



Growing
ideas
through
networks

HARMONIOUS

uas for environmental monitoring



HARMONIOUS

UAS Techniques for Environmental Monitoring

Isabel de Lima, Valencia, 15.2.2018




Using infrared thermography towards optimizing water use in irrigated agriculture

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At present, studies hope 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,

identify water sources, accumulation of waters, connectivity

monitor vegetation evapotranspiration

....

Infrared Thermography

Technique for the detection and measurement of radiated thermal energy

Provides real-time temperature distributions

Measurements are taken at a distance (without contact) and can record fast changes in temperature

Effective, fast and accurate method of monitoring temperature

Validating thermal techniques for monitoring the soil surface



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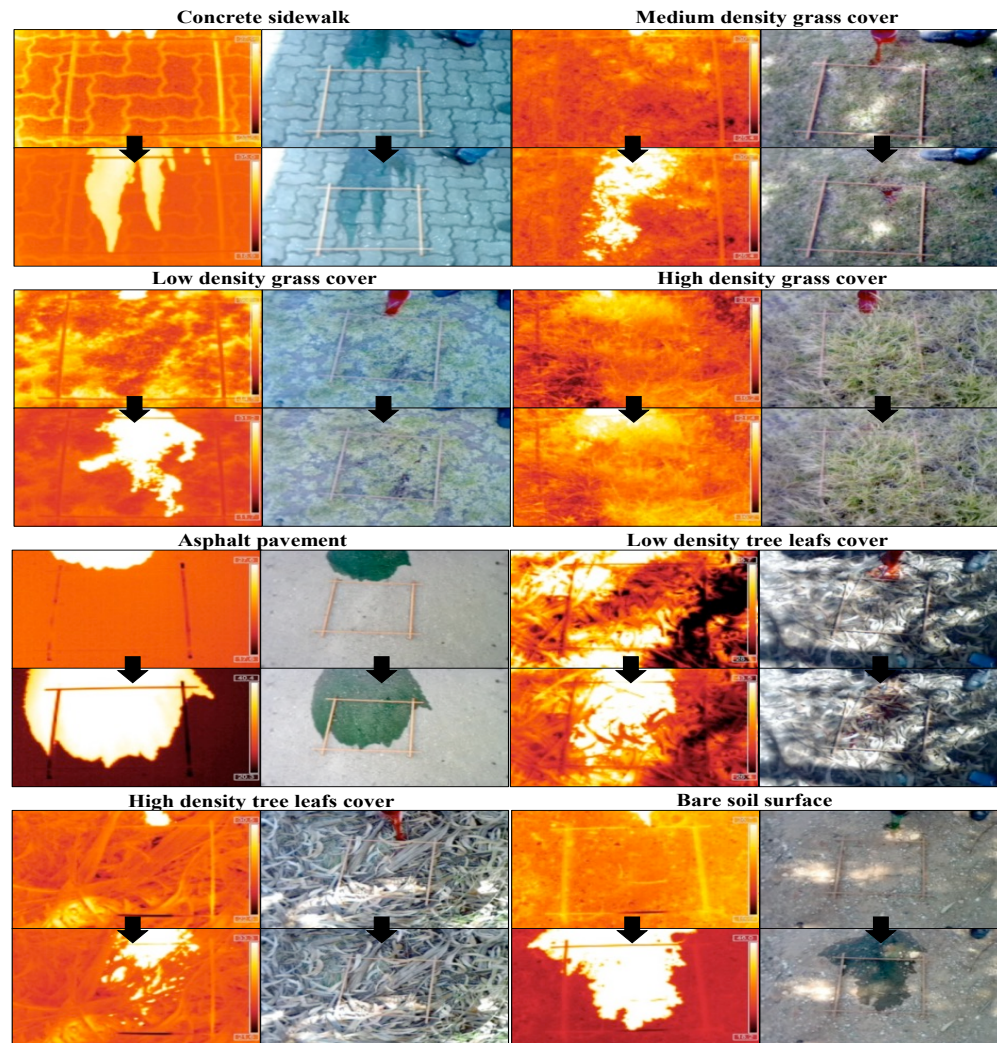


