

Supplementary materials

Karst network and groundwater flow in the Aulp du Seuil (Chartreuse, France)

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Karst network and groundwater flow: the Aulp du Seuil

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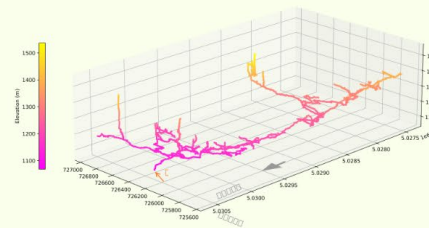
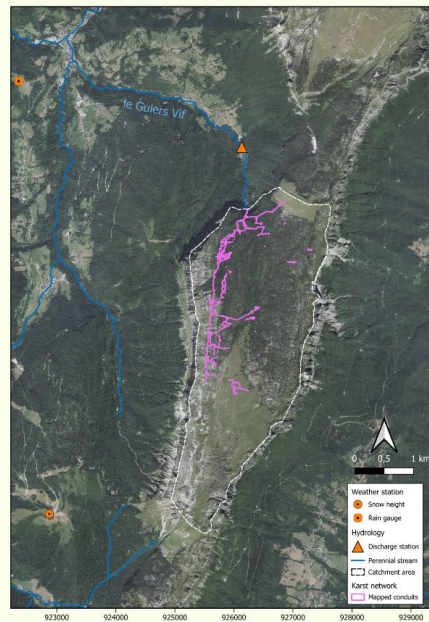
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Study case: the Aulp du Seuil catchment

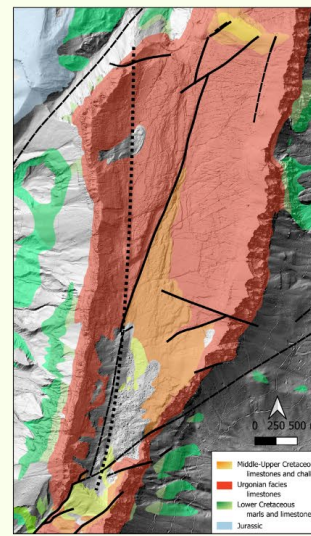
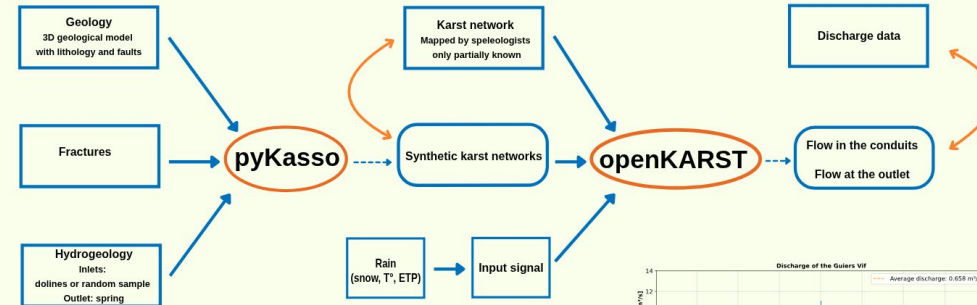


- Why study this catchment ?
- small (~10 km²) and well delimited (topography and tracer tests)
 - relatively simple structure and geology
 - 16-years record of discharge measures
 - 25 km of mapped conduits

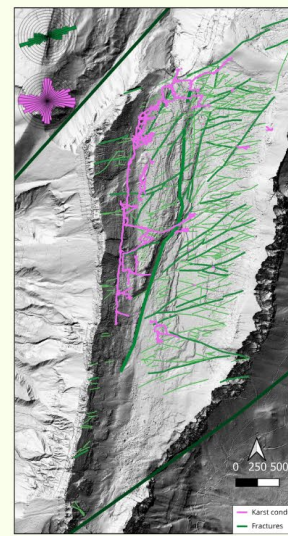


Mapped conduits of the Aulp du Seuil network in 3D [3]

