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Soil erosion under multiple time-varying rainfall events

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Soil erosion is a function of many factors and process interactions. An erosion event produces changes in surface soil properties such as texture and hydraulic conductivity. These changes in turn alter the erosion response to subsequent events. Laboratory-scale soil erosion studies have typically focused on single independent rainfall events with constant rainfall intensities.

This study investigates the effect of multiple time-varying rainfall events on soil erosion using the EPFL erosion flume. The rainfall simulator comprises ten Veejet nozzles mounted on oscillating bars 3 m above a 6 m $\times$ 2 m flume. Spray from the nozzles is applied onto the soil surface in sweeps; rainfall intensity is thus controlled by varying the sweeping frequency. Freshly-prepared soil with a uniform slope was subjected to five rainfall events at daily intervals. In each 3-h event, rainfall intensity was ramped up linearly to a maximum of 60 mm/h and then stepped down to zero. Runoff samples were collected and analysed for particle size distribution (PSD) as well as total sediment concentration.

We investigate whether there is a hysteretic relationship between sediment concentration and discharge within each event and how this relationship changes from event to event. Trends in the PSD of the eroded sediment are discussed and correlated with changes in sediment concentration. Close-up imagery of the soil surface following each event highlight changes in surface soil structure with time. This study enhances our understanding of erosion processes in the field, with corresponding implications for soil erosion modelling.