

Groundwater forecasting

About us

At the *Eau et Environnement* Research Lab within *Université Gustave Eiffel*, we explore the intersection of hydrology, artificial intelligence, and sustainable agriculture. By combining expertise in environmental sciences, data-driven modeling, and decision-support systems, we aim to develop solutions that guide water resource management and strengthen resilience in agricultural systems.

The project

This project aims to build AI-powered decision-support tools for agricultural water withdrawal management. With water availability becoming increasingly uncertain due to droughts and changing river flows, farmers and stakeholders need more reliable forecasts to adapt practices such as crop selection and irrigation planning.

To address this challenge, we will develop spatio-temporal deep learning models to forecast groundwater reservoir levels at multiple locations and quantify the uncertainty of these predictions. The proposed approach is to train a hybrid LSTM–GNN architecture:

- LSTM will capture temporal dependencies in ground water reservoirs and climate forecasts.
- GNN will represent the ground water system as a graph, where nodes are measurement stations and edges capture hydrological relationships.

Based on the model outputs, we will implement post-processing to assess:

- Predictive accuracy (e.g., RMSE, MAE, Nash–Sutcliffe efficiency, Kling–Gupta efficiency)
- Uncertainty quality (e.g., coverage of intervals)
- Efficiency (training and inference times)

Data and annotations

A dataset containing ground water reservoirs at multiple stations along with associated climate forecasts will be provided.

Keywords

Neural networks, GNN, LSTM, time-series forecasting, uncertainty quantification

Bibliography

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