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ABSTRACT

Field applications of infrared thermography: estimation of hydrological and hydraulic variables

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Data issues are often pointed out as holding back our understanding of natural systems; difficulties are often inherent to measurement approaches. Thus, in surface hydrology, attention is focusing on exploring innovative observational approaches that could eventually overcome the limitations that are inherent to conventional measuring techniques: for example, used for tracing water at the basin, hillslope and even field or plot scales. In particular, at present, different studies are being conducted hoping to demonstrate the potential for thermal infrared imagery to indirectly make a quantitative estimation of several hydrologic processes. These tools use non-invasive and non-destructive technology. Areas of application include e.g. infiltration mapping, macropores identification, estimation of flow velocities, identification of water sources, water retention characterization or even connectivity or monitoring vegetation evapotranspiration. At the local and field scales, the acquired insight could benefit optimizing the use of water in agricultural systems.

This work focuses on the monitoring of an irrigated maize field in the Lower Mondego valley, in Central Portugal, by using infrared thermographic techniques applied at different spatial scales. By correlating the data obtained by detailed field work involving relevant variables and local IR thermography measurements at the local and field scale (for assessing the canopy, leaf and soil, using handheld cameras and UAS) and satellite images, we aim at better understanding bridging between the different scales of observation that could assist in water management sustainability issues and goals. For these purposes, temperature and crop water stress indices are calculated from data at different scales, which can be used to evaluate the water distribution uniformity, as well as to reduce water losses by means of adequate water management practices.