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# A dedicated robust instrument for water vapor generation at low humidity for use with a laser water isotope analyzer in cold and dry polar regions

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**Text S1: No mixing between standards A and B during vaporization**

The instrument has been designed with tubing long enough to prevent any mixing. Still, the issue of mixing has been extensively tested during conception by comparing the isotopic composition of the produced water vapor when only one way was in operation (bottle A filled with standard and bottle B empty) and when two ways were in operations (bottles A and B filled with standards of different isotopic composition). The isotopic composition produced on way A was always the same. An additionnal comparison is displayed below.

- Case A: bottle B was filled with FP5 standard ($\delta^{18}O$ = -48.33 ‰) and bottle A filled with EPB standard ($\delta^{18}O$ = -6.24 ‰). Measured $\delta^{18}O$ on way B was -48.96±1‰ (humidity 768±5 ppmv)
- Case B: bottle A and B were filled with the FP5 standard. Measured $\delta^{18}O$ on way B was -49.05±1‰ (humidity 765±4 ppmv).

There is no difference between cases A and B which confirms that there is no mixing in the system.

| Elements | Notation on Figure 2 | Setting points | Accuracy |
|---|---|---|---|
| Vögtlin GSC-A9TS-DD22 | FCA and FCB | 300 and 150 sccm | 3.3 sccm |
| Harvard Apparatus Pump 11 Pico Plus Elite Dual | Syringe pump | 0.01 to 0.3 μL/min | 0.35% of the set speed |
| Hamilton syringes | A and B | 100 μL | |
| Swagelok Ultra-Torr SS-4CD-TW-25 | Evaporation chamber A and B | Internal volume of 25 $cm^3$ | |
| Bronkhorst P-702CV-1K1A-AAD-22-V | P | 650 to 950 mbar | 3 mbar |
| KNF N86KNDC 24V | Pressure pump | | |

**Table S1**: *Description and setting points of the elements composing the LHLG*

| Date | Humidity (ppmv) | $\delta^{18}O$ (‰) | $\delta D$ (‰) |
|---|---|---|---|
| 16 December 2019 | 380 | -32.0 | -207 |
| 17 December 2019 | 369 | -31.9 | -210 |
| 23 December 2019 | 371 | -31.7 | -212 |
| 24 December 2019 | 367 | -31.9 | -211 |
| 25 December 2019 | 378 | -31.7 | -211 |
| 26 December 2019 | 370 | -31.7 | -209 |
| 27 December 2019 | 386 | -32.3 | -208 |
| 28 December 2019 | 370 | -31.5 | -211 |
| 29 December 2019 | 364 | -31.5 | -209 |
| 30 December 2019 | 380 | -31.7 | -211 |
| 31 December 2019 | 372 | -31.8 | -211 |
| 1 January 2020 | 379 | -31.8 | -212 |
| 2 January 2020 | 371 | -31.7 | -211 |
| 3 January 2020 | 381 | -31.6 | -210 |
| 4 January 2020 | 378 | -31.6 | -210 |
| 5 January 2020 | 371 | -31.6 | -208 |

***Table S2***: *Example of daily measurements of humidity (1$\sigma$ over 10 minutes = 9 ppmv), $\delta^{18}O$ (1$\sigma$ over 10 minutes = 1.4 ‰), and $\delta D$ (1$\sigma$ over 10 minutes = 4.5 ‰) of a laboratory standard (NEEM) using the LHLG at low humidity during the austral summer of 2019-2020.*

