

Interactive comment on “Continuous measurements of nitrous oxide isotopomers during incubation experiments” by Malte Winther et al.

Malte Winther et al.

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Dear Kees Jan van Groenigen,

We have realized that our comment in the submitted "Final author comments" file, concerning the section 2.5.1 was incomplete. There fore this additional comment.

Referee 2 wrote:

Whole 2.5.1: The second section is somewhat repetitive as the R2 value is mentioned

C1

twice as optimization criterion and, thus is too verbose. Please make this section more concise and provide information on what “is iteratively found” means exactly (P7, L23).

Our final response is:

We have improved the section as follows:

We determine the respective isotopic fractionation during production and reduction of N₂O for each of the bacterial strains assuming a Rayleigh type process. The best fit (highest R²) is found using an iterative approach between the measured data and the Rayleigh distillation model for the accumulated product (equation 8 and equation 10 for *P. chlororaphis* and *P. fluorescens*, respectively). As *P. chlororaphis* is a pure producer of N₂O this is straight forward. For *P. fluorescens* the section of production is defined as being from the start of the measurements until the net production (net emission) rate turns negative. From the calculations of the net production rates (see Fig. 3) we believe that N₂O production continues after the point of maximum concentration. However, at one point NO₃⁻, NO₂⁻ and NO are fully consumed and *P. fluorescens* is forced to exclusively reduce N₂O. We defined the start of the section where *P. fluorescens* is only reducing N₂O to the point where both δ¹⁵N^α and δ¹⁵N^β start decreasing (assumption based on reduction of δ¹⁵N^α, δ¹⁵N^β, δ¹⁵N^{bulk}, and concentration). Between the end of the net production and the start of the exclusive reduction, no Rayleigh model can be fitted.

The fractionation factors resulting in the highest R² values are picked as the correct fractionation factor for each specific evolution. The highest R² values are iteratively found, by iterative calculations of the 1) extremes of the unreacted fraction parameter (f_{start} and f_{end}) (where $1 < f_{start} < f_{end} < 0$), 2) the reduction correction parameter (γ) (between $\gamma = 0$ and $\gamma = 1$), 3) the fractionation factor during production of N₂O (between $\alpha = 0$ and $\alpha = 1$), 4) the fractionation factor during reduction of N₂O (between $\alpha = 1$ and $\alpha = 2$).

C2