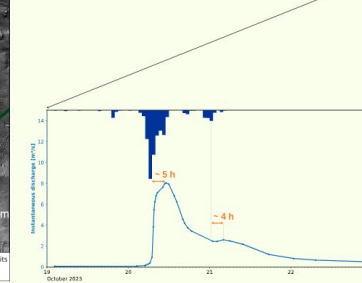
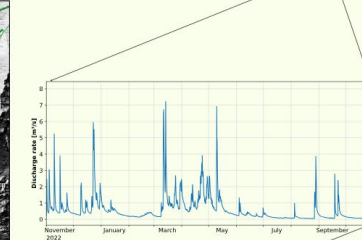
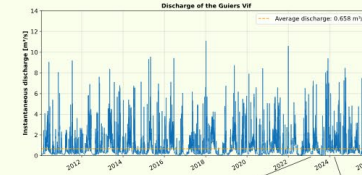
Methodology



Geological map, adapted from [4]



Conduits and fractures with their respective rose diagrams



Discharge data of the Guiers Vif [5]

Context:

Karst aquifers are characterized by a dual flow behavior: rapid turbulent flow in conduits and slow laminar Darcy flow in the fractures and matrix. Due to the fast flow component, they respond very quickly to rainfall events and can trigger **flash floods**.

Objective:

- Model flow in a karstic catchment, with an explicit **representation of the karst conduits** (location, connexion, diameters and roughness), for short time events (hours to days).

Motivations:

- We want to test if **physically-based** model better represent the system than data-driven models, such as neural networks and reservoirs models.

Assumptions:

- Use the model outside historical/known conditions (for example with increased rainfall intensity due to climate change)
- Solve **spatialized** problems such as tracer test or contamination
- Gain insights into network parameters to enable physically-based **network upscaling**

Expected challenges :

- Parametrizing conduit roughness
- Filling missing conduit diameters
- Geometry of the conduit sections (circular, elliptic or more realistic)
- Dealing with high slopes and waterfalls
- What is the system state before the flood event ?

Acknowledgments :

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The authors thank the cavers and divers who explored and mapped the Aulp du Seuil network.

References :

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2. Kordilla, J., Dentz, M., & Hidalgo, J.J. (2026). openKARST. Computers & Geosciences, 207, 106066, and poster 11205 (A.81) of this session
3. Collectif de l'Aulp du Seuil (2026). Base de données du karst de l'Aulp du Seuil (Chartreuse, 38, France) <https://github.com/Dehautenbas/Aulp-du-Seuil-Therion>
4. Gidon, M & Barfety, J.C. (1969). Carte géologique de Montmélan
5. DREAL Auvergne-Rhône-Alpes. Hydroportail, entité V151 5000, <https://hydro.eaufrance.fr>

Link to the abstract :



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Suggestions are welcome !

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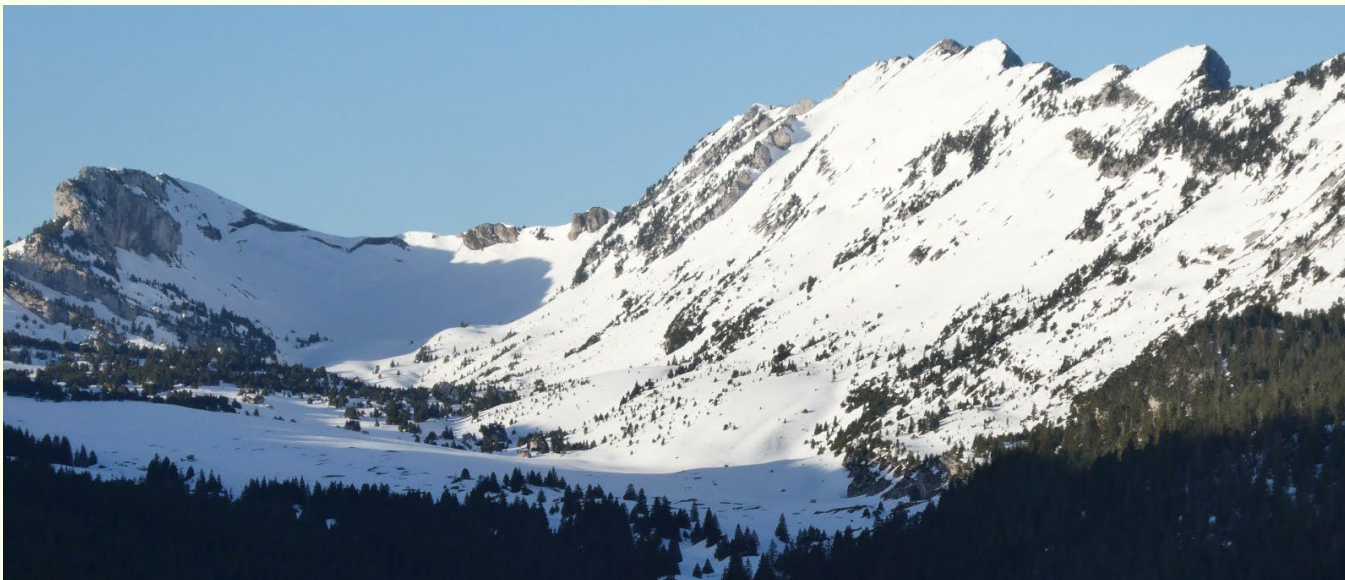


