

1 **Author's response**

2 **1) Comment from the editor**

3 4 **Public justification (visible to the public if the article is accepted and published):**

5 Dear authors,
6 Thank you for your revision, which has now been re-evaluated by Referee #2. While many smaller points were clarified
7 following my own assessment, and the referee acknowledges that you have addressed the lack of well-defined objectives and
8 hypotheses, they remain concerned that the manuscript, as currently structured, lacks a coherent narrative. I invite you to
9 carefully consider this feedback and the suggested reorganisation of the manuscript to work out clearly testable hypotheses
10 and conclusions.

11 12 **2) Reviewer's report**

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14 I thank the authors for beginning to address some of my suggestions. While the authors addressed one of my major concerns
15 - that being the absence of defined objectives / hypotheses - they did not address any others. I would encourage them to do
16 so.

17
18 My major suggestion remains because the paper remains, as written, a moderately organized group of observations meant to
19 provide insight into the role of a rock glacier on an adjacent riverbed. The manuscript lacks a compelling story. I have
20 thought about this a lot, and my best suggestion right now is to incorporate the authors' first hypothesis into their third, and
21 reorganize the paper. If the authors are testing the hypothesis that the rock glacier influences the formation of aufeis then
22 some kind of mechanism needs to be tested here, which there is not, or some kind of test is needed against a paired rock
23 glacier, or a paired outwash plain.

24
25 I wonder if it would be better to use the aufeis data as evidence of hypothesis 3) that there is groundwater exfiltration at the
26 site, because the aufeis is merely a manifestation of groundwater exfiltration during winter. Make this the first hypothesis.
27 The second hypothesis addresses the source/mechanisms of the groundwater and its exfiltration (i.e., is it from the rock
28 glacier, or something else?).
29

I hope these suggestions are useful for the authors as they try to develop some testable hypotheses and come to some fair conclusions supported by data.

3) Author's response

We thank the editor and the reviewer for their constructive feedback and detailed report. The reviewer's suggestions and comments have been instrumental in helping us develop a substantially improved version of the manuscript. We are also grateful for the extension granted for re-submission.

In response to the reviewer's remarks, we redefined our objectives and hypotheses, and subsequently restructured the manuscript around them. We found particularly valuable the suggestion to organize the paper around two hypotheses: (1) the presence of a significant groundwater exfiltration zone near the rock glacier, and (2) the likelihood that this groundwater is not exclusively sourced from the rock glacier's internal drainage—a distinction between direct and indirect influences that we have clarified in the revised version.

We adopted this framework by structuring the Methods and Results sections according to these two hypotheses. In doing so, we sought to establish a coherent narrative with clearly stated objectives and key messages, while removing content that did not contribute to the central argument. These revisions required a reorganization of the Methods, Results, and Discussion sections, as well as substantial rewording and minor structural adjustments throughout the manuscript. As a result, the revised version differs considerably from the previous one.

In the following section, we outline the most significant changes in terms of structure and narrative.

Sincerely,

Bastien Charonnat and the co-authors

4) Author's changes in the manuscript

- Abstract: We emphasized the central idea of the paper, structured around the dual influence (direct and indirect) that a rock glacier can exert on the riverbed system.
- Introduction (1): We clarified the objectives and hypotheses, and explicitly outlined our two-step methodology. Some sections were removed and others reorganized to better highlight the objectives and hypotheses.

- Study site (2): We expanded the description of field observations that supported the formulation of our hypotheses and the establishment of the methodology.
- Methods (3): This section was divided into two subsections: 3.1) Monitoring and surveying of groundwater exfiltration: including the TIR survey, time-lapse monitoring, and radon activity measurements; 3.2) Physico-hydrochemical characterization. In subsection 3.1.2 (time-lapse monitoring), we added TL3, which was excluded from the previous version for redundancy but ultimately provided valuable information on groundwater exfiltration in the “narrow section.” Subsection 3.1.3 (radon activity measurements) was moved here from the physico-hydrochemical characterization subsection, as it validates the presence of a groundwater exfiltration zone in the “narrow section.” Figure 2 was revised to include TL3.
- Results (4): Several subsections were rewritten to align with the stated objectives and hypotheses. We ensured that key messages were highlighted at the end of each subsection, reinforcing the paper’s narrative and linking to the Discussion. Like the Methods, the Results were divided into two parts corresponding to the two hypotheses and sub-objectives. In subsection 4.1.2 (time-lapse monitoring), results for TL3 were integrated, and Figure 6 was updated to include a camera capture. Subsection 4.1.3 (radon activity measurements) was integrated into the first subsection. In subsection 4.2.1 (sampling and field measurements), we retained only the elements directly relevant for interpretation and the justification for PCA analysis.
- Discussion (5): The argumentation was structured into three subsections reflecting the key findings: (5.1) the rock glacier’s hydrological influence is primarily indirect and significant, (5.2) its direct influence is limited, and (5.3) the obstruction linked to frozen content within the rock glacier renders this configuration transient. We also retained subsection 5.4 (Limitations and perspectives).
- Conclusion (6): This section was rewritten to reflect the revised structure and to emphasize the paper’s key messages.
- References: The list of references was updated in line with the modifications made throughout the manuscript.