

Interactive comment on “Tracing the fate of atmospheric nitrate deposited onto a forest ecosystem in eastern Asia using $\Delta^{17}\text{O}$ ” by U. Tsunogai et al.

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Received and published: 1 February 2010

Thank you very much for your comments on our manuscript. We have carefully studied your comments and revised the manuscript accordingly.

Responses to your comments are as follows:

1) Atmospheric nitrate: The word "extraordinary" means the value (+34.5 permille) exceeded the 2 sigma variation range of the whole atmospheric nitrate observed in this study. We would like to clarify this in the revised MS to avoid misleading. All the reported $\Delta^{17}\text{O}$ values of atmospheric nitrate around +35 permille or more are limited to the polar region, such as Alert (82 degreeN), Summit (73 degreeN), DDU (66 degree
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S), and South Pole (90 degree S), while Rishiri is located in mid latitude (44 degree N). Furthermore, the air-mass that had transported nitrate with such high $\Delta^{17}\text{O}$ values in Rishiri had been derived from much lower latitude, as presented in figure 4. To justify our present $\Delta^{17}\text{O}$ data of atmospheric nitrate with such high $\Delta^{17}\text{O}$ value, it must be better to explain the possible reason of the enrichment. The global atmospheric model of nitrate $\Delta^{17}\text{O}$ by Alexander et al. (2009) always exceeded the observed values in mid latitude, including Rishiri in this study. Correspondence with the model might be insufficient to justify the present $\Delta^{17}\text{O}$ data of atmospheric nitrate.

We would like to include N_2O_5 hydrolysis as the source of nitrate with +34.5 permille in the revised MS, as suggested.

2) Definition of $\Delta^{17}\text{O}$: While you requested to present our $\Delta^{17}\text{O}$ data based on the linear approximation to keep the entire dataset of the so far published results coherent between them, we don't want to revise our definition based on the power law (eq.(1)) to keep our internal calculation coherence with the $\Delta^{17}\text{O}$ data of N_2O from which we calculated those of nitrate, otherwise we have to use different formula between natural N_2O and nitrate derived N_2O . As there have not been any international recommendations on this quantity, we would like to present the data based on the power law. Instead of changing the definition, however, we would like to add sentences to notify the difference in the definition in section 2.3 in the revised MS. Besides, we would like to present the approximate extent of differences in $\Delta^{17}\text{O}$ when we change to the linear approximation. Furthermore, we would like to add one reference for the calculation.

Michalski, G., Savarino, J., Bohlke, J. K., and Thiemens, M.: Determination of the total oxygen isotopic composition of nitrate and the calibration of a $\Delta^{17}\text{O}$ nitrate reference material, *Anal. Chem.*, 74, 4989-4993, 2002.

3) ^{17}O correction for d^{15}N of N_2O : Our routine calibration included ^{17}O correction

process for N₂O (Komatsu et al., 2008). We would like to clarify this in section 2.3 in the revised MS.

4) The last sentence of section 3.2 (Page 23087 lines 2-3 in the original MS): We would like to add a few sentences to discuss more concerning to the uniform concentration of atmospheric nitrate in groundwater, in the last paragraph of section 3.2 in the revised MS.

5) The last sentence of the first paragraph in section 3.3 (Page 23087 line 19 in the original MS): The "extent" means the extent of the post-depositional alternation in d¹⁸O of nitrate through assimilation and denitrification. We would like to clarify that in the revised MS, in response to your question.

6) The amount of atmospheric nitrate to total nitrate (section 3.2): We would like to give a range of the amount of atmospheric nitrate to total nitrate (instead of just 7%) in the revised MS, as suggested.

We trust that the revision is satisfactory response to your comments. Please find the revised pdf files of our manuscript attached. Thank you for your consideration.

Sincerely, Urumu

Please also note the supplement to this comment:

<http://www.atmos-chem-phys-discuss.net/9/C10324/2010/acpd-9-C10324-2010-supplement.pdf>

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 23073, 2009.