University of Coimbra

Laboratory of Hydraulics, Water Resources and Environment

Research at UC: Estimation of Flow Velocity

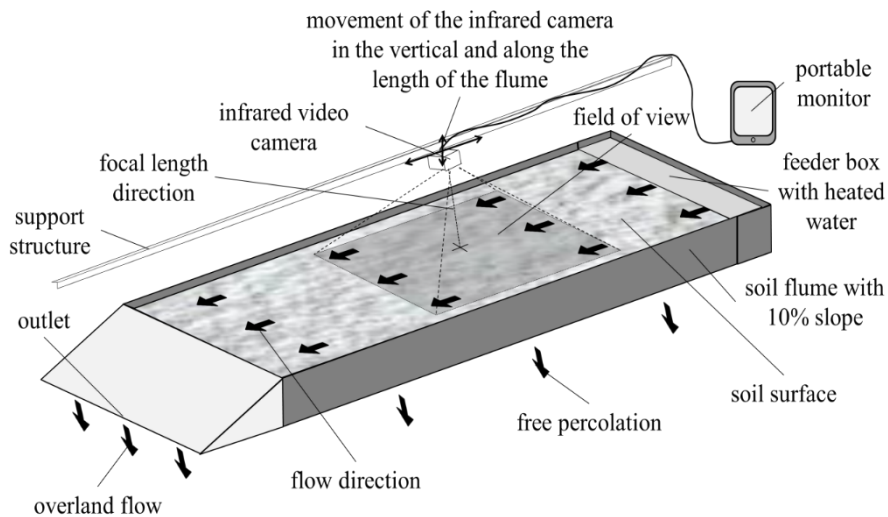
Field experiments (compared with dye tracing)



Research at UC:

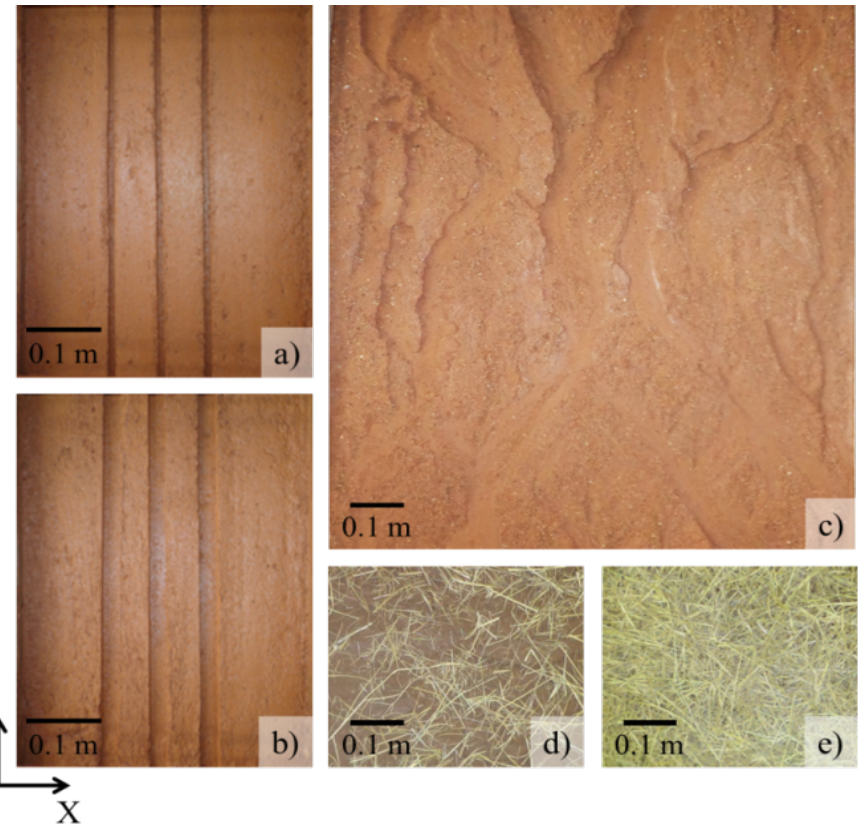
Estimation of soil surface microrelief and rills

Can infrared thermography be used to estimate soil microrelief?



