

## General comments

Piel et al. describe the development of a cavity enhanced spectrometer for the simultaneous measurement of dioxygen concentration and its oxygen-18 isotopic composition. The instrument performances are excellent, reaching detection limits of 0.002 % for O<sub>2</sub> concentration and 0.06 ‰ for  $\delta^{18}\text{O}(\text{O}_2)$  in 20 minutes. This development is of significant interest to the scientific community, with multiple environmental applications. However, although the manuscript is highly relevant to AMT's readership and overall well-written, it needs major improvement before being considered for publication.

## Specific comments

- The instrument description should be rewritten including: a description of the instrument, showing all the elements currently used in the setup (pressure sensor, flow sensor, solenoid valve, mirror, photodiode) and specifying the product reference if commercial. A point-to-point comparison with the reference article should not be made. A technical scheme and an instrument picture should be provided.
- In the results section, there is not enough explanation of how the tests were conducted and there are no data/figures to justify the conclusions given. The link between allan variance and the time used to carry out the measurements is missing. The measurement strategy used should be explained in more detail.
- When results are given, they should be associated with uncertainties and the supplement should explain how they were obtained and the confidence interval chosen.
- Overall, the manuscript is lacking details. It should be revised with additional data to support the development of the instrument.
- The overall structure of the manuscript should be revised. For some sections, the manuscript is written more in the form of a report than a scientific article. The authors should better guide the reader through their instrumental development methodology.
- There are numerous wordings that need to be revised.
- Greater attention should be paid to defining words and acronyms.
- More references are needed throughout the manuscript.

## Technical comments

All small deltas ( $\delta$ ) must be written in italics as " *$\delta$* ".

### Title

$\delta^{18}\text{O}$  should be defined: "High precision oxygen isotope ( $\delta^{18}\text{O}$ ) measurements of ..."

### Short summary

- Line 14: The temporal resolution and precision of measurements should be given.
- Line 15:  $\delta^{18}\text{O}$  and O<sub>2</sub> should be defined.

## Abstract

- Line 19: “(O<sub>2</sub>)” should be placed after “Atmospheric dioxygen”. Then, only O<sub>2</sub> should be used throughout the manuscript.
- Line 20: CO<sub>2</sub> should be defined.
- Line 24: “isotopic” should be added between “oxygen” and “fractionation”. “occur” is missing an “s”.
- Line 26: Please add “isotopic” before “fractionation coefficient”. Of which isotopic fractionation coefficient are you talking about?
- Line 25: “(δ<sup>18</sup>O(O<sub>2</sub>))” should be added after “δ<sup>18</sup>O of O<sub>2</sub>” and then only δ<sup>18</sup>O(O<sub>2</sub>) should be used.
- Line 28: Please reverse “OF-CEAS” with “(Optical-Feedback Cavity-Enhanced Absorption Spectroscopy) as “optical-feedback cavity-enhanced absorption spectroscopy (OF-CEAS)”. Capital letters are not necessary.
- Line 33: “instrumental” should be added before “drift”.
- Line 33-35: need to be more quantitative on humidity and O<sub>2</sub> concentration effects.

## Introduction

- Line 38: “O<sub>2</sub>” should be added after “Dioxygen” and then only O<sub>2</sub> should be used throughout the manuscript.
- Line 48: the δ<sup>18</sup>O notation should be defined explicitly. “(δ<sup>18</sup>O(O<sub>2</sub>))” should be added after “δ<sup>18</sup>O of O<sub>2</sub>” and then only δ<sup>18</sup>O(O<sub>2</sub>) should be used throughout the manuscript. δ<sup>18</sup>O<sub>atm</sub> is useless as it is not used later in the manuscript.
- Line 57-59: δ<sup>17</sup>O, Ar, and Δ<sup>17</sup>O should be defined.
- Line 78: Please reverse “CRDS” with “(Cavity-Ring-Down Spectroscopy) as “cavity ring-down spectroscopy (CRDS)”.
- Line 80: As isotopic ratios are expressed in per mill throughout the manuscript, the associated error should be expressed in the same unit.
- Line 83: same comment as for line 28.