Sharing is encouraged



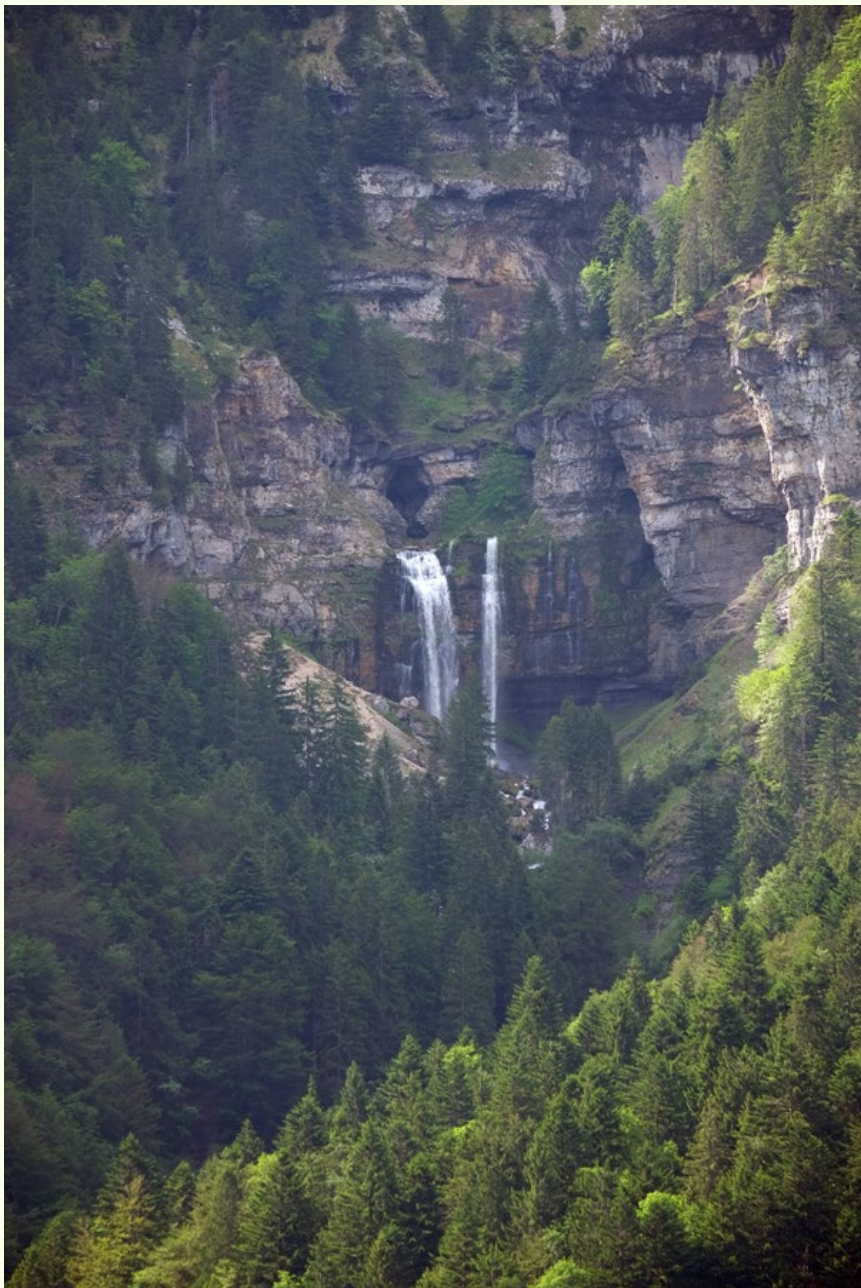
View of the Aulp du Seuil
towards the North

