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Long term monitoring of geomorphological changes caused by torrent activity using terrestrial laser scanning

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Torrential processes present a serious hazard in alpine regions. Especially sediment transport is responsible for most torrent related damages. The material incorporated in torrents is inherently complex, varying from clay sized solids to boulders of several meters of diameter.
For geoscientists it is important to predict possible triggering zones and deposition areas or run out lengths. Run out analysis is an especially important component for hazard assessment in alpine watersheds, which includes prediction of potential hazard areas and mapping the distribution of hazard intensity parameters such as the thickness of the deposit.
In this study terrestrial laser scanning has been applied to investigate the spatial distribution of erosion and deposition of bed load material over a 4000 m long reach of a torrent. Within the monitoring period a new open check dam was built at the study site after removing the old one. Due to the open construction it was expected, that during flood events sediment is stored behind the check dam, but during smaller flood events the deposition area should be self-emptied again. The measurements were carried out to investigate if the new check dam functioned as expected. Therefore the reach has been scanned 6 times during the last 3 years. Several monitoring activities before and after torrent events required global data registration using differential GPS. Tachymetry connected areas with missing GPS reception to GPS measured ones. Terrestrial laser scanning provided dense 3d-data. The RIEGL LMS-Z420i was chosen due to its long range, high accuracy and high scanning speed of the measurements. The accuracy of the measurement was in a range of 8 cm.
The objectives of the TLS survey of the torrent deposit were to determine the volume of the deposited mass as well as to detect zones of erosion and deposition of material by the creation of high resolution DEM's.
The results of the measurements taken at the test site in Carinthia, Austria are presented and the geomorphologic changes of the channel bed caused by the new check dam are discussed.