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

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

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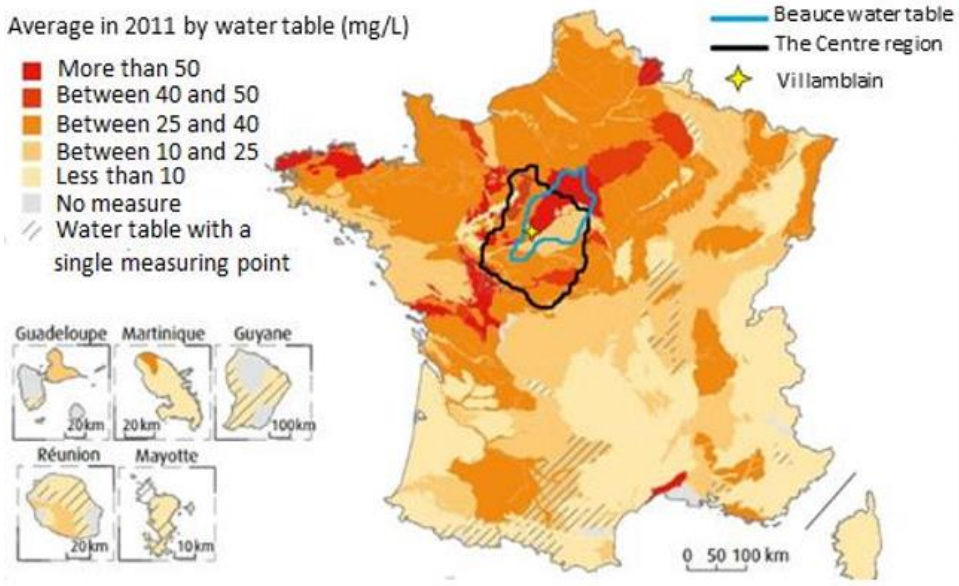
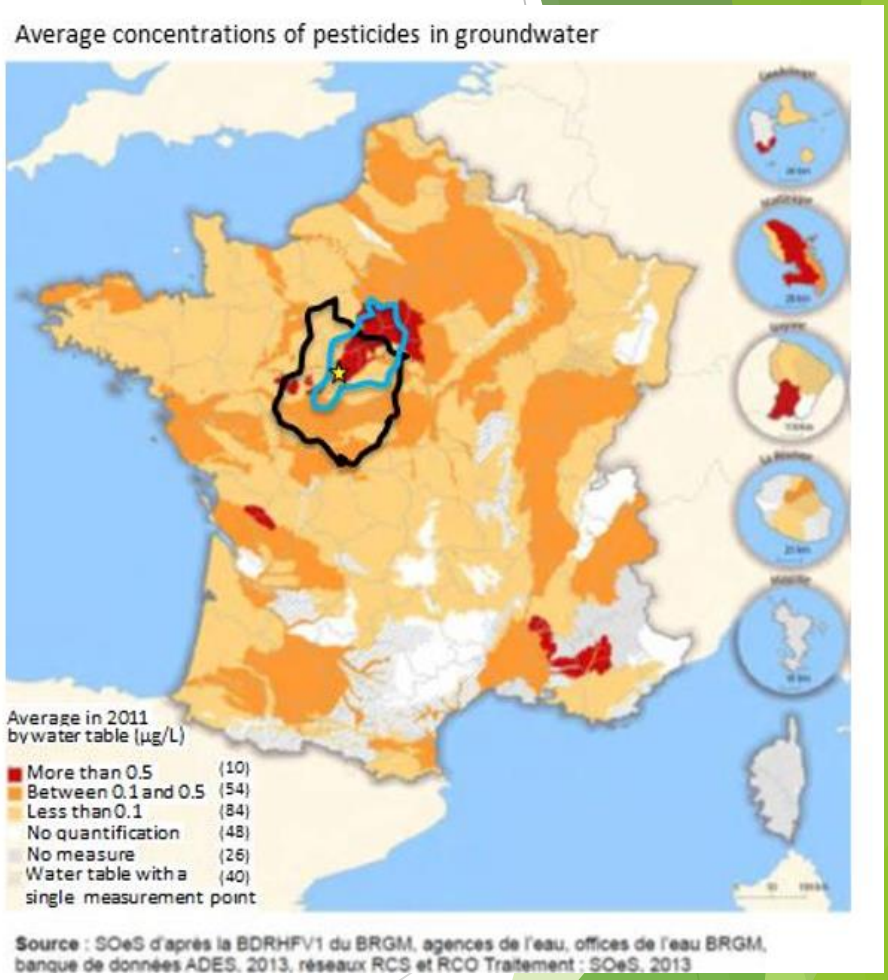
Problematic: groundwater contamination and environmental issues





