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Testing a new and realistic approach to assess eroded channel geometry

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In studies of concentrated flow erosion (rills and gullies), morphologic characterization of erosion channels is essential to both quantify soil losses and to study their dynamic. The most used way to characterize these channels is by measuring their width and depth. To do that, it is frequently assumed that the channel cross section –most of the time (very) irregular– has however a certain geometric forms (e.g., rectangular, triangular). In addition, knowing channel length, rough estimates of channel volume (eroded material) can also be made.

The main problem to characterize channel geometry in this way is to accurate measure the width and depth of the channel. It is because, usually, when a rill or gully profile is obtained, the landscape topography before erosion is unknown and then width and depth are roughly estimated only from the elevation profile of the channel. In doing so, the width is normally defined from an imaginary line whose ends are located in two abrupt changes of slope at both ends of the cross section of the channel. But these two points are not always easy to recognize. Regarding channel depth, it is defined as the vertical distance from the cross section lowest point to the aforementioned upper imaginary line. However, in cross section with irregular bed, it is questionable to consider the minimum elevation point as a representative of the whole channel cross section.

The only realistic and objective way to define the eroded channel geometry is by superimposing, in any place along the channel, the elevation profiles before and after erosion. Then, the channel width is defined by the two intersection points of the profiles. While the cross section area is defined by the area between both profiles. A 3D channel's characterization can be obtained by repeating this operation in many points along the channel. However, as already stated, topographical information before erosion is rarely available.

In this work a detailed characterization of the geometry of small eroded channels (rills) is done from digital elevation models (DEM), before and after erosion. These rills were obtained in the field from different combinations of slope and discharge. Channel geometry (i.e. width and depth) were then defined (see above). Moreover, these parameters were determined again but only considering the DEM after erosion. This last assessment was carried out by different researchers working independently. The first results from a multitude of cross sections are presented herein.