rearrangement at the soil surface and biological activity. An alternative methodology to evaluate soil sensitivity to erosion is proposed.