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Close-range thermal remote sensing over a cryospheric landform in complex topography – challenges and lessons learnt

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Close-range remote sensing often fills the gap between in situ measurements and space-based observations. While most platforms are equipped with RGB cameras, there is a growing availability of thermal infrared (TIR) cameras. Both Uncrewed Aerial Vehicles (UAV) surveys in general and TIR remote sensing pose their individual challenges, especially in complex topography. In particular, TIR datasets are far from being ready-to-use upon acquisition, and thorough post-processing is required. However, they offer a great potential to monitor cryospheric landforms and assess their surface energy budget and related dynamics.

In this contribution, we present two years of TIR and RGB UAV data in combination with multiple in situ measurements, both for calibration and validation, obtained for a creeping permafrost landform, rock glacier Murtèl in the Engadine, Switzerland. We highlight the challenges evoked by the complex topography in the alpine environment (e.g. irradiance distribution, wind) and shed light on varying correction possibilities (e.g. laboratory-, field-, camera-based) that allow for a more accurate retrieval of land surface temperature over middle-sized landforms, such as a rock glacier.

In light of future thermal infrared satellite missions, an appropriate use of close-range remote sensing techniques, including survey protocols for calibration and validation, is urgently needed. This application study contributes to a better across-scale methodological understanding of sensors and methods, as well as the role of close-range remote sensing in complementing in situ and space-based observations, but also illustrates the potential of TIR datasets for cryospheric process understanding and long-term monitoring.