

Reply to reviewer 1 on manuscript amt-2024-43:

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Title: An easy-to-use water vapor sampling approach for stable isotope analysis using affordable membrane valve multi-foil bags

Author(s): Adrian Dahlmann et al.

General comments:

In the manuscript by Dahlmann et al. the authors present an alternative approach (in comparison to Herbstritt et al., 2023, Magh et al., 2022 and Havranek et al., 2021) of obtaining water vapor samples for analyzing the isotopic composition of soil water obtained with gas-permeable membranes (GPM) and storing them in multi-layer foil bags. They performed different experiments to test maximum storage time, potential memory effects and reusability as well as field applicability. The authors conclude that their approach is a simple, cost-effective, and versatile approach.

The paper is nicely written and well structured.

However, I have two main concerns:

As approach and concept in this manuscript are very similar to the paper by Herbstritt et al. (2023) - only a different type of GPM and a different (commercially available) bag type were used - the results should be compared point by point and discussed accordingly. Here some revisions and additional considerations are needed.

Moreover, the cited study by Jiménez-Rodríguez is only available as preprint in HESSD. It was under review in 2019 but not accepted due to substantial issues. No revision was provided by the authors afterwards, thus no accepted peer-reviewed version exists. This preprint can therefore not be cited in your manuscript.

Thank you very much for the positive feedback on our work. We will revise the manuscript in detail to answer all your questions and those of the second reviewer. As part of this revision, we will remove all statements/references to the preprint by Jiménez-Rodríguez. In addition, as recommended by reviewer 2, we will separate the discussion/results and include a detailed comparison with Herbstritt et al. (2023) and other comparable methods, as well as a detailed recommendation about 1) the use of our method, 2) possible errors and how to avoid them, and 3) what should be tested for future use.

Specific Comments:

1. L28: what you call 'precision' is the deviation from the true value, isn't it?

Yes, we will change it to "accuracy" for a better understanding.

2. L30: (and throughout the manuscript) 'water stable isotopes' not 'stable water isotopes'

Will be done.

3. L34: 'suitable for many applications' was already mentioned in L. 31. Please rephrase

We will change it to: "This makes the gas bags suitable for field collection of water vapor samples for many scientific fields."

4. L61: 'which can cost anywhere from' sounds a bit sloppy

We will change it to: "... , which can cost from ~1.2 euros to one to two hundred euros per container."

5. L67: '...provide new insights in research' please be a bit more specific or delete.

Will be done. It now reads: "These simplified and more affordable systems could therefore increase the number of studies on stable water isotopes and provide new insights in research by increasing the number of possible experimental sites and samples."

6. L98: wrong! ‰ is not "million"

Will be changed.

7. L112: P/N of bags? Fitting of bags? Volume of bags?

We could not find a part number but we will add a link to the bags and the product name on the website (Multi Foil Bags with Stainless Steel Fitting, <https://www.smelltest.eu/en/product/multi-foil-bags-with-stainless-steel-fitting/>). These 1 liter bags are equipped with a stainless steel 2-in-1 fitting that combines the valve and septum. Simply put, the septum acts as a seal around which air flows out of the sample bag when the valve is open and seals the opening of the sample bag when the valve is closed. We will add this information (and all other we got from the manufacturer) here or in the supplement.

8. L115: use the manufacturer as reference for material properties such as 'Water Vapor Transmission Rate'

Will be done.

9. L125: Fig. 1: Where is the bag? On the right side in Fig. 1b?

Yes, the bag is on the right side of Fig. 1b. In Fig. 1a, the connector is disconnected from the bag. We'll explain this better and add another picture with a bag and the connector to this figure.

10. L130: how much standard water was added to the 100 mL bottle? And what was the size of the GPM inside the bottle? This is crucial for the isotopic equilibrium

Thanks for your comment and question. The standard water vapor was generated using a 100 ml glass bottle filled with approx. ~ 60 - 80 ml of standard water. Two semi-permeable membranes (GPM) were placed inside the bottle: 1) one for dry air supply, submerged in the standard water, and 2) one in the headspace for sampling of water vapor sampling and transport to the analyzer. We then continuously passed dry

air at a low flow rate (equivalent to flow rates used in common in situ literature) through the water and through the GPM so that the collected vapor was in temperature-dependent water vapor equilibrium with the liquid phase (like e.g. Rothfuss et al. 2013 or Kühnhammer et al., 2021). The measured water vapor concentration was then compared to the saturated water vapor concentration at the given temperature (and pressure) to ensure saturation. The length of the GPM is not as important here as it is more of a safety mechanism to prevent liquid water from entering the tube/analyzer.

11. L275: Jiménez-Rodríguez can't be cited (see general comments)

All statements/references to Jiménez-Rodríguez's paper will be removed from the revised manuscript.

12. L289: Fig. 3: would be nice if you could add "L22" and "M22" directly to the figure, there is enough white space. The Legend is also a bit small.

Will be done.

13. L305: if you assume an error during the measurement, I'm wondering why do you present these data and didn't repeat the measurement?

We did not repeat the measurement mainly because the results after 7 days looked promising and supported our reasoning against a potential storage effect. Following recommendations of reviewer 2, we will split the results and discussion and discuss them in more detail in the revised manuscript.

14. L325 and L332: Jiménez-Rodríguez can't be cited (see general comments)

All statements/references to Jiménez-Rodríguez's paper will be removed from the revised manuscript.

15. L324 to L342: please rephrase and take into account the findings of Herbstritt et al. (2023)

In the discussion of the revised manuscript, we will include a detailed comparison with Herbstritt et al. (2023).

16. L354: Fig. 4: see comments to Fig. 3

Will be done.

17. L378: "...has not been described in the literature before" please rephrase or delete. I would say it is comparable to Herbstritt et al. (2023), Fig. B1.

I think you are referring to Fig. 5b with the SDs of isotope readings from vapor sampling bags, stepwise conditioned with dry synthetic air. A comparison will be included in the revised discussion.

18. L378-400: Please discuss and compare the results of Herbstritt et al. (2023) on memory effects and conditioning here.

Will be done as part of the revised discussion.

19. L504 ff: Please check the reference list thoroughly, e.g. Millar et al., (2018) or Orłowski et al., (2016b) are in the reference list but not cited in the text.

Thank you very much. We will check all references after all changes have been incorporated.

Technical correction:

1. L11: ‘water stable’ not ‘water-stable’

Will be done.

2. L16: ‘easy-to-perform’ instead of ‘easy to perform’

Will be done.

3. L30: I suggest “...using GPM combined with...” instead of “...using GPM and...”

Will be done.

4. L34: ‘suitable’ instead of ‘suited’

Will be done.

5. L83: please use different bullet points for the field experiments e.g. i) ii) iii) or (a) (b) (c)

Will be done.

6. L98: wrong wording: detailed in

Will be done.

7. L108: Majoube is from 1971

Will be done.

8. L215: ‘procedure similar to’ instead of ‘similar procedure to’

Will be done.

9. L247: please delete line break

Will be done.

10. L284: I suggest 'On average' instead of 'In average'

Will be done.

11. L396: 'especially in' instead of 'in especially'

Will be done.

12. L447: please add dates

Will be done.