Response to Reviewer 2 on review of "A versatile water vapor generation module for vapor isotope calibration and liquid isotope measurements"

We thank the reviewer for the time commitment to carry out the review of our manuscript and for providing insightful questions, which have allowed us to discuss further the performance of the vapor generation module. We have provided answers to the comments using red font below.

General comment

This paper presents a new water vapor generation module meant to improve the accuracy and precision of the analysis of water isotopes in the liquid or vapour form, which is a critical issue for the study of certain second-order parameters like d-excess or 17O-excess in atmospheric water vapour or ice cores. The presented calibration module is an efficient technical solution to solve a number of problems encountered by the authors and listed in the introduction, namely reduce the memory effect, increase the robustness and reliability for field calibration and adapt the system for multiple standard analysis while offering a large humidity range and a stability over several days. These technical issues are indeed encountered by many teams working on this specific subject and the first part of the articles gives a very detailed description to duplicate the proposed solution, including technical references.

In a second part, the performance of a Picarro analyser and the vapor generator are presented and discussed, using several tools such as the Allan deviation or the wavelet coherence analysis. By comparing two Picarros, or comparing the new vapor generator module and a commercial Picarro autosampler and vaporizer, the authors are able to determine whether the performance originate from the analyser or the vapor generator module in a very convincing way.

Scientific questions

I have a few questions and comments that might shed some additional light on your discussions:

You demonstrated in this paper a reduction of the memory effect using the new vapor generator module compared to the Picarro vaporizer, especially visible on dD. **Can you precise whether the residual memory effect is dominated by the Picarro response or the humidity generator?**

We believe the residual memory effect to be dominated by the Picarro response, specifically by the flushing time and the volume of the measurement cavity. The calibration system has smaller dead volumes (and specific surface area) on the stages following vaporization than the measurement cavity itself. Accounting for the oven, the outlet manifold, the outlet line and the humidity sensor, the estimated volume is 10 - 11 cm3, roughly ⅓ of the Picarro's cavity. Moreover, the calibration system is flushed usually above 50 sccm/min (usual in the range of

200 sccm/min depending on targeted humidity level), which is higher than the Picarro's flow rate.

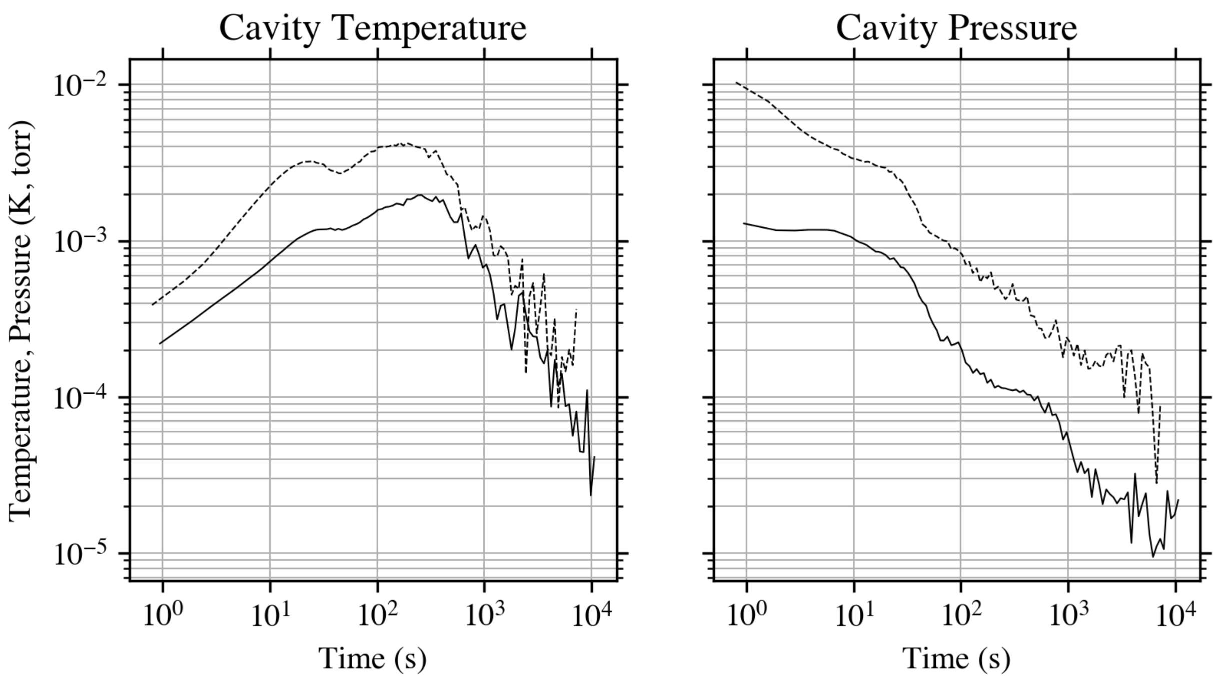
The wavelet coherence analysis gives a good indication on the correlation between the cavity temperature and the delta measurement. **Did you plot the Allan deviation of some of the studied Picarro parameters (cavity temperature, pressure, etc) to check for the presence of the same bump?** It could be interesting to compare it on the two Picarro analysers who do not show the same bump. Also, other parameters such as the cavity temperature or warm box PWM can be interesting to check.