- ✓ Visualize preferential flow paths
 - ✓ Identify microrelief elements
- with/without presence of mulch cover

Different soil surface scenarios tested:



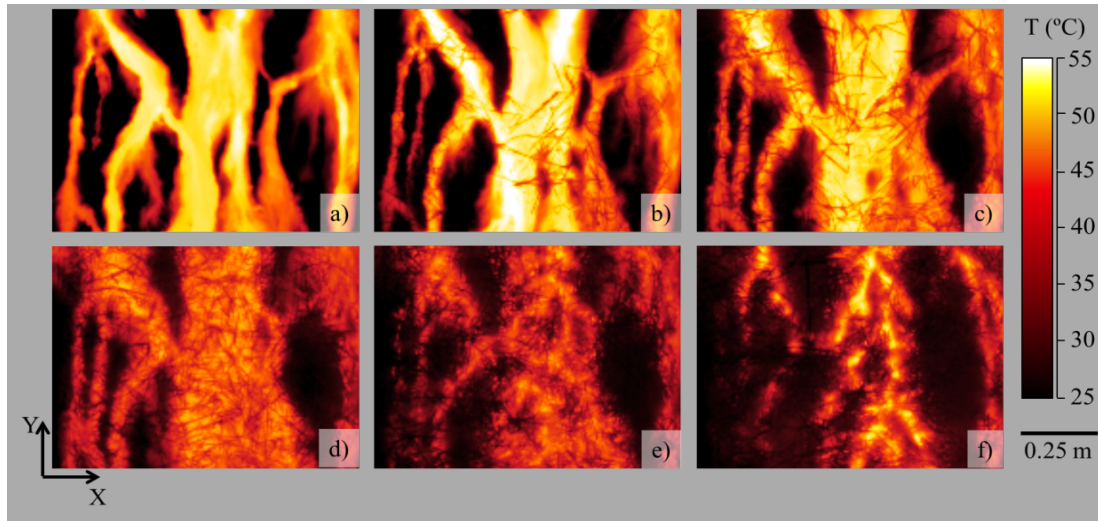
Estimation of a 3D model of the soil surface (from temperature gradient)



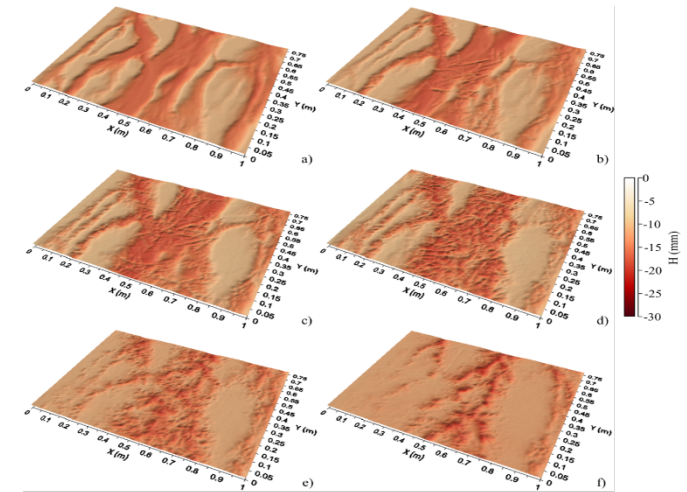
Important input for modelling

Research at UC: Estimation of soil surface microrelief and rills

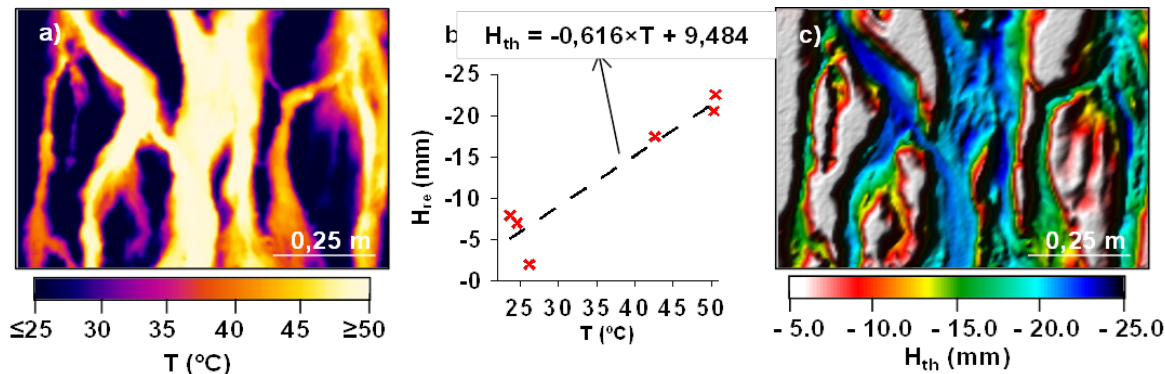
Thermal images with increasing vegetation/mulch



