

Interactive comment on “Inverse isolation of dissolved inorganic nitrogen yield for individual land-uses from mosaic land-use patterns within a watershed” by Y.-T. Shih et al.

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We appreciate the review made by reviewer #2 who raised two main concerns in this study. One is the methods of flux estimation. He/She asked us to remove the global mean method for flux estimation. The other is to encourage us to clearly present the results and implications. The reviewer also asked us to fine-tune the writing to improve the readability and we endeavored to do so. Below are our responses to the comments point-by-point.

General comments: This paper uses data on measured DIN concentrations and dis-

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charge to estimate land use/land cover-specific yields of N for the Danshui River in Taiwan. Data might be useful for watershed managers interested in nitrogen loading to river systems after the paper is re-written. The writing is quite awkward, making it very difficult to evaluate the merit and quality of the work. I do believe, however, much work remains to justify the analysis methods and to clearly present the results and implications. I agree with other reviewer that much work remains to make this paper acceptable for publication. Reply: Both reviewers think the results and implications of this study were not presented clearly enough in the original version mainly due to the writing. In this version, we thoroughly revised the manuscript and invited a native speaker to polish the writing.

Specific comments Title: the current title is quite wordy. I suggest shortening to “Inverse isolation of dissolved inorganic nitrogen yield for individual land-uses within a watershed” or something to that effect. Reply: As suggested, we changed the title to: “Inverse isolation of dissolved inorganic nitrogen yield for individual land-uses within a subtropical mountainous watershed”.

P450 Line 8: The use of “Meanwhile” as a transition here is awkward; I suggest deleting. This is a recurring issue throughout the manuscript. Reply: We eliminated this “Meanwhile” and checked the others throughout the manuscript. This revision was edited by a professional editor.

Lines 17- 18: Delete this sentence; I’m not sure what it means. Reply: Deleted.

Line 18: Delete “. . . therefore, can . . .” Reply: Rephrased. Now the sentence reads: “Based on the yield factors, the riverine DIN export for all possible combinations of land-use, discharge, and population density can be assessed.” [Line 35-36]

Lines 19 – 21: This is a very general statement; I’m also not sure this is quite correct. I think the focus needs to be on what specific management is possible from this work, and on types of watersheds these results apply. Re: This statement is removed. Instead, we added the sentence, “In local-to-regional scale, this method can provide

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the first-order assessment of riverine DIN export for land use change in the ungauged catchments”, stating the applicability of our method for ungauged catchments. [Line: 36-38]

Lines 23 – 25: The opening sentence is not structured well, nor is it grammatically correct. I would suggest changing to something like: “Elevated loading of nitrogen associated with increasing population and food production causes serious water and land pollution . . .” Reply: As suggested, we rephrased the opening sentence. Now it is changed as “Elevated loading of nitrogen associated with increasing population, urbanization and food production has caused nitrogen cycle imbalances (e.g. Howarth, 1998; Galloway et al., 2004; Galloway et al., 2008) which might exceed the safe operating parameters for humankind (Rockstrom et al., 2009).” [Line: 43-46]

P451 Line 1: I do not believe Downing et al. 1999 and Peterson et al. 2001 are appropriate references for this statement. Also, it's important to remember that Rockström proposed safe operating limits for nitrogen, but did not define them based on data. Re: We changed the references. Two studies authored by Howarth (1998) and Galloway et al. (2004) are more appropriate for this sentence. Since Rockström et al. (2009) did not define the safe operating limit, we used “might” in this sentence. [Line: 45]

Lines 1 – 5: I don't disagree with these statements, but they seem out of place in this opening paragraph. In fact, the first paragraph doesn't really build toward a direction of the study; it is just a series of statements about how excess nitrogen loading is a problem (which is well known). Also, change “blue-tinged blood” to “low-oxygenated blood” for more specificity. Reply: Following reviewer's comment, we re-wrote the first paragraph thoroughly. In this revised paragraph, we described the imbalance of nitrogen cycle induced by human activities and the global riverine DIN export. Later on, we highlighted the lack of studies in the tropical and subtropical where the DIN export could very likely be high. [Line: 56-60]. The “blue-tinged blood” has been changed to “low-oxygenated blood” as suggested. [Line: 50]

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Line 7: look at the subject-verb agreement here. Reply: It is not a correct sentence. The original sentence was re-written as “Globally, the observed riverine DIN (including nitrite, nitrate, and ammonium) export varies 0.60 to ~ 2200 kg-N km-2 yr-1 among watersheds world-wide with the average of 229 kg-N km-2 yr-1 (He et al., 2011)” in Line: 50-52.

Line 11: Delete “Meanwhile” here and throughout the paper. It is an inappropriate transition. Reply: Removed.

