

# Workshop Knowledge's frontiers in water unsaturated hydrogeosystems: interface dynamics, heterogeneities & couplings, 27-28 June 2019



## PIVOTS

# Fluids transfers and hydrodynamics of the Vadose Zone of the O-ZNS platform site

(In collaboration with BRGM and INRA)

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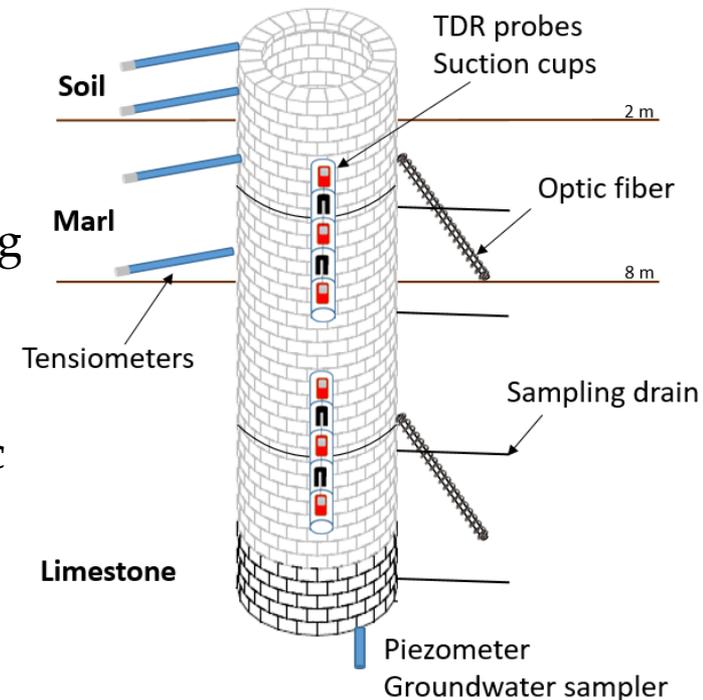


Avec le soutien de :



# O-ZNS platform: hydrogeological approach

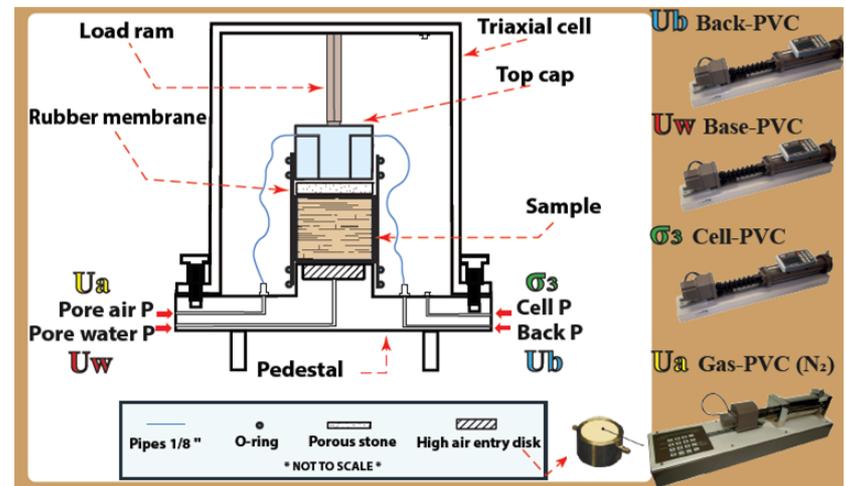
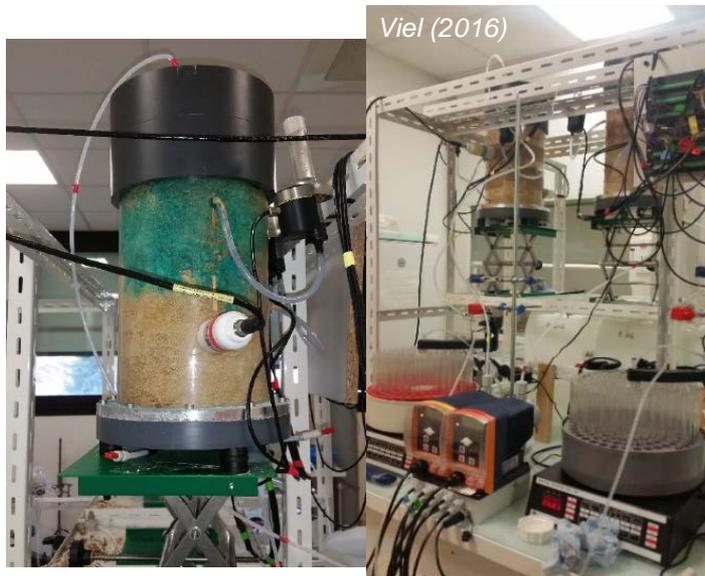
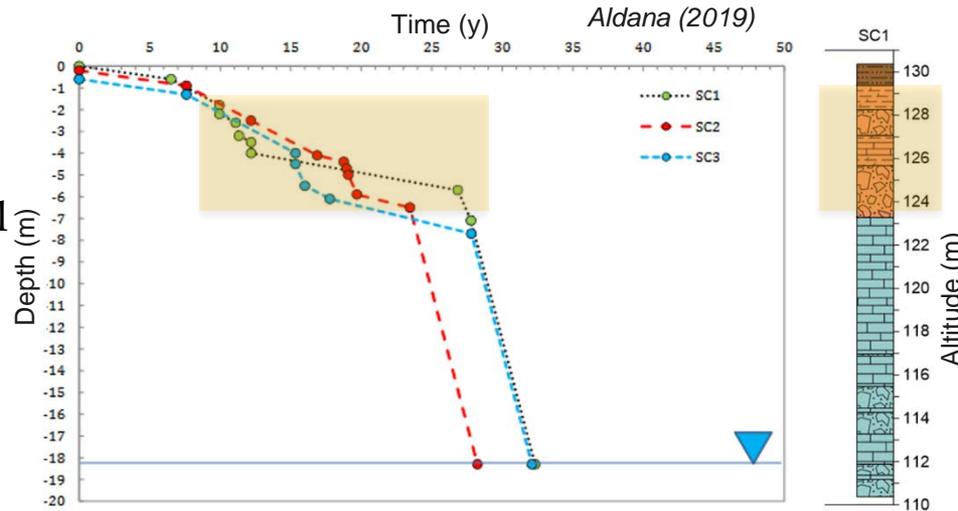
- Understanding the transport properties of the vadose zone (VZ) is a cornerstone in the preservation and management of aquifers under agricultural activity.
- Water retention and hydraulic conductivity are among the most important parameters governing water flow and solute transport in unsaturated porous media
- Numerous methods for estimating effective hydraulic properties of porous media at different scales
- Various sampling method for the collection of the solution moving through the VZ profile



