

Earth Surf. Dynam. Discuss., referee comment RC1
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Comment on esurf-2021-10

Louise M. Vick (Referee)

Referee comment on "Permafrost in monitored unstable rock slopes in Norway – new insights from temperature and surface velocity measurements, geophysical surveying, and ground temperature modelling" by Bernd Etzelmüller et al., Earth Surf. Dynam. Discuss., <https://doi.org/10.5194/esurf-2021-10-RC1>, 2021

I would like to congratulate the (extensive list of) authors for compiling and presenting a wide array of technical data, for more than one location. It cannot have been easy. In particular I really enjoyed the two-three lines of conclusion in every section, which helps to summarise or underscore the most important results. The manuscript can be difficult to follow by virtue of presenting so many different formats of data (time series, maps, profiles etc). It is good that the authors have taken care to clearly present and describe figures. The paper presents a lot of nice data and acts as a reservoir of sorts for information needed in ongoing rock slope studies.

I have made many small comments on grammar, figures, text, references etc in the attached pdf. In the beginning I made grammar suggestions, but soon switched to just highlighting text where the grammar is incorrect. There are also more important comments related to the content contained in the pdf, and in the interests of saving time have not bothered to write everything out again- please forward to the authors so that they may read them. I have described some of the more important comments here.

In some parts of the text, mostly the discussion, the paragraphs are quite rambling and are not formed in a logical manner. For example, section 5.1. I am missing the point of all of these arguments until the last section. Perhaps if the arguments were better set out, more logical or more well developed these would make sense to me. I am also missing a clear explanation between permafrost changes and changes in geotechnical characteristics. This information is seen as accepted, but the discussion is too complicated to follow without fully understanding what the different relationships are. I am missing a clear explanation of the relationship between resistivity and permafrost. This is stated at one point the results, but in the discussion it is difficult to follow (e.g. line 814). The comparison of different rockslides and their annual movement patterns is particularly difficult to follow. I have suggested a table to make it easier for the reader to keep track of the different patterns and how they compare to this study. The logic of presenting these comparisons, and threading into it the concept of reversible damage and 'rock breathing' further complicates the arguments for me. What is the main point of this section? The

ideas behind why the slide moves more in late winter/spring are not presented until the conclusions (key word being pressure). It wouldn't be too hard to set these out. Also, what does water infiltration mean for the potential for permafrost presence?

The temperature modelling of the sites seems to be in direct opposition to many of the conclusions drawn, including thickness, depth and extent of frozen areas taken from the geophysical surveys and temperature records. Also, in the presence of the permafrost all together as opposed to only local patches (e.g. as presented for the first time in the discussion lines c. 725-735). It may be that I misunderstand the interpretation of the modelling, but then this means the model results and their relationship to the presence of permafrost should be better explained. The main conclusion- from line 818- is not something i would draw from both the results and the discussion. This conclusion (Our study suggests a coupling of permafrost development and landslide dynamics) contradicts the line from 777?

Geophysics at Gam-3 is missing the interpretation of signals around the rock glacier- this information is promised earlier on but not delivered in the results section.

The mapping of the rock slide features at Mannen is missing. It is difficult to place any of the results into context for a reader unfamiliar with the site. It is also difficult to place the geophysics in context without a better map and a map inset in the results section- scrolling between figure 1 and figures 10-12 makes interpretations much more difficult for the reader.

Date ranges for monitoring are difficult to find and follow. It would be easier if these are stated absolutely everytime they need to be referenced.

Corner reflectors- are these for satellite insar? This is not clarified. Terrasar-x is at some point referenced, but not when expected in the methods, and no limitations are put on (potential) satellite-insar derived data.

Sample location for rock samples for the lab analysis?

Please also note the supplement to this comment:

<https://esurf.copernicus.org/preprints/esurf-2021-10/esurf-2021-10-RC1-supplement.pdf>