Testing of particle thermal tracer for velocity estimation of shallow overland flows without using image processing algorithms: Laboratory experiments on stony and non-stony soil surfaces

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EUROPEAN COOPERATION IN SCIENCE & TECHNOLOGY

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HARMONIOUS
uas for environmental monitoring

Thermal particle tracing without image processing algorithms

PROJECT HIRT

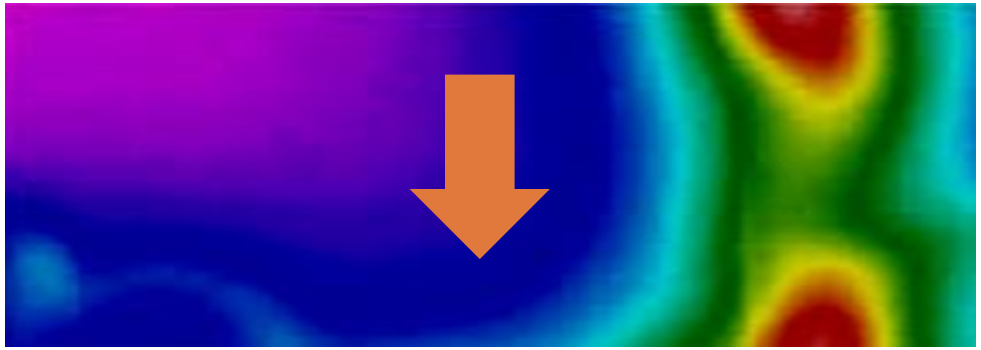
Modelling surface hydrologic processes based on infrared thermography at local and field scales

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

FCT PORTUGAL 2020

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

THERMAL TRACER
& INFRARED THERMOGRAPHY



TECHNIQUE TO ESTIMATE SHALLOW FLOW VELOCITIES

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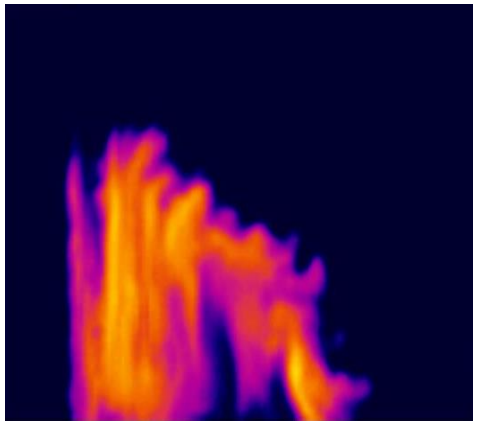
Thermal particle tracing without image processing algorithms

- Velocity measuring techniques for flows of depth in millimeters

Dye Tracing

PTV technique



Thermal tracing

Thermal particle tracing without image processing algorithms

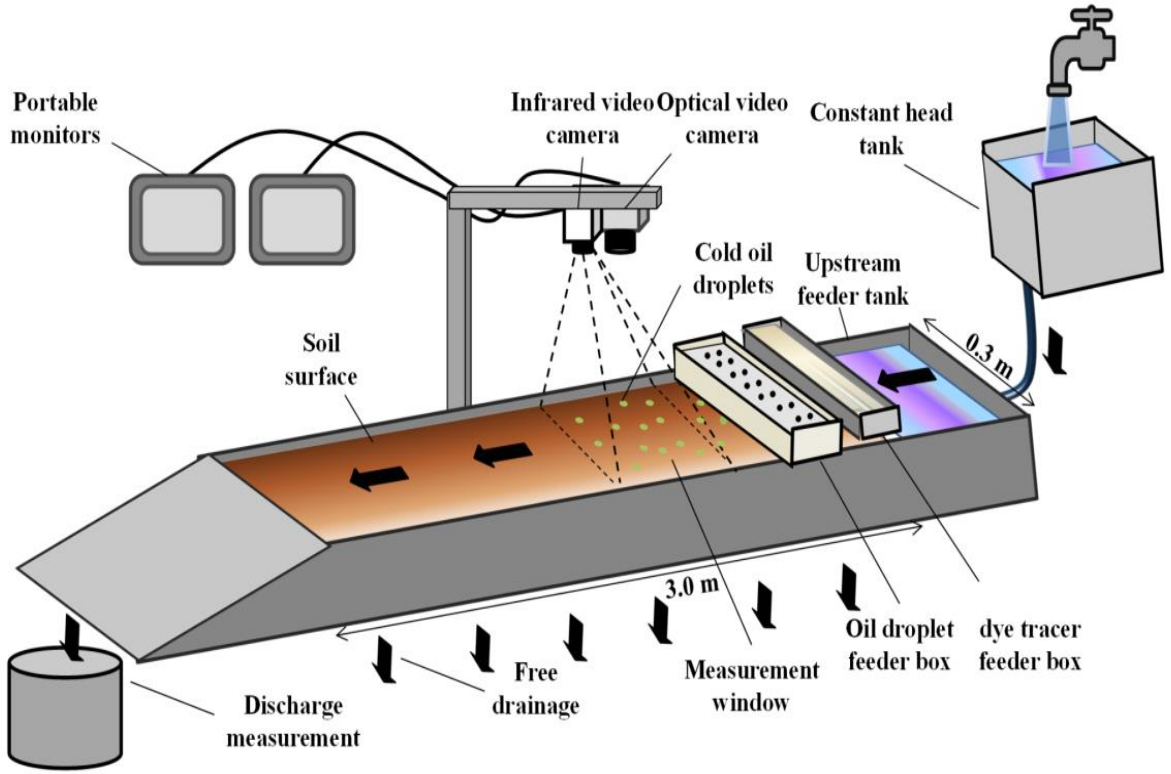
- **Thermal particle tracer-Cold oil droplets**

