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Effect of the acquisition geometry of Airborne and Terrestrial Laser Scanning on high-resolution outlining of microtopographic landforms

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In the past 15 years, Airborne Laser Scanning (ALS) has become a core technology for the acquisition of 3D topographic data. In small areas, especially in open terrain, terrestrial laser scanning (TLS) has proven to be capable to deliver results comparable to ALS in both resolution and accuracy.

Despite of the similar operating principle, the acquisition geometries of ALS and TLS are significantly different. This is due to the fact that ALS is always dynamic (each point is recorded from a different position) whereas TLS is mostly static, i.e. the sensor is mounted on a tripod and remains at a fixed place during the scan. This difference results in e.g. a higher variation of incidence angles in TLS than in the case of ALS and a higher dynamic range of TLS caused by the higher variation of he targets' distances. Moreover, in the case of ALS the laser beam hits the terrain almost perpendicularly. In contrast to this, in TLS the direction of the laser beam might be nearly parallel to the ground or not even hitting it. Furthermore, vegetation –in the sense of an "obstacle" between the scanner's position and the terrain– plays a different role in ALS and TLS, respectively.

In this study, the effects of the aforementioned points on the results of ALS and TLS regarding topographic and geomorphological purposes are analysed. We focus on the derivation of digital terrain models (DTMs) as well as on filtering and classification of point clouds.

Empirical evaluation is carried out by means of the data recorded at the Doren landslide (Vorarlberg, Western Austria). For this area, multitemporal data sets of both ALS (March and December 2007) and TLS (September 2008 and August 2009) are available.

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