

Interactive comment on “Fracture dynamics in an unstable, deglaciating headwall, Kitzsteinhorn, Austria” by A. Ewald et al.

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Fracture dynamics in an unstable, deglaciating headwall, Kitzsteinhorn, Austria

Andreas Ewald et al.

The manuscript by Andreas Ewald et al. discusses experiments and their respective results regarding kinematic observations made in a steep, high-alpine rockwall (permafrost) in the European Alps. In general this is interesting and timely work. Research in this area is appreciated by many although similar work exists/is performed only by a (very) small community. As a result the body of knowledge and related work is compact and many open questions exist. And exactly in this respect I feel that the present manuscript lacks focus and tries to solve (elude to) too many problems at once. Many of

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the claims made are not substantiated by evidence (observation/models) and in parts are contradicting. As such I suggest to limit the manuscript to relate only to processes that are either known and defined in related work or are clearly visible in the data and analysis provided.

The title suggests that an "unstable, deglaciating headwall" is discussed in this paper. While I have no doubts that (significant) glacier retreat also takes place at Kitzsteinhorn, no evidence (retreat rates, references, differential DEM, photos) are given to back up the "deglaciating". W.r.t. to the term "unstable" the paper later states that "irreversible fracture opening was not observed". Additionally there is no further evidence given (rockfall observations, large-scale kinematic observations, debris) that back up the term "unstable". Similarly the term "headwall retreat" should be backed up as well. How much? What is known here? What is observed? Given the collocation with infrastructure (cable car, ski resort) long term evidence should be available apart from regional spatial data and references.

With respect to the data presented there are some issues that should be fixed: The temperature "Crack Top" is not properly described ("Crack top temperatures may not represent the entire fracture"). Where is it measured and what does this represent exactly? The air temperature and snow height that is in large parts used for process analysis is measured on the glacier, yet your rock wall is north facing above the glacier (up to 100m altitude). How do you correct this air temperature/snow height to reflect conditions inside the steep north-facing rock wall? Your precipitation measurement is from a station ~500-600m lower in altitude and ~2km away. This gives you an impression of the regional precipitation (sum), but in an alpine setting it is doubtful if it really captures event-by-event details w.r.t. precipitation, especially for the steep rockwall environment and strong (warm) summer liquid precipitation you are targeting. A co-located precipitation sensor would be highly beneficial here. The model developed here (section 4.3) lacks detail. In its current state, the model cannot be reproduced.

Last I want to comment that you regularly relate to "randkluft systems" and to people

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knowing your project (history) it is known that you are actively exploring/instrumenting also the perimeter of the Kitzsteinhorn rock walls below the glacier surface but this paper does not show any evidence from below the glacier surface. Therefore any connect to processes specific to this "randkluft" regime, e.g. last sentence of the abstract, middle section of section 5.3 are highly speculative at the best. Similarly, speculative statements ("other mechanisms may affect fracture dynamics" "may lead to...") do not offer any sound interpretation of what is/can be observed in this case study. The general impression that this manuscript is not quite mature yet is further exacerbated by the fact that figure captions and figures are not located together, which makes the manuscript rather hard to decipher.

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