Five velocity measurement techniques

- Thermal imaging based PTV technique (PTVi)
- Thermal tracing of oil droplets manually
- Dye tracing
- Volumetric discharge method
- Conventional PTV technique (PTVc)

Without hurdle

With hurdle (stones)



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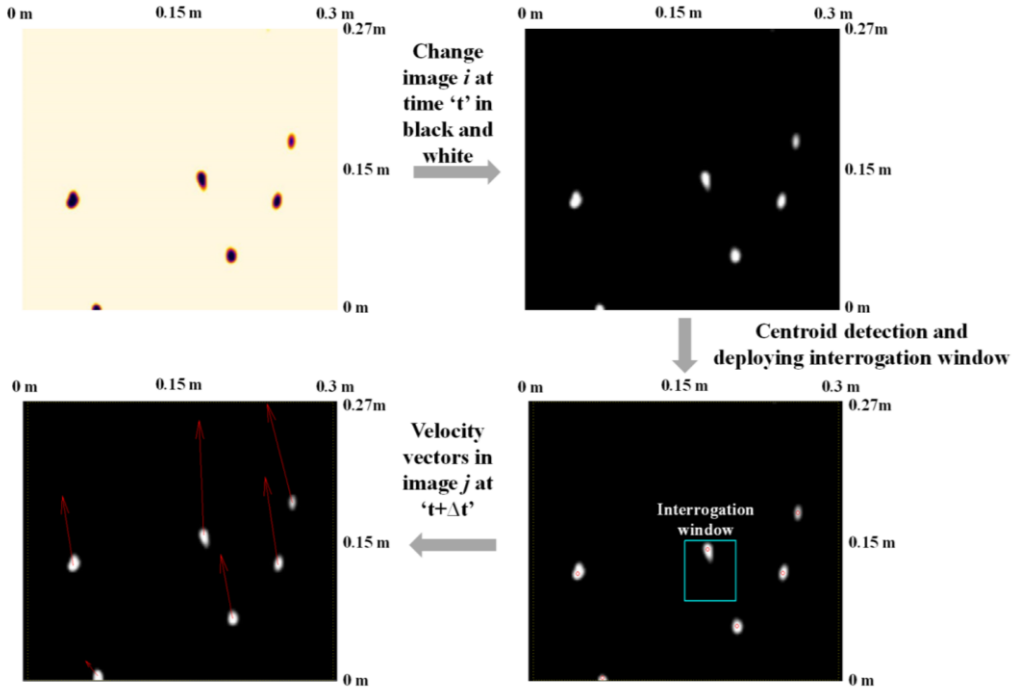
- Fundamental concept of PTVi technique