Photo: Parc naturel regional de Chartreuse,
<https://www.parc-chartreuse.net/>



View of the Aulp du Seuil
towards the South

Photo: Taramont, Skitour,
<https://skitour.fr/sorties/187591>



View of the spring of the Guiers Vif with the first cascade
Photo: Christophe Perrier, http://ch.perrier.free.fr/chartreuse/cirque_st-meme.html

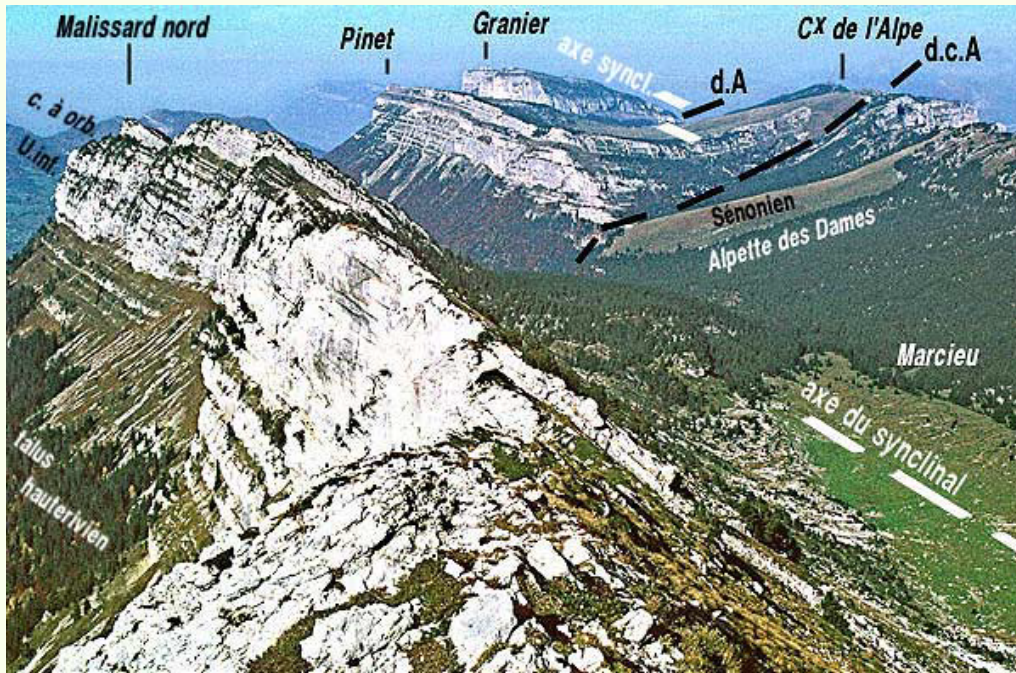


Aerial view of the cirque de Saint Môme and the spring of the Guiers Vif
Photo: Christophe Perrier, http://ch.perrier.free.fr/chartreuse/cirque_st-meme.html

Main perennial resurgences (right), about 30m below the main entrance (left)
Photo: Altituderando, https://www.altituderando.com/spip.php?page=album-photo&id_rando=13516



