Review of “GUARD – An automated fluid sampler preventing sample alteration by contamination, evaporation and gas exchange, suitable for remote areas and harsh conditions” by Arno Hartmann et al.

Review by dr. ir. Rolf Hut

The authors present a novel autosampler that, as per their claim, seals the sample with the outside world after taking it. They rightly claim that common availability of a sampler like this will greatly help the science of hydrology.

Apart from a view minor suggestions I believe are easy for the authors to take into account, I recommend publishing this article in HESS. On top of that, I would also argue that the readership of the EGU- Copernicus journal Geoscientific Instrumentation[1] (GI) will be interested in this work since I see broader application of this device in the geosciences than just in hydrology.

My comments focus on two issues:

1. Validity of the device and claims made in the article
2. Open Science and reproducibility

Validity and claims

The authors claim that their device prevents contact with the environment, including evaporation of the sample, after the sample is taken. They demonstrate in their fieldwork in the karst cave that their samples are statistically identical to manual samples. They furthermore show that their samples do not deteriorate over time by repeating the measurements. The questions I have:

1. I would expect an autosampler to take measurements at regular intervals. However, in figure 5 the samples seem to be taken at rather random times. Can the authors explain why this is?
2. The authors substantiate their claim that the samples are kept airtight by placing them in a fridge for a considerate amount of time. However, there is no control to compare against, ie. no open samples that are exposed to evaporation in that fridge. It is hard for the readership to judge the amount of expected evaporation had the samples not been properly sealed. I would find it unreasonable to ask the authors to redo their experiments, but would like to ask them to provide the readership with an

[1] Disclaimer: I am not an editor on the GI team, although I did publish in it.

estimate of expected evaporation in the setting of their fridge (8 degrees C, high humidity I guess?) based on literature values. This will help to show that indeed, their samples are sealed properly.

Open Science and reproducibility

HESS is a fully Open Access journal and the editors also actively advocate for Open and Reproducible Science in general. In this spirit I think that although the article is it now stands informs the readership about the existence of the new autosampler, it does not allow hydrologists to start using it. The provided technical details are insufficient to rebuild the GUARD using just this article. If the authors intended this (because they maybe want to persue manufacturing the GUARD commercially?) than I think that HESS might not be the ideal outlet to promote it, it is after all a non-for-profit Open Access Scientific journal, not a commercial advertisement leaflet.

I hope the authors did intend the GUARD to be re-buildable by other hydrologists, which would be completely in the spirit of Open Hardware, the movement spearheaded by the Arduino which the authors use as main CPU. By providing a flowchart of their code and their electrical circuitry the authors do hint that this is their intention. For the GUARD to be fully re-buildable I would ask the authors to add:

3. A detailed technical drawing of the physical device, including sizes of all components
4. A Bill of Materials akin to their Table 1, but with more detail. At least the price and an (online?) location where the part can be bought at time of publishing should be included.
5. A step by step build guide. This could be hosted on an external website like instructables.com and linked to in the article, it could also be provided as supplementary material

In this way, the authors will help the readership to have the most benefit from their research.

Minor points

6. The opens lab at OSU[2] is also working on an autosampler, with a complete different setup. Might be worth citing their work: http://www.open-sensing.org/opensampler/. They have a paper forthcoming, but did present it at the AGU fall meeting (where I spotted it). Maybe that abstract can be cited.
7. On line 3 of page 3 the terms “high frequency, long term monitoring” etc. are used. What constitutes high or long term is very dependent of the field of science one is in. Please make this more specific to the GUARD.
8. On page 3, line 6: I had to look up what “septa” is. Maybe this is because I’m not a native English speaker. If septa is considered a technical term, please explain it once you introduce it for the first time.
9. On page 4, line 24: future work might be better place in the discussion, although mentioning it at both places is also fine.

[2] Disclaimer: the director of the opens lab at OSU, prof. John Selker is both a professional and a personal friend of mine.

10. On page 6, line 4: “effectively prevented” assumes certain demands from applications. I suggest with replacing with something like: “prevented for most common use cases”.
11. On page 18, table one: sentences like “the sampler can also run… … important constraint” are more suited in the discussion.

Good luck with these final points and finishing this nice publication.

Best wishes,

Dr. ir. Rolf Hut