RC2: 'Comment on amt-2020-481', Britton Stephens, 24 May 2021

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Number: 1 Subject: Highlight, intercomparison is a word on its own (no hyphen needed)
Response: We removed hyphen from "inter-comparison" through the text.

Number: 2 Subject: Highlight, "on a Round-Robin Exercise" might be more informative / grammatically correct
Response: We revised the sentence according to your comment. (P1, L2)

Number: 3 Subject: Cross-Out, a
Response: We revised the sentence according to your comment. (P1, L26)

Number: 4 Subject: Inserted Text, global
Response: We revised the sentence according to your comment. (P1, L27)

Number: 5 Subject: Cross-Out, based on trends in atmospheric CO2 and d(O2/N2)
Response: We added "based on trends in atmospheric CO2 and δ(O2/N2)" (P1, L27)

Page: 2

Number: 1 Subject: Inserted Text distinct
Response: We revised the sentence according to your comment. (P2, L7)

Number: 2 Subject: Inserted Text, measurements of
Response: We revised the sentence according to your comment. (P2, L10)

Number: 3 Subject: Inserted Text, E
Response: We revised the sentence according to your comment. (P2, L15)

Number: 4 Subject: Inserted Text, as
Response: We revised the word from "and is" to "as" (P2, L15)

Number: 5 Subject: Inserted Text, s
Response: We revised the sentence according to your comment. (P2, L16)

Number: 6 Subject: Inserted Text, e
Response: We revised the sentence according to your comment. (P2, L18)

Number: 7 Subject: Inserted Text, a
Response: We revised the sentence according to your comment. (P2, L24)

Number: 8 Subject: Highlight, cite Aoki et al., AMT 2019 instead / also
Response: We cited "Aoki et al., AMT 2019" and added a year corresponding to the molar fractions. (P3, L2-3)
Number: 9 Subject: Highlight, previous sentence says this is calibrated, so “calibrated” or "measured" would be better than "assumed"

Response: We revised the sentence according to your comment. (P3, L8)

Number: 10 Subject: Inserted Text, of

Response: We revised the sentence according to your comment. (P3, L8)

Number: 11 Subject: Cross-Out, a span stability

Response: We revised the sentence according to your comment. (P3, L9)

Page: 3

Number: 1 Subject: Inserted Text, stability

Response: We revised the sentence according to your comment. (P3, L10)

Number: 2 Subject: Inserted Text, in absolute terms

Author: Subject: Sticky Note, a bit tricky to talk about absolute uncertainty in per meg (a relative unit) - perhaps give in mole fraction instead?

Response: The sentence was revised as expressed as the mole fraction to understand it in absolute terms. But we also add corresponding value in per meg unit. (P3, L14)

Number: 3 Subject: Inserted Text

Response: We didn’t know where to revise. (P3, L15)

Number: 4 Subject: Cross-Out:

Response: We revised the sentence according to your comment. (P3, L22)

Number: 5 Subject: Highlight

Here, it would be good to point out (as you do below) that by comparing to gravimetric mixtures prepared over time, the trend uncertainty can be addressed. Just checking against them once can fix span biases, but not necessarily zero drift over time.

Response: How to evaluate span bias and zero drift is different. We described separately advantages with respect to span bias and zero drift obtained by comparing the scales with gravimetric mixtures. (P3, L20-22)

Number: 6 Subject: Inserted Text, the

Response: We revised the sentence according to your comment. (P3, L23)

Number: 7 Subject: Highlight, give materials?

Response: We revised the sentence according to your comment. (P4, L6)

Number: 8 Subject: Inserted Text, . They

Response: We revised the sentence according to your comment. (P4 L6)

Number: 9 Subject: Inserted Text

Response: We revised it in the overall because the sentence was difficult to understand. (P4 L9)
Number: 1 Subject: Highlight, Why not use a more modern O2 mole fraction estimate? If it does not matter, consider saying so. Since you have gravimetric determinations, I'm guessing the assignment of zero on the scale is arbitrary, so it might help to say "we arbitrarily assign zero on the NMIJ/AIST scale to correspond to a ratio of 0.26825" and also maybe that this corresponds to the late 1960s.