## Material and methods

- Line 95: the reference is not cited correctly, should be “described in Morville et al., (2005).”
- Line 97 : What field applications? References should be given to provide examples
- Line 98 : Simply providing a link to the company is not appropriate. More details should be given.
- Line 99 : “Some specific demands”: which ones?
- Line 100: “DFB” should be defined as “implementation using a distributed feed-back (DFB) diode”. Then only DFB should be used.
- Line 108: “the figure” should be replaced with “Figure 1”.
- Line 121-124: Data should be provided.
- Line 124 - 126 : “Instrumental drift, assessed by the Allan deviation as presented below, should then remain below the desired precision level over the measurement time for two samples of which one would be a reference”. This sentence does not bring necessary information.
- Line 142 : What is “working pressure”? Define here your cavity pressure. “as usual” should be removed.

- Line 144-146 : “Another improvement is a more accurate, stable and fast control of the sample pressure inside the measurement cell, which is also important for low drift.” There is an important lack of information here. More elements should be provided. For example, a figure should be added and comparative values for any improvement of the instrument.
- Line 154 : “Well known” should be removed and references for HITRAN spectral database should be given.
- Line 156: “this point will be addressed below”. Without going into detail here, a few elements can be given here.
- Line 160: The delta notation should be defined when it is first used in the manuscript, i.e. on line 48. “permil” should be written as “per mill”
- Line 162: “reference sample” of what?
- Line 163: “simple” should be removed and equation numbers should be added
- Line 164: Any equation given in the manuscript should have a number.
- Line 170: How do you obtain the value 35 000 ?
- Line 188-189: what is the software used? “This works well”, please be more quantitative.
- Line 198 : What is the frequency dispersion of the cavity modes ? They are not absolutely fixed
- Line 200: References should be provided for the Rautian and Voigt profiles.
- Line 204: “Over the time span of presented results (18 months)”. It's not clear what the point of this information is.
- Line 208 : Add the cavity finesse value
- Line 218-220: The symbol “®” should be added for any deposited trademark cited throughout the manuscript. PFA should be defined. N<sub>2</sub> should be defined.
- Line 227: What is the difference between mode (2) line 221 and the routine mode? Why no longer use a trap with magnesium perchlorate?
- Line 232: There is no need for a “-” between “Isotope” and “ratio”.
- Line 235: If this manuscript is to be published, the reference given must have been published previously. If this is not the case, further details will be required.
- Line 241: A number should be given to the equation. Besides, the expression to calculate the O<sub>2</sub> concentration should be given explicitly.
- Line 248: “is” should be “of”. More details are needed for the peak jumping sequences.

## Results and discussion

- Figure 2 and 3: A different colour palette should be used. Black and green are not colour-blind friendly.
- Line 252-253: This information can be provided earlier and not in the results section.
- Line 254: What is allan deviation? A reference should be provided.
- Line 260-261: The minimum of the allan deviation is not reached at the same time for the oxygen concentration and the isotopy. The time required to reach the minimum for each species must be given with the precision.
- Line 264 : The figure is complicated to understand because of the y-axes
- Line 271: It should be clarified what is considered as a “moderate shift” and “regular measurement.”

- Line 276: The time chosen for the measurement must be explained
- Line 277: How was the time interval between each injection of standard selected?
- Line 284 : The concentration should be kept on the same side of both graphs of figures 2 and 3.
- Line 290: Any results from the secondary configuration should be provided in a supplement.
- Line 293: Data should be provided to support this statement.
- Line 294: This sentence needs rewording.
- Line 300: A reference should be provided. Overall, the structure of section 3.2 should be revised.
- Line 303: The section title should be revised.
- Line 304: This sentence needs rewording.
- Line 314: The linear regression data should be provided in the text. Besides, the given increasing rate of  $\delta^{18}\text{O}$  with  $\text{O}_2$  concentration seems wrong based on Figure 4.
- Figure 4: The overall figure display should be improved (e.g., add label ticks, regression equation, ...). The symbol for the per mill unity should be used. The errors on the slope and intercept of the linear regression should be provided.
- Line 321: the section number where the initial configuration is described should be added.
- Line 323: Too general, should be more precise.
- Line 325: Why every 15 days?
- Line 326: The section title should be revised.
- Line 329: The flow rate used for purging must be specified
- Figure 5: there is a typo in the figure legend
- Line 335: Any results from the secondary configuration should be provided in a supplement.
- Line 336: The overall structure of section 3.5 should be revised which is not appropriate for an article.
- Line 353: "small  $1\sigma$ " should be quantify
- Line 367: This section critically lacks details.

## Conclusion

- Line 390: The unity used throughout the manuscript should be homogenized.
- Line 400-402: Further details can be given on the instrument's application.