Response to Reviews:

We thank the two reviewers for their constructive feedback. Below is our point-by-point response in blue color.

Review Geertsema:

This is a very well-written manuscript that models and helps explain the influence of permafrost degradation on rock slope failure using recent examples from Switzerland and Peru. These types of papers are important because the influence of permafrost degradation on rock slope stability is still poorly understood.

Thanks for this positive assessment.

Lines 104,164, 510   change "half-quantitative" to "semiquantitative"

Thanks. Adjusted.

Line 283 should "4+-" be "-4+-"?

Thanks. Adjusted.

Lines 297,298 suggest changing W and E-orienting to W-facing and E-facing.

Thanks. Adjusted.

Line 517 change "assessment" to "assessments"

Thanks. Adjusted.

Figs 11 and 12 Perhaps make a note of the scale difference between plates d) compared with e) and f).

Thanks. We now write in both figure captions: “Note difference in temperature scale between plate d and plates e/f.”

Lines 527, 528 "A frequency increase at decadal time scales of large landslides from icy peaks can only be explained by climate impacts on thermal characteristics and related stability conditions of frozen rock slopes." Could such a decadal increase, for example, also occur in a seismically active area in response to episodic EQ triggers? Or would that have a different periodicity, rather than an incremental increase?

Regarding the lingering paleo effects of permafrost, and recent LIA cooling, it would be interesting to comment on other studies that looked at rock instability relating to Holocene warm periods. What might this say about the delayed paleo effects, and its evolution (if anything). Eg. Gallach et al. (2020) looking at a 600+ dataset of Mont Blanc area rock falls.

Gallach, X., Carcaillet, J., Ravanel, L., Deline, P., Ogier, C., Rossi, M., Malet, E. and Garcia-Sellés, D., 2020. Climatic and structural controls on Late-glacial and Holocene rockfall occurrence in high-elevated rock walls of the Mont Blanc massif (Western Alps). ESPL 45:3071-3091.

Thanks, excellent. We now write:

“A frequency increase at centennial to decadal time scales of large landslides from icy peaks can only be explained by climate impacts on thermal characteristics and related stability conditions of frozen rock slopes. A close relation with centennial response times between increased frequency of rock avalanches and Holocene warm periods has also been documented by Gallach et al. (2020) in the permafrost-affected Mont Blanc area. In seismically active areas, possible inferences with episodic earthquake triggers remain to be explored. The large majority of the here-discussed events, however, are non-seismic events.

Review 2:

The paper presents two very interesting numerical modelling cases of thermal analysis in Alpine environments and discusses the potential impact of climate change on the slope stability. It offers a well-rounded synthesis of previous efforts and justification of assumptions. The paper is well-written, easy to follow and the conclusions are aligned with the results.

Thanks for this positive assessment.

The reviewer suggests the following minor items be considered in the next iteration:

1. Page 1, Line 28, “Topography”: should be lowercased.

Thanks. Adjusted.

2. Page 2, Lines 61-63, “In the central Alps,… between 1980 and 2000”: have authors looked into the presence of similar observations/data in southern America given that one of the cases studies is located in that region?

Yes, thanks. We now write:

“A high frequency of recent large events from glacier- and permafrost-affected rocks is also documented for the Peruvian cordilleras: Laguna Safuna in 2002 (Cordillera Blanca; Hubbard et al., 2005), Nevado Hualcán/Laguna 513 in 2010 (Cordillera Blanca; Carey et al., 2012), Salkantay/Laguna Salkantaycocha in 2020; Vilca et al., 2021), Auzangate/Laguna Upiscocha in 2022 (Cordillera Vilcanota; Vilca 2022) and Rasac/Laguna Rasac in 2023 (Cordillera Huayhuash; Emmer et al., 2025).”

We also added the references Walter et al. (2020), Pierhöfer et al. (2024) and Bertolotti et al. (2026) concerning the most recent events in the Alps.

3. Page 3, Line 74, “landslides”: given that a cascade of hazards are discussed later in the paragraph, “landslides” should be replaced with “geohazards”.

Thanks. We prefer to write “landslides including complex geohazards”

4. Page 3, Lines 79-80: an interesting report to be cited or included in the text, aligned with the significance of your study, is https://www.science.org/doi/10.1126/science.adm9247.

Thanks. We added references to Svennevig et al. 2022 and 2024.

5. Page 4, Line 104, “half”: should be replaced with “semi” or “pseudo” to avoid confusion.

Thanks. Adjusted

6. Page 16, Line 383, “homogeneous and isotropic”: have authors looked into the impact of heterogeneity and anisotropy by doing a sensitivity analysis? If yes, how the results compared to the ones presented here?

Thanks. As there is near-zero information available about structural details of remote collapsed rocks, such a sensitivity analysis would have gone beyond the scope of our study. In the Blatten/Nesthorn case, however, precise information is presently being collected, which may enable such sensitivity analyses in the future. Detailed analyses about heterogeneity and anisotropy in view of mechanical affects are described in the work by Pfluger et al. (2026).

7. Page 16, Line 387, “3 C”: the degree symbol is missing.

Thanks. Adjusted.

8. Figure 11 & 12: using Fig. 4 and regional geological maps that include regional discontinuities inclination, would it be possible to mark regions that are par-stable and close to the failure? And consequently, track the spatial extent development of such regions through time?

Thanks, this is an interesting perspective for future investigations but was beyond the possibilities of our primarily thermal analysis. Moreover, most regional geological maps are not detailed enough.