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# Compass: A CloudCompare workflow for digital mapping and structural analysis

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UAV-based photogrammetric and LiDAR techniques provide high-resolution 3D point clouds and orthorectified photomontages that capture surface geology in outstanding detail over wide areas. Many studies now use UAV-based and LiDAR methods to collect primary field information but the digital mapping workflow required to efficiently extract geological measurements remains ad hoc. We provide a workflow for performing such digital mapping in CloudCompare, an open-source environment for manipulating point-cloud datasets, using the Compass plugin. This plugin allows interactive orientation and spacing/thickness measurements, as well as the digitization of features such as contacts, fractures, faults and intrusions.

Orientation measurements are currently computed using standard plane-fitting techniques. However, these methods lead to inaccurate results when; (1) used to estimate the orientation of structures intersecting largely flat topography, and (2) applied to structures with multiple segments (stepping fractures, zigzag dykes etc.). Here we present an alternative technique that characterises the uncertainty associated with individual orientation measurements and can estimate the structure-normal at each data point along its outcropping trace. The measurements and digitized-features are easily exported to .csv and .xml formats for further analysis outside of CloudCompare.

These developments provide a workflow, freely available to the geoscience community, for 3D digital outcrop mapping and structural analysis. The approach increases the efficiency, objectivity and reproducibility of structural data collection and allows for better characterisation of associated uncertainty.