

Response to Reviewer 3 on review of “A versatile water vapor generation module for vapor isotope calibration and liquid isotope measurements”

*We thank Reviewer 3 for the detailed comments. While we have not hastily put together the manuscript, we have made note of the comment by the reviewer on the readability of the manuscript and have therefore worked towards improving the language. We have addressed the comments by the reviewer below in **red font**.*

The manuscript "A versatile water vapor generation module for vapor isotope calibration and liquid isotope measurements" by HC Steen-Larsen and D Zannoni describes an excellent addition for those in the laser spectroscopy community interested in pushing the limits of their water isotope instrumentation. It clearly meets the scope of Atmospheric Measurement Techniques and addresses a frustration by many atmospheric water vapor researchers by providing a method for reliable and automatic calibration of their vapor measurements across a wide range of concentrations. The manuscript should be accepted for publication in AMT after attending to my comments and suggestions described below.

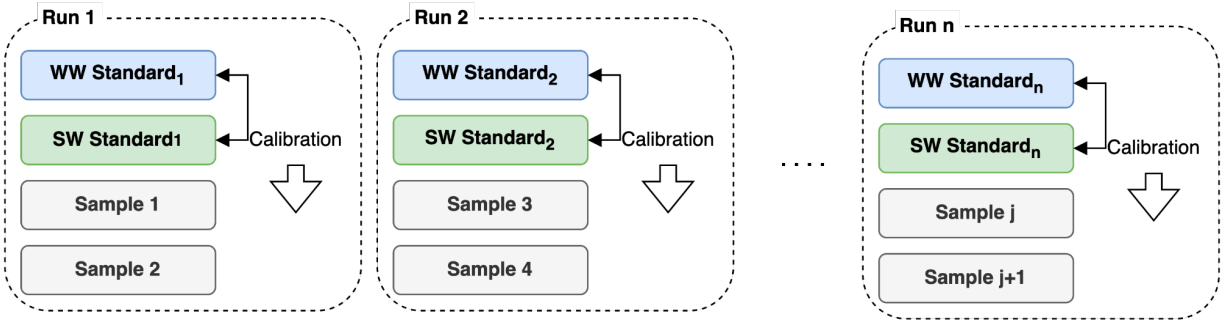
My main criticism is that the manuscript frequently reads like a rough draft that was hastily put together and submitted. To be clear, the content of the study is sound, the science is sound, all of the pieces are present, and it is encouraging that my only criticism is related to the conveyance of the material. Still, the authors need to read through it very carefully, ask a colleague to proofread it, or preferably, both. While the team at AMT will help provide a final polished version, the authors need to take it upon themselves to do much of the work.

Having gone through the manuscript with a careful eye we agree with the reviewer that too many grammatical errors were present and have (hopefully) improved the manuscript.

The measured vs expected results presented in Table 3 are clouded by a confusing description of how these data were calibrated. **I would not be able to reproduce your calibration strategies based on lines 384 to 389. Are the mixtures calibrated to the pure versions of SW and WW or to SP and BER?**

Yes, correct, we use the SW and WW to calibrate the mixtures in the run. The text in the manuscript is now updated.

A typical measurement session (run) is composed of analysis of two standards followed by analysis of two samples, as shown below. Independent calibration means that each run is calibrated using the two standards of that specific run. Average calibration means that the results of the analysis of the standards have been averaged and an average calibration line was built to calibrate the analysis of the samples.



This procedure is described in the text as follows:

Since the standards were from 2 to 4 times for each measurement session, and the solutions were measured on different days, we applied both an average and independent calibration. The average calibration factors were estimated by averaging the raw observations of the standards injected for all the run. Instead, the independent calibration factors were calculated for each couple of reference standards and then applied only to the following couple of solutions (2 standards followed by 2 samples). The results of the experiment are reported in Table 3.

While within error, the bias is interesting and points to a calibration issue. Do the authors have calibration weights for their balance used to create the mixtures? The authors provide no evidence to support the claims in the sentence spanning line 400.

These are some of the most likely issues affecting our results, hence, there is no way to prove them.

What is the maximum consumption rate of liquid water from a 2 mL vial?

We estimated the amount of water required by the system via mass balance (known dry air flow rate between 50 and 500 sccm/min, 100% vaporization, no leaks, calibrated H₂O Picarro readings). **The actual consumption rate of liquid is estimated to be ~1.5 μl/min, which dries out a 2ml vial in ~22 hours.** This is consistent with our observations/experience.

We have added this information in section 3.1.

Given the variety of concentrations one could choose from for a deployment, what volume of reservoir do the authors recommend, or perhaps more to the point of this paper, what is the maximum reservoir volume given the dry-air-pump enrichment noted on line 465.

We would recommend a volume between 2 and 10 ml, and possibly to not dry out the vial in order to minimize the volume of water exposed to dry air in the head space (i.e. large volume of water, small volume of push gas/air). 2 ml of standards (inside a 10 ml vial) should be enough per one calibration hour for nearly three weeks, likely more, and to minimize the dry-air-pump enrichment <<0.05‰ for d₁₈O, between start and end.

Regarding the data presented in Figure 6 and the different patterns observed in dD compared with d₁₈O, I wonder if the authors could speak to the relevance of memory. What order were the standards analyzed in and were the vapor concentrations always stepped through from high

to low or low to high? Or did the authors rule out memory and were left with suggesting spectral fitting. If the pattern is spectral, I wonder if the ^{18}O of laser 2 shows a different pattern compared with the ^{18}O of laser 1. What about ^{17}O ? Does it show a unique pattern?

The reviewer is absolutely correct that memory needs to be taken into account when carrying out the humidity-isotope response curve. In fact, we believe this is an often overlooked source of error. It is therefore important to make sure that memory has been removed before starting the humidity-isotope-calibration. We believe that we did this with care. Laboratory tests have shown an advantage that once you have removed the memory effect, you can get a more stable humidity isotope-response curve when change the humidity from low to high. The effect of this, is only present when you have ensured that there is not influence of memory effect. We do note that the difference in humidity isotope response as function of water isotope value is a consistent result across our combined laboratory and field experience with multiple different instrument analyzer. If the reviewer has a suggestion for testing this further and understanding the course of this difference in humidity-isotope-response we will be very happy if the reviewer contacts us off-line for discussing tests to be done and instrument performance values to be extracted.