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Practical thresholds for separating non-erosive, Interrill and rill storms

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To identify thresholds of simple and practical determination capable of operating a separation between non-erosive and erosive rains and even between rains that determine rill and interrill processes, has considerable importance from both a practical and scientific point of view (Poesen et al., 2003; Morgan et al., 2016; Xie et al.,2002). It allows to reduce the work necessary to manage and process erosive events and provides useful information to determine the triggering of erosion processes of different entities and nature and consequently to better understand their dynamics.
The objective of the paper is to develop and evaluate, starting from the rain hyetographs, thresholds able to separate a) non-erosive rains from those that induce interrill erosion, b) rains that determine interrill from those that cause rill erosion.
For this purpose a procedure (Xie et al.,2002) was applied which consists in selecting the thresholds based on the principle that the overall erosivity of the events above threshold must be equal to the overall erosivity of the erosive events. The identified thresholds were then evaluated by efficiency indices. The variables chosen to determine the relative thresholds were the general characteristics of the rain event and other describing the hyetograph (Todisco,2014).
The databases of Masse (central Italy) and Sparacia (southern Italy) experimental stations were analysed. The monitoring and measurements of the rainfall events and of the corresponding soil loss is carried out since 2008 at Masse (silty-clay loam soil) and since 2001 at Sparacia (clay soil). In both stations, experimental plots of different length (l), width (w) and slope are present but for the study only the databases relative to the plots with l=22 m were analyzed (at Masse w=4 and 8 m on a 16% slope, at Sparacia w=2 and 8 m on a 14.9% slope). For the characteristics of the two stations and the experimental methodologies applied, refer to Bagarello et al. (2013) and Todisco et al.(2012). The databases consistency was of 258 rainy events at Masse (188 non-erosive and 70 interrill) and of 124 rainy events at Sparacia (47 non-erosive, 64 interrill and 13 rill).
For both the stations thresholds able to separate interrill erosive events from non erosive events were developed and tested. For Sparacia thresholds able to separate erosive-interrill events from erosive-rill events were also developed and verified.
At Masse the threshold in terms of event rainfall depth, Pe, was, among the analyzed variables, the most effective one to distinguish between non-erosive and erosive interrill rainfall events. The rainfall events with a total depth Pe>13 mm were identified as interrill erosive events. This value is very similar to the 12.7 mm selected by Whischmeier and Smith (1978) that propose a compound criterium (Pe>12.7 mm or I15>6.35 mm in 15 minutes). In our case the compound criterium does not guarantee an improvement in the effectiveness of the single threshold.
At Sparacia the threshold I15>8.75 mm in 15 min is the most effective, among those analyzed, to select erosive rill events from all erosive events.