

Observatory of Transfers in the Vadose Zone "O-ZNS" (in Orléans, France): Instrumentation strategy and installation of fiber optic sensors (DTS, DAS and DSS)

B. Abbar^{1,*}, A. Isch¹, C. Mallet¹, C. Jodry², L. Gautier¹, M. Abbas¹, and M. Azaroual¹

¹Institut des Sciences de la Terre d'Orléans, Université d'Orléans, France (bouamama.abbar@cnrs-orleans.fr)

²École et Observatoire des Sciences de la Terre, Université de Strasbourg, France

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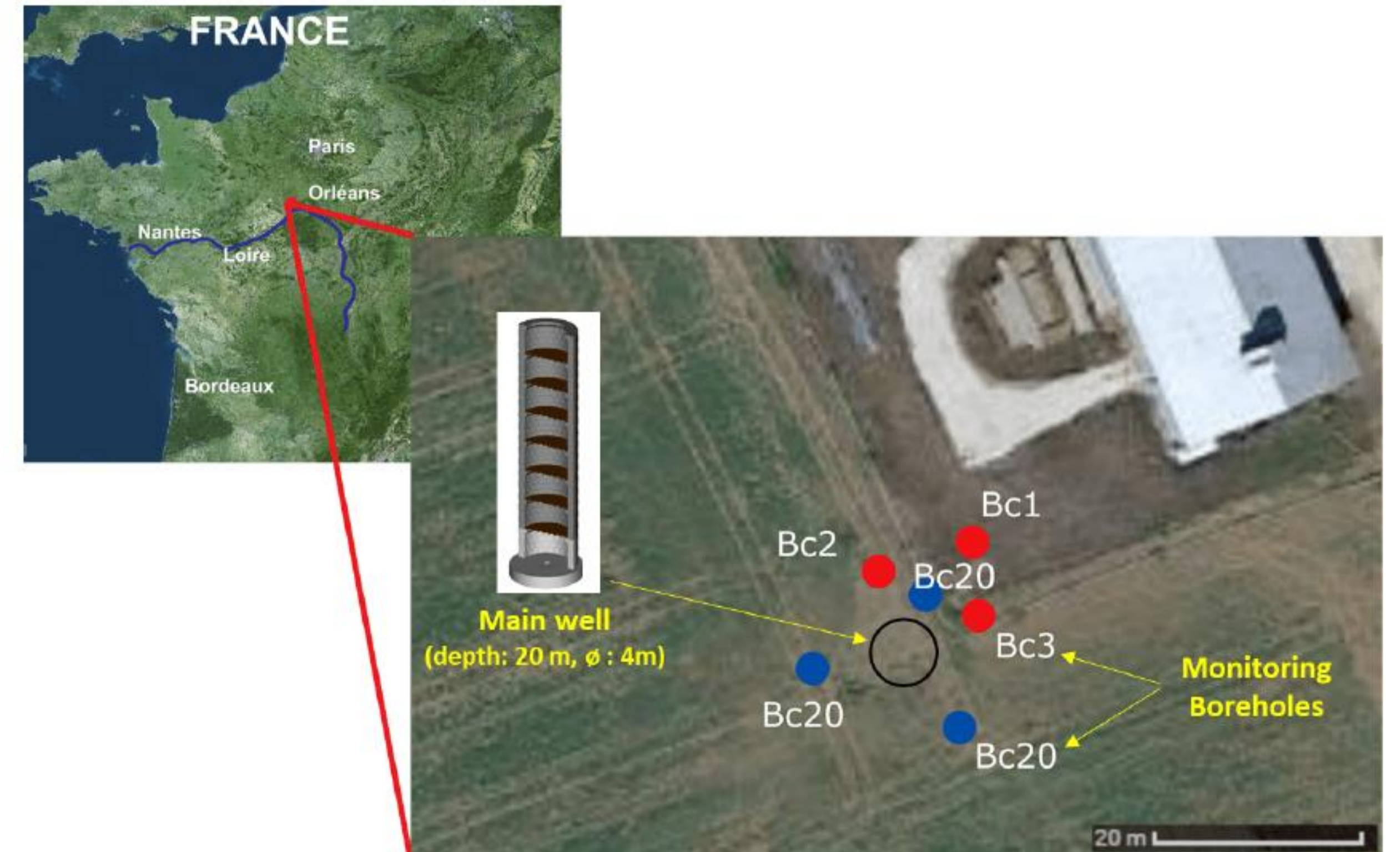
O-ZNS Platform

Motivation: Contamination of groundwater and environmental issues caused by intense agriculture

- The O-ZNS project consists of an access well with a diameter of 4 m and a depth of 20 m, which will allow access to the entire vadose zone of the Beauce aquifer.
- The well is also equipped with several monitoring boreholes and it will be fully instrumented by several monitoring techniques to follow the transfer of contaminants from the ground surface to the water table.

Study Site

- Located in the Beauce Limestone Plain, near Orléans (Centre Val de Loire, France).
- The site is in an agricultural field (typical of french agricultural and anthropic practices).

