Towards more robust evaporation estimates for hydrological modelling under global change

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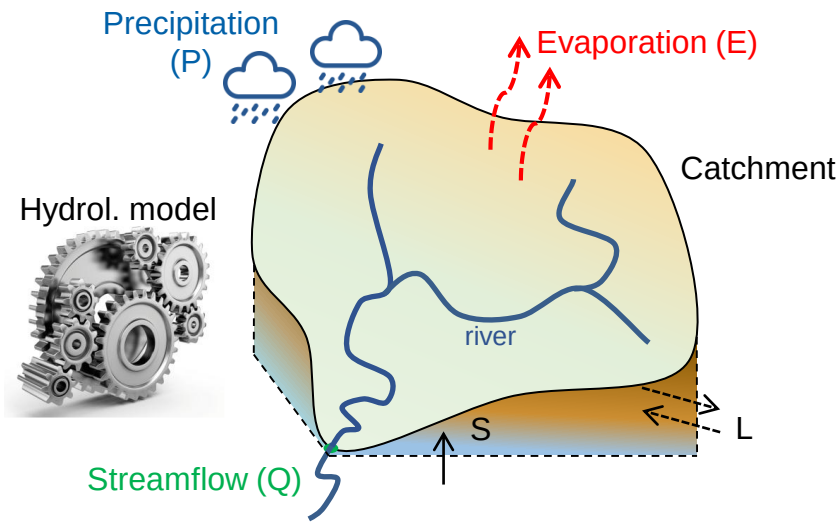
CONTEXT

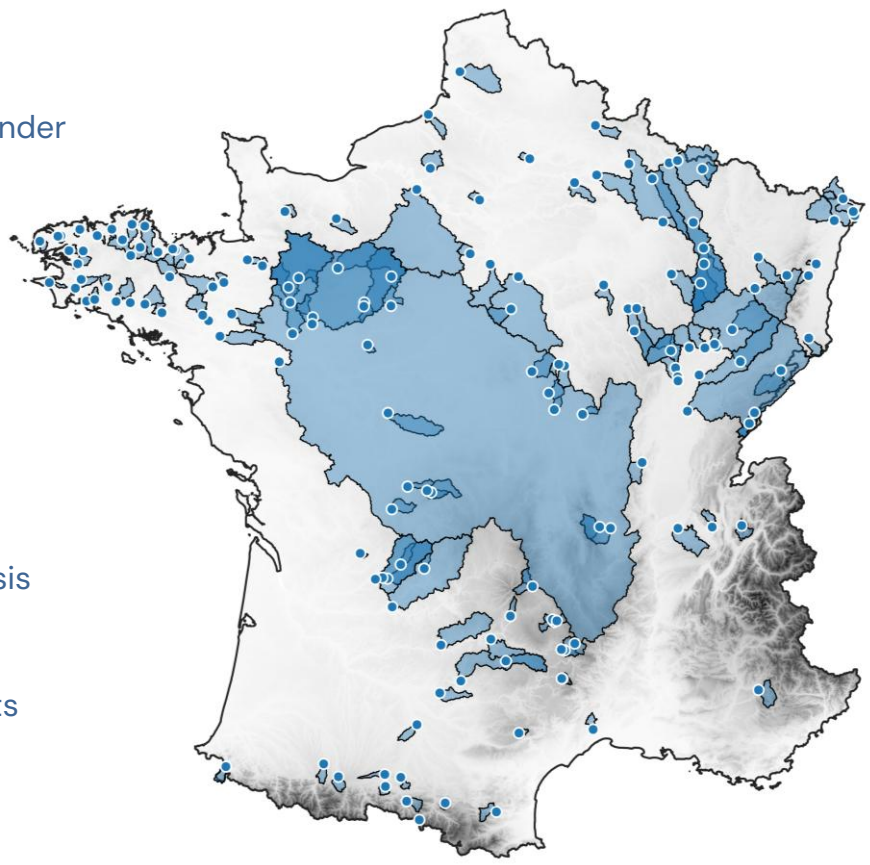
- Climate change is profoundly altering the terrestrial water cycle. Reliable hydrological projections therefore require robust estimates of evapotranspiration, one of the largest and most uncertain components of the water balance.
- Most hydrological models rely on potential evaporation (PE) to estimate actual evaporation.
- However, numerous PE formulations exist, ranging from simple temperature-based equations to physically based energy-balance approaches, and there is still no consensus on which formulation is best suited for hydrological modelling.



SCIENTIFIC OBJECTIVES

This project aims to investigate whether integrating additional environmental drivers can improve the evaporation estimates under changing climate conditions. More specifically, it aims to:

- Compare several formulations used to estimate potential evaporation
- Assess their influence on hydrological simulations
- Develop and evaluate a new climate-adaptive evaporation formulation



THE MISSION

- Review the scientific literature on potential evaporation
- Implement several PE formulations using the SAFRAN reanalysis
- Compare their spatial and temporal variability across France
- Quantify their impact on hydrological simulations based on a snow-hydrological model applied on a large set of catchments
- Explore the integration of vegetation and albedo dynamics to improve model robustness

REQUIRED PROFILE

- MSc student in Hydrology, Environmental and Earth Sciences
- Strong interest in hydrological modelling and climate change
- Good programming skills (R or Matlab)
- Good command of scientific and technical English
- Curious, rigorous and motivated

EXPECTED OUTCOMES

- Experience in large-scale hydrological modelling
- Scientific programming
- Handling national hydrological datasets
- Scientific writing
- Preparation for a PhD

REFERENCES

Lemaitre-Basset, T., Oudin, L., Thirel, G., and Collet, L. (2022). Unraveling the contribution of potential evaporation formulation to uncertainty under climate change, Hydrol. Earth Syst. Sci., 26, 2147–2159, https://doi.org/10.5194/hess-26-2147-2022.

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Ruelland, D., Antoine, F., and, Rabatel, A. (2026). Representing glacier evolution for modelling hydrological responses to climate change in mountainous catchments. J. Hydrol., 677, https://doi.org/10.1016/j.jhydrol.2026.135769.

THE RESEARCH TEAM

- HydroSciences Montpellier (HSM) is a joint research laboratory (CNRS, University of Montpellier, IRD and IMT Mines Alès) internationally recognized for research on the water cycle under global change.
- The student will join an interdisciplinary team working on hydrological modelling, snow hydrology and climate change.