Hydrology and
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Discussions

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Interactive comment on "Data-based mechanistic model of catchment phosphorus load improves predictions of storm transfers and annual loads in surface waters" *by* Mary C. Ockenden et al.

Anonymous Referee #2

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General Comments:

The manuscript "Data-based mechanistic model of catchment phosphorus load improves predictions of storm transfers and annual loads in surface waters" addresses relevant scientific questions and should be published after some major revisions. The highlight of the value of high temporal resolution measurements to capture the system dynamics is very valid, as well as the benefit of the chosen approach in determining the "optimal" temporal resolution for future measurement campaigns. However, especially the "methods" section needs to be expanded by clearly stating and justifying the assumptions made.

Specific comments:

Chapter 2.3:

What is exactly the meaning and the implications of not using a noise model in Eq 2? This should be explained in more detail. Any inference algorithm (in this case probably the RIV(C)BJ), needs to make assumptions about the errors to estimate parameters. Does not using a noise model mean that you assume the errors to be uncorrelated? Or is the error model inferred by the algorithm itself? The assumptions made in the inference process should be clearly stated and checked.

Eq 4 leads to significant violation of the mass balance w.r.t. water if $Q(t-1)$ is larger than 1 (this depends strongly on the units of Q) and beta is larger than 0. This should be clearly stated, and then briefly mentioned why this is not a problem in this case (if it is not).

Chapter 3:

It would be interesting to validate some models with noise to get the total predictive uncertainty, not just parameter uncertainty. This would be a more meaningful validation and would allow actual statements about the uncertainty related to predictions of TP loads.

Most plots show observed and modeled quantities in the identification period. It would be interesting to have some more plots in the validation period (ev. including the total uncertainty bands including the noise). Also some zooms to specific time periods showing the strengths and the weaknesses of the models would be interesting.

Page 11 L33: The comparison of the quality of fit to process-based models needs a more detailed analysis. How exactly do you compare the quality of fit? With NS coefficients only? Is this justified, are the assumptions underlying NS coefficients fulfilled?

Technical corrections:

Page 8 L4: should be Table 2

Page 10 L27/28: one of the "fast pathway" should probably mean "slow pathway"?

Page 11 L22: "in" should be "an"