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Geomechanical characterization of rock masses by means of remote sensing techniques

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Improving the methods for the characterization of rock masses by integrating traditional field surveys with remote sensing techniques is fundamental for practical and realistic discontinuous modelling, in order to identify the failures and kinematics, develop landslide susceptibility assessment and plan prevention and mitigation measures.

A 20 m-high cliff at Polignano a Mare (Southern Italy) was selected as case study for the presence of well-developed discontinuities (bedding and joints) and due to the local morphology, consisting of a valley with opposite slopes at a distance of 150 m, and a pocket beach at their toe. This configuration allowed to perform both traditional and remote sensing surveys. First, photogrammetry methods were carried out on the ground and with the help of a boat. Structure from Motion (SfM) technique was then used to process and combine the pictures, in order to elaborate a raw point cloud of the case study. Secondly, high resolution Terrestrial Laser Scanning (TLS) and Unmanned Aerial Vehicle (UAV) techniques were conducted after positioning Ground Control Points (GCPs) all over the rock mass, with the aim of obtaining a more detailed point cloud. Eventually, a unique and optimized georeferenced point cloud was obtained by combining the previous models, also removing the non-geological objects. Furthermore, Infrared Thermography (IT) was carried out in order to investigate the fracture pattern, the areas of concentrated stress, and the presence of humidity and voids.

The structural analysis of the rock mass was performed directly on the point cloud, by testing procedures and algorithms for the automatic identification of discontinuity sets and of their orientation, spacing, persistence and roughness.

The next step of this research will concern the evaluation of the instability mechanisms with the help of kinematic analyses, by means of stereographic projections. Finally, the reliability of the procedure for a complete rock mass characterization, which is expected to be obtained as the final result, will be tested by means of numerical stability solutions, after calibrating the geomechanical model and importing the fracture system in an appropriate software.

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