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Radiometric enhancements of thermal infrared images for rock slope investigation by coupling with groundbased LiDAR

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Modern infrared thermal (IRT) cameras make easy to acquire images of “apparent” temperature in the field. Usually based on a microbolometer, they actually record the irradiance [W/m2] collected by the sensor in the LWIR band (8-12 micron). This irradiance results from a quite complex mixing of thermal contributors and factors, and its interpretation in terms of temperature is not straightforward. The apparent temperature of a rock surface may differ very significantly from its “real” temperature (properly named “kinetic” temperature). Some of the factors intervening in the measurement depends on the rock cliff geometry (local incidence angle, dip direction and angle, cliff orientation relatively to the sun position, sensor to cliff range).
We propose to use terrestrial LiDAR data to correct IRT images for these geometrical effects. To do it, xyz points from LiDAR data are projected in the focal plane of the IRT camera in order to produce images of geometric properties. These images can then be used to correct the radiometric values of the IRT images based on various empirical relationships.
Preliminary results on a cliff show that a difference of range inside an image may account for up to 1 degree of temperature and local incidence angle up to 2 degrees (for a homogeneous rock surfaces at constant emissivity). The impact of ambient radiative environment (sky, sun, ground, etc) will be assessed in a next step.