Biogeosciences Discuss.,
https://doi.org/10.5194/bg-2018-406-RC2, 2018
© Author(s) 2018. This work is distributed under
the Creative Commons Attribution 4.0 License.

Biogeosciences Discussions

Interactive comment on "Reduced phosphorus loads from the Loire and Vilaine Rivers were accompanied by increasing eutrophication in Vilaine Bay (South Brittany, France)" *by* Widya Ratmaya et al.

Anonymous Referee #2

Received and published: 9 November 2018

This paper studies the long term trends in nutrient and phytoplankton dynamics in the Loire and Vilaine rivers, and in the Vilaine Bay (VB). The authors discuss changes in eutrophication of these systems, and relate changes in the VB to those in nutrient inputs from the two rivers. They show that, even though phytoplankton blooms decreased in the riverine systems following reduction in dissolved inorganic P, phytoplankton biomass in the VB has continued to increase. This could be fueled by nitrogen delivery from the rivers (slightly increasing trend for the Loire), together with phosphorus and silica recycling from bottom sediments in the coastal area. This is an

interesting discussion point, that totally fits Biogeosciences' scope. This is however only superficially discussed, and the layout of the paper makes it difficult to identify the main conclusions. I also noted important gaps in the methods' description.

The presentation of the river trajectories is extensive, but was already thoroughly discussed in a previous study (Minaudo et al., 2015). Very complete time series of Chla concentrations and abundances of different phytoplankton species in the VB are presented, and could be extremely valuable to examine changes in community structure. However, these are not discussed in depth. Moreover, more elements should be provided to the reader to justify that the data presented here is enough to support the conclusions of the study. In fact, interpretations of the dynamics in the VB are derived from observations at a single point, at which the influence of the Loire river is not obvious and not discussed.

I believe these major shortcomings should be addressed before this work can be published.

—— General comments ——

1. More information on the influence of the Loire river on the VB dynamics is needed. In fact, nutrients need to travel more than 120km from the Loire river monitoring station (Saint Luce sur Loire) to the Bay, through the Loire estuary and along the coast. Do coastal currents carry most of the Loire river's exports to the VB? How can processing in the estuary and along the coast impact loads reaching the VB?

2. Methods on the Dynamic Linear Models (DLM) and Mann-Kendall (MK) test analysis are not detailed enough. I am also not convinced that the MK test provides any more information than the DLM analysis. To my understanding, numerical estimates on trends and seasonal variations can also be extracted from the latter. Using these two methods to come up with the same interpretations waters down important messages in the results and discussion sections.

3. Authors refer several times throughout the manuscript to “management scenarios focused solely on P reduction” or on “P alone”. However, this is not totally accurate for the study area, and should be moderated. Even though ecosystems responded quicker to P reduction strategies (e.g. for point sources) than to policies on agricultural fertilization, those already exist (e.g. EU Nitrates Directive).

4. In general, statements are sometimes vague or not totally accurate. The structure of the results and discussion sections makes it difficult for the reader to identify the main conclusions of the study.

These points, together with more minor concerns, are more detailed hereafter, in the specific comments.

—— Specific comments/scientific questions ——

1. L7-8, P2. “This result is consistent with the idea that reducing P alone, and not N, can mitigate eutrophication of freshwater systems (Schindler et al., 2008)”: This paper from Schindler et al. does not show this; they study the effect of reducing N only. Moreover, this is not a scientific consensus (e.g. Pearl et al., 2016, Environ. Sci. Technol. 50, pp 10805–10813). This sentence should be moderated.

2. L14-15, P2. “Nutrient inputs... control phytoplankton production in coastal waters of the northern Bay of Biscay”: Riverine inputs constitute the major nutrient source, but don’t necessarily control phytoplankton dynamics. Guillaud et al. (2018) show that sediments have a high influence on Chla levels as well (light limitation in high flow periods/winter).

3. L22-24, P2. Consider adding references to support this.

4. L9, P3. “The VB... is located under direct influence of these two rivers”: This is not really clear from Fig. 1. See general comment 1.

5. L4-5, P4. The link between the first two sentences of this paragraph is not clear.

6. L25, P4 – L6, P5. This paragraph would benefit from more explanations on the DLM method. When you say “look like interpolation”, do you mean it is equivalent to interpolation? If yes, which kind of interpolation? Why do you choose to fit second order polynomial functions for the trends, and bimodal trigonometric functions for the seasonality? Is it based on any preliminary analysis of the data? What does “time units” refer to? Is it the frequency at which the trends/seasonal variations are estimated? Why are those plotted with (two different types of) log scales? It makes it more difficult to link the figures with the values provided in text.

7. L14-19, P5. What extra information does the MK test provide? Trend values can already be extracted from the DLM analysis. Is the method applied to the trend/seasonality functions from the DLM analysis, or to the raw data? Are uncertainties accounted for?

8. L19, P7-L7, P8. Results on Chla concentrations and phytoplankton species in the VB are not thoroughly presented here. It seems from the seasonality plot that, in the timeframe of the study, Chla has always peaked in spring and summer, and that since 2006 the summer peak has reached similar concentrations to the spring one. It’s also interesting to note that there seems to be a succession of 3 algae blooms: a diatom bloom in spring, a dinoflagellate one in early summer, when DSi is depleted, and another diatom one in late summer.

9. L21-22, P8. Why would trends in discharge in the studied rivers depend on variations in the precipitation in river basins flowing to the North Sea?

10. L30, P8-L4, P9. This paragraph would be more convincing if estimates of the loads from the different sources were provided. Is the Loire “probably” the major nutrient source, or has it been shown that it actually is? How much water/nutrients are retained in the Arzal dam, and how does it influence the loads reaching the VB? Are the discharge and loads from the Vilaine really negligible in summer, even though it flows directly to the Bay, while the Loire river plume has to travel 120km?

11. L9, P9-L20, P9. The phytoplankton succession is not thoroughly discussed here. See Specific comment 8. Even though they are decreasing, spring diatom abundances are still superior to summer ones. It is mentioned that temperature changes can induce shifts in species' succession. Is it the case here? It would also be interesting to discuss the relationship between phytoplankton successions and variations in DSi, for example.

12. L20, P10. Does Table S2 show values for the Bay of Biscay or for the Ouest Loscolo station only?

13. L21-23, P10. Precise that these correlations are at the annual scale. Seasonal variations of DIN and DSi do not seem correlated.

14. L5-16, P11. Please provide some numbers to support your conclusions.

15. L9-12, P12. An opening on eutrophication and its mitigation would fit better, regarding the introduction.

16. Table S1. When different measurement methods were used for a same variable, consider indicating which time period corresponds to which method.

—— Wording ——

- Throughout the text: "Vilaine Bay/VB" -> "the Vilaine Bay/VB"

- L15, P1. "in relation to those in their. . ." -> "in relation to changes in its"?

- L4, P2. "myriad responses" -> "myriad of responses"

- L15-18, P4. "The removed. . . general trend observed": Please reformulate.

- L10&12, P5. "position of" -> "timing of"

- L14, P9 & L8, P12. "course" -> "succession"

Interactive comment on Biogeosciences Discuss., https://doi.org/10.5194/bg-2018-406, 2018.