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Interactive comment on “Human land uses enhance sediment denitrification and N_2O production in Yangtze lakes primarily by influencing lake water quality” by W. Liu et al.

Anonymous Referee #2

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General Comment:

This is a timely and important analysis of N_2O production and water quality related to human land use in lake catchments. It fills a gap in our understanding of the factors that contribute to N_2O production in lacustrine systems. As a general recommendation, however, I would advise the authors to emphasize more clearly those findings which are new and add unique insight. It is generally known that land use affects water quality and N_2O production in terrestrial environments. However this work is unique because the clear documentation of these connections in lacustrine environments, especially the effect on STN, was lacking until this publication.

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Specific Comments:

1) In the Abstract on lines 10-11, the following sentence seems ambiguous: "Increased background denitrification rate would result in increased production rate." Is this meant to indicate that increased background denitrification would hypothetically or theoretically result in increased N_2O production rates? Or that it in fact *did* result in increased N_2O production rates? Later it is stated that " N_2O production rates increased with increasing background denitrification rates."

2) In the introduction it is stated that "the percentage of eutrophic lakes...increased from 41% in 1980 to 85% in 2005." It seems more appropriate to say that there was an increase in the percentage of lakes *classified* as 'eutrophic' (presumably according to a classification method outlined in Liu et al., 2010). It's not necessary to spell out what exactly is defined as 'eutrophic', but keep in mind this word is often used to describe relative as well as absolute nutrient levels. This also applies to lines 18-20 in the "Study sites" section which also reference eutrophication. In addition, there is a reference to 'built-up' lands. It might be good to say "the percentage *classified as* built-up lands" to make it clear you are talking about a land classification scheme. I notice later in the paper there is an explanation of the method used to classify land use.

3) Later in the introduction it is stated that "the relative N_2O production for heavily polluted river and estuary sediments is approximately 0.03." I'm assuming you mean the $N_2O : N_2$ ratio is 0.03? Many readers may be familiar with the work of Seitzinger and Kroeze and will know what is meant, but it would be good to make this more clear.

4) In the section called "Watershed land use calculation," the categories 'cropland' and 'built-up land' are combined to create a variable called 'human-dominated land uses.' However it seems likely that crop production might have a distinct effect on water quality when compared to other human land uses (for example sewage treatment and urban runoff and groundwater effects). Is there reason to believe that the different land uses will affect the lake in similar ways, with respect to the variables measured? For

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example, is there reason to believe that both 'built-up' land and 'cropland' add the same type of inorganic nitrogen to the water column in these systems? Could it be the case that the N additions from these two sources have a distinct effect on denitrification? It might be a good idea to add a sentence or two justifying the choice to combine these variables.

5) As far as adding NO_3^- to the model and excluding NH_4^+ and TN, it might be a good idea to add some insight into how much the model would change if NH_4^+ , for example, were included or substituted for NO_3^- . If the conclusions hold even when NH_4^+ is added or substituted into the model, then this could bolster the assumption that NO_3^- can stand in for NH_4^+ and TN in the model. Or maybe there is some other reason to think NH_4^+ shouldn't have it's own unique effect in these systems, apart from the strong correlation with NO_3^- ?

6) Related to point 5, it is stated that "100% of the positive indirect effect of HDL on background denitrification (0.55) was mediated through water quality (principally via NO_3^-)." This is where NH_4^+ could make a difference. If HDL affects NH_4^+ , which in turn is nitrified to NO_3^- , then this could be an additional indirect effect of HDL on denitrification and N_2O production, although it would require one extra step. It may be that the experiment described cannot fully evaluate this possibility, since the nitrification rate was not measured. However later in the paper it is stated that "nitrification processes [are] the major source of N_2O ." This raises the possibility that future research on lake N_2O and land use will have to measure nitrification directly, or risk missing the most important process of N_2O production.

7) It is stated the "The relative N_2O production >1 implies that the production of N_2O through nitrification must have occurred..." But it is also stated that the relative N_2O production was 0.17 - it would be good to clarify what this means.

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