

Hydrol. Earth Syst. Sci. Discuss., referee comment RC3  
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## Comment on hess-2021-207

Anonymous Referee #3

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Referee comment on "Temporally resolved coastal hypoxia forecasting and uncertainty assessment via Bayesian mechanistic modeling" by Alexey Katin et al., Hydrol. Earth Syst. Sci. Discuss., <https://doi.org/10.5194/hess-2021-207-RC3>, 2021

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### General Comments:

This is a well written manuscript on an extremely important topic of predicting hypoxia in a water body of global significance. The methods and findings from this study are also applicable to similar water bodies across the world. The novel approach of using data-driven modelling (particularly, Bayesian statistical modelling) makes this a suitable paper for HESS. The results and discussion are generally well written (save one comment about being confused by Table 2). However, I do think that it would be good to see more details in the methodology about the approach taken in this study. This is coming from the perspective of someone who thinks this work is very relevant to the work of watershed planners and managers - who may want more detail on how they could apply similar work themselves.

I understand the reasoning for not detailing the Bayesian Mechanistic Model in this paper (because it was previously published) - however, I do think that more details on the model formulation are required in Section 2.1 so that this can be a stand-alone paper in its own right. Particularly - what are the key parameters and what are the model equations? Similarly in Section 2.2, readers need to refer to the DMO 20 publication, and to Matli et al. 2018. I do think that these details should be brought across to this paper too.

I also think more emphasis in the methodology needs to be placed on the forecasting method and the regression modelling of June-September Discharge and Loading. I didn't realise until quite later in the paper that Bayesian methods were used in determining these data. This is quite important and could be applied not only in the context presented in the paper, but to other sites. In particular the details I would like to see are: what software/platform was used for the modelling (is this available on github etc?), how did you check convergence of chains?, how many iterations?, was there a burn-in period?, how many models did you produce in the exhaustive search (just to place the scale of the work in context), what are the prior distributions?, how were the assumptions checked?

I would also like to see an assessment or further discussion of how the uncertainty in the forecasts are propagated through the Bayesian Mechanistic Model. How do you account for this? How does the final uncertainty change? More details on how this assessment is conducted would be good to see in the methodology.

#### Specific Comments:

Lines 60-63: I am a little confused as to what the difference here is between hindcasting and forecasting? Would these need different modelling/simulation strategies? Is the forecasting process the same as the hindcasting process - just using input data representing future conditions? Then how would you validate the success of the forecasting? Perhaps a brief clarification of these points would be useful here.

Line 101: 'geostatistical estimates from Matli et al' - please elaborate on this a bit more: what are the geostatistical estimates of? What does Matli et al. 2018 provide?

Line 101-102: Could you please provide a few more details here too? I assume that this is referring to the estimates of BWDO and HA, but it is not 100% clear. Why is it that the monitoring cruise data have lower uncertainty? Also - how often do these monitoring cruises happen?

Line 321-324: The authors state that the projections of summer riverine inputs improve hypoxia forecasting skill - and refer to Table 2, however even after the explanation in Section 3.2, I am still confused about this table. I would have thought that if the projectings are improving forecasting skill, we should see higher R<sup>2</sup> in the Forecasted vs Observed columns compared to the Forecasted vs Hindcasted columns. Or perhaps I am completely misunderstanding the table.

#### Technical Comments:

- The authors have used a large number of acronyms throughout the manuscript (e.g., HA, BDOM, NGoM, MAR). This is perhaps a subjective comment, but I highly suggest that these acronyms are avoided and terms written out in full to make the manuscript more readable.

- Fig S1: I suggest putting this figure in the main manuscript - not all readers are familiar with the Gulf of Mexico

- figure 1 was a very useful figure for me and helped me understand the process - but for those who are not familiar with the different text box shapes - could you please provide a legend either in the figure or in the caption? also perhaps to make it easier for the reader, it might be nice to have the section heading numbers in the figure.