Response: We adopted a more modern O2 mole fraction estimate according to your comment. (P4, L22-23)

Number: 2 Subject: Cross-Out Date:

Response: We revised the sentence according to your comment. (P4 L27)

Number: 3 Subject: Cross-Out Date:

Response: We revised the sentence according to your comment. (P4 L28)

Number: 4 Subject: Inserted Text, as

Response: We revised the sentence according to your comment. (P5 L1)

Number: 5 Subject: Highlight, this is unclear - does it refer to the standard, the true value of the standard, or the reported values by the labs? Is the "round-robin" subscript necessary or could it be removed throughout?

Response: The δ(O2/N2)round-robin represent the measured values by the labs. We adopted the subscript to distinguish the round-robin values and other values clearly. This sentence was revised according your comment. (P5 L2)

Number: 6 Subject: Inserted Text, m

Response: We didn't know where to revise. (P5 L4)

Number: 7 Subject: Cross-Out

Response: We revised the sentence according to your comment. (P5 L9)

Number: 8 Subject: Highlight, considering giving values on established reference scales

Response: We added the sentence according to your comment. (P5 L11-14)

Page: 5

Number: 1 Subject: Highlight, might be helpful to start by saying why these corrections are needed - dilution, peak overlap, etc.

Response: we explained the reason that these corrections are needed. (P5 L22-24)

Number: 2 Subject: Inserted Text, for (first sentence says these are O2/N2 corrections, not Ar corrections)

Response: Because we corrected O2/N2 using the deviation in Ar molar fraction from atmospheric value, the sentence was revised. (P5 L29)

Number: 3 Subject: Inserted Text, for (first sentence says these are O2/N2 corrections, not Ar corrections)

Response: because we corrected O2/N2 using the deviation in Ar molar fraction from atmospheric value, the sentence was revised. (P6 L1)

Number: 4 Subject: Highlight, say 'corrected' here instead? (first sentence already says 'calculated based on' 16/14)
Response: We revised the sentence according to your comment. (P6, L15)

Page: 6

Number: 1 Subject: Inserted Text, nearly (?)
Response: We revised the sentence in overall. (P7, L6-7)
Number: 2 Subject: Highlight, consider rewording for clarity - if you already have gravimetric Ar and N2, why do you need (O2+Ar)/N2 and CO2 to get (Ar/N2)? Also, change "in this study" to "For NIES" or equivalent.
Response: We changed the values to gravimetric Ar and N2. NIES's δ(O2/N2) values was recalculated using the gravimetric values. (P7, L24-25)

Page: 7

Number: 1 Subject: Inserted Text, cylinders
Response: We revised the sentence according to your comment. (P7, L26)
Number: 2 Subject: Inserted Text, with respect to these cylinders (primaries could still drift right?)
Response: We revised the sentence according to your comment. (P7, L27)
Number: 3 Subject: Highlight, might be of interest to say why 15N14N is used instead of 14N14N more specifically, 2 sentences later says mass spec measures 28 - why is it not used?
Response: We used mass 29 because the spread of both ion beams for mass 28 and 32 was too wide to measure simultaneously. This sentence was revised according your comment. (P8, L7-9)
Number: 4 Subject: Highlight, this is of course true because they are on different scales - did you instead mean d(O2/N2)round-robin here?
Response: The word "unequal" was wrong. We revised it to "not equivalent" (P8, L9).
Number: 5 Subject: Highlight, Table 2 mentions mass-spec measurements of 40Ar and 14N14N - discuss here?
Response: Mass-spec measurements of 40Ar and 14N14N were removed from Table 2 because SIO used gravimetric values instead of mass-spec measurements of 40Ar and 14N14N.

Page: 8

Number: 1 Subject: Cross-Out, SIO applies
Response: We revised the sentence according to your comment. (P9, L12)
Number: 2 Subject: Cross-Out
Response: We revised the sentence according to your comment. (P9, L15)
Number: 3 Subject: Highlight, consider moving up immediately after So2, Xo2, and lco2 are defined.
Response: We moved up it immediately after $\text{So}_2$, $\text{Xo}_2$, and $\text{Ico}_2$ are defined. (P9, L11-12)

Number: 4 Subject: Cross-Out,

Response: We revised the sentence according to your comment. (P10, L2)

Page: 9

Number: 1 Subject: Cross-Out, (unclear what is averaged)

Response: We revised the sentence in overall. (P10, L7-8)

Number: 2 Subject: Cross-Out

Response: We revised the sentence according to your comment. (P10, L16)

Number: 3 Subject: Inserted Text, '

Response: We revised the sentence according to your comment. (P10, L16)

Number: 4 Subject: Highlight, this would increase d(O2/N2), no?

