



We gratefully acknowledge the financial support provided to the PIVOTS project by « La Région Centre – Val de Loire » and the European Regional Development Fund.

EGU General Assembly 2020

Vienna | Austria | 3–8 May 2020

Monitoring of the mass and heat transfers through a heterogeneous karstic limestone vadose zone of an agricultural field (Beauce Aquifer, Orleans, France)

Bouamama Abbar, Clara Jodry, Arnaud Isch, Gautier Laurent, and Mohamed Azaroual

UMR 7327 ISTO, CNRS, Université d'Orléans, BRGM, 45071 Orléans, France

bouamama.abbar@cnrs-orleans.fr

Earth Sciences Institute of Orleans.

1A rue de la Férollerie - CS 20066. 45071 ORLEANS Cedex 2 - FRANCE.

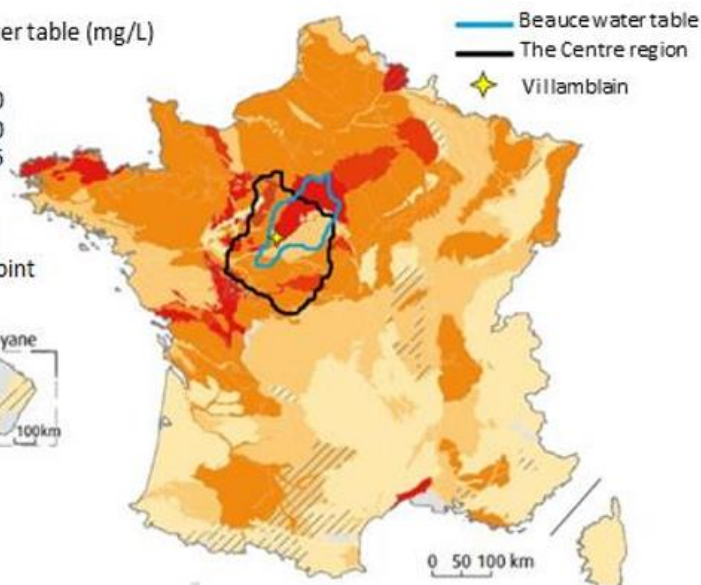
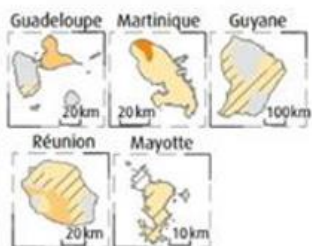
EGU2020-5294

<https://doi.org/10.5194/egusphere-egu2020-5294>

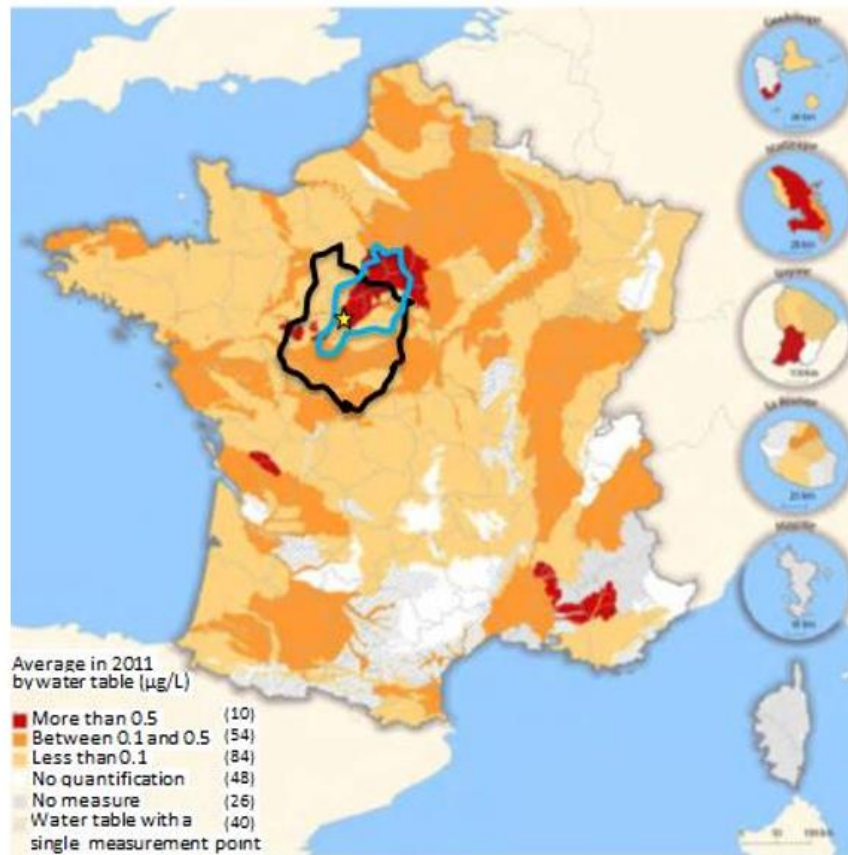
Problematic: groundwater contamination and environmental issues

Average in 2011 by water table (mg/L)