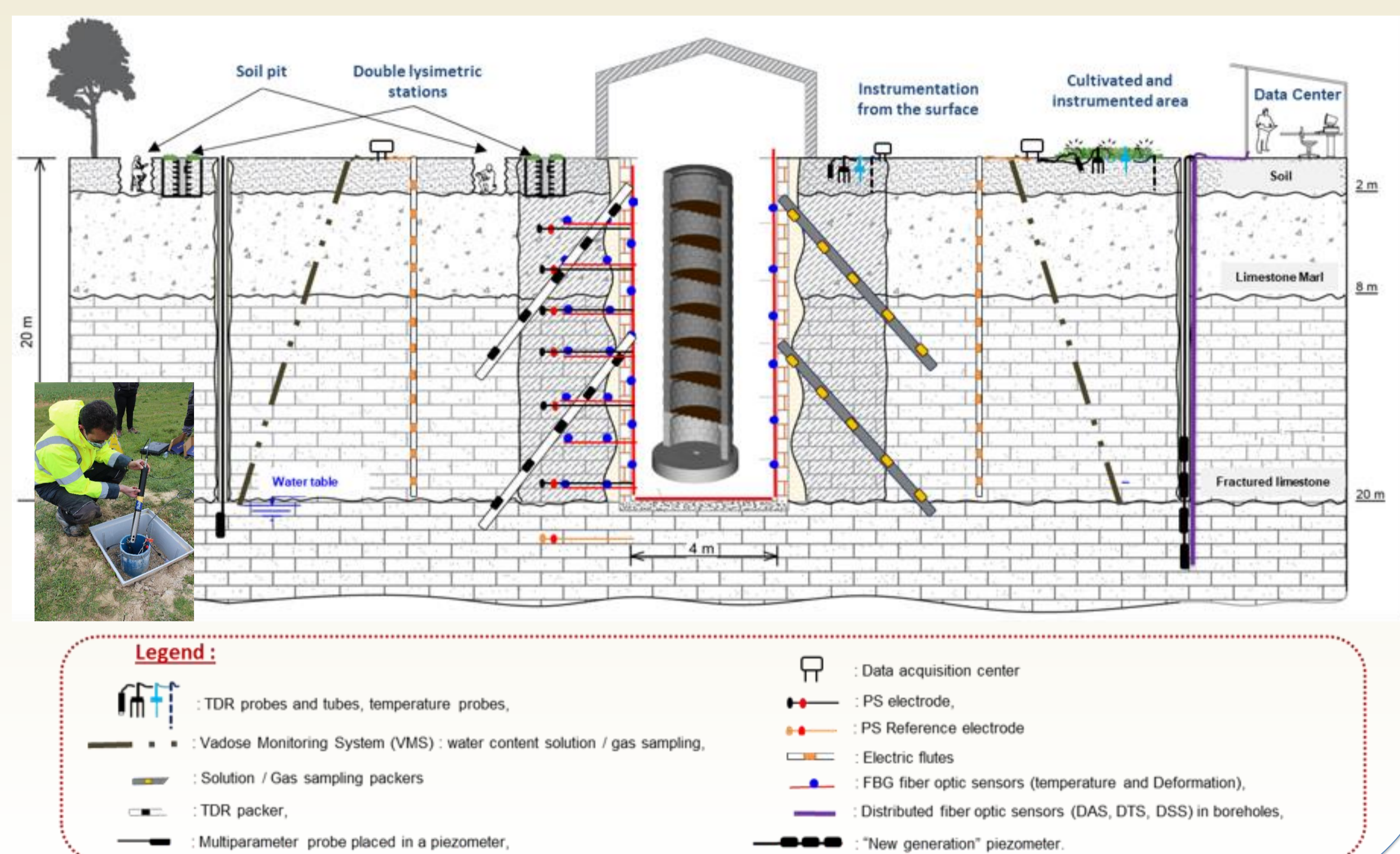


Experimental site located in Villamblain (Orléans, France) at the heart of the Beauce Region

Innovative instrumentations in perspective for the O-ZNS project

Many **environmental monitoring solutions** are planned for the O-ZNS site, this includes:

- Instrumentation from the surface for soil characterization, such as probes for water content, temperature, matrix potential, pH, Eh ...,
- New generation of lysimeters which represent an excellent tool for the study of transfers at an intermediate scale between the laboratory and the field.
- Innovative solutions such as new probes for the monitoring of the water content in hard rock materials of the vadose zone,
- New solutions for the sampling of water and gas at several levels in the VZ,
- Multiparameter probes are installed in the O-ZNS piezometer for monitoring the quality and level of the water table.



Fiber optic sensors deployment in the O-ZNS experimental site

Fiber optic sensors make it possible to obtain similar functions to conventional sensors (monitoring, control, measurement), while offering interesting specificities:

- Small footprint,
- Low attenuation,
- Immunity to electromagnetic fields,
- Multiplexing of many sensors.

Three distributed optical fiber sensors were installed in a continuous loop along three boreholes surrounding the O-ZNS well in July 2020, this include:

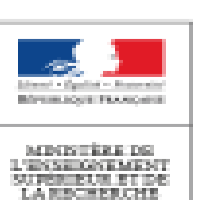
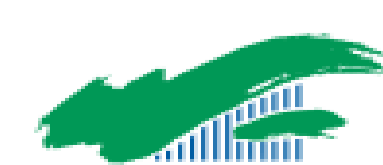
- DTS: Distributed Temperature Sensing
- DSS: Distributed Strain Sensing
- DAS: Distributed Acoustic Sensing



Conclusion

- The O-ZNS project will allow the coupling of different techniques (geophysical, hydrogeological, geochemical) for the multi-scale study of water flows in the VZ.

- 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.



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