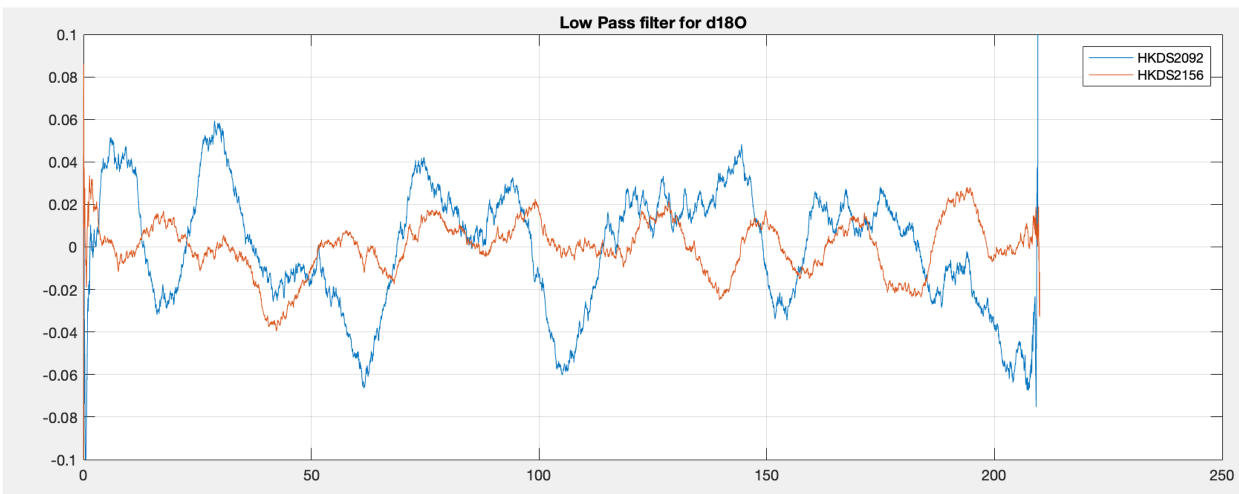
To further shed light on our finding we provide additional figures below, which has not been included in the manuscript. First we report the Allan deviation for Cavity Temperature and Cavity pressure of the two instruments (HKDS2092 dashed lines, HKDS2156 solid lines). The two analyzers have very similar Allan deviation shape, but no evident feature at the same timing of the bump in the delta measurement. The bump in the delta measurement might be due to non-stationary effects in the spectroscopic measurement system, since they occur at different timings between the two different instruments.

