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New potentials of laser scanning in landslide hazard assessments

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The increasing availability of airborne (ALS) and terrestrial (TLS) laser scanning data in geomorphological studies has started to lead to a "revolution in geomorphology". Laser scanning data offers new details not only on vegetation surface but also on earth surface and subsequently provides new insights into geomorphological forms and respective past and present processes which created these forms. Within this study, mainly the potential of ALS in regional landslide hazard assessments is addressed.
The starting point for each regional landslide hazard assessment should be an excellent landslide inventory, which often is not available at the beginning of such an assessment. Usually, landslide inventories were set up by e.g. field mapping, digitizing of landslide information from geological or geomorphological maps or interpretation of aerial photos. High resolution digital terrain models (DTM) derived from ALS provide new and excellent data sources for more efficiently mapping landslides. Very accurate landslide inventories can be mapped regarding especially the location and completeness of landslides by analysing ALS DTM's. However, there are quite some limitations involved, since past landslides might be invisible in the DTM due to natural erosion or human impact. Other landslides might be too young to be captured in the DTM. New challenges arise if the study area gets too large. Quite often, resources on time and manpower are limited so that not all landslides can be mapped. Thus, new strategies for efficient landslide mapping and preparation of sufficient complete inventories must be developed beside activities to automate landslide mapping from DTM's.
Since landslide structures are modified over time, relative age might be estimated from the freshness of the structures itself. However, these are strongly dependent on the type of land use. Whereas they are preserved under forest, they change more rapidly e.g. in agricultural areas. The challenge is, if the age of the landslides can be roughly estimated based on freshness of the structures and the land use. If possible, general ideas of landslide activity in respective regions can be checked and revised if necessary. Multi-temporal DTM's might be very helpful in this respect, but are very rarely available at present. Furthermore, such return periods might be calculated for a larger region if complete landslide inventories are mapped for a sub-region and a maximum age of the landslides is assumed.
Regarding landslide susceptibility modelling quite often important information is not spatially available, e.g. the location of important natural or artificial structures (terraces, road cuts, etc.). The challenge is in which form such information can be extracted from ALS DTM's to improve subsequently the landslide susceptibility models.
Potentials and limitations of these aspects are discussed and examples are given.