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Hydrology and Earth System Sciences Discussions

Interactive comment on "Holistic versus monomeric strategies for hydrological modelling of modified hydrosystems" *by* I. Nalbantis et al.

Anonymous Referee #3

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Holistic versus monomeric strategies for hydrological modelling of modified hydrosystems

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General comments:

The article presents the comparison of two modelling approaches, one representing the bottom-up (BU) modelling approach (called monomeric in the article), and the other one representing the top-down (TD) approach (called holistic in the article). The advantages and drawbacks of the two approaches are first discussed in the perspective of modelling catchments influenced by human activities. Then their performance is

evaluated and discussed on a case study in Greece. The monomeric approach proves much less robust than the holistic one, and the authors conclude that the second one is more relevant for studying catchments influenced by human activities.

This is an interesting article. It gives a nice illustration that some preconceived ideas commonly seen in the literature can be wrong. Here it shows that the bottom-up approach classically followed to model influenced catchments can prove to be a wrong choice.

Below are some detailed comments that the authors could consider when revising their manuscript. Minor revision is suggested.

Detailed comments:

1. Page 8266, line 7: The term "monomeric" could be defined here in a few words

2. Page 8267, end of abstract: a few sentences could be added on the main outcomes of the comparison

3. Page 8268: The discussion opposing the monomeric and the holistic approaches could probably be made more balanced at this stage. There are numerous "integrated" physically-based models (e.g. the SHE model, see the recent discussion by Refsgaard et al., 2010) that can help solving complex water management issues. Some comments could also be added on the contrasted results obtained in past studies of comparisons between TD and BU type models (see e.g. Refsgaard, 1997). Some more examples could

4. Page 8268: Some more examples could be given on the attempt to account for human influences following TD approaches (see e.g. Ivkovic et al., 2005; Payan et al., 2008).

5. Page 8269: I found it would help the reader if names more explicit than "A" and "B" had been given to the two modelling approaches (e.g. BU-M for bottom-up-monomeric and TD-H for top-down holistic). Sometimes one feels lost on the meaning of A and B.

HESSD

7, C3934–C3939, 2010

If this is changed, this should be changed throughout the text and in figures and tables.

6. Page 8269, second paragraph: Some examples from the literature could be given on strategy A and shortly discussed (see e.g. Hingray et al., 2010)

7. Page 8270: Multiple citations should appear by chronological order.

8. Page 8270, line 22: Add reference to Klemeš (1986)

9. Page 8271, last paragraph: It would be interesting to make the parallel between these various options and some modelling guidelines proposed in the literature (see e.g.Refsgaard and Henriksen, 2004; Scholten et al., 2007). To which main stages of the modelling process do these options correspond?

10. Pages 8271-8275, part 2: I found this part of the article too long. I think it could be presented in a more concise way, only keeping the major ideas without discussing them in too many details. A few lines each time should be sufficient. It would be more interesting to discuss these aspects in light of the results presented in the article, i.e. towards the end of the article.

11. Pages 8275-8277: The level of details given on the two approaches could be more balanced. Here the description of approach B is much more detailed. It could be reduced to make things more homogeneous.

12. Pages 8277-8283, section 4: I also find this part too long. There are probably too many details that are not essential here. This could be shortened somehow.

13. Page 8275, lines 18 and 22: References describing each algorithm could be added.

14. Page 8279, line 26: The location of raingauges could be shown in Fig. 2 (or reference to a previous publication where they appear could be given).

15. Page 8282, section 4.4: I find this approach very interesting. However, it could be acknowledged that it involves somehow some expert judgement that may be difficult to have on some systems simply because it is difficult to know what could be the actual

HESSD

7, C3934–C3939, 2010

catchment behaviour. For example, in some climate change studies, some models show clear trends whereas others don't, while it is difficult to know which one is right!

16. Page 8282, section 4.4: It could be said in a few words how model warm-up was made to avoid errors due to unknown initial conditions.

17. Page 8283: I found sub-section 5.1 not well placed in the Results section. As it explains methodological aspects, it maybe better placed at the end of section 4.

18. Page 8284, section 5.2: The title of the section should be modified as "... performance in calibration and validation" (see line 19).

19. Page 8285, line 18: Could the authors add a few words to explain why this trend is unlikely.

20. Page 8286, line 4: Change to "through"

21. Page 8286, end of section 5: I think the author should add a discussion sub-section, to replace the results of their experiment in the context of other modelling studies. To which extent does it corroborate/contradict previous results? The authors could also discuss to which extent their results are general or not. Do they think similar conclusions would be drawn on other case studies and/or using different models representative of modelling frameworks A and B. Their case study is only an illustration and cannot be considered as a demonstration of the superiority of modelling framework B in general. For example, if the authors had chosen a less simple hydrological model and/or parameter estimation strategy in modelling approach A, would the conclusions have been similar? For example, a lot of work was done over the past years on the calibration of physically-based distributed models. Could this help improving strategy A?

22. Pages 8295-8296, Tables 2 and 3: For the third spring, instead of not making validation tests, it could be preferred to split the available record in two parts to make calibration and validation (even if records are short). This would give more insights

HESSD

7, C3934–C3939, 2010

than solely having a calibration result.

23. Pages 899-8303, Figures 2 to 5: A scale should be added in each figure. The meaning of colours should be explained when appropriate (e.g. altitude in Fig. 2).

24. Page 8299, Figure 2: Maybe a small location map of the catchment within Greece could be added in one corner of the figure.

25. Page 8300, Figure 3: The limits of the watershed could be added on the graph to better see the differences with the geological boundaries.

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Hingray, B., Schaefli, B., Mezghani, A. and Hamdi, Y., 2010. Signature-based model calibration for hydrological prediction in mesoscale Alpine catchments. Hydrological Sciences Journal-Journal Des Sciences Hydrologiques, 55(6): 1002-1016.

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HESSD

7, C3934–C3939, 2010

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