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# Towards a better understanding of the interaction between bed roughness and flow hydraulics in small eroded channels

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Rills eroding cohesive materials are hydraulically different from rivers or large channels. Unlike rivers, rills are small, shallow flow stream with frequently a relatively steep slope gradient. Besides, rills evolve morphologically over much shorter timescales due to active bed erosion. This leads to a strong interaction between the channel flow and bed roughness. This interaction gives rise to a reconfiguration of the bed geometry generated by the important erosive action of the flow. This new shape is characterized by a typical alternance between concavities (pools) and more or less flat reaches (steps). The new rill geometry affects, in turn, the behaviour of the flow that is why we talk about interaction or feedback. In addition, the greatest energy dissipation occurs in the pools –mainly due to the action of hydraulic jumps– which, in turn, lead to an increase in the pool size. We hypothesize there is a regular spacing of step-pools units and that, both the frequency and the depth of the pools will be strongly conditioned by the discharge and the general rill slope. The determination of that periodicity (if any) would be an important contribution for concentrated flow erosion modelling of small channels. That is because the majority of erosion models are based on formulations which assume that a rill has a flat bed, only affected by micro-roughness. For instance, equations like Manning's – widely used in river and large channel hydraulics –, if a constant value of roughness is assumed, would be inappropriate in erosion rills since, as explained above, the roughness is not constant.

The objectives of this work are then: (i) to investigate the geometry of erosion rills aiming at determining if there is a spatial arrangement of the macro roughness of their beds; and (ii) to establish (semi)-empirical models of prediction of this periodicity, mainly based on topographic parameters.

Rills were generated in an agricultural field in a homogeneous hillslope (with no abrupt slope changes) by the action of different discharges and slopes. The protocol of experimentation in each rill is briefly as follows. The presence of pools along the channel was identified using markers of the position of the pools following and ad hoc procedure. Then, pictures of the rill were taken and a detailed DEM of it was obtained by photogrammetry. Moreover, a morphological characterization of the channel –e.g., longitudinal height profile– was made from the DEM.

Preliminary results from 3 contrasting discharges and a similar slope suggest that in well defined –i.e. no incipient– rills there is a systematic and regular spacing of pools along the channel. More experiments are needed to confirm these findings.