

## ***Interactive comment on “Sources, fate and geochemical dynamics of nitrate in an oligotrophic lake” by U. Tsunogai et al.***

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Evaluation of Sources, fate and geochemical dynamics of nitrate in an oligotrophic lake by U. Tsunogai, S. Daita, D. D. Komatsu, F. Nakagawa and A. Tanaka

The manuscript is an interesting consideration about nitrogen dynamics in a Japanese lake. Its links to transparency of lake water is mentioned but should be better explained. Further links to re-suspension of bottom sediments, mobilisation of suspended matter from the outside by increased runoff are only mentioned to a lesser degree and should be incorporated into the discussion. For this longer-term climatic data could be correlated with trends of transparency (Fig. 2). Perhaps other long-term nutrient and biogeochemical data (major ions, temperature, oxygen, nutrient contents etc. could also be correlated with data from Fig. 2).

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Detailed comments:

Abstract If the nitrate isotope compositions were only determined in June and August 2007 it seems difficult to make annual assumption such as mean residence times of 1.2 years. How could seasonality be accounted for?

P4 – L 1 how can nitrate be remineralised to nitrate? Do you mean nitrite to nitrate?  
– L 8 can you name the international standards? – Eqn 1: what does the X mean?

P 5 – L 16: Seasonal variations from when to when? – L 25 Are you sure the autumn overturn occurs in December to January after the lake is already covered with ice and snow?

P 7 – L 12 Name the temperature of the refrigerator

P8 – L 5 can you describe the reaction leading to  $\text{HN}_3$  and subsequently to  $\text{NO}_2$ ?  
– L 8 made basic to which pH exactly – L 27 “Defined schedule”, what do you mean?  
P9 – L 2&3 if you want for daily variations, it does not seem enough to run a control standard once per day  
P11 – L 24 what is the end member value of  $\text{NO}_3(\text{atm})$ ?

P12 – L 5 it is surprising that during June there should have been no stratification of the lake and only two months later there was? How can you explain this? Do you have seasonal climatic and temperature data? – L 8 point out that this enrichment happened in surface waters

P13 – L 24 can you show either by calculation or by reference that the molecular diffusion of nitrate causes a fractionation factor of 0.5? Also does this apply for N or O or both?

P14 – L 3 “with respect” do you mean “in comparison”? – L 6 If it is approximated a “closed system” then atmospheric input cannot be accounted for – L 10&11 Do you have experimental evidence for  $\delta^{17}\text{O}$  staying stable or at least a reference?  
– L 14 is a contradiction to line 6 – L 16 remove “somewhat”

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P15 – L 1 the page before you stated that delta 17 O was stable and in the following line you also state it was uniform. It should be clearly stated what you decide for and which exceptions apply – L 13 to 15 contain the word “average” too often. Consider shorten sentences – L 20 what would be the source material of such nitrification and could you attribute isotope end member values to them?

P16 – L 6 to 8 While a description of processes is ascribed to another section no mention is made for the “other sources”. Those should be identified as well.

P17 – How did you determine initial and temporal inventories and averages?

P18 – L 21 & 22 If the authors mean that the values of 1.3 Mmol and 2.6 Mmol per two months are similar, they should explain why something twice as high can be similar.

P19 – L 6 What is meant by Nos.? If the authors mean the previously described equations they should explain why they are important corrections.

P21 – L 6 if you assume that lake Mashu and the Rishiri Island have similar water isotope values the same latitude is not the only driving factor. There are continental, altitude and source effects to be considered. The best would be to state similar isotope values of the water in both locations.

P24 – L 19 Presumably N-uptake is also controlled by temperature and daily availability of light. Can you provide data for these two parameters at least for the period of investigation? – L 25 Are there really no phosphate data?

P27 Conclusions – Should contain an outlook for future studies with combined application of techniques and inventory of sediment samples. – Overall the conclusion is a little thin and should take up undisputable facts and findings that need further research and debate. It also should refer to objectives in the introduction and how they were achieved – A clear statement about the controlling factors of lake clarity with depth is missing? How could these be controlled?

Table 2: use same number of digitals at least within columns

Fig 3 What is the explanation for DO remaining so stable over the depth of the lake?

Fig 5 & 7 Do you mean permille on the x and y axes?

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