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Searching palaeoearthquakes in fault bedrock scarps based on reflectivity, erosion features and surface ruptures with terrestrial laser scanning

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The terrestrial laser scanner (TLS) has been used for the investigation of escarpments (bedrock fault scarps) at different sites in Greece in order to identify the palaeo-slip events and rates. Our approach is based on differential weathering, karstification and bioerosion of the subsequentially exposed limestone free face from repeated earthquake surface faulting events. Data acquisition with the TLS method and the high-resolution spatial surface analysis can help to improve data quality and to provide a more accurate prediction for a plane analysis of the fault bedrock scarps. Scientific objectives are the analysis of rock surface roughness in different scales, orientations and methods, which may help us to determine the relative age of slip. Furthermore, the intensity of the backscattered reflection of the scarp surface can offer us the possibility to identify different weathering stages semi-automatically. The degradation and erosion features of the fault plane can help to reconstruct the plane geomorphology. We applied the LiDAR at limestone fault scarps with clear free faces that have experienced large surface faulting events in the past, such as the Kaparelli Fault or the Sparta Fault in mainland Greece. Some of these scarps have been dated with cosmogenic isotopes. The results of the cosmogenic nuclide dating on scarps give an absolute age of the individual palaeoseismological slip events. This ensures the cross validation of the TLS data. Additionally, geodetic measurements with compass and GPS were carried out to cross-validate the quality of the TLS point cloud data and to georeference.