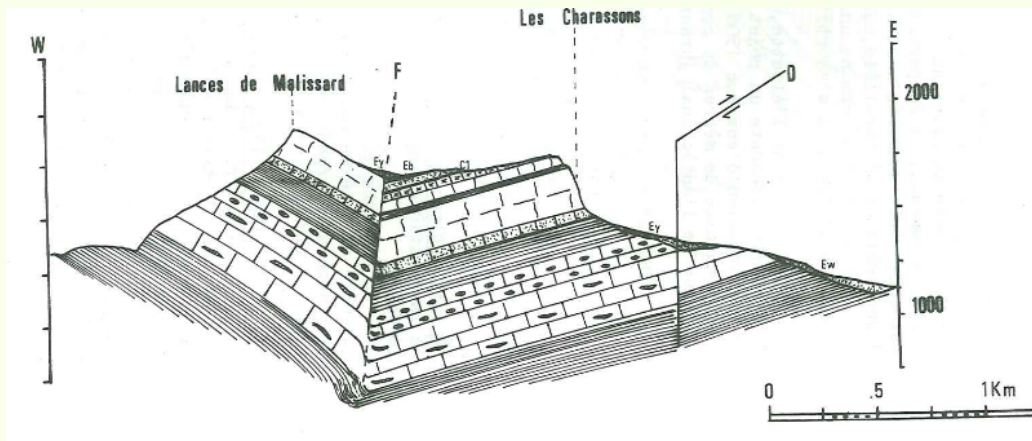
Geological context



View from the Aulp du Seuil towards the North

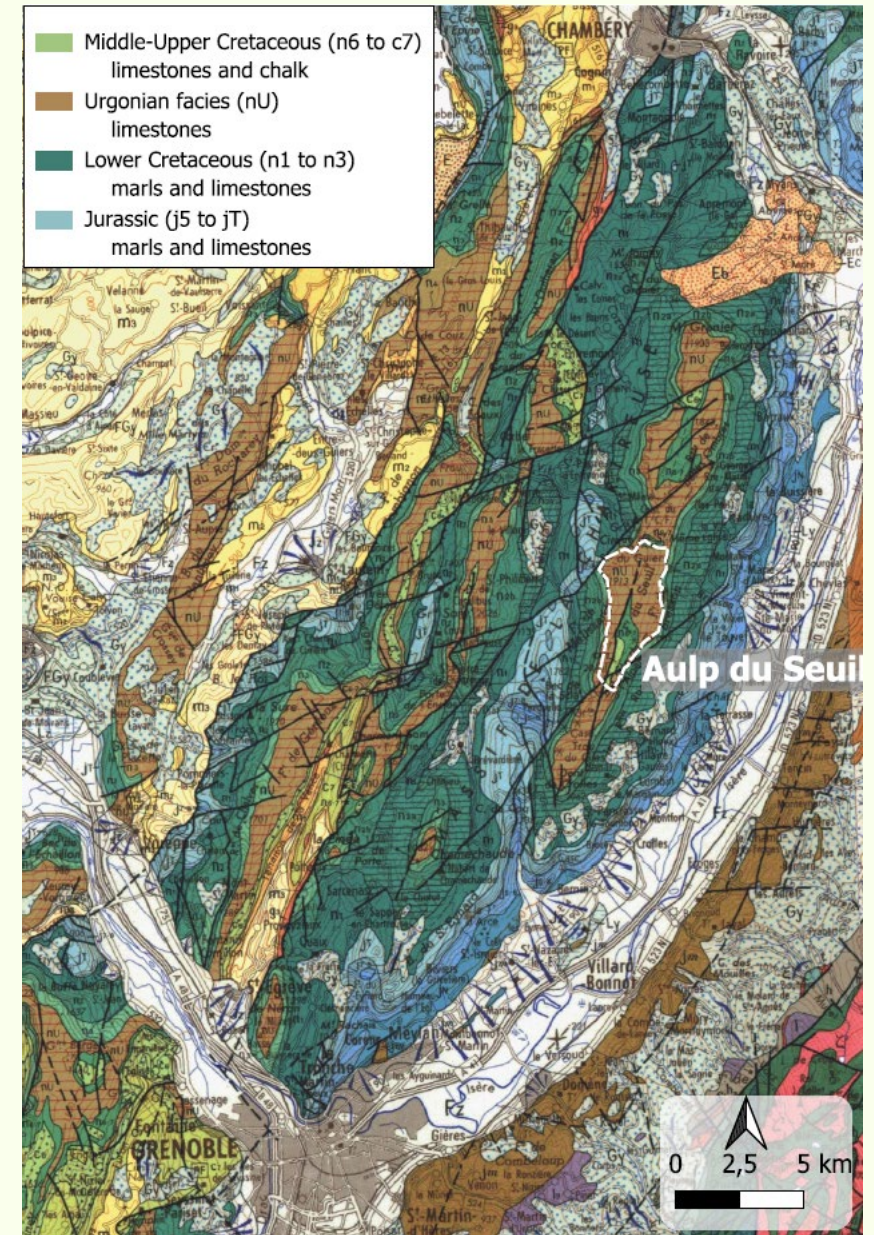
The eastern syncline of the Chartreuse is segmented by dextral strike-slip faults, creating separated hydrogeological units (Dent de Crolles, Aulp du Seuil, Alpe, Granier)

Photo: Maurice Gidon, Geoalpe (geol-alp.uiad.fr)



Cross-section of the Aulp du Seuil

Bozonat, 1988



French geological map (1/250 000) of the Chartreuse, BRGM