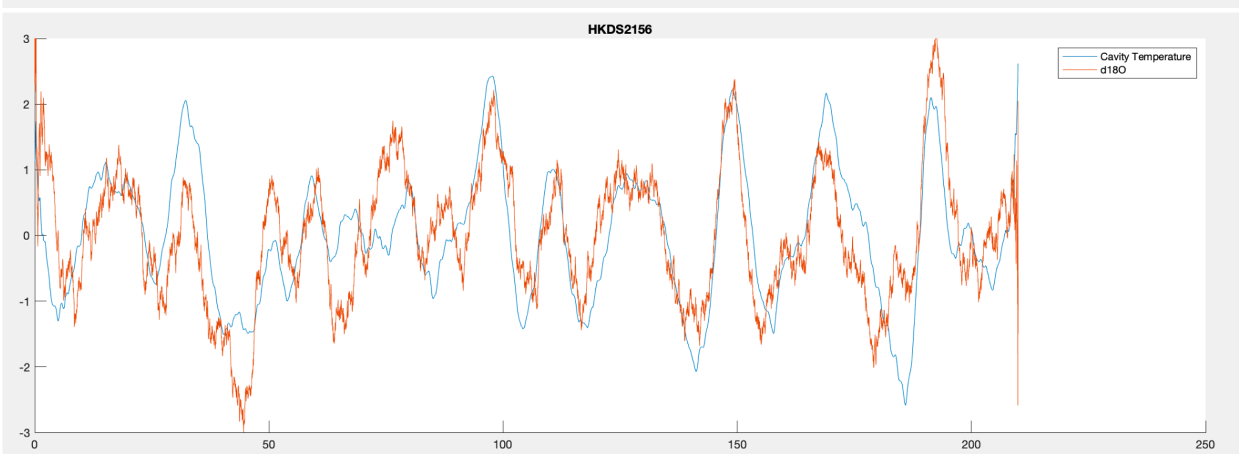
We further show low pass filtered d18O of the two instruments on the common time scale to illustrate that the increased variability in d18O at these integration times are not common between the two instruments.

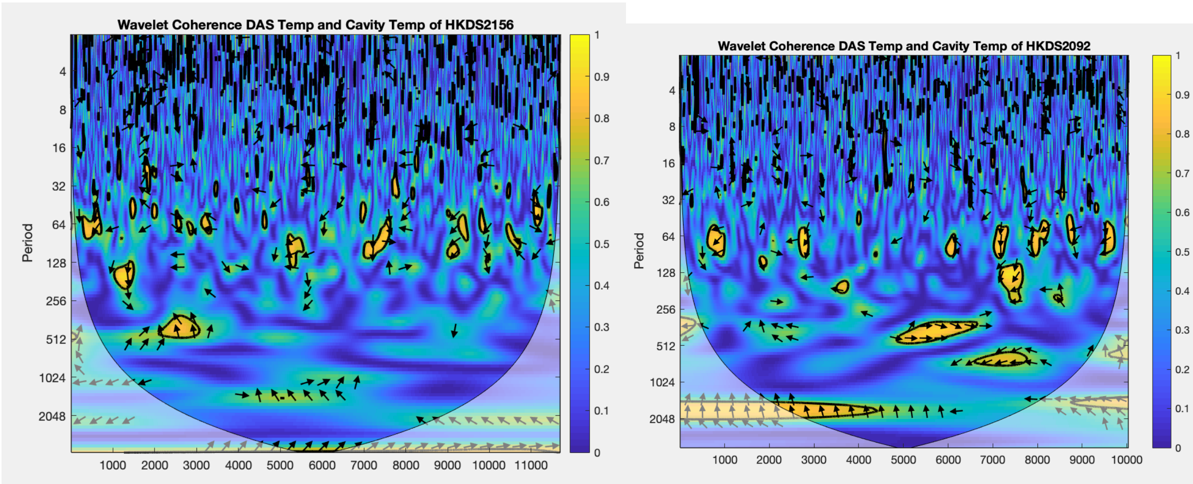
Further we show the low pass filter of the cavity temperature and the low pass filter of the d18O, which ultimately is the values that goes into Figure 7. However, here we show the variability on a time scale, which indicate very strong coherency.

We also show the wavelet cohency between the DAS temperature and the cavity temperature to understand if the variability in the cavity temperature were forced by the room temperature variation. This hypothesis we reject, which leads us to conclude that it is likely an internal variability in the cavity temperature that is at play.


Cavity Temperature
Cavity Pressure
Temperature, Pressure (K, torr)
Time (s)
Time (s)


Low Pass filter for d18O
HKDS2092
HKDS2156


HKDS2156
Cavity Temperature
d18O



Technical corrections

The legend of fig. 7 should be removed or made smaller to avoid covering the Allan deviation curves

Figure 7 edited following reviewer comments.

Table 2 could be easier to read in a graphic way, by putting for example the humidity as x-axis and the other metrics as y-axis

We follow the advice of the reviewer and make a new figure to illustrate tabel 2. We also place Table 2 in supplement material.

For an easier reading of fig. 8, I suggest a centering of the delta values around zero (by subtracting the mean value to the raw dataset) and share the same y axis for d17O (a and b), d18O (c and d), dD (e and f), dexcess (g and h) and D17O (i and j).

