

Interactive comment on “Can integrative catchment management mitigate future water quality issues caused by climate change and socio-economic development?” by Mark Honti et al.

Anonymous Referee #1

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This paper describes a catchment water quality model that purports to satisfy the objectives of being both comprehensive and sufficiently simple for full uncertainty analysis. The model addresses both traditional water quality parameters, such as nutrients, as well as emerging contaminants, such as micropollutants. It also addresses features including climate change, population growth, migration, and socio-economic development. The model is demonstrated through application to a catchment in the Swiss plateau. Major results pertain to observations regarding the major sources of uncertainty as well as the relative importance of land use, management decisions, and climate change on water quality.

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The manuscript is overall well-written, despite a few small grammatical and language errors, and is well-supported by figures and tables. The claim of a comprehensive model that can be subject to uncertainty analysis is certainly a potentially important contribution that is within the scope of HESS. However, it is unclear what novel breakthrough or insight the authors have made that allowed them to accomplish this contribution. In other words, what is it that allowed them to achieve this balance of completeness and simplicity when other previous researchers could not? The authors need to more clearly and convincingly explain this important aspect of their work. If they can do this, I believe the work is publishable in HESS.

Specific comments: 1. The abstract is unnecessarily long. I think it could be cut by a third to allow for a more concise overview. In particular, the first few sentences, which are mostly introductory content, could be removed without loss of information. Additionally, the abstract is rather vague near the end. The use of uncertainty quantification to inform robust management could be described more specifically.

2. The introduction is strong, with adequate citation of previous work and models. The last paragraph, however, should give an indication of HOW the main novelties of the paper were accomplished. What major task or insight allowed these contributions to be made?

3. My suspicion is that the separation of relevant flow components described in section 2.2 is one of the important contributions of this work, however it is described in too little detail for this to be clear.

4. How was the calibration accomplished? What calibration methods and criteria were used?

5. The results are described in good detail and are adequately supported by figures and tables. However, it would be valuable to describe how such results might actually be used. Robust management methods in response to high uncertainty is mentioned, but no specific examples are given. I think it is important to show how and why the

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ability to perform uncertainty analysis adds value.

6. Section 5.1 includes the term “change signal” in the section title. What does this mean? This aspect is not actually described. At the top of page 14, it is described that “relative differences between different alternatives are often robust and can lead to a stable ranking of management alternatives.” Is this what is meant by “change signal”? This point would be valuable to explore and to discuss. Might some of the large uncertainty in model predictions disappear if the focus is on differences between alternatives, rather than absolute predictions of alternatives?

7. In the conclusions, I found the first sentence of the second paragraph promising: “From our results we can derive definite recommendations for practical water management.” However, I felt that the recommendations that followed (e.g. uncertainty analysis should always be performed, one should follow climate change effects) were not specific enough to be practical. I would have liked to have read more about how “proper accounting of uncertainty today” will “make management fairly robust” in the next decades. By what means is such robustness actually achieved? Overall, I feel the authors need to more strongly articulate their contribution in terms of the means by which they were able to accomplish their objectives. The paper would also be more valuable if they could demonstrate how the information on uncertainty would actually be used to formulate more robust management decisions.

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