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Sophie Leguédois, Isabelle I. Cousin, Frédéric Darboux, Olivier Fischer, Yves Le Bissonnais

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Sophie Leguédois, Isabelle Cousin, Frédéric Darboux, Olivier Fischer, Yves Le Bissonnais

sophie.leguedois@orleans.inra.fr
INRA Orléans Soil Science, France

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Developments of soil erosion modelling need to take spatio-temporal dynamics of soil surface characteristics into account especially soil surface structure. Soil surface structure is a key factor influencing interrill soil erosion behaviour through soil hydrodynamic properties, runoff rate and sediment detachment. For cultivated soils and between field works, surface structure is driven essentially by evolution of soil crusting. As a consequence, soil surface structure is modified during rainfall event and varies with the topographic position. Soil surface structure is also soil dependent.

The aims of this study were:

- to develop a tool relevant to describe and to quantify spatio-temporal evolution of soil crusting, and that could be used for soil erosion modelling needs,
- to confront information about spatio-temporal evolution of soil crusting and dynamics of interrill soil erosion given by runoff rate, splash rate and sediment delivery, for a range of soil types.

Soil surface structure evolution was made by laboratory rainfall simulations. Rainfall simulations were carried out on air-dried soils samples packed in small trays of 0.5×0.5 m² with a 5 % slope. Soil surface was initially moulded with an oriented roughness of about 2-cm high, parallel to the slope. Three cultivated soils with various susceptibilities to crusting were studied. Rainfall was applied with an intensity of about 30 $mm.h^{-1}$ during 2 hours after the runoff initiation. Three replicated rainfall simulations were done for each soil type.

Soil erosion characteristics were measured by sampling runoff every 10 min and splashed particles every 20 min. Splash was collected with a box set at the upstream side of the tray.

Digital colour pictures of the soil surface were taken every 10 minutes during the whole rainfall event. Photographs were studied by image analysis in order to obtain spatial information about soil surface sealing and crust type.

Digital Elevation Models (DEMs) of the soil surface were obtained with a high-resolution profile laser scanner. Three acquisitions were done at different times:

- before the beginning of the rainfall simulation,
- when runoff coefficient reaches 10 %,
- after the rainfall event.

For each micro-topographic acquisition, a photograph of the soil surface was taken. DEMs were processed in order to quantify spatial evolution of soil surface roughness.

Finally, results obtained from image analysis and study of DEMs were coupled to quantitatively describe spatio-temporal evolution of crusting and surface roughness in order to follow dynamics of soil surface structure.