Figure 8 edited following reviewer(s) comments.

Fig. 3: If possible, I would be interested in seeing the temporal signal of d18O and dD (below the H2O curve for example). Maybe with a rolling average the memory effect can be directly observed?

Attached below is the time series (rolling average window 1800 s). We have also included this in the supplement material.

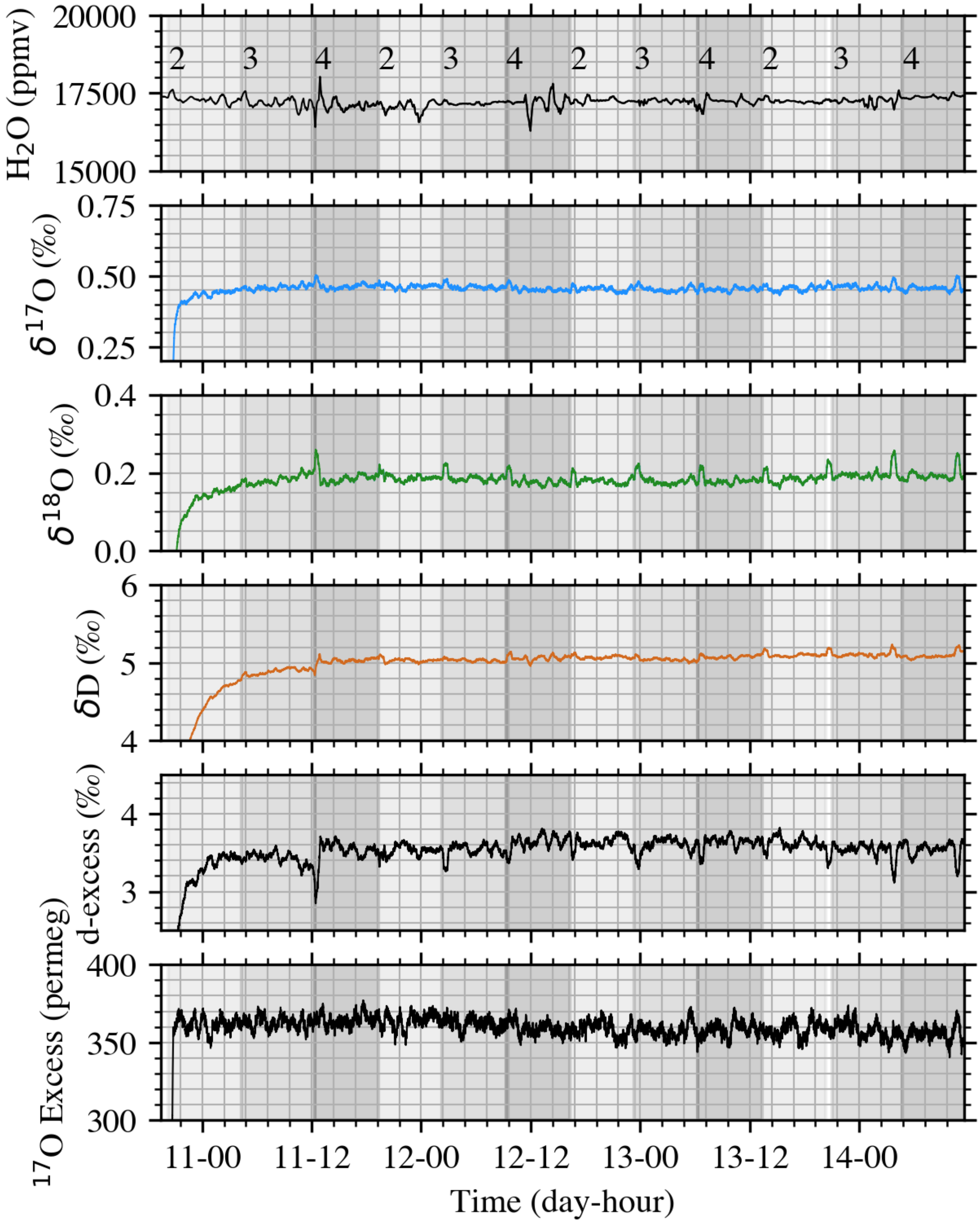


Fig. 2: I would be interested in having a global 3D drawing of the water vapor generator to understand how the two pieces are connected. Otherwise, a photo of the module would be appreciated.

Photos are attached to the supplementary material.

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