

The Cryosphere Discuss., referee comment RC2  
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## Comment on tc-2021-5

Anonymous Referee #2

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Referee comment on "Effect of ephemeral snow cover on the active layer thermal regime and thickness on CALM-S JGM site, James Ross Island, eastern Antarctic Peninsula" by Filip Hrbáček et al., The Cryosphere Discuss., <https://doi.org/10.5194/tc-2021-5-RC2>, 2021

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The paper entitled *Effect of ephemeral snow cover on the active layer thermal regime and thickness on CALM-S JGM site, James Ross Island, eastern Antarctic Peninsula* presents and discusses ground temperature and weather records (snow depth only available for 1 year) over the summers 2016-2017 and 2017-2018, together with GPR measurements, mechanical probing and UAV survey on a permafrost monitoring site in the Antarctic Peninsula to infer summer snowfall effects for one of these two summers.

### General comments

Overall, the paper is well written and easy to follow. However, I do not get the broad significance of the study. How does these results will impact other researches and current understanding of active layer and permafrost dynamics at a broader temporal and/or spatial scale ? Results point out very minor ground temperature and active layer thickness changes, and conclusions appear very speculative. One major concern here, is that the reported observations are so minors and questions about uncertainty in the measurements arise. Snow measurements are restricted to 1 summer only, and air temperature difference, despite presented as similar from year to another, are apparently not so similar (0.3°C difference reported for January in comparison to minor ALT change, this is meaningful, L 144). Furthermore, the paper lacks of integration of the international and recent literature. These limitations make the paper not suitable for publication in The Cryosphere.

Therefore, to lower the reviewing time, this review below is not complete. A few major concerns and suggestions for improvements are listed in order to guide the authors for manuscript improvement. I suggest to submit the study in another journal that rather targets researches with a regional impact. I also suggest to couple this study based on observations only with a modelling approach to see if the observed patterns are reproducible, and if yes, to extrapolate the results to give them a broader significance.

### Specific comments

- Abstract :

The abstract is overall very poor and do not point out any peculiar finding that could help improving active layer thermal regime. The fact that summer snowfalls affect seasonal thawing dynamics is not new. Possibly, the study could have made some step forwards if these effects would have been more generally quantified (and not only for a few days in a specific summer) and that the significance of these results for long term permafrost dynamics in regards to climate change could be assessed.

The term « ephemeral » that is used all along the study must be defined.

The same is true for « AWS-JGM » and « AWS-CALM », it is not clear to what they precisely refer to.

« ... a decrease of mean summer ground temperatures ... ca 0.5-0.7 °C » : compared to what ? The day before ? the summer before ? but how consistent is it ?

- Introduction :

The introduction is based on very general sentences while the study aims at describing very specific patterns. More references should be considered. For example, to determined the threshold for snow insulation effect, the only considered study is Zhang, 2005, while, for example, and among many others (e.g. Luetschg et al., 2008) give other threshold. And of course, this threshold is depending on a variety of snow properties that are not describe here. This should be better explain all along the manuscript.

L 21-22 : the insulation effect of snow is not due to the albedo !!! Here again, a thorough understanding and accurate reference to the existing knowledge and literature is necessary.

Globally, references are only studies condcuted in Antarctica. Studies on the interactions of permafrost and snow in other regions worldwide must be considered to enlarge the impact of your study.

- Study area :

L73-74 : to which period does this ALT (50-120 cm) is valid for ? From which measurements it is known ? Given the variability described here (> 100%), the ALT changes reported in the abstract are ridiculously low !

Fig. 1 : Provide a map of the entire Antarctica. Reader in international journal such as TC do not all know where is the AP exactly.

L78 : reference is missing

Fig. 2 : add north . The AWS reported in the figure must introduced at least in the figure caption.

- Material :

L 93-94 : at which depth are the ground temperature sensors ?

L 98 : give correlation value

L 112-113 : this would be nice to report these measurement points on Fig. 2.

Overall, there is no consideration for uncertainty in your ALT and GPR measurements. One can wonder if the major results reported in the abstract, which are minor changes in ALT, are not in the range of uncertainty.

Fig. 3. This needs to be better explain. How are these values obtained ? Not every reader is familiar with GPR measurement and GPR data processing.

L 130-131 : when reading that the snow probe was not working before 2017-2018, I wonder how meaningful it is to present effect of snow fall by comparing temperature patterns to previous years while only 1 year of snow measurements are available.

- Results :

L 144 : is it mean monthly temperature for January ?

L 168ff : explain how did you observe the snow storm and snow deposit evolution. Meteorological record ? Direct observation ... ?

Fig. 6 : I do not understand from which data is built this figure. Probing was done 2 or 3 times during each summer. Is it interpolation within temperature sensor ?

Fig. 7 : it is for a specific day ? Average over the month ?

- Discussion

Section 5.1 is part of the results.

See general comments and comments on the introduction : this is broadly speculative and lack of references to the international literature.