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Abstract

Use of Air-Based Photogrammetry for Soil Erosion Assessment †

Marx L. N. Silva [1,*], Bernardo M. Cândido [2], John N. Quinton [3] and Michael R. James [3]

[1] Department of Soil Science, Federal University of Lavras, Lavras 37200000, Brazil
[2] Agronomic Institute of Campinas, Soil Centre and Environmental Resources, Campinas 13145056, Brazil; b.moreiracandido@lancaster.ac.uk
[3] Lancaster University, Lancaster Environment Centre, Lancaster LA1 4YQ, UK; j.quinton@lancaster.ac.uk (J.N.Q.); m.james@lancaster.ac.uk (M.R.J.)
* Correspondence: marx@ufla.br
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Abstract: Water erosion affects all types of soils around the world at different intensities. However, in the tropics, water-based processes are the most important of the erosion processes and have received much attention in the last decades. Understanding and quantifying the processes involved in each type of water erosion (sheet, rill and gully erosion) is key to developing and managing soil conservation and erosion mitigation strategies. This study aims to investigate the efficiency of unmanned aerial vehicle (UAV) structure-from-motion (SfM) photogrammetry for soil erosion assessment, as well as to address some gaps in our understanding of the evolution of erosive processes. For the first time, we used a UAV-SfM technique to evaluate the relative contribution of different types of erosion (sheet, rill and gully sidewall) in gully development. This was possible due to the millimetric level of precision of the point clouds produced, which allowed us to evaluate the contribution of laminar erosion as a new component to gullies studies. As a result, it was possible to quantify sediment volumes stored in the channels and lost from the gully system, as well as to determine the main sediment sources. The UAV-SfM proved to be effective for detailed gully monitoring, with the results suggesting that the main source of sediments in the gully was mass movement, followed by rills and sheet erosion. Our findings support the use of UAV-based photogrammetry as a sufficiently precise tool for detecting soil surface change, which can be used to assess water erosion in its various forms. In addition, UAV-SfM has proven to be a very useful technique for monitoring soil erosion over time, especially in hard-to-reach areas.

Keywords: structure-from-motion (SfM); unmanned aerial vehicle (UAV); digital close-range photogrammetry; sheet erosion; rill erosion; gully erosion

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