- More than 50
- Between 40 and 50
- Between 25 and 40
- Between 10 and 25
- Less than 10
- No measure
- ▨ Water table with a single measuring point



Average concentrations of pesticides in groundwater



Average in 2011 by water table (µg/L)

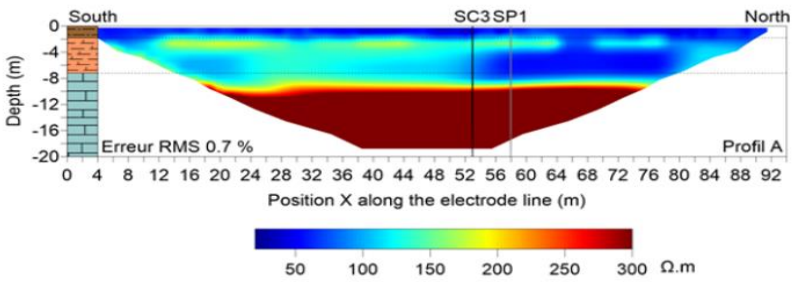
- More than 0.5 (10)
- Between 0.1 and 0.5 (54)
- Less than 0.1 (84)
- No quantification (48)
- No measure (26)
- ▨ Water table with a single measurement point (40)

Source : SOeS d'après la BDRHFV1 du BRGM, agences de l'eau, offices de l'eau BRGM, banque de données ADES, 2013, réseaux RCS et RCO Traitement : SOeS, 2013

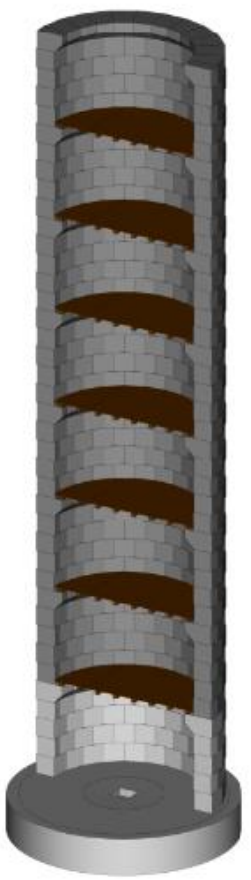


We gratefully acknowledge the financial support provided to the PIVOTS project by « La Région Centre - Val de Loire » and the European Regional Development Fund.

O-ZNS: Observatory for mass/heat exchanges between the atmosphere and groundwater to understand reactive and transfer processes

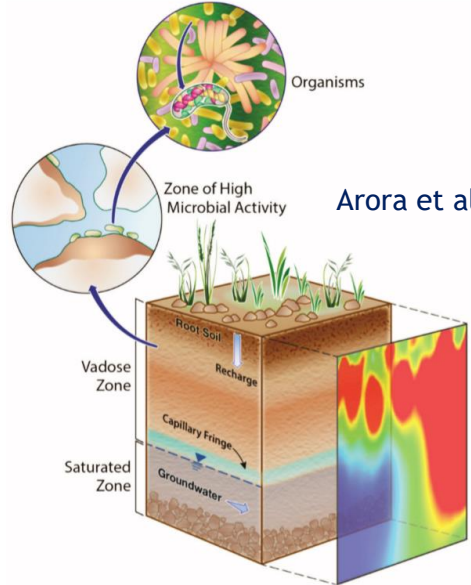


Electrical resistivity tomography and representation of the lithological section of the project site (2018/2019)



Conceptual scheme of the O-ZNS well (depth ~ 20 m; diameter ~ 4 m)

- Original and unique device with exceptional dimensions.
- Many technological challenges associated with the construction of the well.
- Supporting circular structure in limestone keystones assembled in staggered rows,
- Preferential flow prevented by filling the voids between the well and the VZ materials.
- The well allows access to the entire vadose zone.
- The position of the monitoring and imaging tools for long term measurements and coupling between processes (geophysics, geochemistry, hydrogeology, microbiology, etc.)



We gratefully acknowledge the financial support provided to the PIVOTS project by « La Région Centre – Val de Loire » and the European Regional Development Fund