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

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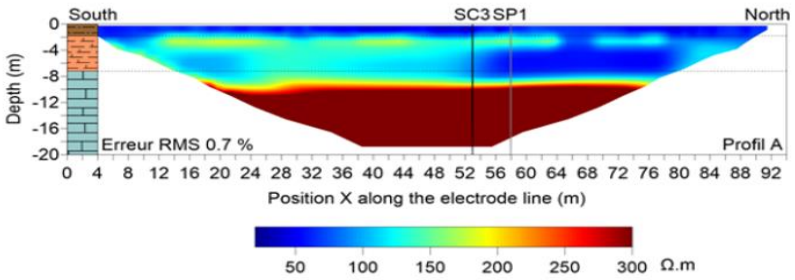
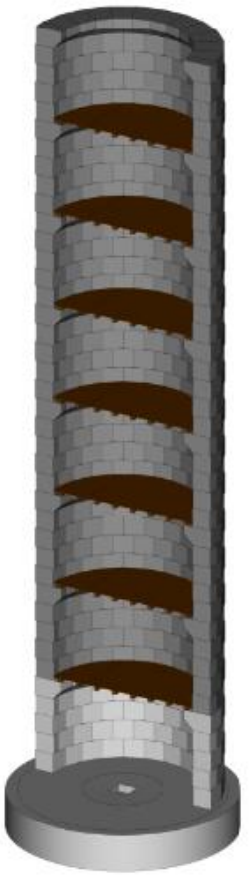
O-ZNS: Observatory for mass/heat exchanges between the atmosphere and groundwater to understand reactive and transfer processes

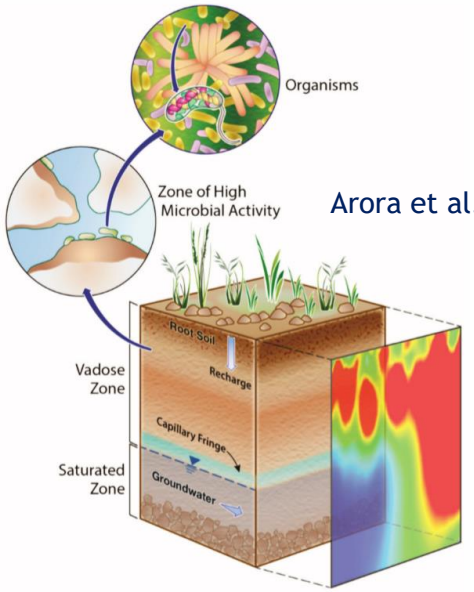


Electrical resistivity tomography and representation of the lithological section of the project site (2018/2019)



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.)



Arora et al., 2019

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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.

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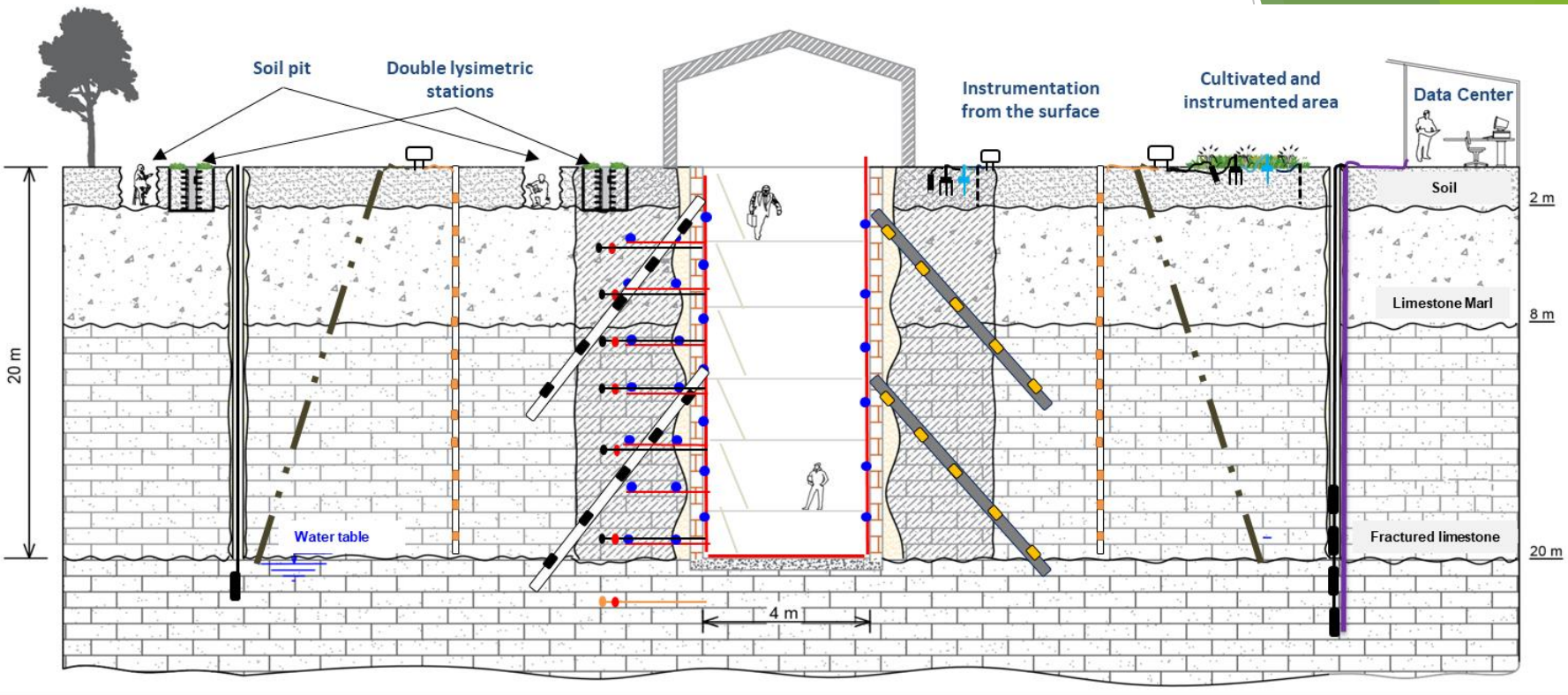
Conceptual scheme of the instrumentation of the O-ZNS Site



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.

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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)

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Thank you for your attention

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