Line 21: Change to “evaluated first” Reply: Line 21: The whole introduction was re-written and this sentence was not used in this revision.

Line 23: Delete “all kinds of” Reply: Removed.

P452 Line 2: Change Harworth to Howarth Reply: Sorry for the typo. We corrected it.

Lines 7 – 10: The statement that “which has not been considered before” is not true. See Groffman et al. 2004 (Ecosystems 7:393-403), Jones et al. 2001 (Landscape Ecology 16:301-312), and many others for examples. Re: Thanks, the original sentence is not clear and incomplete. The references the reviewer provided are helpful to clarify the statements. Now, we rewrote the sentence as: “knowledge of the regional export coefficients of specific nitrogen sources on riverine export is needed in order to better understand the possible consequences of additional N inputs for management.” [Line: 74-76]

Lines 11 – 22: I don't see clear statement of your objectives and hypotheses here; only a list of what you did in this study. Reply: The aims of this study are to apply the inverse estimation method onto a subtropical watersheds. We addressed this in the last paragraph of the introduction. It reads: “In this study, we aimed to apply the inverse estimation method for DIN yield of individual land use with the consideration of the variability of stream discharge and population density.” [Line: 77-78]

P453, Line 14: Change “Since” to “Because”. Reply: Changed.

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Line 29: Here and throughout, I think a more appropriate term to “buildings” is “urban development”. Reply: As reviewer suggested, buildings is not a good term. We checked several global land use dataset and found “urban” and “built-up” are widely used. We replaced “buildings” with “urban” in this revised manuscript.

P454 Line 11: Here and throughout the paper, change present tense (“is”) to past tense (“was”). Re: We changed the present tense to past tense throughout the paper.

P455 Lines 12-15: I’m not sure why the global mean method is even considered here given the relatively high frequency of samples, and the fact that its use is discouraged in most literature on the subject when other methods are more suitable. Why not just take the average of the LI and FW methods? Line 19-20: FG? Do you mean FW? And how do you know it’s more accurate? Do you mean more realistic? Re: As suggested, we used FW and LI for flux estimation in this revision. Section 2.3 was rewritten. LI method is widely used in most cases, particularly for large rivers. FW is also a good alternative and widely applied to low sampling frequency. Since some sites only had the monthly sampling frequency, the average of LI and FW was used. [Line: 148-155]

P456-457 Lines 1 – 25 (both pages): This approach does not take into account spatial structure of land uses within watersheds, e.g., urban/ag lands located far away from the stream channel will have different runoff factors than those land use types immediately adjacent to the channel. The current approach might work for small watersheds, but I question the validity in applying to larger river systems. Reply: Thanks for pointing out the implicit assumption of this approach. In this revision, we described this assumption in section 2-4 [Line: 173-179].

P460 Lines 9 -13: I think it is inappropriate to average the methods together. If the GM method clearly is inappropriate, then why use it? I don’t think the approach of averaging all of the methods together makes sense; I think it is much more appropriate (and right) to pick the best method (probably the LI) and move forward with those calculations. Reply: Please see the previous reply.

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P462 Discussion in general: this section needs to focus on discussing the meaning of the results, not present a mixture of discussion and results. A good portion of this section can be put in the results section. Reply: In this revision, we clearly separated the results and discussion. The entire results section and discussion were re-written. The main story remained, but the statements were clarified.

P464 Line 3: What’s a bomb and tea plantation? Reply: “Bamboo and tea plantation”

Line 9: Need a reference here. Re: A reference authored by Galloway et al. (2008) was added. This paper demonstrated the complexity of N cascade in many aspects.

Lines 12-13: This is a generic statement; if you’re going to make it, you need to provide a little more background on what is possible for reducing fertilization given the cropping system there. Reply: We added two sentences, “Since 2004, the government actively promoted eco-regulation on agriculture (<http://info.organic.org.tw>). The organic agricultural land increased from 1246 to 6071 ha which may be of help to mitigate the over-fertilization.” [Line: 332-336]

P465 Lines 6-7: I have absolutely no idea what this means. This paragraph in general is hard to interpret. Reply: The whole paragraph was re-written. We broadly discussed the riverine DIN per capita loading in Line: 348-357.

P466 Lines 5 –15: You’re assuming that values that you measured in Taiwan can be applied globally, which is completely unrealistic. Reply: What we wanted to highlight is that facing this global issue, we need to act locally. In this revision, we changed the sentences as “For land managers who attempt to assess the land-use change impact on DIN export within an ungauged catchment, this method may provide a preliminary assessment on a similar local-to-regional scale.” [Line: 406-408]

Tables Table 3: What are the blank spaces? Table 4: What are the dashes? Re: Thanks for the reminder. We used a dash instead of a blank to indicate the null.

Figures Figure 2: Is this figure really needed? Re: Removed.

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