Response: Because this sentence was wrong, we revised it. (P10, L24-25)

Number: 5 Subject: Cross-Out, EMRI/AIST

Response: This word is correct, while the words of data is wrong. We revised the word from data to date. (P10, L27)

Number: 6 Subject: Inserted Text, at EMRI/AIST?

Response: We revised the sentence according to your comment. (P11, L1)

Number: 7 Subject: Highlight, Not sure what this means - selected for what?

Response: We removed the sentence. (P11, L5)

Number: 8 Subject: Inserted Text, which showed

Response: We revised the sentence according to your comment. (P11, L6)

Page: 10

Number: 1 Subject: Inserted Text, Their

Response: We revised the sentence according to your comment. (P11, L10)

Number: 2 Subject: Inserted Text,

Response: We revised the sentence according to your comment (This overlaps Number: 1?). (P11, L10)

Number: 3 Subject: Inserted Text, values.

Response: We revised the sentence according to your comment. (P11, L11)

Number: 4 Subject: Cross-Out

Response: We revised the sentence according to your comment. (P11, L12)

Number: 5 Subject: Cross-Out

Response: We revised the sentence according to your comment. (P11, L12)

Number: 6 Subject: Highlight, Table 4 calls these "standard uncertainties" - say how calculated, and if standard
deviations, say of what.

Response: "standard deviations" is wrong and it is "standard uncertainties". We added "the standard uncertainties which were calculated based on the Deming least-square fit". (P11, L22-23)

Number: 7 Subject: Cross-Out
Response: We revised the sentence according to your comment. (P11, L27)

Number: 8 Subject: Cross-Out
Response: We revised the sentence according to your comment. (P11, L27)

Number: 9 Subject: Highlight, see alternate suggestion of how to cite (it is not clear here that "the GOLLUM comparison" is a citation, and some more description is warranted). Should probably also cite: WMO, 2005: Global Atmosphere Watch, 12th WMO/IAEA Meeting of Expert on Carbon Dioxide Concentration and Related Tracers Measurements Techniques (Toronto, Canada, 15-18 September 2003). GAW Report No.161, WMO TD No. 1275, Geneva. and/or A. Manning pers. comm. for the actual values since they are not included in either of these.
Response: We revised how to cite according to your suggestion. (P11, L27-29)

Number: 10 Subject: Inserted Text, a
Response: We revised the sentence according to your comment. (P11, L27)

Number: 11 Subject: Inserted Text , the GOLLUM exercise coordinated by SIO and the University of East Anglia from 2003-2014 (GOLLUM, 2015),
Response: We revised the sentence according to your comment. (P11, L27-29)

Number: 12 Subject: Cross-Out
Response: We revised the sentence according to your comment. (P12, L5)

Page: 11

Number: 1 Subject: Inserted Text, )
Response: We revised the sentence according to your comment. (P12, L15-16)

Number: 2 Subject: Inserted Text, We found a change of
Response: We revised the sentence according to your comment. (P13, L9-10)

Number: 3 Subject: Inserted Text, to
Response: We revised the sentence according to your comment. (P13, L9)

Number: 4 Subject: Inserted Text,
Response: We didn't know where to revise.

Number: 5 Subject: Inserted Text, are
Response: We revised the sentence according to your comment. (P13, L11)

Number: 6 Subject: Inserted Text, to
Response: We revised the sentence according to your comment. (P13, L11)

Number: 7 Subject: Cross-Out
1. **Response:** We revised the sentence according to your comment. (P13, L12)

2. Number: 8 Subject: Cross-Out

3. **Response:** We revised the sentence according to your comment. (P13, L16)

4. Number: 9 Subject: Highlight, to support this statement, please say what value Resplandy used for their estimate of span uncertainty (2% 1-sigma) and what value(s) you would recommend instead. For example, would you recommend 1.6% (standard deviation of slopes reported here) without any correction, and some smaller uncertainty if a span correction is applied?

