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# Discontinuity characterisation in metamorphic rock based on scanline and photogrammetric methods

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The Ötztal-Stubai crystalline basement (Tyrol, Austria) is characterised by several ductile and brittle deformation phases. Concerning slope stability, landslide formation as well as engineering projects e.g. dam and tunnel construction brittle deformation phases forming brittle fault zones and fractures are highly relevant. These are the structures, which control failure processes, deformation behaviour and groundwater flow in fractured rock masses.

A high alpine area of about two square kilometres in size, and located mostly in fractured granodioritic rock was selected to study the discontinuity pattern of faults and joints. Within this area, brittle fault zones are mapped by field survey and analyses of remote sensing data i.e. aerial views and high resolution digital elevation models based on airborne laser scanning. Concerning the joint pattern, sampling points for investigating the geometrical properties are distributed evenly over the area covered with granodioritic gneiss. Whereas most of the collected data is gathered through conventional scanline mapping, at some selected outcrops photogrammetric mapping methods (window mapping) are applied.

Among the recorded and analysed parameters of the discontinuities are: orientation, number of joint sets, spacing, frequency, trace length, size, termination, roughness and waviness, block size and GSI. A systematic pattern of recurring discontinuity sets can be observed in the outcrops throughout the whole investigation area. Thus, spatial uniformity is assumed for the whole granodioritic gneiss lithology. Based on this the orientation of the discontinuities and their respective estimated sets are compared between scanline and photogrammetric measurements. For certain representative joint sets, calculated spacing data (mean and probability distribution) as well as joint trace lengths are compared between the scanline surveys and computed parameters from the photogrammetric models. This will help to understand the sampling bias which results from the applied method. For example, the photogrammetric method neglects fractures and therefore overestimate the spacing and the trace lengths. Derived from the orientation, spacing and length distributions, block sizes and GSI values can be estimated for the respective data acquired with the two sampling methods.

The comparison of the two methods in sampling and analysing with regard to these parameters should lead to a better understanding of where remote sensing method can be useful for investigating fractured rock masses as opposed to outcrop sampling by scanlines. Discontinuity data concerning jointing and faulting of rock masses are crucial for the application of rock mass classification systems, strength and deformability estimations of a rock mass, slope design, and numerical modelling focussing on geomechanical and hydraulic studies e.g. underground cavities, dams, slope stability and landslide hazards.