Thank you for these very encouraging comments! We appreciate the time spent on the review and will implement all the suggestions to the best of our ability in a revised version of the manuscript. We respond to specific comments below.

For readability, reviewer comments are in black in this document and our responses are in blue.

General comments

The spectacular active rock glacier in the Äusseres Hochebenkar of the Ötztal Alps, Austria, is among the best documented viscous creep features in warm and warming mountain permafrost. The submitted paper compiles, homogenizes and interprets geodetic/photogrammetric observations of extraordinary length (68 years) complemented by modern airborn-uncrewed laser scanning with extreme spatio-temporal resolution. Emphasis is on technical innovation and on the analysis of flow acceleration to destabilization. The unique and extraordinarily rich data set including such novel aspects as, for instance, subseasonal effects and phenomena of block rotation enables detailed insights concerning the landslide-type evolution of the steep frontal part with an earlier, weaker destabilization between the 1950s and 1970s, followed by more stable conditions until the most recent, ongoing and extreme acceleration and destabilization. The text is well written and illustrated, follows a clear/logical structure and discusses the applied techniques and observed phenomena at the forefront of the rapidly growing research field and scientific literature. The paper can essentially be recommended for publication in its present form. The authors may, nevertheless, wish to consider the following reflections.

More could be said about local permafrost conditions as the decisive environmental aspect related to the analyzed creep phenomena. The high-resolution, Alpine-wide permafrost map by Boeckli et al. (2012) should at least be mentioned. A superposition using the publicly available kmz file of permafrost occurrence onto a Google-Earth image would be instructive (Figure 1 in Haeberli 2013 is an example from the Oetztal region).

We will add the permafrost map to Fig. 1 in the manuscript as suggested and expand comments on the permafrost conditions in the study site in the text.

The excellent meteo-data in the region can be used to calculate mean annual air temperatures at the investigated site. This would immediately make clear that permafrost is quite warm despite the cooling effects of the ventilated surface layer consisting of coarse blocks.

We will add more detail on the climatological conditions based on the meteo-data and previous publications.

Mention ongoing permafrost warming trends as documented by borehole measurements (Etzelmüller et al. 2020) and related paleo-effects at depth (thermal anomaly down to >

50m). The perennially frozen, ice-rich condition of the creeping mass is documented by high but variable P-wave velocities and by electrical D.C. resistivities in the medium to high kOhmm range.

We will include a reference to Etzelmüller et al. 2020 and give context in the text, as suggested.

The geometry and kinematics should strictly relate to the moving mass of perennially frozen talus rather than to the landform "rock glacier" (as mental constructs and conventions, landforms can – strictly speaking – not flow). It is important to make clear that the thickness of the landform rock glacier (sediment above bedrock?) can differ from the depth of the thermally defined permafrost, and that the thickness of the moving mass may depend on the occurrence of shear horizons rather than on landform thickness or permafrost depth.

We agree with the reviewer that this is an important issue and will revise the text to improve clarity throughout the different sections.

While the term "acceleration" is self-explaining, the term "destabilization" is more complex and needs a precise definition. Critical strain rates for crevasse formation as an indication of tensile strengths had already been discussed at Gruben rock glacier (Haeberli et al 1979) and may relate to the onset of rapid local sliding. Interesting destabilization phenomena have also been documented in creeping subarctic permafrost (Daanen et al. 2012).

We will add more context regarding the term and concept of "destabilization" as we use it here, based on the suggested references.

Minor remarks

Line 25: In connection with the fully justified statement that "… rock glaciers are … generated by … creep of frozen ground …", the reference to the PhD thesis of Whalley (1974) is astonishing. Whalley had postulated that rock glaciers are debris-covered glaciers and that permafrost is unlikely to occur in the Alps. Still today and against all measured evidence, this author keeps fighting against what he calls "the permafrost model" of rock glacier formation (see the recent discussion in The Cryosphere). The authors should either mention this fact or skip this reference. The latter may be more adequate as long-outdated beliefs from intuitive landform interpretation are at best of historical interest and hardly relate to the excellent quantitative material presented in the submitted paper.

We will remove this reference.

Line 66: The paper by Daanen et al. about permafrost destabilization in the Brooks Range could be cited here.

Will add citation of Daanen et al.'s work on the Dalton Highway debris lobes.

Line 100: Zahs et al. (2019) report resistivities (medium to high kOhmm range) at the rock glacier margin which indicate ice-rich frozen ground with variable ice content, not just "isolated ice-lenses").

We will adjust the text to better reflect this.

Table 1: Take care of "Umlaute" and be consistent: Ladstädter/Ladstaedter. Check throughout the paper and the reference list.

Will check for consistency of Umlaute.

Figure 1: The top-left graph could include the regional permafrost occurrence after Boeckli et al. (2012). The longitudinal profile and the central flowline in the lower-rigth graph cannot easily be discriminated and are not identical – flow directions in the root zone deviate from the given black line.

We will include the permafrost map and attempt to improve the visualization of the flow line.

Bulk creep factor (BCF): This is a useful but rather abstract concept. At an individual location, where surface slope remains nearly constant and changes in flow depth cannot realistically be accounted for, changes in BCF directly reflect changes in surface velocities. The authors rightly emphasize that changes in space and time of both, BCF and strain rates combined, may most significantly indicate the onset of rapid sliding-type movements.

Will edit text to emphasize this more strongly.

Line 279: Be more precise concerning depth values for landforms, permafrost and flowing mass as explained above.

We will revise text to ensure consistent and clear terminology.

Line 296: Perhaps better " the frozen mass of the rock glacier entered …"

Agreed.

Line 381: what does "often by a substantial margin" mean?

Will edit text to be more precise.

Figure 8: The important information is hard to deciffer – enlarge.

We will rework the figure to improve this.

Lines 400-406: Be consistent with the times (present – past) used in writing.

We will revise the manuscript to ensure consistent tenses.

Line 415: These values may be compared with the “critical strain rates for crevasse formation” discussed for Gruben rock glacier by Haeberli et al.(1979).

Will add citation and compare values.

Line 568: Perhaps better “rheology of perennially frozen materials in rock glaciers”

Line 598: Perhaps better “permafrost creep” or “premafrost creep in rock glaciers”

Agreed.

Line 821: Check “Umlaute”: Blockströmen, Ötztaler

Will check for consistent Umlaute.

I congratulate the authors for their outstanding work and hope their important contribution to be published soon.

Thank you again for this very encouraging and motivating review!