**O-ZNS approach aims to integrate observations over a wide range of spatial (nm- to km-) and temporal (minutes to decades) scales by combining several broad characterizations (laboratory experiments, geophysics imagery, field monitoring, lysimeters, fluid sampling, ...)**

# Laboratory experiments

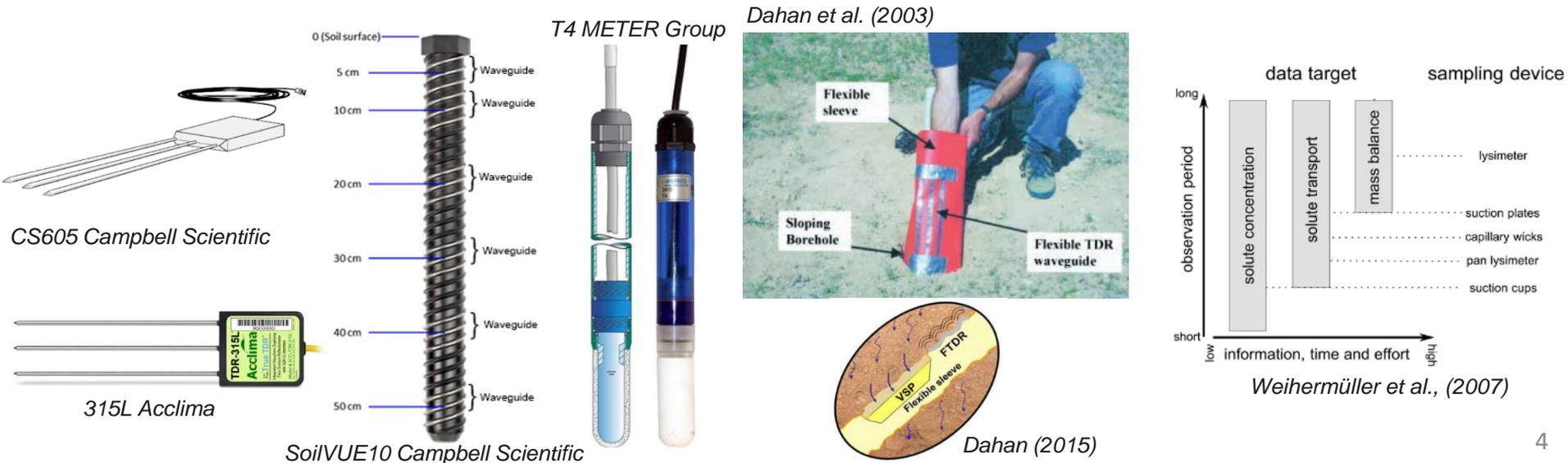
- Instrumented column to study solute transport (preferential flows, dispersivity)
- Estimation of hydraulic functions  $\theta(h)$  and  $K(h)$  of soils and rocks using an unconventional triaxial system based on the multistep outflow
- First experimental approximation of the solute travel time of about 30 years and controlled by the inertial effect of the marly limestones located between 2 and 8 m deep



*Aldana (2019)*

# In situ instrumentation

- Numerous solutions regarding instrumentation of the well and the surroundings boreholes
- Estimation of permeability with boreholes permeameter and infiltrometer tests
- Real-time and continuous monitoring of water content (TDR probes) and matric potential (tensiometers) in shallow horizons. New monitoring methodology in deep vadose zone
- Sampling methods to collect solution in and below the root zone:
  - ✓ Zero tension applied : pan lysimeters
  - ✓ Tension applied: suction cups, wick lysimeters, suction plates, VZ sampling ports (VSP)
  - ✓ Aim of solution collection depends on specific scientific questions and targeted data
- Weather station (precipitation, evapotranspiration, etc.), piezometers, groundwater samplings



# Overview of future steps (in collaboration with BRGM and INRA)



- Future studies with BRGM and INRA and by gathering data over the long term
- Measurement of water balance at the O-ZNS site scale and estimation of groundwater recharge at watershed scale considering the water flow in the VZ
- Impacts of crop management on water flow, nutrients and contaminants (agrochemicals, heavy metals, trace elements) transport
- Determination of hydrodynamic parameters of the VZ materials and modeling of fluid transfers in the VZ (1D to 3D), by taking into account geophysical and geological observations

**This large monitoring program will help to better understand transport processes in the VZ of the Beauce hydrosystem for sustainable aquifer management and water resource preservation.**