Calls for expression of interest for Ph.D. position *(36 months/starts in Oct. 2024)*

Ph.D. Topic - Reuse of non-conventional water in the Mediterranean context: implementation of a strategic planning at the scale of a French coastal watershed

Université Côte d'Azur / Lab: UMR 7329 Géoazur (France- Nice)
Doctoral School of Fundamental and Applied Sciences (ED 364 SFA)
Partners: University Côte d'Azur (UMR 7329 Géoazur/IMREDD) - Observatory of the Côte d'Azur (OCA) - Régie Eau d'Azur (REA)
Supervision: University Côte d'Azur (Morgan Abily, Emmanuel Tric), REA (Félix Billaud).
Collaborators: Métropole Nice Côte d'Azur and Catalan Institute for Water Research (ICRA)

Application Procedure: send email with the following email subject [Ph.D. Application REUT], to Morgan.abily@univ-cotedazur.fr : CV, motivation letter, transcript and ranking of the obtained or ongoing master's degree. Applications will be reviewed and candidates contacted on a weekly basis until **April 30th, 2024.**

Note: due to the nature of partnerships with French municipality, the candidate shall have a basic level of French language at the beginning of the Ph.D., with a commitment to reach a B1/B2 level after 6 months as plenty documents and reports to be provided by partners (e.g. municipality) are written in French.

Scientific context

In 2022, severe drought throughout the hydrological year endangered the exploitation of the unconfined aquifer in the lower Var Valley [1]. According to short- and medium-term projections, this type of quantitative stress on the resource is expected to worsen: not only due to the impacts of climate change on drought events (frequency and duration), but also because of population growth and increased anthropogenic activity in the coastal areas of the French Mediterranean region [2]. Promoting the infiltration of rainwater and treated wastewater (reuse of non-conventional water) is a potential strategy to mitigate stress on the resource, gaining importance, especially in the Mediterranean region (Spain, Israel, etc.) [3, 4, 5, 6]. However, the reuse of non-conventional water involves a rigorous balance between strict legal frameworks [7,8] and complex cost-benefit analysis, requiring in-depth scientific evaluation of systems (fluvial, hydrogeological, urban) and the state of the resource. Also necessary is a deep understanding of interactions and developments of drivers such as climate change, political, regulatory, and socio-economic contexts [9], which act upon these systems. Therefore, developing and optimizing a strategy for the reuse of non-conventional water at the basin level is a challenge. In reality, investment strategies for the reuse of non-conventional water often lack a clear global vision regarding long-term investment forecasting. This hinders optimal investment and safe resource exploitation.

Objectives

Develop a methodology to evaluate strategic investment scenarios for the reuse of non-conventional water at the scale of a coastal alluvial aquifer for the horizon 2050. The originality of the work will come from the combined use of (i) the development of a solid strategic planning to establish scenarios for the infiltration of non-conventional water, and (ii) the implementation of future scenario in numerical models based on physics integrated into an existing decision support tool (DSS), for the lower Var Valley (France - AquaVar [10, 11] DSS and models currently operating). The development of optimization approaches and quantitative and qualitative monitoring strategies should result from this work and be implemented in the DSS of the economic partner REA (Régie Eaux d'Azur).

Assigned tasks and axis for activities framing

1- Review the Reuse state of the art in Mediterranean countries (in terms of practices for assessing qualitative and regulatory requirements, infiltration strategies, quantitative and economic aspects - CAPEX/OPEX - of solutions, monitoring and modeling methods, etc.).
2- Characterize the potential of the alluvial aquifer of the lower Var Valley and urban systems regarding infiltration or reuse of non-conventional water. Notably, characterize with the laboratory team the behaviors of the river/aquifer system of the lower Var Valley during drought. Local adaptation and exploitation of global change scenarios from the IPCC for the horizons 2030 and 2050. Particularly, through (i) the use of input data centralized by the European Commission within the Climate Data store of the COPERNICUS Climate Change Service, then (ii) the implementation of resource management and exploitation scenarios.
3- Develop a methodology for strategic planning for the infiltration of rainwater and treated wastewater, combining scenarios based on global and local projections and on investment and resource exploitation strategies. Set up appropriate indicators for strategic planning development and monitoring.
4- Include projections of non-conventional water reuse based on scenarios in an existing DSS based on a chain of numerical hydrological-hydraulic-hydrogeological models to analyze impacts on volumetric and pollutant fluxes on recharge.

Références

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