

**Reviewer #1 (doi.org/10.5194/egusphere-2024-3933-RC1)**

This article describes a novel use of time lapse gravity to assess water storage changes from the active layer of a rock glacier in Switzerland. The paper is well written, has a comprehensive description of methodologies, and cites appropriate literature.

**We thank the reviewer for his/her time. We appreciate the positive overall assessment of our manuscript and the helpful comments. Likewise, we will make the edits as suggested, which will improve the clarity for readers of the final version.**

General comments for authors:

Only 8 gravity stations were reoccupied on and around the rock glacier for this study. Having more measurements would have provided more statistical significance to the interpretations of storage changes in different areas. Can the authors provide an explanation as to why only 8 stations? Can they recommend including more stations in future studies?

**In gravimetric surveys with a relative gravimeter, even a relatively stable one such as the CG6, it is necessary to return to reference points to correct for instrument drift. As an absolute reference, we chose a first-order station (highest precision type of reference points in the Swiss Gravity Network other than absolute stations**

**(<https://www.swisstopo.admin.ch/en/national-gravity-network>). Travel between this reference station and the survey area involved driving, using a cable car with a fixed schedule, and hiking on the rock glacier. Due to time constraints, multi-day surveys were not possible. Thus, the number and location of the survey points were chosen to balance spatial coverage and a reasonably short survey duration. We will add a brief explanation of this in S3.2.**

Are there historical repeat lidar surveys that could help determine rates of subsidence or uplift of the rock glacier over time?

**Horizontal kinematic data are available from PERMOS. Estimates of vertical changes from laser scans and geodetic surveys suggest, however, small (mm/yr) or insignificant vertical changes.**

Figure 2 and Figure 3 could be improved by annotating the station numbers **We will annotate as suggested.**

Detailed comments:

Page 2, line 46. I don't understand why there are 2 numbers for ice storage changes. Are these minimum and maximum changes over a period of years? The authors just need to clarify this a bit better.

**We will clarify.**

Page 2, Line 54. Seismic is a broad category. Do the authors mean seismic refraction, seismic reflection, passive seismic monitoring? Should clarify.

**We will clarify.**

Page 3, line 88. Is "slightly continental" the correct technical term? Consider rephrasing for accuracy

**We will rephrase.**

Page 3, Line 91. I had trouble understanding what "permafrost-underlain" meant. Consider rephrasing to "Surficial material within the small (30 ha), non-glaciated Murtel catchment consists of unvegetated debris (on rock glaciers and talus slopes) and bedrock, with occurrences of permafrost".  
**We will change the text for clarity.**

Page 4, Line 94. What was measured in the bedrock depression? Consider rephrasing to "...depression and the buried bedrock topography has been mapped with a multi-geophysical..."  
**We will change the text for clarity.**

Page 4, line 97. For clarity, consider changing "...that its thickness..." to "...that the AL thickness..."  
**We will change the text for clarity.**

Page 4, Line 105. For clarity, consider changing "... distance, share this three-part stratigraphy" to "...distance, intercept this three-layer stratigraphy"  
**We will change the text for clarity.**

Page 6, Line 135. How were the gravity observation points marked? With nails into rock? Spray paint? Please include this detail to help others trying this.  
**We will add this info (paint).**

Figure 2. Label the black dots with the station numbers.  
**We will add this as per your earlier comment.**

Page 10, line 237. Could the authors not calculate the snow volume change by subtracting the July DSM from the September DSM?  
**This is essentially what we did (L234 in the pre-print), but it is slightly more complex as, in order to avoid noisy influences in non-snow covered areas, our process also involved smoothing and masking (as documented in S4.4).**

Page 10, line 262. Change "changes in the" to "changes were in the"  
**We will modify it.**

Page 10, line 263. Add the detail that the -15.2 uGal change was for MUERTEL05  
**We will add this.**

Page 10, line 264. Would "terminus" be a better word than "front"?  
**We prefer the term "front", which is the more widely used term for rock glaciers.**

Figure 3. Add directions "S" and "N" to the plot in (a) to make it easier for the reader and label the 2024 points with the station numbers in both (a) and (b).  
**We will modify the figure as suggested.**

Page 14, Line 295. Change "comparisons on a relative" to "comparisons to the 2024 data on a relative"

**We will do this.**

Page 14, line 296. Change "with an offset" to "with a DC offset"

**DC means direct current. We will use the term linear.**

Page 14, line 302. I did not see the ~200 uGal increase as described. Can this be annotated on Figure 3? Does it increase between the July and September surveys or from the smoothed trend of the 1991 points? Some clarification is needed here.

**We will clarify what we mean here (2024 vs 1991 trend line).**

Figure 5. What are the dashed blue lines? Can you add this extra detail in the figure caption?

**We will add this.**

Page 18, line 377. Change "aproportion" to "proportion"

**We will do this.**

Page 19, line 389. Instead of neighbouring 'regions', can you be more specific and say neighbouring 'catchments'?

**Regions is correct, some neighbouring regions are different catchments.**

Caption to Table 3. Change "environment potentially affecting" to "environments that potentially affect"

**We will do this.**

Page 22, Line 464. Do the authors mean elevation instead of 'altitude'? Altitude is height above the local ground surface

**You're right. We will modify it.**

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