Water Storage and Streamflow Recession in Cévennes Catchments
Geomorphological and Geological Controls and Climate-Change Impacts

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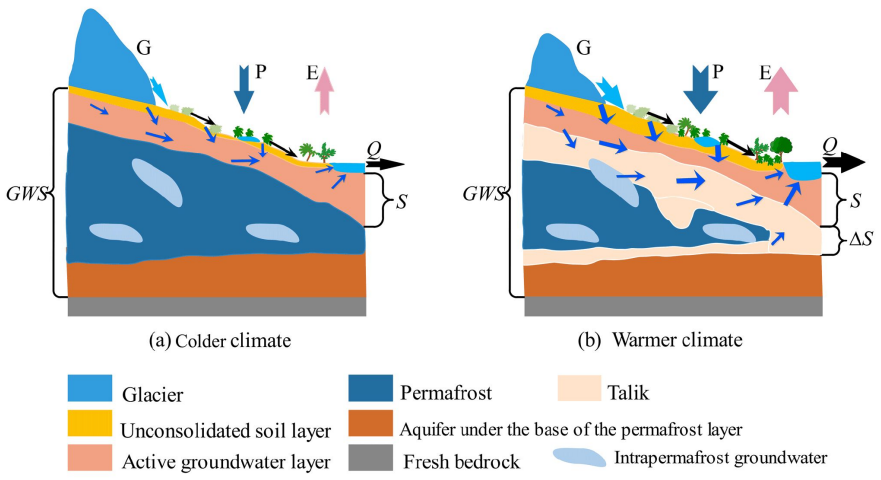
CONTEXT

- Headwaters refer to the source area and upper tributaries of stream systems. They are major contributors to downstream streamflow, so they play a critical role in sustaining aquatic ecosystems and supporting human activities.
- Climate change is expected to substantially alter streamflow dynamics in headwater catchments [1, 2, 3]
- Still, the processes and factors regulating water storage in headwater catchments and its release to streams remain poorly understood [4]
- In particular, the complex interplay between landscape characteristics, geological heterogeneity, and climate forcing shapes streamflow recession behavior in ways that are still not fully understood



Schematic illustration of the climate warming effect on surface conditions and the subsurface profile. The larger sizes of the arrows indicate a large increase in the hydrological variables, e.g., glacier melting, precipitation, discharge, and evaporation. [5]

SCIENTIFIC OBJECTIVES

Assess the potential of upscaled geomorphological and geological factors to predict stream recession behaviour in the Cévennes region

Assess the impact of climate change on stream recession behaviour

THE MISSION

Analyse stream recession behaviour, determining recession parameters [6]

Characterize the geomorphological and geological properties of the catchments

Statistically assess the relationships between recession properties and catchment characteristics

Evaluate how geomorphology and geology modulate the impact of climate change on recession behaviour

Complement existing datasets with targeted field observations where necessary

Carry out numerical simulations to complement the analysis, where feasible

Main tools: Google Earth Engine or similar, QGIS, in-house Python codes

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REFERENCES

[1] Mroczek et al, *The Fate of Western Headwaters: Climate Controls on Base-Flow Decline*, Earth's Future (2026). DOI: 10.1029/2025ef007971
[2] Alaniz et al, *Multiscale spatial analysis of headwater vulnerability in South-Central Chile reveals a high threat due to deforestation and climate change*. STOTEN (2022) DOI: 10.1016/j.scitotenv.2022.157930
[3] Wang et al, *Anthropogenic climate change has influenced global river flow seasonality,* Science (2024). DOI: 10.1126/science.adi9501
[4] Trotter et al, Recession constants are non-stationary: Impacts of multi-annual drought on catchment recession behaviour and storage dynamics. J. HYDROL (2024). DOI: 10.1016/j.jhydrol.2024.130707
[5] Wang et al, Changes in nonlinearity and stability of streamflow recession characteristics under climate warming in a large glaciated basin of the Tibetan Plateau. HESS (2022) DOI: 10.5194/hess-26-3901-2022, 2022.
[6] Jachens et al, *Recession analysis revisited: impacts of climate on parameter estimation*, Hydrol. Earth Syst. Sci. (2020) DOI:10.5194/hess-24-1159-2020

THE RESEARCH UNIT: HSM

- HydroSciences Montpellier is a mixed research units (UM, CNRS, IRD, IMT Ales) dedicated to the water cycle under global change.
- HSM address research activities on the various components of the water cycle as well as the relation with human activities, regarding both quantity and quality.
- Students will be able to integrate themselves into a rich and welcoming environment of scientific diversity. They will share the building with key structures of the water community in Montpellier (OSU OREME, UNESCO ICIREWARD)