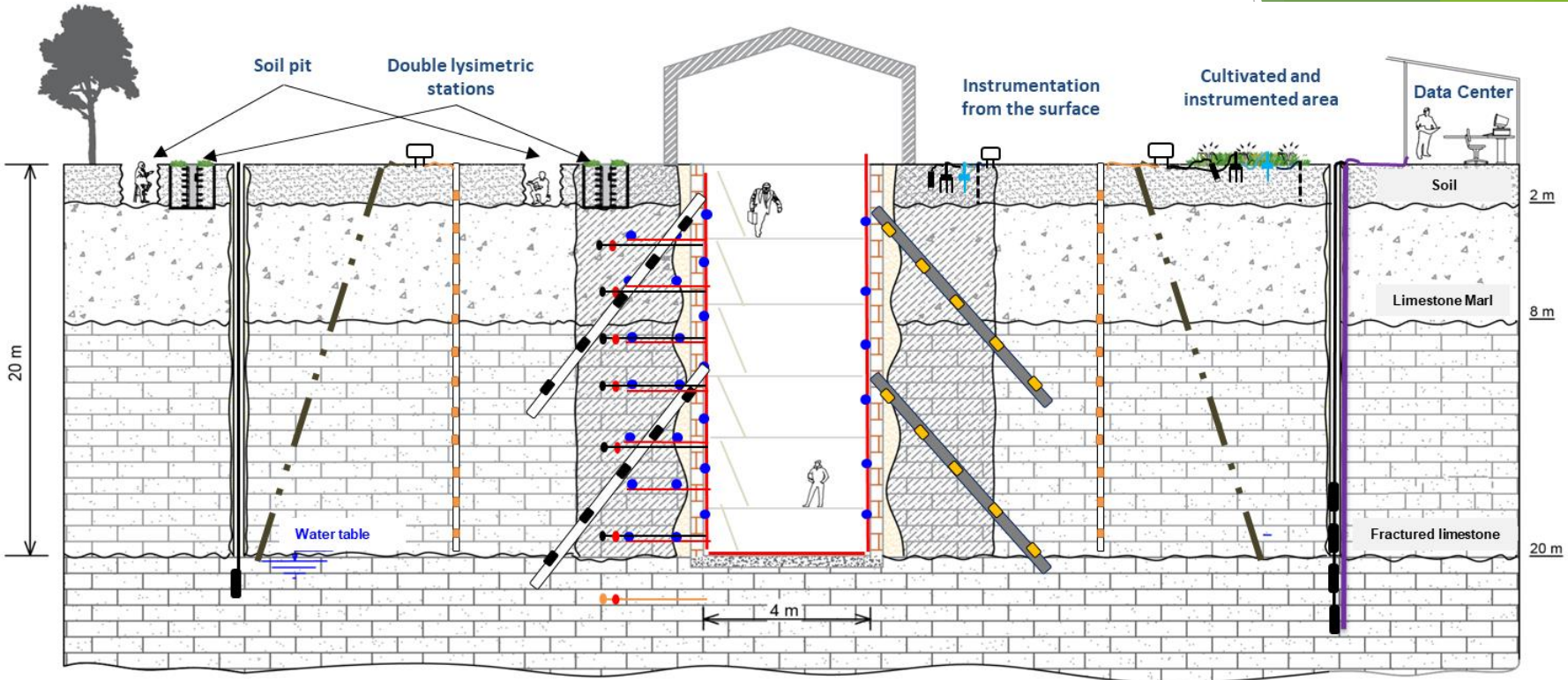
Main objectives and originality of the O-ZNS project

- **In situ** monitoring in real time of mass and heat transfers from the soil surface to the groundwater (soil-rhizosphere-vadose zone-capillary fringe-saturated zone).
- Support the development of **innovative sensors** (optic fiber, microchips, geophysical imagery, coupling between knowledges and needs from/for "disciplines", etc.) for fine characterization of the Unsaturated Zone dynamics,
- Use geophysical imagery to characterize the raid/moving fronts, critical interfaces (between phases and subsystems) to improve coupled multiphase reactive transport models (hydrodynamics, biogeochemistry, etc.)
- Identify the critical phenomena inducing the flooding, shrinkage-swelling, etc. and the key mechanisms of storage/destocking of the diffuse pollution in the Vadose Zone of the carbonate aquifers
- Development of national, European, international and industrial collaborations for innovative monitoring technologies and advanced/renewed concepts and new generation of numerical models.



We gratefully acknowledge the financial support provided to the PIVOTS project by « La Région Centre – Val de Loire » and the European Regional Development Fund.

Conceptual scheme of the instrumentation of the O-ZNS Site



Legend :

- : TDR probes and tubes, temperature probes,
- : Vadose Monitoring System (VMS) : water content solution / gas sampling,
- : Solution / Gas sampling packers
- : TDR packer,
- : Multiparameter probe placed in a piezometer,
- : Data acquisition center
- : PS electrode,
- : PS Reference electrode
- : Electric flutes
- : FBG fiber optic sensors (temperature and Deformation),
- : Distributed fiber optic sensors (DAS, DTS, DSS) in boreholes,
- : "New generation" piezometer.



We gratefully acknowledge the financial support provided to the PIVOTS project by « La Région Centre – Val de Loire » and the European Regional Development Fund.

Chronology of the installation works of the O-ZNS observatory

- 2020**
 - Installation of boreholes - Digging of the well (20m x 4m),
 - Field monitoring, sampling,
 - Installation of sensors and fiber optics.
- 2021**
 - Continued installation of sensors,
 - Valorization of results,
 - Development of concepts, models, etc.
- 2022**
 - Improvement of models,
 - New sensors, ...

Progress of work:

- The boreholes drilling started in February 2020 and will continue until Summer 2020,
- The digging of the large central well will start in Summer/Autumn 2020
- The installation of the entire O-ZNS observatory system will be finalized in 2021.



Boreholes drilling in O-ZNS site (25/02/2020)

Thank you for your attention

<https://plateformes-pivots.eu/launch-of-the-field-installation-of-the-o-zns-observatory/?lang=en>