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Quantitative characterization of fracture networks on Digital Outcrop Models obtained from avionic and terrestrial laser scanner

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We present a semi-automatic workflow aimed at extracting quantitative structural data from point clouds obtained with avionic and terrestrial laser scanners (Lidar and TLS). The workflow is characterized by a calibration phase followed by an automatic data-collection phase. The large datasets of “fractures” mapped in this way are analysed with statistical methods allowing to define representative parameters of the fracture network.

In the first phase, the intervention of an expert interpreter with structural geology skills is fundamental to evaluate which features can be interpreted as fractures in the point clouds. In the second phase, an automatic segmentation and classification is performed, based on phase 1 calibration, that allows extracting very large fracture datasets. The main steps in phase 1 are: manual segmentation of facets representing fracture surfaces, orientation analysis and definition of fracture sets (possibly supported by kinematic analysis), definition of orientation parameters to be used for automatic segmentation. Phase 2 analysis proceeds with the automatic segmentation of subset point clouds that include just one fracture set. In these point clouds, facets representing fractures lying on different planes are well separated and disconnected, and this allows applying automatic vectorization techniques that extract individual facets representing single fractures on the outcrop surface. The datasets issued from this processing are analysed with automatic algorithms allowing to define fracture spacing and orientation statistics with a very large support, that would not have been allowed by other methodologies.