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Testing a Terrestrial Laser Scanner for studying badlands forms and erosion rates. Vallcebre (Catalan Pre-Pyrenees)

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The aim of this study was to assess the in situ operational resolution of a Terrestrial Laser Scanner (Riegl VZ-400 near infrared laser wavelength) in order to evaluate the potential error associated to the characterisation of minor landforms and the detection of topographic changes as for erosion measurements. The scanned area is an active badlands slope of approximately 1200m2 with an average denudation rate of about 8 mm per year near Vallcebre (Catalan Pre-Pyrenees), where seven permanent control points were installed in the ground. Three successive scans were performed from every one of three viewing points on the same day in June 2011. The Terrestrial Laser Scanner instrument was repositioned in every one of the viewing points, as simulating a fully new scanning exercise. A fourth scan was finally performed in September 2011.

The results showed that the scans are adequate to analyse badland topography, including detailed features in the area such as small rills and centimetric hillslope irregularities, but some artefacts appear when the data are forced to visualise minor features in hillslopes. The analysis of the errors when raster grids were built from point clouds showed that initially it is possible to measure changes of a few millimetres on hillslopes but the resolution decreased in minor forms such as rills. When scans made from repositioned viewing points were analysed, the operational resolution somewhat worsened, showing the need for the improved performance of the permanent control points. These preliminary results show that this equipment is of great value to perform qualitative and morphometric analyses of badland major and minor features as well as to monitor qualitative features such as the appearance/disappearance of rills and the occurrence of mass movements, but the operational resolution for erosion measurements means that monitoring exercises must be made along several years' periods.