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Detecting erosion induced geomorphic change in small- to medium-sized agricultural catchments (Fugnitz, Austria; Nitra, Slovakia) using Terrestrial Laserscanning (TLS) and Structure from Motion (SfM) techniques

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In the last decades, increased agricultural activities and land use changes dramatically enhanced the rates of soil erosion, often resulting in substantial geomorphic surface change. To quantify soil erosion at the catchment scale, DEM of difference are often created with multi-temporal airborne LiDAR data in order to reveal erosion-induced surface changes. Nevertheless, this method is only reliable for change detection covering areas with a greater extent, as the resolution of LiDAR data is too low to provide detailed information about surface change at larger spatial scales. To better understand and visualize microtopographic soil erosion processes, high resolution DEM are crucial, which can be generated with two promising techniques: Terrestrial Laser Scanning (TLS) and Structure from Motion (SfM). However, these methods are rarely applied in soil erosion studies.

The generation of high resolution DEM is done along two gullies with an extent of approx. 15m to 30m in the Fugnitz (Lower Austria) and Bocegaj catchments (Slovakia). Both study sites are surveyed twice using unmanned aerial vehicles (UAVs) and a TLS-Scanner (Riegl VZ-6000) in order to create a multi-temporal dataset. The data are processed using the SfM software Agisoft Photoscan and the TLS software Riscan PRO. Point clouds of both datasets are analyzed with Cloud Compare to adapt the final high resolution DEM of each technique, allowing the generation of a DEM of difference (DoD), in order to approve the quantification of the erosion induced surface change.

Our first findings suggest that UAV are quite useful low-cost alternatives to create high resolution surface models, requiring much less time for data acquisition in the field. Furthermore, this method is very flexible and the device has a beneficial perspective, easily preventing blind spots. Nevertheless, post-processing of the taken images to generate suitable 3D-data requires a high computation demand. In contrast, TLS as a more expensive technology provides 3D information directly and especially when applied at larger scales, the systematic error is quite low. However, unlike the UAV, Laser Scanners mostly have an almost horizontal scanning view, resulting in an unfavorable data noise.