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Hydrology and Earth System Sciences
Discussions

# *Interactive comment on* "Technical Note: Evaluation of a low-cost evaporation protection method for portable water samplers" *by* Jana von Freyberg et al.

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Dear colleagues,

With great interest, I have read your manuscript on the design of an evaporation reduction method for automatic water samplers, facilitating their use in isotope hydrology studies. Given the popularity of these samplers, the topic is, in my opinion, relevant for the HESS community.

The simple concept is described in detail and since the required parts are low-cost and readily available, the method is easy to apply (if the reader has access to an automatic



sampler).

The experimental designs are well-thought-out and the corresponding results indicate that the suggested mechanism is indeed capable of reducing post-sampling evaporation, although there are limitations (certain climatic conditions, storage times).

The manuscript is also well structured and written.

I do have a few remarks (see below), but overall I think the manuscript should be published as a Technical Note in HESS, after minor revisions.

Introduction: I think Williams et al. (2018) should be cited somewhere in the introduction. They have tackled the topic of post-sampling evaporation from automatic samplers before and should be given credit for their efforts. As their approach was rather different from yours (other evaporation reduction methods; experiments in insulated boxes instead of real automatic samplers), mentioning their work will provide additional context (and justification) for your work.

Line 47: That the tube dips into the collected water is obviously the most important aspect of this mechanism, but for sake of completeness, you could also mention the complementing aspect of the Gröning et al. (2012) design, i.e. the pressure equilibration tube (e.g. "Tube-dip-in-water collector with pressure equilibration", IAEA 2014). To additionally cite the pioneer work by IAEA (2002) is a good idea, but the reference is missing in the reference list.

Lines 61-63: This sentence is a bit misleading. It suggests that only changes in air temperature and humidity would cause problems, but evaporation and vapor mixing would also occur if temperature and humidity remained constant.

Line 78: I suggest to refer to Figure 1a directly after "9 cm in length"

Line 80: The word "tightly" is misleading here. If the syringe housing is really plugged tightly into the bottle opening (i.e. air-tight), the whole mechanism would not work anymore. When additional water is supposed to flow into the bottle, air needs to be

displaced and has to leave the bottle. You do mention this aspect later (Section 4, line 412-413), but this should be made clear here. You could even explicitly mention that you skip the "pressure equilibration tube" of the original concept (Gröning et al., 2012; IAEA 2002, 2014; see comment above).

Lines 85-91: I appreciate that this potential pitfall is highlighted and that you provide a maximum filling rate. I can imagine that debris (e.g. sediment, insects) may further reduce the tubing diameter (1 mm is quite small) in a field setting. Hence, it is probably a good idea to use a screen at the intake (e.g. a funnel screen) and maybe you want to mention this explicitly somewhere.

Line 104: For sake of consistency, this part should read "...during 62 two-to-three-week cycles..." (as in lines 179 and 382)

Line 111: Please provide some details on the climate-controlled chamber. If this was a commercial chamber, please mention model and manufacturer. If it was a custom-made chamber, please indicate this.

Line 113: Please also mention details on the temperature and humidity loggers (model, manufacturer, precision). Sometimes, it is these technical details that matter for the reader, particularly if they want to conduct similar experiments (as indirectly suggested in line 452). Knowing which logger can cope with such conditions (rel. humidity of up to 100 %), can be valuable.

Line 217: Wouldn't $\Delta\delta$18O and $\Delta\delta$2H be more accurate?

Line 230: Please specify what the reference water is here (tightly sealed bottles).

Lines 237-239: The 1°C temperature difference between the climate chamber and the ISCO (inside the climate chamber) is a bit surprising, particularly because the temperatures matched quite well before the logger as moved "to a more representative position".

Table 1: Probably, this should read "... relative to the reference water...".



Lines 264-267: The isotopic shifts observed for days 10 and 12 are indeed remarkable and I wonder if it is a coincidence that this was about the time when a humidity of about 100 % was reached. Could condensing water play a role here (i.e. liquid water drops flowing into the bottles)? Concerning the possible explanations that are given: I do not understand how spillage could explain the phenomenon.

Fig. 2: I am a bit confused about the x-axis in Fig. 2c. I was able to match all blue data points in 2b and 2c and conclude that some of the blue points in 2c represent the first days of the experiment (e.g. days 0 and 2). During this time, humidity was around 50 % according to 2a, but in 2c the x-axis only shows humidities above 87.5 %.

Line 282: Please make clear that the "low relative humidity" refers to the chamber conditions (not the conditions inside the ISCO).

Lines 296-298: If these temperatures and humidities are not shown anywhere, please indicate this to avoid confusion.

Lines 312-314: If wind plays a role strongly depends on the geometry of the setup. A possible scenario that is not mentioned here so far is temperature-triggered gas volume changes. In contrast to Experiment 1 (climate chamber), Experiment 2 was characterized by significant daily temperature fluctuations (20°C and more inside the ISCO; outdoor setting; Fig. 4a). Upon heating (daytime), the air inside the ISCO expanded and some of the (moist) air was pushed out of the device. When temperatures dropped (at night), the opposite happened, i.e. the air in the ISCO contracted and sucked in fresh air from outside. This "sampler breathing" probably happened on a daily basis, resulting in a greater air exchange, which in turn (apparently) caused lower humidities inside the ISCO (and more evaporation). Maybe this effect could have played a role here as well.

Lines 328-329: This sentence is confusing. Do you mean "...exchange with the heavier RefA water..."?

Lines 370-372: I am not sure if this statistical summary is sufficient. The mean value is close to zero, but I think you should at least mention that the isotopic shifts showed a fairly large scatter and ranged from about -2 (i.e. isotopic depletion) to about +3 ‰ (isotopic enrichment) in case of $\delta$2H (Fig. 7c and 7d). In case of $\delta$18O, the maximum deviations are remarkable as well. Here, $\Delta\delta$18O scatters between about 0.7 and about +1.2 ‰ (Fig. S5c and S5d). Both values are clearly beyond the analytical precision.

Practical implications: Here, the wind issue is stressed again. Maybe the "sampler breathing" (see above) also deserves to be mentioned here. If it really played a role, a practical consequence may be the need of a thermal insulation of the ISCO (reducing the temperature fluctuations inside the device).

Practical implications/Conclusions: The partly significant $\Delta\delta$2H and $\Delta\delta$18O values observed in Experiment 3 (see above) underscore the relevance of such "field controls". These pre-filled bottles (known isotopic composition and mass), placed into the automatic sampler upon field installation, allow for a hindsight evaluation of the samples' isotopic integrity. Although their advantage is somewhat obvious, it may be a good idea to explicitly recommend this technique to the reader.

I hope you will find these comments useful.

Best regards,

Nils Michelsen

References

Williams, M.R., Lartey, J.L., Sanders, L.L., 2018. Isotopic ($\delta$18O and $\delta$2H) Integrity of Water Samples Collected and Stored by Automatic Samplers. Agricultural & Environmental Letters, 3(1), 1-5. https://doi.org/10.2134/ael2018.02.0009

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