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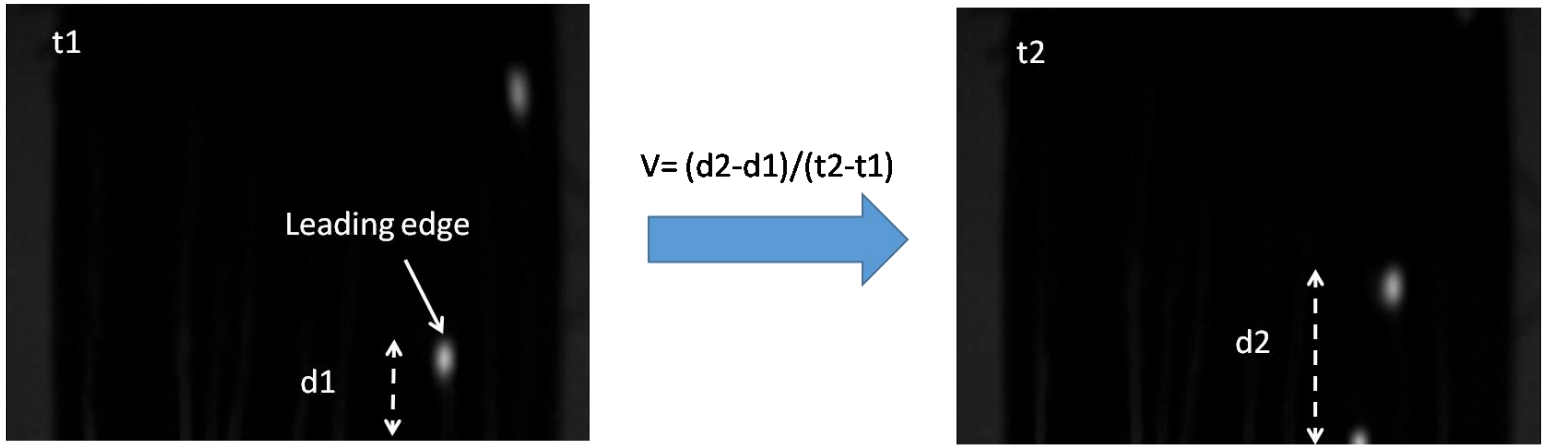
- Oil droplet's thermal tracing similar to dye tracing



We tracked 15 oil droplets for each experiment

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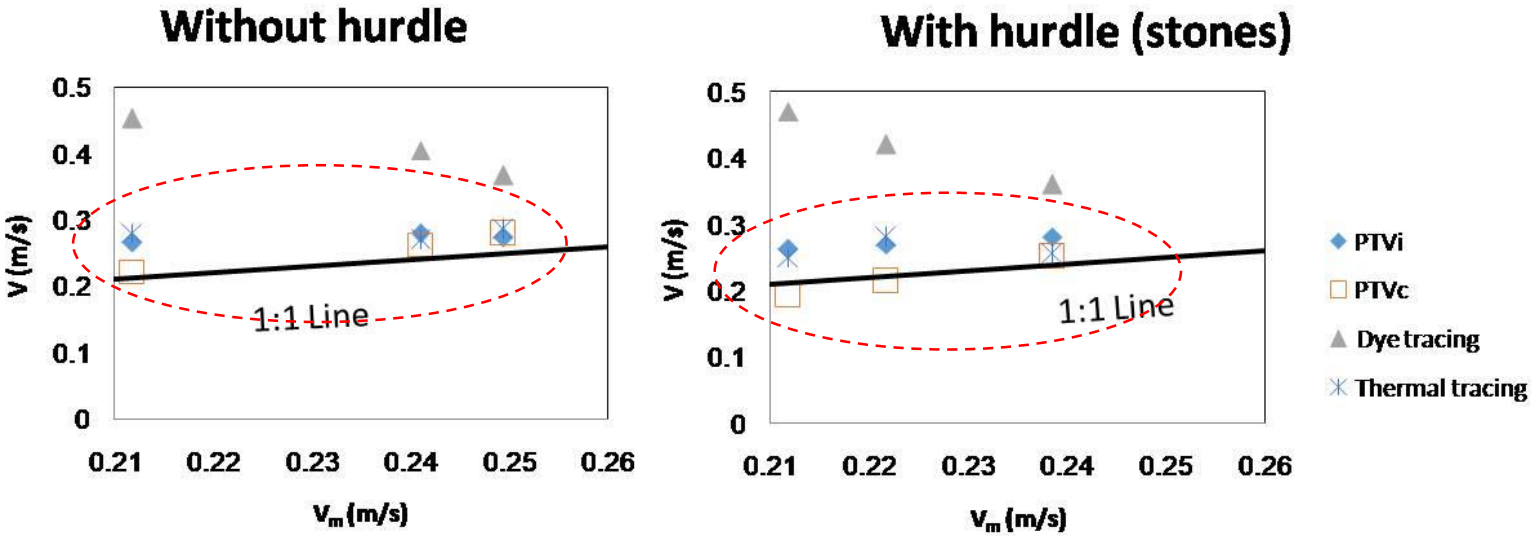
- Results and Discussion

