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Field experiments on the application of infrared thermography for better use of water in agriculture

João de Lima (1), José M. Gonçalves (2), and Isabel de Lima (1)

(1) University of Coimbra / MARE, Dep. Civil Engineering, Coimbra, Portugal, (2) Polytechnic of Coimbra, College of Agriculture, Coimbra, Portugal

Data limitations are often pointed out as holding back our understanding of the hydrologic response, which is partly attributed to measurement issues. This problematic affects many areas of application in hydrology and constitute a major motivation to 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.
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 (e.g. map infiltration, macropores, estimate flow velocities, define sampling strategies, identify water sources, accumulation of waters or even connectivity or monitor vegetation evapotranspiration). In particular, we will address the work in progress in project HIRT - Modeling surface hydrologic processes based on infrared thermography at local and field scales, regarding the development of infrared thermography based tools for the analysis of water distribution efficiency in irrigated agricultural fields, aiming at optimizing the use of water in agricultural systems. These tools use non-invasive and non-destructive technology.
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 many 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.