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Comment on gi-2022-4

Fabian Walter (Referee)

Referee comment on "Towards a self-sufficient mobile broadband seismological recording system for year-round operation in Antarctica" by Alfons Eckstaller et al., Geosci. Instrum. Method. Data Syst. Discuss., <https://doi.org/10.5194/gi-2022-4-RC2>, 2022

This submission by Eckstaller et al. proposes technical solutions for deploying on-ice seismic broadband stations in Antarctica. The authors present a setup that solves some of the technical problems implied by the rough Antarctic environment and offer an outlook on future developments and additions to their system to tackle other challenges like limited sunlight during the Austral winter.

The manuscript is clearly written and easy to follow. As someone who has installed seismometers in icy conditions throughout his scientific career, I welcome such a communication. Written and publically available documentation on technical details of instrument deployments can be extremely important for future projects and may make the difference between research success and failure. At the same time, I would encourage the authors to make some major modifications on how this material is presented. I detail these points of criticism below.

Fabian Walter.

MAJOR COMMENTS

An easily implemented though to me essential change would be not to mislead the reader in thinking that a technical solution to year-round broadband station deployment has been successfully tested. This is suggested in the title and the last paragraph of the introduction. In the final paragraph of the Discussion, the authors back down from this claim stating that bridging the winter gap was not yet the goal of this technical solution but is left for future efforts. This will likely annoy the reader who truly looks for useful information for his/her future deployment and feels encouraged by the abstract and introduction. At all parts of the manuscript, the reader should be clear on what this study

is for. To my mind there is nothing wrong with presenting an intermediate step to an ideal broadband setup, but this has to be communicated from the beginning.

My second point of major criticism is that the material tends to be presented as an experience report rather than a systematic evaluation of different options, which I would expect for a scientific paper. It would help to see more numbers, especially on power consumption, that were the basis for the hardware choices. See my specific comments below.

Finally, I suggest providing more information on the Antarctic setting: Like I said, I have deployed many instruments on glacial ice myself, however, the majority was on ablation zones, which are ice-free in the summer. This is a very difficult environment, as well, although completely different from the Antarctic setting. For example, if the station is visited infrequently and rarely, which is the final goal of the author's set up, how do you deal with snow accumulation? Do the instruments have to be unburied and moved close to the snow surface regularly? Or is snow accumulation negligible at the locations and over the time scales of interest?

SPECIFIC COMMENTS

The manuscript has a few typos and grammatical mistakes (in particular the use of past tenses) that should be corrected with a thorough proofread.

"Data" is plural.

Line 37: rewrite: "However, there is little on ...".

Line 53: "adequate capacity" should be defined.

Line 75: "ice lying over solid rock": as opposed to what? Lying over subglacial till?

Figure 2 and associated text: The wind battery box still seems an idea rather than an established solution. This should be made clear from the beginning of the manuscript. What is the difference between an equipment and an electronic box?

Table 1: This table would strongly benefit from numbers, especially on power consumption or supply (which is given in the text for some elements). Such a concise presentation would be extremely useful for a reader interested in adopting the author's approach or parts of it.

Lines 103-106: Here some numbers about the power consumption for different configurations would be more helpful than just specifying the authors' favorite choice.

Figure 3A: Is the battery box associated with solar or wind power? Later from the text it is clear that it's the former, but it should also be stated in the figure or its caption.

Line 152: As a non-expert I would expect a reference for this statement.

Section 3.1.3: This paragraph is held rather general and superficial. Many readers would be interested at which temperature range or minimum temperature battery heating is worth it and when it costs more than it provides gains in terms of power supply. Ideally, this information should be given here and backed up with numbers, e.g., from test measurements.

Line 157: Not sure what is meant by "which can switch 6 amperes of heating current".

Line 167: What is meant by "switched opposite to each other"?

Lines 174-175: What is meant by "cascading batteries"?

Lines 184-185: This sentence reads more like an instruction manual than a scientific piece of text.

Lines 194-195: Is this based on test measurements? Or is there a reference for this statement?

Line 196: delete "additionally"

Line 201: use of "huge" is awkward.

Lines 210-211: Why can Li batteries not be recharged? Because of low temperatures?

Lines 217: Which remaining energy?

Line 218: "easily integrated" sounds a bit fuzzy. The reader is left wondering why then it hasn't been integrated (see following sentences).

Lines 224-225: Why is the wind turbine installation so involved?

Line 232: The use of adjectives like "careful" and "proper" weakens this part of the paper. More specifics would help.

Line 241: Quantify "very low temperatures".

Line 244: Is "mass" the right word here? Better "ground"?

Section 4.3: A general remark: we also had big problems with static charge on Alpine glaciers. In the end we found it beneficial to make sure all station elements (sensor, digitizer, metal frames, ...) were connected and at the same potential. This solved most problems although no ground was available on the ice.

Line 253: rewrite "partly very different"

Line 255: "fast to deploy" with respect to what?

Lines 274-278: Here the original goals are redefined. This has to be changed.

Line 291: In this sentence the term "polar" or "on-ice" or something equivalent should appear.

Lines 294-295: This statement is trivial.

Lines 296-298: Perhaps it's worth considering that seismic records have high sampling rates and thus the setup could easily afford power supply for GPS, temperature gauges, and other environmental monitoring logging at lower sampling rates.

General question: Would it be possible to stream data with this setup or is this more than an incremental step in power consumption?

There are two sections 3.1.1. In general, I find this manuscript contains many sub and sub-sub sections given its limited length.