

1 **RC2:** ['Comment on amt-2020-481'](#), Britton Stephens, 24 May 2021

2

3 Page: 1

4 Number: 1 Subject: Highlight, intercomparison is a word on its own (no hyphen needed)

5 **Response:** We removed hyphen from "inter-comparison" through the text.

6 Number: 2 Subject: Highlight, "on a Round-Robin Exercise" might be more informative / grammatically correct

7 **Response:** We revised the sentence according to your comment. (P1, L2)

8 Number: 3 Subject: Cross-Out, a

9 **Response:** We revised the sentence according to your comment. (P1,L26)

10 Number: 4 Subject: Inserted Text, global

11 **Response:** We revised the sentence according to your comment. (P1,L27)

12 Number: 5 Subject: Cross-Out, based on trends in atmospheric CO₂ and $\delta(O_2/N_2)$

13 **Response:** We added "based on trends in atmospheric CO₂ and $\delta(O_2/N_2)$ " (P1, L27)

14

15

16 Page: 2

17 Number: 1 Subject: Inserted Text distinct

18 **Response:** We revised the sentence according to your comment. (P2, L7)

19 Number: 2 Subject: Inserted Text, measurements of

20 **Response:** We revised the sentence according to your comment. (P2, L10)

21 Number: 3 Subject: Inserted Text, E

22 **Response:** We revised the sentence according to your comment. (P2, L15)

23 Number: 4 Subject: Inserted Text, as

24 **Response:** We revised the word from "and is" to "as" (P2, L15)

25 Number: 5 Subject: Inserted Text, s

26 **Response:** We revised the sentence according to your comment. (P2, L16)

27 Number: 6 Subject: Inserted Text, e

28 **Response:** We revised the sentence according to your comment. (P2, L18)

29 Number: 7 Subject: Inserted Text, a

30 **Response:** We revised the sentence according to your comment. (P2, L24)

31 Number: 8 Subject: Highlight, cite Aoki et al., AMT 2019 instead / also

32 Author: stephens Subject: Sticky Note Date:

33 given global trends, it would also be helpful to give a year (1967-70?) corresponding to this mole fraction estimate

34 **Response:** We cited "Aoki et al., AMT 2019" and added a year corresponding to the molar fractions. (P3, L2-3)

1 Number: 9 Subject: Highlight, previous sentence says this is calibrated, so "calibrated" or "measured" would be better
2 there than "assumed"

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

4 Number: 10 Subject: Inserted Text, of

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

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

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

8

9 Page: 3

10 Number: 1 Subject: Inserted Text, stability

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

12 Number: 2 Subject: Inserted Text, in absolute terms

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

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

17 Number: 3 Subject: Inserted Text

18 **Response:** We didn't know where to revise. (P3, L15)

19 Number: 4 Subject: Cross-Out:

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

21 Number: 5 Subject: Highlight

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

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

27 Number: 6 Subject: Inserted Text, the

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

29 Number: 7 Subject: Highlight, give materials?

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

31 Number: 8 Subject: Inserted Text, . They

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

33 Number: 9 Subject: Inserted Text

34 **Response:** We revised it in the overall because the sentence was difficult to understand. (P4 L9)

35

1 Page: 4

2 Number: 1 Subject: Highlight, Why not use a more modern O₂ mole fraction estimate? If it does not matter, consider
3 saying so. Since you have gravimetric determinations, I'm guessing the assignment of zero on the scale is arbitrary, so it
4 might help to say "we arbitrarily assign zero on the NMIJ/AIST scale to correspond to a ratio of 0.26825" and also maybe
5 that this corresponds to the late 1960s.

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

7 Number: 2 Subject: Cross-Out Date:

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

9 Number: 3 Subject: Cross-Out Date:

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

11 Number: 4 Subject: Inserted Text, as

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

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

15 **Response:** The $\delta(O_2/N_2)$ round-robin represent the measured values by the labs. We adopted the subscript to
16 distinguish the round-robin values and other values clearly. This sentence was revised according your comment. (P5 L2)

17 Number: 6 Subject: Inserted Text, m

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

19 Number: 7 Subject: Cross-Out

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

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

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

23

24 Page: 5

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

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

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

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

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

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

34 Number: 4 Subject: Highlight, say 'corrected' here instead? (first sentence already says 'calculated based on' 16/14)

1 **Response:** We revised the sentence according to your comment. (P6 L15)

2

3 Page: 6

4 Number: 1 Subject: Inserted Text, nearly (?)

5 **Response:** We revised the sentence in overall. (P7 L6-7)

6 Number: 2 Subject: Highlight, consider rewording for clarity - if you already have gravimetric Ar and N₂, why do you
7 need (O₂+Ar)/N₂ and CO₂ to get (Ar/N₂)? Also, change "in this study" to "For NIES" or equivalent.

