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Implementation of InfraRed Thermographic surveys in complex coastal areas: the case study of Polignano a Mare (southern Italy)

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InfraRed Thermography (IRT) spread quickly during the second half of the 20th century in the military, industrial and medical fields. This technique is at present widely used in the building sector to detect structural defects and energy losses. Being a non-destructive diagnostic technique, IRT was also introduced in the Earth Sciences, especially in the volcanology and environmental fields, yet its application for geostructural surveys is of recent development. Indeed, the acquisition of thermal images on rock masses could be an efficient tool for identifying fractures and voids, thus detecting signs of potential failures.
Further tests of thermal cameras on rock masses could help to evaluate the applicability, advantages and limits of the IRT technology for characterizing rock masses in different geological settings.
We present some results of IRT surveys carried out in the coastal area of Polignano a Mare (southern Italy), and their correlation with other remote sensing techniques (i.e. *Terrestrial Laser Scanning* and *Structure from Motion*). The case study (*Lama Monachile*) is represented by a 20 m-high cliff made up of Plio-Pleistocene calcarenites overlying Cretaceous limestones. Conjugate fracture systems, karst features, folds and faults, were detected in the rock mass during field surveys. In addition, dense vegetation and anthropogenic elements, which at places modified the natural setting of the rock mass, represent relevant disturbances for the characterization of the rock mass. In this context, IRT surveys were added to the other techniques, aimed at detecting the major discontinuities and fractured zones, based on potential thermal anomalies.
IRT surveys were carried out in December 2020 on the east side of the rock mass at *Lama Monachile* site. Thermal images were acquired every 20 minutes for 24 hours by means of a FLIR T-660 thermal imager mounted on a fixed tripod. Ambient air temperature and relative humidity were measured during the acquisition with a pocketsize thermo-hydrometer. A reflective paper was placed at the base of the cliff to measure the reflected apparent temperature. In addition, three thermocouple sensors were fixed to the different lithologic units of the rock face. These parameters, together with the distance between the FLIR T-660 and the rock face, were used in order to calibrate the thermal imager and correct the apparent temperatures recorded by the device, during the post-processing phase. Successively, vertical profiles showing the temperature of the rock face over time were extracted from the thermograms. Thermal anomalies were correlated with stratigraphic and Geological Strength Index profiles, obtained by means of field

surveys and Structure from Motion techniques. The presence of fracture and voids in the rock mass was also investigated.