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Biogeosciences Discussions

Interactive comment on "NO_x reduction is the main pathway for benthic N_2O production in a eutrophic, monomictic south-alpine lake" *by* C. V. Freymond et al.

Anonymous Referee #1

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Freymond and colleagues paper focus on the benthic nitrous oxide budgets of alpine-lakes involving isotopes techniques in order to address main pathways involved during a seasonal scale. Their finding indicates high magnitude of nitrous oxide production from the sediments towards the overlying water column "probably" derived from NOx reduction since no significant nitrous oxide were produced from ammonium isotope enrichment. This research covers understudied continental water bodies which eventually could be very large sources of nitrous oxide towards the atmosphere. The paper is well written and also discussed some of the possible biases derived from the methodological approaches used. However, I think that is still very descriptive and lack for further interpretation and analyses, such as evaluate the contribution of the different evalu-

ated rates such as nitrous oxide derived from nitrate labeled experiments with the total fluxes from anamended experiments? What is the actual contribution in percentage and thus the potential role of nitrification?. The paper also lacks for a statistical support (like multivariable) in order to clearly state the potential relationship with oxygen or other variables such as nutrient concentrations variability to the nitrous oxide fluxes observed. I consider that the authors should centre their interpretations with the help of statistical approaches and focus on this from the title on to the main results associated with a variable nitrous oxide production reaching significantly high magnitudes in certain periods probably linked also with the response of the microbial community to other factors such as those explored in the main study. At this point the author's can't determine the contribution of nitrification using the experimental settings since many biases are associated with label ammonium determinations. Determine the main pathway which originates nitrous oxide in this environment is a challenge that the authors did not accomplish jet since the technique did not help to decipher the contribution of each pathway in this ecosystem, for example combine the experiments with nitrous oxide isotopomers. Nitrification could be important in some periods sampled such as January when no significant NOx reduction was detected but still unlabeled nitrous oxide is produced in ammonium labeled experiments. The authors consider dilution effects by remineralization of labeled ammonium as possible explanations of a lack in being able to evaluate nitrification source of nitrous oxide. I think that also a significant assimilation by the microbial community should also be a significant unaccounted sink of labeled ammonium. The authors should explore this possibility since in their experiments they determine higher 44-mass-nitrous oxide fluxes in ammonium labeled experiments compared with nitrate labeled ones in various months.

Specific comments Title. Focus to the main findings.. "Nitrous oxide variability in alpine.. in a seasonal scale and the contribution of reduction pathways . . .... Sampling and Methods How the oxygen was determined, detection limit of the technique? Was the oxygen evaluated all through the experiment as well? Results The rates results should also be shown more clearly like merged in table 1 as average with standard

errors for the different cores. Also percentages of contribution of the only pathway evaluated should be determined in order to have an idea of its variability and will allow the authors to discuss other potential contributors such as nitrification. Statistical analyses (for example canonical analyses or multidimensional) must be run considering the comparison with the other physical-chemical factors that influences the microbial community in this aquatic ecosystem. Discussion The discussion will be enriched from the analyses suggested above and should be reformulated accordingly. The paragraph below line 25 under the first subtitle should be rephrased is confusing as it is written, your results vs the discussion.

Interactive comment on Biogeosciences Discuss., 10, 4969, 2013.