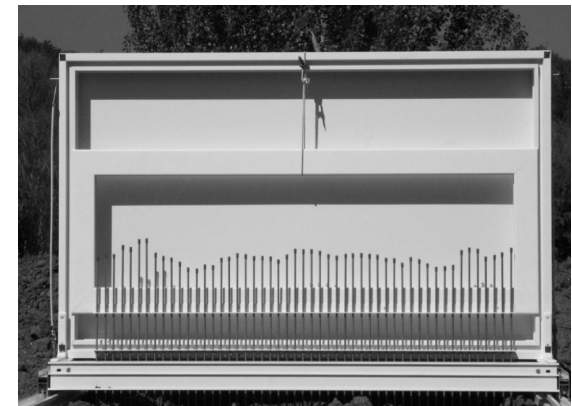
3D Model from thermograms



2 Points calibration (temperature - measure)

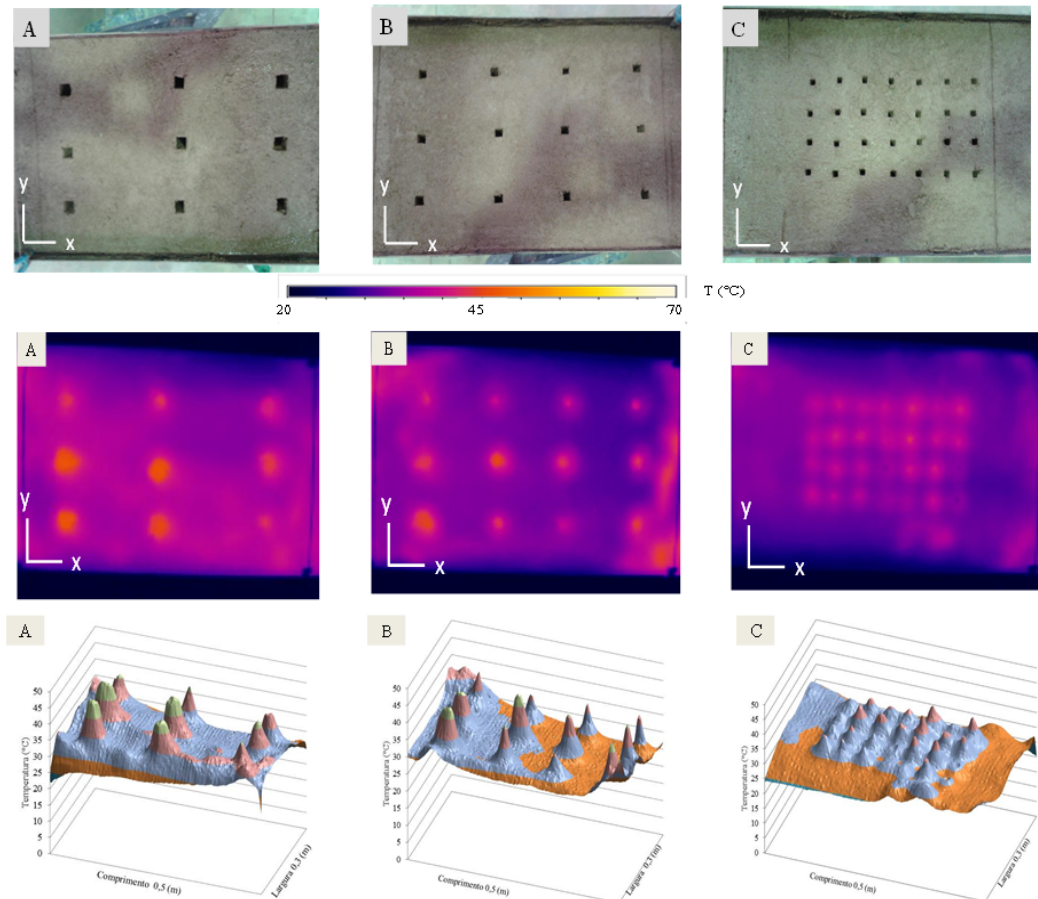
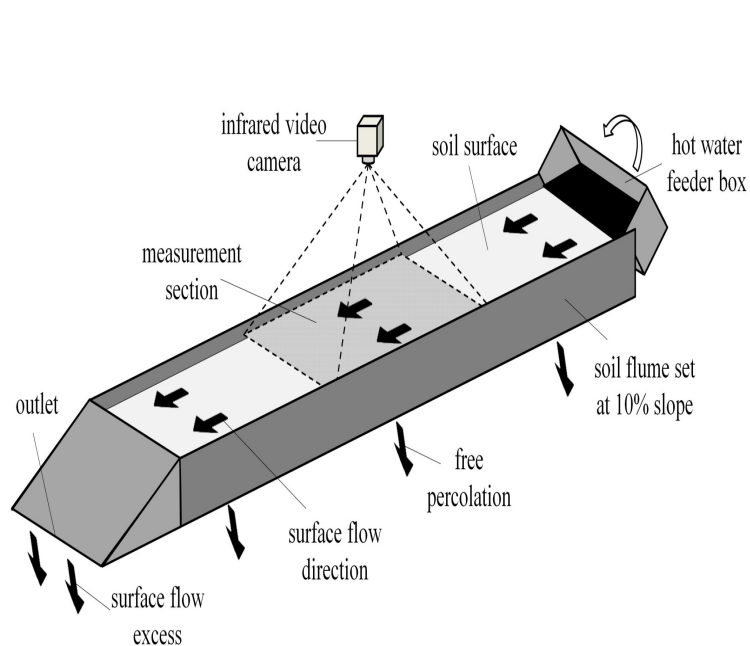


