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Geometrical properties of a discontinuity network in gneissic rock, a case study in high alpine terrain

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For the purposes of estimating slope stability and investigating landslide formation processes, it is indispensable to obtain information about the discontinuity properties of the rock mass. These properties control failure processes, deformation behaviour and groundwater flow. Scanline measurements represent a systematic surveying method, however they make certain demands in case of natural outcorps in a high alpine terrain. The performance of the scanline method is tested and the thereby obtained and evaluated data is compared to findings from other studies.

An area of a well exposed, fractured rock mass composed of granodioritic gneisses in the Oetztal-Stubai crytalline basement of the Alps (Austria) has been chosen to perform the investigations. Eight scanlines have been measured on a single hillside with varying lengths between 8 and 30 meters. The orientations of the scanlines have been varied in order to minimize the sampling bias associated with the angle between the scanlines and the intersected discontinuities. For every intersecting discontinuity at a certain tape length, the orientation, the trace length and the terminations of the trace have been recorded.

Primarily, the discontinuity data from all scanlines have been analyzed with the software package Dips (Rocscience, 1989) in order to determine their allocation in sets. For the evaluation of the spacing and trace length properties, two scripts have been developed in the language Matlab (The MathWorks, 1984) to faciliate setwise processing of the entire dataset.

Variation of the scanline directions and lengths returned homogeneous sample sizes for the individual discontinuity sets. Both, normal spacings and trace lengths show negative exponential distributions for all sets. A comparison of four different methods to estimate trace lengths show that the result is highly dependent on the chosen method itself. However, when the relation of the results for the respective sets within one of the methods is considered, the consistency is obvious.

Scanline measurements and analyses provide siginificant results for discontinuity properties under the described circumstances. Considering sampling biases, the obtained dataset is even benefiting from the randomized sampling process, due to the natural terrain. The scanline survey provides a statistical database which can be used for rock mass characterization. Geometrical rock mass characterization is essential to model the in-situ block size distribution, to estimate the degree of fracturing and rock mass anisotropy for quarry oder tunnelling projects or define the mechanical rock mass properties based on classifications systems. The study should contribute a reference for the development and application of other methods for investigating discontinuity properties in instable rock masses.