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Terrestrial photography as method to identify sediment sources in eroding rills

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One weak point in available studies on erosion processes in eroding rills is the lack of information about the real source of transported sediment. So far, such sources can only be identified by observation during the event or the experiment. Quantification is not possible by this way, additionally only large and clear visible changes are considered.
In this study we present a method to quantify even small topographical changes in eroding rills during experiments or real rainfall events.
We tested the suitability of DEMs created from terrestrial stereo photographies before and after application of artificial runoff to quantify eroded, transported and sedimented material in the rill. In 1 m intervals, pairs of photos are taken along the tested rills. The setup ensures that both cameras are moved with a constant parallax. The height of only about 1 m above ground level ensures that even low quantities of moved material can be identified. Based on technical data of the camera and the shot level, the theoretical accuracy of the images is below 1 mm horizontal ground resolution.
The camera carrier bases on a rotating tower crane which has been developed from a customary survey tripod.
The stereo images are combined with free-hand photographies from different angles of view to reach overhangs in rill sidewalls and ensure a fully 3D representation of the rill.
In the analyses of the photographies 2 different kinds of software are used: The standard software Leica Photogrammetry Suite requires stereo images and ground control points whereas the open source software package is able to handle either stereo images as well as free-hand photographies. Ground control points are not needed, the software identifies point clusters which are to find in overlapping images. Using these feature-points, spatial marks are positioned which are used to match and rectify the single images to get an apposite panorama. By this way images from very different angles of view can be combined.
The overall image can be converted to a point cloud with x-, y- and z-coordinates. Based on these point clouds difference images are used to calculate the transported and eroded volume.
We present (1) the experimental method, (2) analyses of the real accuracy, (3) the results of first field tests in Germany and Spain and (4) evaluate existing technical and methodical problems and the proposed approaches for solving.
The method shows to be promising as an economic alternative to the much more expensive laser scanning.