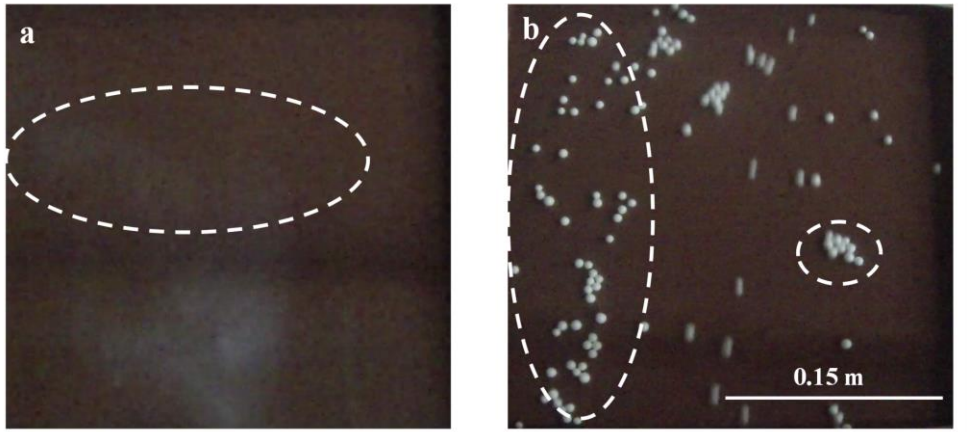


Thermal particle tracing without image processing algorithms

- **Restrictions in dye tracing and PTVc techniques for shallow overland flows**

Dye tracing

PTVc technique



- **Failed detection of leading edge**
- **Over estimation of flow velocity – a crude method**

- **Stagnation of polystyrene beads**
- **Expertise in image processing algorithms required**

Better illumination conditions required

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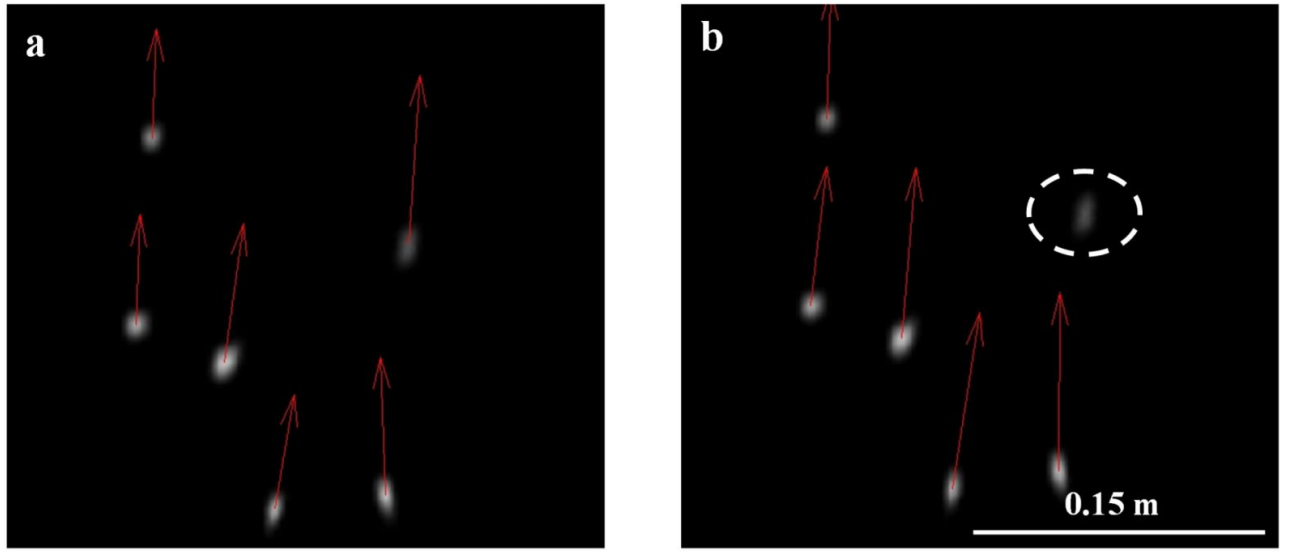
- **Restrictions in PTVi technique for shallow overland flows**

- Shape and intensity of oil droplet changes
- Expertise in image processing algorithms
- Seed density problem
- Many experimental runs
- Less environment friendly



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- **Conclusions**

- **For shallow overland flows velocity measurements, manual tracking of particle thermal tracers can be used as an alternative to the practise of sophisticated image processing algorithms in laboratory conditions, given that:**
- Study area is small
- Less analysis time

- **More environmental friendly.**
- **Less intrusive than dye tracing.**

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Thank you