8 **Response:** We changed the values to gravimetric Ar and N₂. NIES's $\delta(O_2/N_2)$ values was recalculated using the
9 gravimetric values. (P7,L24-25)

10

11 Page: 7

12 Number: 1 Subject: Inserted Text, cylinders

13 **Response:** We revised the sentence according to your comment. (P7 L26)

14 Number: 2 Subject: Inserted Text, with respect to these cylinders (primaries could still drift right?)

15 **Response:** We revised the sentence according to your comment. (P7 L27)

16 Number: 3 Subject: Highlight, might be of interest to say why 15N14N is used instead of 14N14N

17 Subject: Sticky Note Date: 5/24/2021 11:21:18 AM

18 more specifically, 2 sentences later says mass spec measures 28 - why is it not used?

19 **Response:** We used mass 29 because the spread of both ion beams for mass 28 and 32 was too wide to measure
20 simultaneously. This sentence was revised according your comment. (P8, L7-9)

21 Number: 4 Subject: Highlight, this is of course true because they are on different scales - did you instead mean
22 d(O₂/N₂)round-robin here?

23 **Response:** The word "unequal" was wrong. We revised it to "not equivalent"(P8, L9).

24 Number: 5 Subject: Highlight, Table 2 mentions mass-spec measurements of 40Ar and 14N14N - discuss here?

25 **Response:** Mass-spec measurements of 40Ar and 14N14N were removed from Table 2 because SIO used gravimetric
26 values instead of mass-spec measurements of 40Ar and 14N14N.

27

28 Page: 8

29 Number: 1 Subject: Cross-Out, SIO applies

30 **Response:** We revised the sentence according to your comment. (P9, L12)

31 Number: 2 Subject: Cross-Out

32 **Response:** We revised the sentence according to your comment. (P9, L15)

33 Number: 3 Subject: Highlight, consider moving up immediately after So₂, Xo₂, and Ico₂ are defined.

1 **Response:** We moved up it immediately after So₂, Xo₂, and Ico₂ are defined. (P9, L11-12)

2 Number: 4 Subject: Cross-Out,

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

4

5 Page: 9

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

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

8 Number: 2 Subject: Cross-Out

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

10 Number: 3 Subject: Inserted Text, '

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

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

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

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

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

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

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

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

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

20 Number: 8 Subject: Inserted Text, which showed

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

22

23 Page: 10

24 Number: 1 Subject: Inserted Text, Their

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

26 Number: 2 Subject: Inserted Text,

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

28 Number: 3 Subject: Inserted Text, values.

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

30 Number: 4 Subject: Cross-Out

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

32 Number: 5 Subject: Cross-Out

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

34 Number: 6 Subject: Highlight, Table 4 calls these "standard uncertainties" - say how calculated, and if standard

1 deviations, say of what.

2 **Response:** "standard deviations" is wrong and it is "standard uncertainties". We added "the standard uncertainties which

3 were calculated based on the Deming least-square fit". (P11, L22-23)

4 Number: 7 Subject: Cross-Out

5 **Response:** We revised the sentence according to your comment. (P11, L27)

6 Number: 8 Subject: Cross-Out

7 **Response:** We revised the sentence according to your comment. (P11, L27)

8 Number: 9 Subject: Highlight, see alternate suggestion of how to cite (it is not clear here that "the GOLLUM

9 comparison" is a citation, and some more description is warranted). Should probably also cite: WMO, 2005: Global

10 Atmosphere Watch, 12th WMO/IAEA Meeting of Expert on Carbon Dioxide Concentration and Related Tracers

11 Measurements Techniques (Toronto, Canada, 15-18 September 2003). GAW Report No.161, WMO TD No. 1275, Geneva.

12 and/or A. Manning pers. comm. for the actual values since they are not included in either of these.

13 **Response:** We revised how to cite according to your suggestion. (P11, L27-29)

14 Number: 10 Subject: Inserted Text, a

15 **Response:** We revised the sentence according to your comment. (P11, L27)

16 Number: 11 Subject: Inserted Text , the GOLLUM exercise coordinated by SIO and the University of East Anglia from

17 2003-2014 (GOLLUM, 2015),

18 **Response:** We revised the sentence according to your comment. (P11, L27-29)

19 Number: 12 Subject: Cross-Out

20 **Response:** We revised the sentence according to your comment. (P12, L5)

21

22 Page: 11

23 Number: 1 Subject: Inserted Text,)

24 **Response:** We revised the sentence according to your comment. (P12, L15-16)

25 Number: 2 Subject: Inserted Text, We found a change of

26 **Response:** We revised the sentence according to your comment. (P13, L9-10)

27 Number: 3 Subject: Inserted Text, to

28 **Response:** We revised the sentence according to your comment. (P13, L9)

29 Number: 4 Subject: Inserted Text,

30 **Response:** We didn't know where to revise.

