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The Cryosphere Discussions

Interactive comment on "Surface temperatures and their influence on the permafrost thermal regime in high Arctic rock walls on Svalbard" *by* Juditha Undine Schmidt et al.

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General comments:

This manuscript presents a four-year time series of eight temperature loggers at rock cliffs in the surroundings of Ny- Ålesund. The authors use the model CryoGrid 3 in order to discuss the measurements and resolve the influence of the different components on the energy balance on the observations. In addition, the model is combined with three different representative concentration pathways in order to predict the evolution of rock cliffs temperature and active layer thickness throughout the next century. The measurements advance our knowledge of the energy balance at rock cliffs in the

Arctic, and the model is useful for their discussion. However, I have some concerns regarding the manuscript. In my opinion, the temperature measurements are not up to the state of the art, and the modelling work is promising but could be largely integrated with more simulations: adding the two parts is still not sufficient for a publication.

Regarding the measurements: I could not find any information about the calibration of the temperature loggers. This is a major point of concern and strongly weakens all the sequent results and discussion. Additionally, I don't understand why the measurements have been performed with an accuracy of only 0.5°C. In general, I would like to have an explanation of the sampling strategy, which is to my knowledge not up to the state of the art in this field.

Regarding the modelling: a sensitivity study to the many model parameters would be beneficial to the conclusions of the paper and could, with a proper set up, provide interesting insights in the investigated processes. In the modelling in general, and in particular for the future climate scenarios, the quantification of the uncertainty (related to the climate scenarios and their propagation in the modelling) is required.

Due to the limits of the temperature time series and the current state of the modelling, I suggest to restructure the manuscript in order to provide a more thorough study. Personally, I suggest to focus the manuscript on the modelling part: use the observations for model calibration and then use this to perform a more complete series of synthetic experiments to investigate the energy balance in different conditions. Therefore, I consider the manuscript promising and potentially suited for publication, but I suggest some major revisions prior to publication. A short list of specific comments (non exhaustive) is listed below.

Specific comments:

Abstract: I suggest to focus the abstract (according to the comments above) having in mind the novelty and the scope of the manuscript.

Abstract: The abstract could benefit from a more quantitative description of the main results.

Line 1: The manuscript investigates rock temperatures, which have an impact on many topics also beyond rock wall instabilities (ecology, biology. . .). I suggest to extend the rationale to clarify the potential influence of the study.

Figure 2: Please show the location of the loggers on the images. The quality of the figure is not high, I guess this can be improved in the reviewed manuscript. Line 121: If there are any important overlapping methodological points with other papers it would be helpful to explain this more explicitly.

Figure 3 (and 5 later): It would be beneficial to show – maybe in the Appendix – the entire time series of the measurements (and of the modelling results for Fig. 5).

Line 161: what about rock joints? The bedrock is limestone – heavily fractured – as mentioned in the manuscript and shown in the figures.

Table 2: this could include the references directly in the table.

Line 226: is the sea temperature constant throughout the entire simulation for all the three scenarios?

Line 319 and Figure 6: what happens in summer? A short explanation would complete the paragraph and in case could also lead to an extension of the figure.

Line 476: this paragraph has no connection with the rest of the manuscript, I suggest to avoid it. Possibly it could be mentioned as an outlook.

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