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Comparing the accuracy of several field methods for measuring gully erosion

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Most field erosion studies in agricultural areas provide little information on the probable errors associated. The aim of this paper is to evaluate the accuracy of different methods (LiDAR, photo-reconstruction, total station, laser profilemeter and pole) estimating gully erosion at a reach scale and the expected errors when 2D methods are used at gully scale. Field measurements of a reach 7.1 m long and nine gullies (100s m) were carried out near Cordoba, Spain. At the reach scale, the cross sectional area E^A and reach volume E^V errors were calculated. Sinuosity and measurement distance (D)influence on gully length error (E^L) was investigated. Multiple configurations of gully cross sectional area were simulated to assess volume error variability (σ_{Ev}) as a function of measurement distance factor (*MDF*) and to obtain a E^V confidence interval for a given probability.

3D photo-reconstruction and total station produced E^A values lower than 4%, whereas the remainder of the 2D methods, greater than 10%. For volume estimation, 3D methods deliver similar values, but 2D methods generated large negative E^V values (<-13% for laser profilemeter and pole). E^V confidence intervals are negatively biased but converge as gully length increases. The *MDF* decreases with increasing gully length and sinuosity, remaining in the proximity of 2.5% for$\left|E^V\right| < 10\%$ and 95% probability. We demonstrate that the observed results are in line with the proposed error expressions. This study provides information on probable errors in field gully measurements and the survey effort required to achieve a specified accuracy.