Post doc project (1 year and possibly 18 months during 2024 - 2025)

Field of research

Modeling flow and reactive transport through the unsaturated zone of the Beauce aquifer.

Project title

Modeling flow and reactive transport through the unsaturated zone of the Beauce aquifer – Observatory of the Unsaturated Zone (O-ZNS).

Summary of the subject

The ISTO laboratory (Orléans) is developing an observatory of transfer in the unsaturated zone (O-ZNS), 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 mean goal of this project is the understanding of the vadose hydrochemical dynamics, from the ground surface to the groundwater table, throughout the entire unsaturated 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 geosciences tools efficient for policy makers and / or industrials decision.

The main mission of the postdoctoral position is to model reactive transport in the unsaturated zone (UZ), on the scale of the Beauce aquifer. Thanks to the water characterizations of O-ZNS materials in the laboratory, hydrodynamic parameters were determined over the entire unsaturated zone and will be used in the development of the hydrogeological model. The targeted model is to provide an in-depth understanding of the vadose structure and to identify the key physicochemical processes with their multilevel couplings and inter-dependencies across different scales and fluid phases. The O-ZNS observatory, located at an agricultural site in Villamblain (Centre Val de Loire, France), offers a unique experimental setup composed of an exceptional well having a depth of 20 m and a diameter of 4 m, along with a variety of boreholes and environmental sensors suitable for geophysical, geochemical, microbiological, and hydrogeological investigations (https://www.isto-orleans.fr/2022/03/17/installation-de-lobservatoire-o-zns-a-villamblain-pour-le-suivi-et-la-protection-de-la-nappe-de-beauce/). The observatory instrumentations allow the deployment of innovative sensors that can provide quantitative, massive, and highly resolved 3D measurements related to fluid flow and heat/mass transfer processes within the vadose zone (including reactive chemicals, redox processes/barriers, soil water content, electrochemical and electro-kinetic signals, etc.). The retained applicant will integrate the O-ZNS platform team and the porous media group of ISTO. She/he will have in charge of developing the hydrogeological model of the O-ZNS observatory, by integrating different types of available geoscientific data and concepts (geology, geophysics, hydrogeology, bio-geochemistry, etc.) and ongoing monitorings.

The retained researcher will possibly perform laboratory experiments, quantitative interpretation based on joint inversions and multidisciplinary skills supporting general concepts and specific numerical modelling. He/she will contribute helping in the choice of smart environmental monitoring tools to be installed in the O-ZNS well in Villamblain (35 km north-west of Orléans, Centre Val de Loire, France).

Required Skills

- A strong interest in reactive transport numerical modeling
- Knowledge in the geology, geophysics, hydrogeology and geochemistry fields
- Knowledge in geochemical and hydrological numerical modeling tools (e.g., Hydrus, Phreeqc, etc.) or equivalent
- Knowledge in numerical modeling tools (e.g., Matlab, Python)
- Strong analytical, coding, or mathematical skills would be an advantage

Teamwork skills, scientific curiosity and motivation for scientific research work is a prerequisite qualities.

Doctorate level

Engineering sciences in environmental sciences, doctorate in a geoscience related field.

Useful information

Beginning of the postdoc: March-April 2024 (postdoc of 1 year and possibly 18 years). This position is open till **February 29, 2024**.

Contact person for more details

Mohamed AZAROUAL (mohamed.azaroual@cnrs-orleans.fr), Tel: +33 2 38 49 26 04 / + 33 6 85 27 03 27
ISTO – Earth Sciences Institute of Orléans, University of Orléans, CNRS, 1A, Rue de la Ferollerie, 45071 Orléans Cedex 2, France.