Biogeosciences Discuss., 10, C6247–C6250, 2013
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Biogeosciences Discussions
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# *Interactive comment on* "Extreme dissolved organic nitrogen fluxes in the human impacted Pamba River, Kerala, India" *by* S. Elizabeth David and T. C. Jennerjahn

**Anonymous Referee #1**

Received and published: 30 October 2013

Review of "Extreme dissolved organic nitrogen fluxes in the human impacted. . ."

This manuscript presents data on DON concentrations and estimated fluxes/yields from a southwest Indian catchment with a very particular anthropogenic disturbance – in addition to the high population density the catchment holds one of the most visited pilgrim sites, with high associated N delivery expected to be linked to this. While the manuscript has some potentially interesting data, I have some concerns on the data itself, and the manuscript requires a lot of clarification before its conclusions and interpretation can be properly evaluated.

*The number of samples collected is rather low to quantify fluxes and yields for DON



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(monthly sampling over 9 months). I would be useful to show any relationships between discharge and DON concentrations, or at least provide the full data so that the reader can reconstruct these.

* Please provide some additional methodological details, e.g. (i) which standards were used to analyse TDN ? (ii) how were DIN samples taken and preserved ? (iii) the detection limits mentioned for TDN analyses seem very high compared to what is typically reported in the literature for these types of instruments, the authors mention a detection limit of 0.29 to 0.32 mg N L-1 for their instruments (equivalent to ~20 to 23 $\mu$M – which would be a better unit to use given that this is used throughout the rest of the ms to report concentrations). Stubbins and Dittmar (2012, L&O Methods 10, 347–35) for example report detection limits between 0.6 and 11 $\mu$M, Shimadzu itself suggests detection limits to be around 4 $\mu$M.

* DIN analyses are mentioned in the Methods section, but data are not shown in detail – reference is made to a paper under revision but we have no access to this at the moment. It would be good to describe the DIN data in more detail in this paper.

*While we have no objective reason to question the data, the concentrations and fluxes are obviously extremely high compared to data from other systems globally. A number of questions and suggestions in this context: -The fluxes/yields reported here (90-1976 kg N ha-1 y-1, i.e. 9000-197600 kg N km-2 y-1) are so much higher than in other systems that it's hard not to raise an eyebrow. The authors have a few strong arguments to suggest the system here is indeed exceptional (e.g. calculations based on number of pilgrims) but these estimates, which don't take possible loss terms and N processing into account, still fall short at reaching the N yield observed. For comparison, the NEWS model output for calibration and validation catchments (Harrison et al. 2005) report DON yields up to ~1000 kg N km-2 y-1, global output up to ~2200 kg N km-2 y-1; and the data compilation by Alvarez-Cobelas et al. (2008, reference below) has empirical data that do not go higher than ~500 kg N km-2 y-1. The fact that the authors here find a DON yield of approximately 9000 kg N km-2 y-1 for the upper catchment



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(section I), which is reportedly pristine with a population density < 1 inhabitant per km$^2$, is therefore suspect. The authors should convince us their numbers are correct and if so, provide a hypothesis on why their DON yields from the pristine upper catchment would be so much higher than that reported in even highly anthropogenic catchments elsewhere. Alvarez-Cobelas et al. (2008) Export of nitrogen from catchments: A world-wide analysis. Environmental Pollution 156 (2008) 261-269.

- I can only assume that the authors have also measured concentrations of dissolved organic carbon (DOC). These would be very useful to have a little more insight as to what the major form of DON might be (low DOC/DON ratios expected if e.g. labile compounds such as AA or urea contribute substantially); and as a quality check to constrain the DON concentrations. DOC:DON ratios have a global average of around 20, but can vary substantially. Even if we assume a relatively low DOC:DON ratio of $\sim$10 (as observed e.g. by Seitzinger et al. 2002 in agriculturally dominated systems), the DON data reported here would translate into huge DOC concentrations unseen elsewhere. DOC analyses are thus a good check to confirm the validity of the data.

* The Discussion section mentions a few other parameters such as TSS, BOD, pH which are not described in the Methods section and it's unclear where these data come from.

* page 16149 top lines: It is mentioned here that pH decreased from 7.3 $\pm$ 1 to 7.1 $\pm$ 0, then increased to 7.1 $\pm$ 1 – Given the errors reported I doubt we can classify these as a clear or significant decrease and increase.

* It is often hard to follow the arguments and trace the numbers being cited. For example, on page 16149 you meniton a DON flux of 606 kg (organic N) ha-1, based on the number of pilgrims and the average organic N content in human waste. Does this number only refer to the 10 km$^2$ are where the pilgrimage is concentrated in, or is this extrapolated over the segment, or the entire catchment ? is this per day, per year ? Why is this number different from the 271 kg DON ha-1 y-1 mentioned in Table 3 ?



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A little explanation is provided on page 16155: “As discussed before a DON input of 606 kg ha−1 was calculated from the 10 km2 temple area and when normalized to the whole catchment, the input from the pilgrim activity amounted to 271 kg ha−1 yr−1.”, but I don’t see the link between the numbers 606 kg ha-1 for a 10 $km^2$ area, how does this convert to 271 kg ha-1 yr-1 for a catchment of 2235 $km^2$ ?

* The total potential DON input is calculated as 514 kg N ha-1 yr-1, and the range mentioned is 477-752 kg N ha-1 yr-1. While Table 3 lists the numbers for individual components that add up to 514 kg N ha-1 yr-1, it’s not clear how the estimated range was calculated.

P16138 L 14: rephrase this sentence, “inadequate sewage treatment” is not a land use practice.

P16150 line 12: ambiguous to where these numbers refer to (your study or those of the study in Spain). Also on line 23 of the same page “application rate was about 8-fold higher”: ambiguous in which of the two studies it was higher.

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Interactive comment on Biogeosciences Discuss., 10, 16137, 2013.