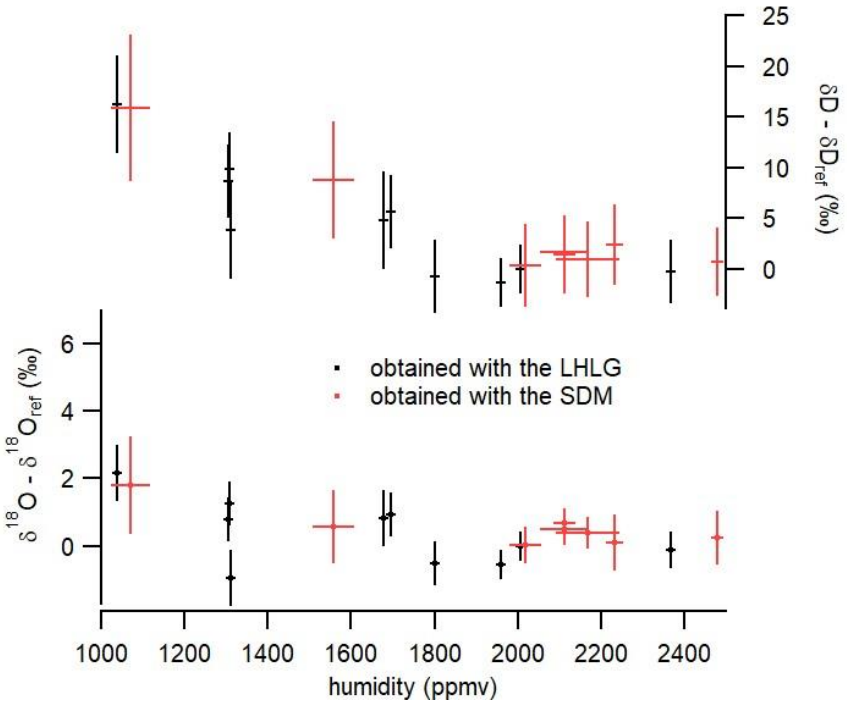


***Figure S1**: Comparison of the difference in isotopic composition ($\delta$D top, $\delta^{18}$O bottom) between the measured and the reference (measurement performed at 2000 ppmv) values as obtained with the SDM (red) and with the LHLG (black) coupled to the same Picarro L 2130-i with the same lab-standards (FP5) calibrated against VSMOW. The same measured $\delta^{18}$O and $\delta$D values are obtained at 2,000 ppmv through the SDM and the LHLG set-up.*

