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Geomorphic changes of a scarp on a slope gully by applying 3D photo-reconstruction technique (Duratón river valley, central Spain).

Lourdes Rodríguez and Luis M. Tanarro
Universidad Complutense de Madrid, Spain (lrmoreno@ucm.es)

Recent advances in the field of photogrammetry and the computer vision has allowed the improvement of the art 3D Photo-Reconstruction (FR-3D). This technique, which uses Structure from Motion (SfM) and Multi-View Stereo (MVS) reconstruction algorithms, allows us to obtain three-dimensional models of the terrain of high resolution. Its application in the field of Earth Sciences is recent (Westoby et al., 2012, James and Robson, 2012), and has been applied mainly to evaluate the activity of different morphodynamic environments (coastal cliffs, gully erosion, etc.).

In this work the FR-3D technique is applied to analyze the geomorphological dynamics of a scarp modelled on the valley-side gully of the right side of the Duraton river (41º 16'N, 3º39'W, 988 m, central Spain). The scarp has a length of about 50 m and a height in the central part of 10 m and the lithology is constituted by red clays with levels of conglomerates of Miocene age. Photographs along the scarp have been taken with a compact digital camera (Canon PowerShot S95, 10 MP) in two different time periods (2014/08/27 and 2016/02/06), and have been processed using Bentley ContextCapture software, generating the respective 3D meshes and from these, directly the Digital Surface Models (DSM) for each date. Finally, DSMs have been compared, obtaining the difference in surface elevations. Previously, at the base of the scarp were placed three wood-stakes, whose coordinates were obtained by GPS, and have been used as control points for georreferencing the models.

The DMS obtained have a high resolution (the default cell size of each model are 0.0039 m and 0.0063 m respectively). Volumetric change from elevation differences for the entire time interval (529 days) shows a predominance of sedimentation against erosion (426.79 m3 versus 65.61 m3).

In conclusion, FR-3D technique provides high resolution Digital Surface Models, allowing to detect changes in the surface at a high level of detail (cm or even mm). However, the uncertainty due to the difficulty in identifying the control points accurately must be taken into account in the interpretation of the results. This is fundamental for the detection of surface changes at centimetric scale and for a short time interval.

James, M.R. y Robson, S. (2012) "Straightforward reconstruction of 3D surfaces and topography with a camera: Accuracy and geoscience application", Journal of Geophysical Research, 117: F03017.

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