31 Number: 5 Subject: Inserted Text, are

32 **Response:** We revised the sentence according to your comment. (P13, L11)

33 Number: 6 Subject: Inserted Text, to

34 **Response:** We revised the sentence according to your comment. (P13, L11)

35 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
5 span uncertainty (2% 1-sigma) and what value(s) you would recommend instead. For example, would you recommend
6 1.6% (standard deviation of slopes reported here) without any correction, and some smaller uncertainty if a span
7 correction is applied?
8 **Response:** We added what value they used for their estimate of span uncertainty and what value(s) we recommend
9 instead of their estimate of span uncertainty.(P13,L15-18)
10 Number: 10 Subject: Cross-Out
11 **Response:** We revised the sentence according to your comment. (P13, L20)
12 Number: 11 Subject: Cross-Out
13 **Response:** We revised the sentence according to your comment. (P13, L24)
14 Number: 12 Subject: Inserted Text, changes
15 **Response:** We revised the sentence in overall. (P13, L24-25)
16

17 Page: 12

18 Number: 1 Subject: Cross-Out, We speculate that t
19 **Response:** We revised the sentence in overall. (P13, L28-30)
20 Number: 2 Subject: Cross-Out
21 **Response:** We revised the sentence in overall. (P13, L29-P14,L1)
22 Number: 3 Subject: Highlight, adsorption?
23 **Response:** We revised the sentence in overall. (P13, L29-P14,L1)
24 Number: 4 Subject: Inserted Text, ,
25 **Response:** We revised the sentence in overall. (P13, L29-P14,L1)
26 Number: 5 Subject: Inserted Text, than t
27 **Response:** We revised the sentence in overall. (P13, L29-P14,L1)
28 Number: 6 Subject: Inserted Text, from
29 **Response:** We revised the sentence in overall. (P13, L29-P14,L1)
30 Number: 7 Subject: Cross-Out
31 **Response:** We revised the sentence in overall. (P14, L4-5)
32 Number: 8 Subject: Highlight, uncertainty? bias was within uncertainty, no?
33 **Response:** Because values of NIES and AIST by the conversion was consistent within uncertainty. We added "within
34 uncertainty" to the sentence. (P14, L4-L6)
35 Number: 9 Subject: Highlight, I suggest acknowledging Andrew Manning for the GOLLUM results.

1 **Response:** We were grateful to Manning for the GOLLUM results in acknowledgments. (P14, L14-15)

2

3 Page: 13

4 Number: 1 Subject: Highlight, This link does not work. This one does: <https://gollum.uea.ac.uk/apo-2015.shtml>

5 **Response:** the link was revised to "<https://gollum.uea.ac.uk/apo-2015.shtml>" (P16, L6)

6

7 Page: 17(Table 1)

8 Number: 1 Subject: Highlight, formatting issue here

9 **Response:** We revised the sentence according to your comment.

10 Number: 2 Subject: Inserted Text, dry air?

11 **Response:** We described that figures are given in the unit of $\mu\text{mol mol}^{-1}$ in dry air. (P20, L10)

12 Number: 3 Subject: Highlight, see earlier comments - give reference year and consider using more recent value

13 **Response:** The sentence was revised according to your comment (P20,L11-L13).

14 Page: 18 (Table2)

15 Number: 1 Subject: Highlight, line spacing in this column could be improved

16 **Response:** line spacing in this column was improved

17

18 Page: 19 (Figure 1)

19 Number: 1 Subject: Inserted Text, as

20 **Response:** We revised the sentence according to your comment.

21

22 Page: 20 (Figure2)

23 Number: 1 Subject: Highlight, should y-axis label on 2a be the same as on 3a?

24 **Response:** We revised y-axis label of the Figure 2a according to your comment.

25 Number: 2 Subject: Inserted Text, at EMRI/AIST

26 **Response:** We revised the sentence according to your comment.

27 Number: 3 Subject: Highlight, say what whiskers are here

28 **Response:** The whiskers were explained according to your comment.

29

30 Page: 21 (Table 3)

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

3 **Response:** We specified in footnote that these are all reported on own scales
4

5 Page: 22 (Figure3)

6 Number: 1 Subject: Highlight, say what whiskers are

7 **Response:** The whiskers were explained according to your comment.
8

9 Page: 23 (Table4)

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

13 **Response:** We revised the sentence according to your comment.

14 Number: 2 Subject: Inserted Text

15 **Response:** We didn't know where to revise.

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

17 **Response:** We revised the sentence according to your comment.

18 Number: 4 Subject: Inserted Text

19 **Response:** We didn't know where to revise.

20 Number: 5 Subject: Inserted Text, the

21 **Response:** We revised the sentence according to your comment.

22 Number: 6 Subject: Inserted Text, the individual laboratory

23 **Response:** We revised the sentence according to your comment.

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

26 **Response:** We revised the sentence according to your comment.
27

28 Page: 25 (Figure5)

29 Number: 1 Subject: Highlight, panel letters missing

30 **Response:** We revised the panel letters missing

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

32 **Response:** The y-axes in (b) was updated because we assigned $0.2093391 / 0.7808943 = 0.2680761$ as δ (O₂/N₂)
33 $NMIJ/AIST=0$. It reflects conversion to NMIJ/AIST