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Using infrared thermography for understanding and quantifying soil surface processes

João L.M.P. de Lima

MARE - Marine and Environmental Sciences Centre, Coimbra, Portugal; Department of Civil Engineering, Faculty of Science and Technology of the University of Coimbra, Rua Luís Reis Santos, Pólo II – Universidade de Coimbra, 3030-788 Coimbra, Portugal; plima@dec.uc.pt

At present, our understanding of the soil hydrologic response is restricted by measurement limitations. In the literature, there have been repeatedly calls for interdisciplinary approaches to expand our knowledge in this field and eventually overcome the limitations that are inherent to conventional measuring techniques used, for example, for tracing water at the basin, hillslope and even field or plot scales.

Infrared thermography is a versatile, accurate and fast technique of monitoring surface temperature and has been used in a variety of fields, such as military surveillance, medical diagnosis, industrial processes optimisation, building inspections and agriculture. However, many applications are still to be fully explored. In surface hydrology, it has been successfully employed as a high spatial and temporal resolution non-invasive and non-destructive imaging tool to e.g. access groundwater discharges into waterbodies or quantify thermal heterogeneities of streams.

It is believed that thermal infrared imagery can grasp the spatial and temporal variability of many processes at the soil surface. Thermography interprets the heat signals and can provide an attractive view for identifying both areas where water is flowing or has infiltrated more, or accumulated temporarily in depressions or macropores. Therefore, we hope to demonstrate the potential for thermal infrared imagery to indirectly make a quantitative estimation of several hydrologic processes. Applications include: e.g. mapping infiltration, microrelief and macropores; estimating flow velocities; defining sampling strategies; identifying water sources, accumulation of waters or even connectivity. Protocols for the assessment of several hydrologic processes with the help of IR thermography will be briefly explained, presenting some examples from laboratory soil flumes and field.