

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

**Malte Winther et al.**

malte.winther@nbi.ku.dk

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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](#)

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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).

BGD

Interactive  
comment

Our final response is:

We have improved the section as follows:

We determine the respective isotopic fractionation during production and reduction of N<sub>2</sub>O for each of the bacterial strains assuming a Rayleigh type process. The best fit (highest R<sup>2</sup>) 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 N<sub>2</sub>O 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 N<sub>2</sub>O production continues after the point of maximum concentration. However, at one point NO<sub>3</sub><sup>-</sup>, NO<sub>2</sub><sup>-</sup> and NO are fully consumed and *P. fluorescens* is forced to exclusively reduce N<sub>2</sub>O. We defined the start of the section where *P. fluorescens* is only reducing N<sub>2</sub>O to the point where both  $\delta^{15}\text{N}^{\alpha}$  and  $\delta^{15}\text{N}^{\beta}$  start decreasing (assumption based on reduction of  $\delta^{15}\text{N}^{\alpha}$ ,  $\delta^{15}\text{N}^{\beta}$ ,  $\delta^{15}\text{N}^{bulk}$ , 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 R<sup>2</sup> values are picked as the correct fractionation factor for each specific evolution. The highest R<sup>2</sup> 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 ( $\gamma$ ) (between  $\gamma = 0$  and  $\gamma = 1$ ), 3) the fractionation factor during production of N<sub>2</sub>O (between  $\alpha = 0$  and  $\alpha = 1$ ), 4) the fractionation factor during reduction of N<sub>2</sub>O (between  $\alpha = 1$  and  $\alpha = 2$ ).

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