Response to reviewer 2

Title: Global riverine N and P transport to ocean increased during the twentieth century

despite increased retention along the aquatic continuum

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We are very grateful to the two reviewers for their constructive feedback. The suggestions definitely led to significant improvements of our text, particularly where the reviewers found sections that were not clear enough, or not quantitative (the sensitivity analysis, reviewer 1).

The concerns have been addressed below and in the revised manuscript. Below are the reviewer comments, **our response in bold**, and the new text that will be included in the revision of our paper, which is found between "".

Reviewer 2.

As I responded before accepting, the manuscript is largely beyond my expertise. Having said that I have read it with interest and consider it well written. My comments mainly refer to some presentation issues. Overall I think it is suitable for publication after satisfactory revisions.

1. Lines 8 and 9: N => P for the second ranges I guess?

Response: We thank the reviewer for this comment, we made the correction.

2. Section 2: I found this Data and methods section very condensed and referring to many other data sources and publications mostly. It is very difficult to learn from this section how the study was performed precisely. A lot of further reading is needed when readers are not familiar with these sources.

Response: because this paper focuses on model results, we have tried to describe the model in simple terms without repeating text from the full model description. Interested readers will have to, indeed, read the full model description, which is also in an open access journal.

3. Section 3: I like and welcome the attempt to validate the global model with some local data. That is fairly rare but very much needed! Having said that, I have two comments: in fact some of this first paragraph should go to Section 2 (Data and methods) and I find the conclusion that the model performed acceptable (line 19, page 20128) a bit easy – this requires more underpinning. On page 20137 the authors even conclude that the model performance was in 'good agreement' with measurements. Not sure I can conclude this from Figure 2.

Response: In our GMD paper we compared model data with monitoring data for 125 European stations from EEA, 11 stations in the Mississippi and the rivers Meuse and Rhine. In this paper we show three examples of rivers not shown in the GMD paper. To make this clear we changed

the text to: "Beusen et al. (2015) compared model results with the discharge-weighed annual mean calculated from long-term time series (from 1970 onwards to most recent years, depending on the station) of observed concentrations and discharge *for 125 European rivers*, and for the river Mississippi (11 stations), and the rivers Rhine and Meuse. *In this paper we show details of the model predictions and compare those with long-term time series for stations in the Danube in Hungary, Missouri in the USA and Ångermanälven in Sweden (Figure 2)."* Since the Missouri comparison is in the Supporting Information of the GMD paper, we added this to the figure caption: "Figure 2a is modified from Beusen et al., 2015)."

4. Page 20129: line 4: the validation was only partial and again, the underpinning of the conclusion is not so strong.

Response: see response to #3.

5. Sections 3.1-3.3 present a lot of data in the narrative, which makes the text a bit hardgoing. Is there no better way to present all these numbers? E.g. in some tables, while the text only highlights the key issues? Perhaps some schemes or diagrams with numbers may also help to make things more clear and provide more overview to the readers.

Response: this is our hard-core way of discussing our model results, i.e. text describing all these dramatic changes. We feel that condensing all the results on a table would minimize the discussion. The supporting information provides movies and additional figures, which readers can use as a support to the descriptive text. In addition, we will make the complete output data available via http://dx.doi.org/10.17026/dans-zgs-9k9m **. A sentence at the end of the introduction about the data and the doi has been added.**