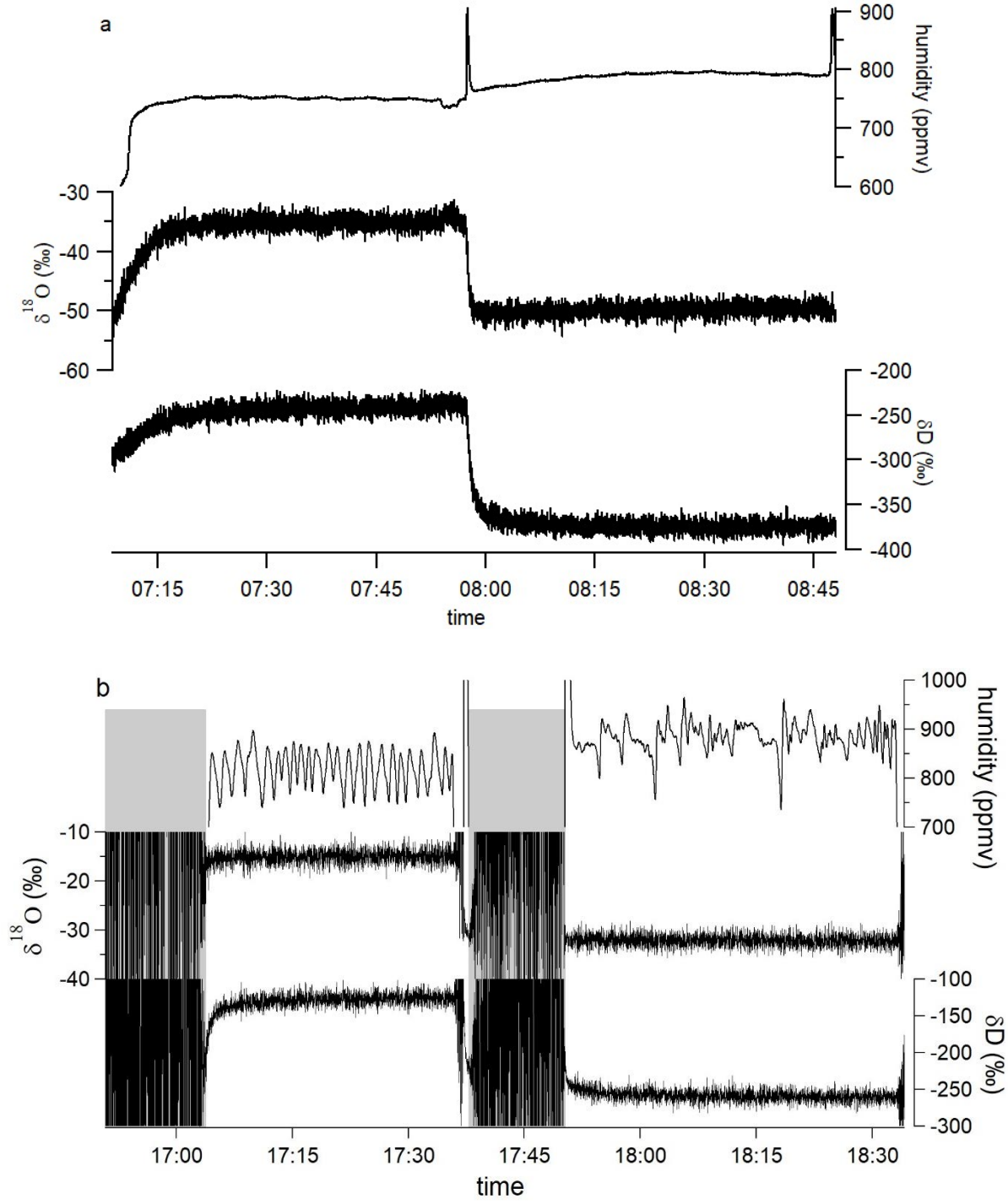


***Figure S2**: Comparison of humidity plateaus (800 ppmv) generated with the LHLG (a) and with the SDM (b). The grey rectangles indicate period with only dry air injected.*

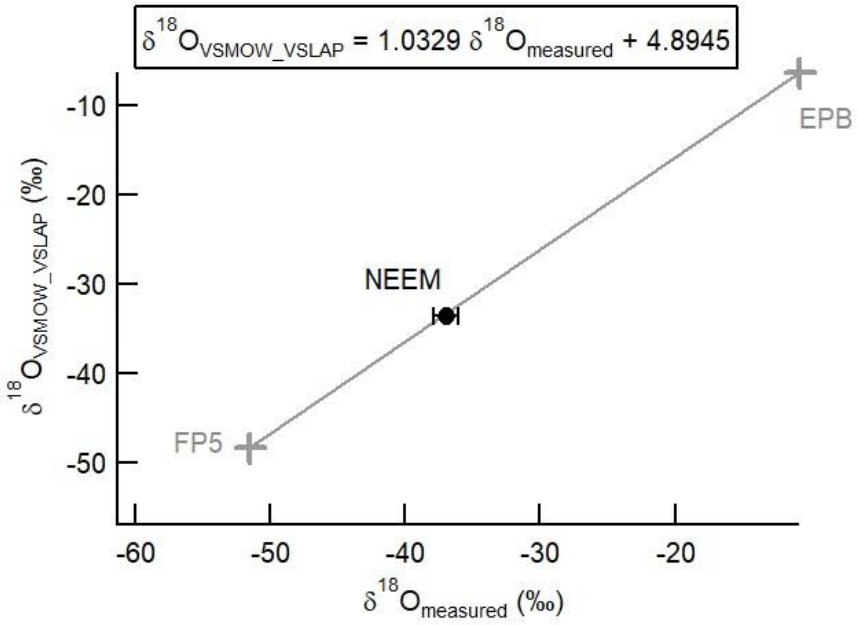


***Figure S3**: VSMOW-VSLAP* d18O *values vs measured d18O values for three standards (FP5 and EPB in grey; NEEM in black).*