

The Cryosphere Discuss., referee comment RC3  
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## Comment on tc-2021-208

Anonymous Referee #3

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Referee comment on "Glacier–permafrost relations in a high-mountain environment: 5 decades of kinematic monitoring at the Gruben site, Swiss Alps" by Isabelle Gärtner-Roer et al., The Cryosphere Discuss., <https://doi.org/10.5194/tc-2021-208-RC3>, 2021

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This paper investigates about five decades of kinematic monitoring at the Gruben rock glacier and glacier site in the Valais, Swiss Alps. The study tries to better understand the evolution between a more permafrost influenced structure and the polythermal glacier part, which form several complex geomorphological forms with different vertical and horizontal changes. This study is an excellent example what efforts of long-term observations can provide to better understand geomorphological landforms and their process-based behaviors. The study is very well prepared and written and the history of the study is carefully compiled.

General comments:

- Figure 1 and 2 could be joined into one single figure and the color scale of the permafrost distribution model of Böckli et al. 2012 could be strongly reduced to a very light transparency level. If the authors do not want to change this, then the figure 2 should be deleted and the dashed white lines should be integrated in figure 1.
- It is understandable that the authors have not included the old measurements of Käab et al. 1997. However, this study is somehow missing this important information and the study would strongly profit, if the old information of Käab et al. 1997 could be included in Figure 5 to particularly show the whole investigated period. I do not think that this is a duplication of information, but readers would probably like to have access to full five decades and not only the new data since 1994 to 2016.

Specific comments:

Line 124: additional citation: there are more permafrost models with higher resolution such as Kenner et al. 2019 (Kenner, R.; Noetzi, J.; Hoelzle, M.; Raetzo, H.; Phillips, M., 2019: Distinguishing ice-rich and ice-poor permafrost to map ground temperatures and ground ice occurrence in the Swiss Alps. *Cryosphere*, 13, 7: 1925-1941. doi: 10.5194/tc-13-1925-2019

Line 135: please add some references how sediment rates are determined, if the authors want to estimate the sedimentation during the whole Holocene and the development of the rock glacier and glacier evolutions. How would certain sediment rates fit with their own estimates to create the current periglacial and glacial environments?

Line 169: at many places numbers are written like 10m instead of 10 m -> please correct all these numbers in the whole paper

Figure 5: please change in all diagrams blue versus red. Red is more suited to negative values and blue more to positive ones

Figure 6: how was the blue line in the figure distinguishing rock glacier from glacier affected part in the figure and why is there no connection between topographical features in the map and the blue curve. Please give some more details

Line 331: giving a retreat of the no debris covered glacier part is somewhat problematic

as this part is not really the glacier tongue as it is still connected to the debris covered part of the glacier and showing a retreat of this part is not very convincing. In addition, giving the full retreat of 370 m is ok, but showing the annual mean values of 17 m does not make sense, as one knows that glacier retreat can be highly variable and if the individual annual values are not measured, the annual values should not be provided.