5. **Response:** We added what value they used for their estimate of span uncertainty and what value(s) we recommend instead of their estimate of span uncertainty. (P13, L15-18)

6. Number: 10 Subject: Cross-Out

7. **Response:** We revised the sentence according to your comment. (P13, L20)

8. Number: 11 Subject: Cross-Out

9. **Response:** We revised the sentence according to your comment. (P13, L24)

10. Number: 12 Subject: Inserted Text, changes

11. **Response:** We revised the sentence in overall. (P13, L24-25)

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12. Number: 1 Subject: Cross-Out, We speculate that t

13. **Response:** We revised the sentence in overall. (P13, L28-30)

14. Number: 2 Subject: Cross-Out

15. **Response:** We revised the sentence in overall. (P13, L29-P14,L1)

16. Number: 3 Subject: Highlight, adsorption?

17. **Response:** We revised the sentence in overall. (P13, L29-P14,L1)

18. Number: 4 Subject: Inserted Text, ,

19. **Response:** We revised the sentence in overall. (P13, L29-P14,L1)

20. Number: 5 Subject: Inserted Text, than t

21. **Response:** We revised the sentence in overall. (P13, L29-P14,L1)

22. Number: 6 Subject: Inserted Text, from

23. **Response:** We revised the sentence in overall. (P13, L29-P14,L1)

24. Number: 7 Subject: Cross-Out

25. **Response:** We revised the sentence in overall. (P14, L4-5)

26. Number: 8 Subject: Highlight, uncertainty? bias was within uncertainty, no?

27. **Response:** Because values of NIES and AIST by the conversion was consistent within uncertainty. We added "within uncertainty" to the sentence. (P14, L4-L6)

28. Number: 9 Subject: Highlight, I suggest acknowledging Andrew Manning for the GOLLUM results.
Response: We were grateful to Manning for the GOLLUM results in acknowledgments. (P14, L14-15)

Page: 13
Number: 1 Subject: Highlight, This link does not work. This one does: https://gollum.uea.ac.uk/apo-2015.shtml
Response: the link was revised to “https://gollum.uea.ac.uk/apo-2015.shtml” (P16, L6)

Page: 17 (Table 1)
Number: 1 Subject: Highlight, formatting issue here
Response: We revised the sentence according to your comment.
Number: 2 Subject: Inserted Text, dry air?
Response: We described that figures are given in the unit of µmol mol⁻¹ in dry air. (P20, L10)
Number: 3 Subject: Highlight, see earlier comments - give reference year and consider using more recent value
Response: The sentence was revised according to your comment (P20, L11-L13).

Page: 18 (Table2)
Number: 1 Subject: Highlight, line spacing in this column could be improved
Response: line spacing in this column was improved

Page: 19 (Figure 1)
Number: 1 Subject: Inserted Text, as
Response: We revised the sentence according to your comment.

Page: 20 (Figure2)
Number: 1 Subject: Highlight, should y-axis label on 2a be the same as on 3a?
Response: We revised y-axis label of the Figure 2a according to your comment.
Number: 2 Subject: Inserted Text, at EMRI/AIST
Response: We revised the sentence according to your comment.
Number: 3 Subject: Highlight, say what whiskers are here
Response: The whiskers were explained according to your comment.

Page: 21 (Table 3)
Number: 1 Subject: Highlight, specify/remind here or in footnote that these are all reported on different (lab-specific) scales

Response: We specified in footnote that these are all reported on own scales

Page: 22 (Figure3)

Number: 1 Subject: Highlight, say what whiskers are

Response: The whiskers were explained according to your comment.

Page: 23 (Table4)

Number: 1 Subject: Highlight, This term is new here - say what “GOLLUM 15” refers to. I suggest just saying “GOLLUM” as the 15 doesn’t really indicate anything about the experiment (which ran 2003-2014) other than the date of the cited presentation.

Response: We revised the sentence according to your comment.

Number: 2 Subject: Inserted Text

Response: We didn’t know where to revise.

Number: 3 Subject: Inserted Text, from the Deming fit. (true?)

Response: We revised the sentence according to your comment.

Number: 4 Subject: Inserted Text

Response: We didn’t know where to revise.

Number: 5 Subject: Inserted Text, the

Response: We revised the sentence according to your comment.

Number: 6 Subject: Inserted Text, the individual laboratory

Response: We revised the sentence according to your comment.

Number: 7 Subject: Highlight, "provided by Andrew Manning" instead? Or did you internally redo this comparison based on SIO, TU, and NIES results?

Response: We revised the sentence according to your comment.

Page: 25 (Figure5)

Number: 1 Subject: Highlight, panel letters missing

Response: We revised the panel letters missing

Number: 2 Subject: Highlight, y-axes in (b) reflect conversion to NMIJ/AIST?

Response: The y-axes in (b) was updated because we assigned $0.2093391 / 0.7808943 = 0.2680761$ as $\delta$ (O2/N2) NMIJ/AIST = 0. It reflects conversion to NMIJ/AIST