

Review on:

A new setup for simultaneous high precision measurements of CO₂, $\delta^{13}\text{C}$ -CO₂ and $\delta^{18}\text{O}$ -CO₂ on small ice core samples by Jenk et al.

This paper presents a method to precisely measure concentrations as well as stable carbon and oxygen isotope ratios of CO₂ in air extracted from ice core samples. A new approach is proposed for the correction of the procedural blank leading to more accurate results particularly for the measurements of small samples. Based on $\delta^{18}\text{O}$ -CO₂ and $\delta^{18}\text{O}$ -H₂O measurements, the authors introduce a method for analytical outlier detection. The use of isotope ratios for paleo-atmospheric records of carbon dioxide in ice cores provides important constraints on the natural variability of the carbon cycle.

The experimental work is of high quality and excepting some points, that need to be addressed, both description and discussion of measurements are well founded. The manuscript contributes to scientific progress within the scope of the journal, therefore it is suitable to be published in AMT.

Specific comments:

- Page9Lines268-276: The paragraph introducing the CO₂ mixing ratio and the delta notation requires total revision. The authors should consider using IUPAC recommendations (see e.g. Brandt et al., Pure Appl. Chem 2010).

For better readability, very long phrases must be broken apart into shorter clearer sentences. Examples: Page3Lines63-67, Page22Lines679-682, Page23Lines704-709

The description of switching valves in the Section3 is very confusing. Add in the caption a description like '1' for the depicted position and '2' for the switched one...

Editorial revisions:

- Page2Line35: replace 'although' by 'though'
- Page5Line149: insert 'to' between 'size,' and 'allow'
- Page5Line50: replace 'on' by 'in'
- Overall: replace 'core' of the (setup, design, ...) by 'centerpiece' (e.g. Page6Line159).
- Page6Lines169-170: reformulate the sentence
- Page6Line179: remove 'the' before 'time'
- Page7Line194: replace 'pressed' by 'drawn'
- Page7Line195: replace 'omitted' by 'spared'
- Page7Line201: replace 'rather than' by 'instead of'
- Page7Line202: replace 'in' by 'by'
- Page7Line205: replace 'by' by 'with'
- Page7Line209: replace 'nitrogen above through the isolated tube to D2.' by nitrogen upward through the isolated tube toward D2. "
- Page7Line213: replace 'rest water' by 'water remained'
- Page7Line220: replace 'minimal' by 'minimum'
- Page8Line232: replace 'on' by 'in'
- Page8Line235: replace 'to' by 'into'
- Page8Line243: replace 'a gas chromatography setup' by 'a separation section containing traps and GC units'
- Page8Line247: replace 'detection systems' by 'detection section'
- Page11Line316: replace 'immersing into' by 'being immersed into'
- Page12Line356: insert 'the' between 'and' and 'remnant'
- Page12Line359: replace 'on/off' by 'reference'

- Page12Line379: remove 'require and'
- Page 13Line388: insert 'the' before 'used'
- Page13Line397: replace 'will in the following be referred to as' by 'will be further referred to as',
- Page 13Line412: insert 'the' before 'inlet 12'
- Page14Lines 439-441: rephrase
- Page14Line446: replace 'already being closed beforehand' by 'having previously been closed'
- Page15Line179: remove ', ' before 'does'
- Page15Lines 477-479: rephrase
- Page 16Line484: insert 'loss and' before 'fractionation'
- Page16Line490: replace 'where they might be' by 'here being'
- Page17Line535. Page19Line596: replace 'independent' by 'independently'
- Page18Line 547. I don't understand 'surplus signal'
- Page18Lines570-571: replace 'In the supplementary material, the equivalent figure can be found for $\delta^{18}\text{O}$ (Fig. S3).' by 'The same procedure was applied to investigate the d^{18}o nonlinearity (see Fig S3, Supplement)'
- Page19Line576: replace 'cover' by 'study'
- Page19Lines584-586: rephrase
- Page19Line591: replace 'will vary dependent' by 'depending'
- Page19Lines599-600: see above
- Avoid 'heavily depleted' (e.g. Page20Line607). Instead: 'strongly depleted'
- Page20Lines607-609: rephrase
- Page21Line648: remove 'then'
- Page21Lines656-658: rephrase
- Page21Lines660-661: rephrase
- Page22Line671: replace 'is crucial. The system blank is considered for the analysis of standard air samples used for' by 'crucial, being used for'
- Page22Line688: replace 'In this study, we therefore assumed' by 'We therefore assumed in this study'
- Page22Line699: replace 'size' by 'magnitude'
- Page22Line700: insert 'sample' before 'size'
- Page23Line717: see above
- Page23Line720: insert 'The' before 'results'
- Page23Line724: replace 'was' by 'were'
- Page24Line740: replace 'ice samples of 8-13 g' by '8-13 g ice samples'
- Page24Line745: insert 'the' before 'system'
- Page25Lines781-784: rephrase
- Page26Lines802-805: rephrase
- Page26Lines829-830: replace 'Results for CO_2 and $\delta^{13}\text{C}$ of 829 such samples were then rejected.' by 'For these samples, the CO_2 and d^{13}C measured values were rejected from the analyses.'
- Page27Line836: replace 'is four' by 'of four'
- Page27Lines841-842: replace 'the analytical precision of the presented system resulted with 1.9 ppm' by 'a high analytical precision was reached, being 1.9 ppm.'
- Page27Line849: insert 'the' before 'precision'