

Job offer for a postdoctoral position on fixed-term contract at ISTO (Geosciences Campus, Orléans) – hydrogeophysics & subsurface imaging for ecological transition & groundwater protection/management.

Domaine

Geophysical imaging, hydrogeology, electrokinetics, electrochemistry, reactive transport, geophysical signatures of physico-chemical interfacial properties of reactive phases (porous/fractured media – micro-organisms – water – air) in the vadose zone.

Informations générales

Type of contract : Fixed duration 12 months

Working hours : Full time

Place of work: CNRS-ISTO, Orléans

Desired starting date: march- april 2024

Funding: Project O-ZNS (ARD, Région Centre Val de Loire)

Employer : Centre National de la Recherche Scientifique (CNRS) ;

Host laboratory : Earth Sciences Institute of Orléans, University of Orléans, CNRS (ISTO, <http://www.isto.cnrs-orleans.fr/>) - UMR 7327

Level of education required: Doctorate

Domain: Geophysical imaging of critical physico-chemical interfaces and pollutant transfer in the vadose zone of the Beauce aquifer - The O-ZNS Observatory of Villamblain.

Context

The ISTO laboratory (Orléans) is developing an observatory (O-ZNS platform) on the unsaturated zone (UZ), as part of the regional PIVOTS program, in order to understand how the water-rock-biosphere interactions evolve through time and space in a dual porosity media, driven by the mass (water and contaminants) and heat transfers. The main goal of this project is to characterize the vadose zone and improve the understanding of its hydrochemical dynamics, from the ground surface to the groundwater table, throughout the entire unsaturated zone thickness (around 20 m at the study site). The long-term objective is to identify the key processes promoted by the anthropogenic pressure along the soil-aquifer continuum, founding stone of a new generation of predictive modeling tools efficient for policy makers and / or industrial decision.

Mission

The mission of the postdoctoral position is to design and carry out some field measurements and numerical models allowing the characterisation of the UZ heterogeneities and the exploitation of available geophysical data for quantitative measurements of water transfer properties and redox (bio-)barriers in a porous/fissured carbonated structure. The working hypothesis is to use the sensitivity of geophysical parameters to different geological, geochemical and hydrological properties in order to develop a multimethod hydrogeophysical approach capable of providing high resolution images of the vadose zone complexities (lithology, fractures, etc.) and hydrodynamic parameters (e.g., water content, preferential flow, etc.) that can parametrize reactive transport models. Furthermore, the project also aims to focus on the electrokinetic phenomena associated with multiphase reactive transport as well as electron transfers along interfaces, involving the specificities of the interfacial properties. Indeed, various advancements have been achieved during the last 15 years to bring together the electrokinetic characterizations (double layer, redox potential and electron activity) and geophysical techniques such as the self-potential (SP) and the Spectral Induced Polarization (SIP). In parallel, the development of the lab-on-a-chip concept in Earth sciences, is offering controlled porous structures, associated to large range of in situ measurements tools giving new possibilities to study the coupling mechanisms between geophysical signals and local physico-chemical mechanisms. The field observatory (O-ZNS platform)

¹ Plateforme sur les phénomènes de transport réactif entre dans et à travers la ZNS depuis le sol jusqu'à la nappe aquifère

² Plateformes d'Innovations, de Valorisation et d'Optimisation Technologique environnementales, un ensemble coordonné de 7 plateformes destinées à la surveillance de la qualité de l'environnement et à la gestion durable des ressources naturelles dans un contexte de changement global.

based on an exceptional well (depth - 20 m & diameter - 4m) associating a team of geophysicists, geochemists, microbiologists, and numerical modelers complements these laboratory devices allowing testing the validity of any lab-driven conclusion. It offers a unique support for deciphering, at the relevant scales, the coupled phenomena in the environmental geoscience based on non-intrusive spatialized sensors at different levels throughout the UZ. The applicant will integrate the O-ZNS platform team and the porous media group of ISTO. She/he will be responsible for the geophysical data acquisition/processing and interpretation, allowing studying the coupled geophysical-geochemical phenomena. The researcher will benefit from a network of specialists in the three key areas: i) geophysics, ii) physico-chemistry of interfaces & iii) multiphase reactive transport modelling.

The postdoc is also expected to perform joint inversions with multidisciplinary skills supporting concepts and numerical modelling. He/she will contribute to the choice of smart environmental monitoring tools to be installed in the O-ZNS well under construction in Villamblain (35 km north-west of Orléans, Centre Val de Loire, France).

Activities in charge

The postdoc sought will interact with the O-ZNS project leaders (ISTO) and BRGM geophysical teams to conduct the following activities:

- Critical analysis of geophysical data already acquired on the O-ZNS site
- Organize field geophysical measurement campaigns to test different geophysical monitoring and imaging techniques in the laboratory
- Organize heterogeneous and multi-domain databases to ensure their interoperability
- Interpret data using numerical models of mass/heat transfer in UZ, inversion of geophysical signals for petrophysical properties, evaluate mass/heat transfer properties
- Contribute to the implementation of geophysical, electrochemical and physicochemical tools in the O-ZNS well and in the boreholes around the main well
- Contribute to the scientific valorization and presentation of the project results in workshops and international conferences
- To interact constructively with the network of geophysical partners of the O-ZNS project and to be a force of proposal for future ANR, Région Centre, Horizon Europe projects.

Required Skills

- Demonstrated skills in the acquisition, processing and interpretation of geophysical data (GPR, electrical resistivity tomography, self-potential, seismic refraction, gravimetry)
- Knowledge in numerical modelling and geophysical data processing and inversion softwares (ReflexW, res2Dinv, Matlab, COMSOL Multiphysics, etc.), and in 3D data presentation and modelling softwares (Voxler, Surfer, Paraview, etc.).
- In-depth skills in the theoretical analysis of acquired results and the joint interpretation of different data types (geophysics, hydrogeology, geology, etc.).
- (hydro) geological and (hydro) geochemical knowledge will be a plus.
- skills in measuring the physical, chemical, electrokinetic and electrochemical properties of geological bodies and associated fluids.
- Taste for teamwork and strong curiosity to interact with specialists in related fields (or at interfaces) in geophysics and geochemistry
- Good level in computer science programming languages (Fortran, C, C++, etc.)
- Ease of writing scientific papers for the valorisation of the results.
- Excellent English language skills (written and spoken).

Contact person for more details:

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