Geophysical Research Abstracts
Vol. 20, EGU2018-12248, 2018
EGU General Assembly 2018

Semi-automated rock mass characterization from scanline and terrestrial LIDAR data in the Ötztal-Stubai crystalline complex (Kühtai, Austria)

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Survey techniques such as scanline sampling and terrestrial laserscanning (TLS) allow detailed and objective evaluations of various rock mass characteristics such as the joint orientations, joint sizes or joint spacings. Point clouds from remote sensing also provide the possibility of area-wide analyses of geological and geometrical data in the entire area of interest. Consequently, the outcomes of these data usually can be more quantitative and qualitative than conventional geological / geotechnical punctual outcrop descriptions. Nevertheless, the analysis of the raw data of scanlines and point clouds can be very time consuming. Therefore, new tools were developed which allow fast but detailed analyses.

This work presents the analysis of scanline and TLS data of two rock slopes at the opposing sites of an Alpine valley (Kühtai, Austria) by semi-automated methods facilitating the data processing. Scanline data were used to investigate differences between the two rock slopes. A MATLAB tool was developed and applied to determine various rock mass characteristics such as the joint surface conditions and the GSI from this data. TLS point clouds were used to investigate spatial heterogeneities which could not be identified by the scanlines. The software tool LIS Pro 3D (an extension for SAGA-GIS) was developed and applied to derive parameters such as normal joint set spacings, to estimate in-situ block size distributions and to create maps highlighting area-wide heterogeneities in the fracturing properties.

The investigated non-persistent and dominantly slightly alterated joints in the granodioritic gneisses show only minor spatial variations in the orientations of the joint sets, but spatial variations in the normal joint set spacing and in-situ block sizes do occur. The results obtained from the point cloud data are generally in a good agreement with those of the scanline data. Further, visualisation of small-scale spatial variations of rock mass characteristics derived from point clouds can be beneficial for, e.g., rockfall analyses or the planning of quarry mining.