

Interactive comment on “The isotopic fingerprint of the pre-industrial and the anthropogenic N₂O source” by T. Röckmann et al.

T. Röckmann et al.

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We thank the referee for his thorough review. Here are our answers to his comments

1) Regarding the term "anthropogenic contribution": Following the suggestion by the referee, the paper now states that also changes in natural emissions, e.g. due to climatic changes, may have contributed to the increase of N₂O since pre-industrial times.

2) The explanation is indeed not entirely satisfactory. As the internal precision is the same for both datasets, the reason for the reduced scatter in the latter set of measurements is most likely due to improvements in the sample admission procedures. This is now stated in the text. We still have no clear indications but did not want to simply exclude the data set that has a larger scatter. Anyway, the combined data are well represented by the model results.

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3) The way the errors are estimated is now more clearly described in the caption of table 1. As a response to the other referee, we have also added a column in table 1 giving the range of scenarios that were used for the error range estimate. The ranges reported represent the range of model scenarios from figure 1 for which the firm profile bracket the experimental errors of the bottom samples; model errors are not included. The date for the IPCC recommended fluxes is given.

4) Actually, if the fluxes are multiplied by the delta values, the isotope budget calculations are correct, not approximated.

5) Rather than including a lengthy step-by step derivation of the two-box model, we now give a reference that is accessible from outside (book and web address). The tropospheric mixing ratio has been given.

6) The reference has been clarified.

7) We hope the problems with the figures have been solved. It has been clarified that the scenarios are obtained by scaling the "depleted ocean" scenario up and down in steps of 10% of the total difference between the present and pre-industrial values.

Technical corrections:

page 2023, line 8: Has been changed to: "should have left a signal in the isotopic composition"

page 2023, line 18: Has been changed to: "atmospheric history of the trace gas signatures" (general statement)

page 2026, line 17: This is not only true for the isotope fractionation, but also for concentration changes, so it was not changed.

page 2027, line 29: Has been changed to "fractionation due to gravitational separation and diffusion alone"

page 2030, line 16: Has been changed

page 2033, line 22: Has been changed

Interactive comment on Atmos. Chem. Phys. Discuss., 2, 2021, 2002.

ACPD

2, S988–S990, 2002

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