PhD title: Numerical modeling of karst for the protection of water resources

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PhD description :
The proposed PhD position focuses on the formation and dynamics of karst systems within the framework of the research project KASPER (https://anr-kasper.gm.umontpellier.fr). Karst environments provide water resources for a quarter of the world's population and represent the main perennial water resource in the Mediterranean basin. Understanding their physical properties (structural and hydrodynamic) as well as their dynamic is essential for adequate water resource management. To achieve this, it is necessary to deepen our understanding of the hydrogeochemical conditions and processes that determine karst formation and dynamic.
This project focuses in particular on the theory of ghost-rock karstification, which assumes a decoupling of hydrological and chemical processes along existing discontinuities and heterogeneities. To this end, numerical simulations will be performed using an existing research code (e.g., PFLOTRAN) from fracture to fracture-network scale, with the following steps. (i) Injection of a reactive fluid into a fracture with high mineralogical heterogeneities in the surrounding rock and comparison with laboratory experiments. (ii) Simulations at the fracture network scale and the impact of carbonate dissolution on network properties. (iii) Application to the Larzac site with the integration of different types of field data.
This subject requires good knowledge of flow processes, transport, and (geo)chemical reactions, and an interest in environmental sciences, particularly hydrogeology. Knowledge of modeling is also required, with notions of discretization methods, numerical schemes, and process coupling.

Work context:
The PhD student will be employed by CNRS (Occitanie Ouest delegation) and enrolled in the GAIA doctoral school at Montpellier University (STE, Earth and Environmental Sciences, https://adum.fr/as/ed/page.pl?site=gaia&page=l_ed_gaia).
The PhD student will be hosted by the Geosciences Montpellier laboratory (UMR5243, https://www.gm.umontpellier.fr), which brings together CNRS researchers and lecturer-researchers from Montpellier University and is affiliated with OREME (Mediterranean Environmental Research Observatory) Universe Sciences Observatory. The PhD student will be integrated into the TMP (Transport in Porous Media) team and Hydrosystems research axis, in relation with the laboratory's Numerical Computing Platform. The supervision will be carried out by Delphine Roubinet (CNRS researcher) in collaboration with Linda Luquot (CNRS researcher) for the experimental part and Philippe Vernant and Cédric Champollion (lecturers) for the field part. A research engineer in scientific computing and an assistant engineer in experimental chemistry are involved in this project. Collaborations with the University of Neufchâtel and the IDAEA-CSIC in Barcelona are envisaged.

Rick and constraint : none
Duration : 36 months
Starting date: October 1st, 2025