

Atmos. Meas. Tech. Discuss., author comment AC2
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Reply on RC2

Nobuyuki Aoki et al.

Author comment on "Influence of CO₂ adsorption on cylinders and fractionation of CO₂ and air during the preparation of a standard mixture" by Nobuyuki Aoki et al., Atmos. Meas. Tech. Discuss., <https://doi.org/10.5194/amt-2022-41-AC2>, 2022

General:

The manuscript presents new updated CO₂ concentration (and auxiliary) measurements regarding fractionations associated with adsorption/desorption on metal surfaces as well as fractionations during decanting experiments (mother-daughter, dilution experiments). These fractionations, in particular the latter, are relevant for assigning concentration and isotope values as best as possible as it significantly changes the concentration values. Aoki et al., did a thorough experimental study combined with explanations using models that has been used earlier on. Their results clearly show that care must be taken during dilution and decanting (mother-daughter) experiments. This manuscript deserves publication in AMT after the manuscript has been checked for English language shortcomings as mainly addressed by Reviewer 1 and additionally outlined below.

Response: We appreciate the reviewer's thoughtful review and constructive comments. All the comments have been addressed in the revised manuscript, and the responses to each comment are given below.

Minor points:

Title: consider changing to: Influence of CO₂ adsorption on cylinders and the fractionation of CO₂ and air during the production of a standard mixture

Response: we revised title according to your comment.

Abstract: We conducted a study to fully understand carbon dioxide (CO₂) adsorption

I do not know whether you should write it in such an absolute manner, consider

skipping fully or exchange it with better.

Response: we revised the sentence to "We conducted a study to evaluate carbon dioxide (CO₂) adsorption". (P1, L10)

Abstract: The CO₂ molar fractions in standard mixtures prepared by diluting pure CO₂ with

air three times deviated by $-0.207 \pm 0.060 \mu\text{mol mol}^{-1}$ on average from the gravimetric values which were calculated from masses of source materials by evaluating their CO₂ molar fractions based on standard mixtures by diluting the

pure CO₂ with the air only once.

This sentence is difficult to understand, consider splitting it up.

Response: We revised the sentence to "It became clear that the CO₂ molar fractions in standard mixtures prepared by diluting pure CO₂ with air three times deviated by $-0.207 \pm 0.060 \mu\text{mol mol}^{-1}$ on average from the gravimetric values." (P1, L12-14)

Abstract: rewrite: When the cylinder pressure was reduced from 11.0 to 0.1 MPa, the CO₂ mole fractions in the mixture stream exiting the cylinder increased by 0.16 ± 0.04

$\mu\text{mol mol}^{-1}$.

Response: We revised the sentence according to your comment. (P1, L26 - P2, L28)

Intro: However, the compatibility goal has not been achieved among laboratories using their scales (Tsuboi et al., 2017, Flores et al., 2019), preventing precise evaluation of sources and sinks of CO₂.

Here, I agree with Reviewer 1. Your conclusion is indeed misleading as the accuracy within the WMO GAW network does not play role as all the values needs to be reported on the same scale. The accuracy of the scale itself is of secondorder. Your cited references document differences among different scales in use.

Please reformulate this part.

Response: we reformulated this part according to your comment. (P2, L39-43)

Line 105-106: The mixture flow after through the regulator was branched to two ways by Tpieces. T, rephrase to "After flowing through the regulator, the mixture flow was branched in two ways by T-pieces.

Response: We revised the sentence according to your comment. (P55, L107-108)

Line 141:(N₂+O₂,+Ar+CO₂=1). Use(N₂+O₂+Ar+CO₂=1)

Response: We revised the sentence according to your comment. (P6, L151)

Line 507-510:The fractionation factor in the transfer of the CO₂/Air mixture was 0.99968 ± 0.00010, indicating that the CO₂ molar fraction decreased by 0.032 % ± 0.010 % by transfer of a source gas and the CO₂ molar fraction in a source gas increases by 0.30 ± 0.10 μmol mol⁻¹ as the inner pressure decreased from 11.5 MPa to 1.1 MPa.

rephrase this sentence.

Response: We reconstructed the sentences. (P21, L509-515)

Fig. 4: refer to subgraphs a), b) and c) in the Figure legend

Response: we revised Fig.4 according to your comment.