Profile meter (single line)



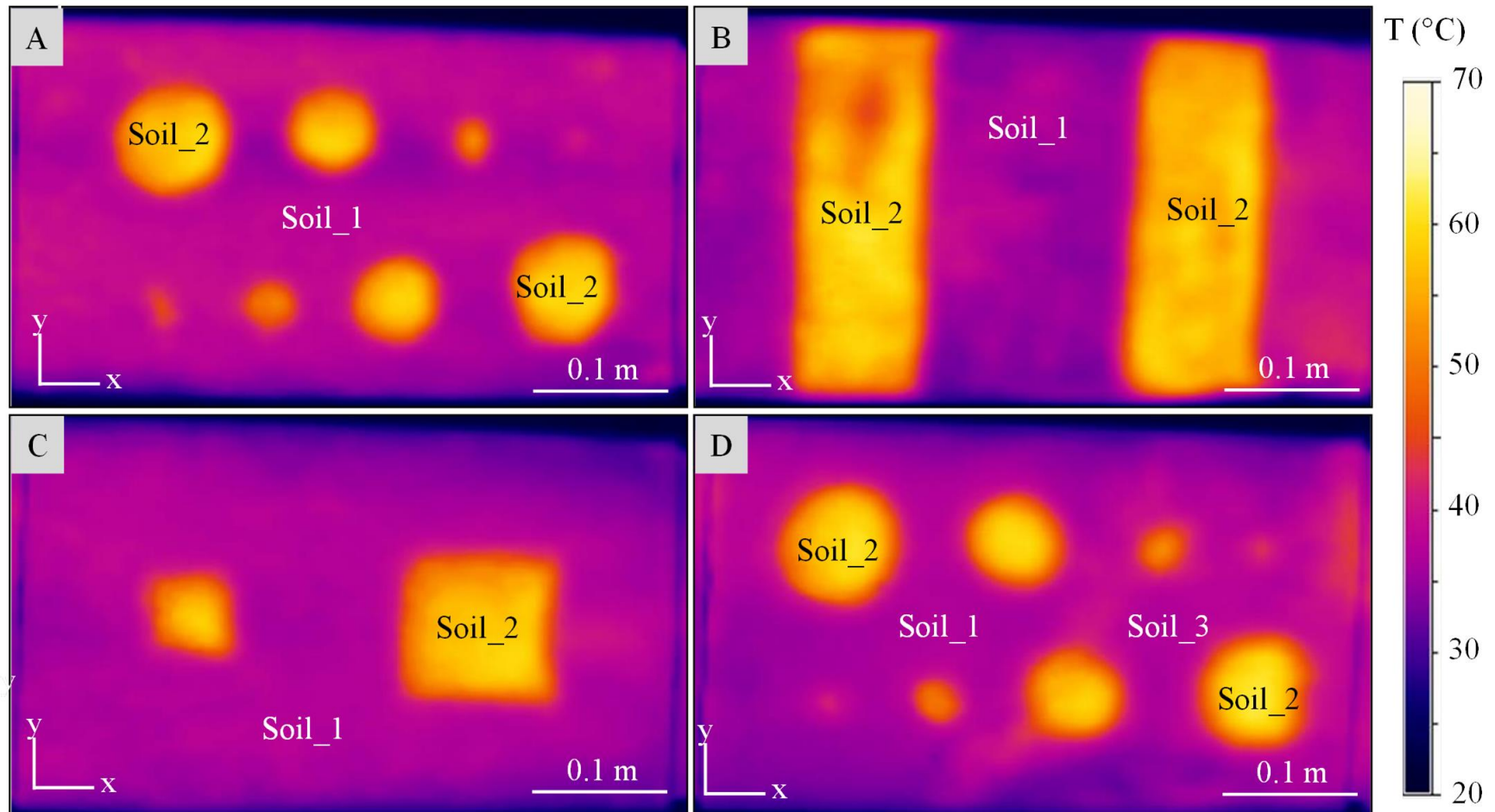
Research at UC: Mapping soil permeability and macro-porosity

