

This second version of the paper *Distinguishing ice-rich and ice-poor permafrost to map ground temperatures and ground ice occurrence in the Swiss Alps* from Kenner et al., has significantly improved in terms of text legibility. The permafrost mapping approach and/or the results' presentation has changed : in the first version the study presented 2 permafrost maps, while only 1 map with 2 zones is described in this second version, which clarifies the paper.

As already mentioned in the first review, it is evident that the authors focus on a main research gap which is to differentiate genesis processes of alpine permafrost by considering the role of mass-wasting processes and ice burial, based on topography and surface characteristics, in addition to the well-known topoclimatic controlling factors. This study is therefore highly relevant for the mountain permafrost community and deserves publication in *The Cryosphere*.

Although this second version shows a clear improvement compared to the the first version, some paragraphs remain hard to read and understand. The results presentation and their discussion could be significantly improved. I therefore recommend this paper for publication after considering the following improvements.

General comments

Abstract : Try to group the sentences related to the background and those related to the methods to ease the reading. Highlight most relevant results, which are not only the evidence of a permafrost-free belt, but also outcome from the regression analysis and validation for example. Hint at the broad significance, not only « new information for users ».

Methods : I wonder about the relevance of presenting the « Mapping approach » before the regression analysis as it introduces concepts related to the regression (example of « the double standard error of our model output»). Some details are not necessary at this stage (example : « the buffer area was mapped in yellow ») and confuse the reader. At this stage of the method, it is in my opinion better to introduce the modelling approach rather than the mapping approach which is the final product and a way to express the model. Similarly, the regression approach is presented at the same time as the mapping approach (P4, L1-5) and it would be better to start from description L31 (P3) : explaining main predictors variables, then the regression analysis and finally the mapping approach. This is a suggestion, but in the current state, the method section is still confusing.

In addition, there is one technical point which remains very unclear to me. In the methods (P4), it is stated that an aspect-dependent factor is used to account for long-wave solar radiation. Do the north faces receive such long-wave solar component ? Even though north faces have temperature close to the air temperature they remain warmer than the air. Why do the aspect-dependent factor is 0 for North faces ? Wouldn't it be a way to account for this offset between air temperature and rock surface in shaded faces ?

In the step 1 you use a 2 m resolution DEM and in step 4 a 25 m DEM. Why not always using the best resolution DEM ? Can you explain your choices ?

Could you add a figure to illustrate Step 3 (regression results).

You propose a sensitivity analysis (P6) based on a « randomly bisected sample ». I wonder why not being aligned with former statistical studies and common statistical approach such as (Boeckli et al., 2012) using a 10-folds cross-validation . Wouldn't it provide more robust results ?

In your sensitivity analysis, you state that the PISR can not provoke random changes in the regression results because it is based on same calculation. However, you assume some snow-cover areas for 6

months, which might be very far from real-world situation with lower elevation getting snow free earlier than higher elevation. Considering the same « winter time » for all terrains might be an important limit in your approach and this might be explained and discussed.

Results : This section is messy. Please divide in sub-sections, presenting results of the regression analysis, sensitivity analysis and then the map. It is a pity that the pattern of permafrost distribution is not better described but I understand that this is not the main message of the paper as reflected by the title. But giving a few statistics (min, max, mean elevation for example) for comparison with other maps would reinforce the results and would be interesting for the community. In my sense, it would strengthen the visibility of this paper.

Discussion : Section 4.4 is very poor. Either you develop a little bit more with examples showing how your map could support societal decisions and challenges, or you move these sentences in the introduction or perspective. In section 4.5, I am quite doubtful about the application of your mapping approach with future climate scenarios. Your suggestion doesn't account for transient effect. The same is true for your mapping approach and this might be introduced in the methods and discussed in the discussion. P17 L17-19 : this is not clear what should be tested (other areas ? future scenarios ?) and what is in preparation. Please clarify.

Detailed comment

P2 L9 : « a ground temperature dataset »

P2 L20 : « to convert the energy balance results » sounds clumsy

P3 L14-15 : list the processes again, maybe in brackets, but the reader has lost track of the above description when reaching that point.

P3 : sometimes you use « Zone », and sometimes « zone » : be consistent.

P4 L15 : it is inaccurate to state that most alpine ground surface are snow-covered during 6 months. I would suggest using « winter time », since snow cover duration is highly dependent on elevation and aspect.

P4 L17 : could you just explain why you chose a threshold of 40° ? Based on which assumption or background ?

P4 L23 : which « feedback » are you talking about ?

P4 L24 : I do not understand, you are describing processes of rock walls and speak about « wet avalanche » ? Are avalanche really a typical process of rock walls ? I think that most of snow accumulating on rock walls melts away, but doesn't accumulate over substantial thickness and surface area to trigger avalanche. Could you clarify ?

P6 L4 : remove « work » from « manner as in work step 1 ».

P7 L15-17 : what about permafrost forming in deglaciated rock walls (*e.g.* Wegmann et al., 1998) ?

P7 L32 : what do you mean ? « The human polygon editor » The authors ? Not aware of the position of the validation points ???

P8 L20 : what about talus slopes ? Are they considered ? Are some relevant data existing for validating the model ?

P15 L30-31 : it might be something missing in this sentence, not clear

P16 L15 : a « a » is missing in « permafrost »

P17 L5 : something wrong in the phrasing