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Factors controlling volume errors through 2D gully erosion assessment: guidelines for optimal survey design

Carlos Castillo and Rafael Pérez
University of Córdoba, Department of Rural Engineering, Córdoba, Spain

The assessment of gully erosion volumes is essential for the quantification of soil losses derived from this relevant degradation process. Traditionally, 2D and 3D approaches has been applied for this purpose (Casalí et al., 2006). Although innovative 3D approaches have recently been proposed for gully volume quantification, a renewed interest can be found in literature regarding the useful information that cross-section analysis still provides in gully erosion research. Moreover, the application of methods based on 2D approaches can be the most cost-effective approach in many situations such as preliminary studies with low accuracy requirements or surveys under time or budget constraints.
The main aim of this work is to examine the key factors controlling volume error variability in 2D gully assessment by means of a stochastic experiment involving a Monte Carlo analysis over synthetic gully profiles in order to 1) contribute to a better understanding of the drivers and magnitude of gully erosion 2D-surveys uncertainty and 2) provide guidelines for optimal survey designs.
Owing to the stochastic properties of error generation in 2D volume assessment, a statistical approach was followed to generate a large and significant set of gully reach configurations to evaluate quantitatively the influence of the main factors controlling the uncertainty of the volume assessment. For this purpose, a simulation algorithm in Matlab® code was written, involving the following stages:
- Generation of synthetic gully area profiles with different degrees of complexity (characterized by the cross-section variability)
- Simulation of field measurements characterised by a survey intensity and the precision of the measurement method
- Quantification of the volume error uncertainty as a function of the key factors

In this communication we will present the relationships between volume error and the studied factors and propose guidelines for 2D field surveys based on the minimal survey densities required to achieve a certain accuracy given the cross-sectional variability of a gully and the measurement method applied.

References

Casali, J., Loizu, J., Campo, M.A., De Santisteban, L.M., Alvarez-Mozos, J., 2006. Accuracy of methods for field assessment of rill and ephemeral gully erosion. Catena 67, 128–138. doi:10.1016/j.catena.2006.03.005