

Hydrol. Earth Syst. Sci. Discuss., referee comment RC1
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Comment on hess-2020-681

Anonymous Referee #1

Referee comment on "A Bayesian approach to understanding the key factors influencing temporal variability in stream water quality – a case study in the Great Barrier Reef catchments" by Shuci Liu et al., Hydrol. Earth Syst. Sci. Discuss., <https://doi.org/10.5194/hess-2020-681-RC1>, 2021

This manuscript presents a Bayesian modeling approach to understanding factors affecting temporal variability in stream water quality. Overall, I think the manuscript is well written and will become a worthwhile contribution to the hydrological community after moderate revisions. Below I provide some comments to the author, which I hope can help improve the manuscript.

1. The authors have made it explicit that the current work follows previous study investigating water quality variability in the same region (Liu et al., 2018). There are also other publications from these authors, e.g., Guo et al., 2019, 2020. The discussion section seems not provide much comparison or synthesis of the results from these different but related studies, which appears to be a missed opportunity. I am aware some of these studies focused on temporal patterns and some on spatial patterns. It can potentially become a nice addition to the manuscript and a contribution to the community if the authors can provide some reflection on what different modeling techniques they have used and what new insights on water-quality patterns they have learned from those techniques.
2. The authors have analyzed nine water quality constituents. While I do appreciate the amount of efforts the authors invested in data analysis and modeling, I wonder if it helps everyone stay focused if the authors were more selective on the constituents. Since a key message from this work is on the different drivers of particulate and dissolved constituents, it may be sufficient to select two constituents from each category, as opposed to showing data and results for all nine constituents.
3. Of the two clusters of sites (Figure 2), Cluster 1 sites are quite concentrated, whereas Cluster 2 sites are much more scattered. Also, there seems to be more sites in cluster 2 than cluster 1. I noted that the Bayesian modeling framework was applied to the two clusters independently, I wonder if any of these two aspects (geographical proximity and

number of sites) could potentially affect your models and comparison of results between the two clusters. In addition, have you considered developing a single Bayesian model on all sites with the cluster assignment has an explanatory variable?

4. Line 35: In addition to sources, mobilization, and delivery, "transformation" should be included.

5. Section 2.2.3: The authors have quantified the correlation between explanatory variables (Figure B1). Have you considered excluding some variables based on the correlations? If any two variables are highly correlated, it may be wise to keep just one of them in the models.

6. BMA model coefficients plots (Figure 5 and other related figures in the SM): I found it difficult to compare the patterns across clusters or among constituents because the variables are not displayed in the same order in these panels.

7. Predictive model performance (Section 3.2 and Table 4): The NSE values are not high, some are very low. This seems to limit the utility of the proposed Bayesian approach, which the authors should discuss and defend against.

8. Line 415: Again, the effect is not only on transportation but also on transformation. Specifically, temperature is expected to affect the intensity of biological processes, e.g., denitrification.