Detection of macro-porosity



Research at UC: Mapping soil permeability and macro-porosity

Mapping of soil porosity





website:
hydrothermo.890m.com/

PROJECT HIRT



Modelling surface hydrologic processes based on infrared thermography at local and field scales

MODELAÇÃO DE PROCESSOS HIDROLÓGICOS DE SUPERFÍCIE COM BASE EM TERMOGRAFIA DE INFRAVERMELHOS ÀS ESCALAS LOCAL E DA PARCELA



PTDC/ECM-HID/4259/2014 – POCI-01-0145-FEDER-016668

Work in progress...

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.

STUDY AREA



- Irrigated area of 12.500 ha, supplied by
- of 12.500 ha, supplied by Mondego



Evaluation of the plant water status via its thermal reflectance

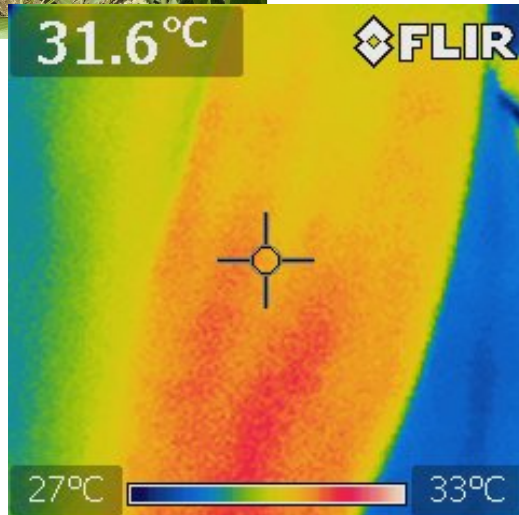


In addition to other detailed data:

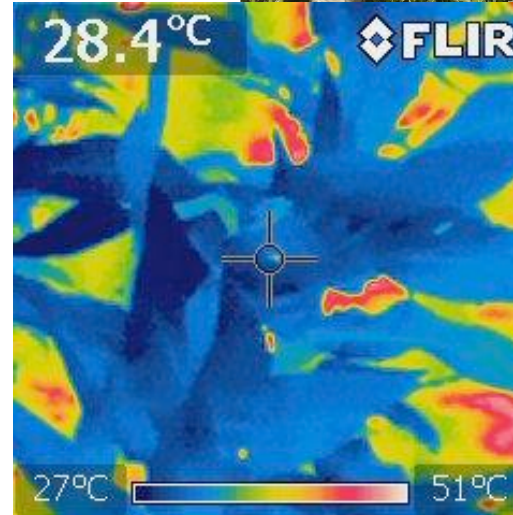
- ✓ **IR thermography (ground) measurements** at the **local** and **field** scales (*for assessing the canopy, leaf and soil*), using handheld cameras and UAS,
- ✓ **satellite** based images.

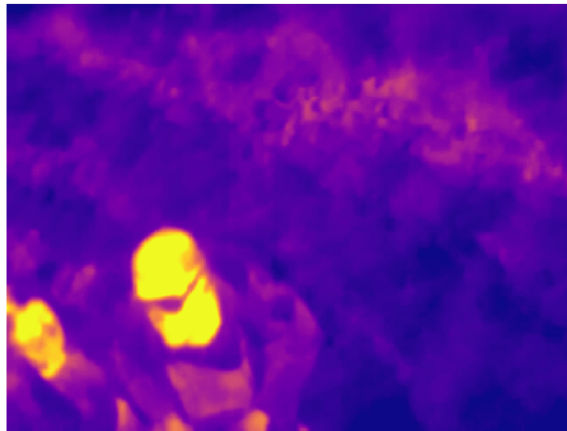


Leaf



Canopy





Exploratory...

✓ **satellite based images.**



Thermal Infrared Sensor

different scales...

CONCLUDING REMARKS

We aim at better understanding **bridging between the different scales of observation....**

... and contributing to using **infrared thermography based tools** (*that use non-invasive and non-destructive technology*) to achieving water management sustainability goals.