Hydrol. Earth Syst. Sci. Discuss., 9, C5504–C5513, 2012
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Hydrology and Earth System Sciences Discussions

Interactive comment on "Incorporation of rating curve uncertainty in dynamic identifiability analysis and model structure evaluation" *by* S. Van Hoey et al.

Anonymous Referee #2

Received and published: 28 November 2012

General comments

The manuscript "Incorporation of rating curve uncertainty in dynamic identifiability analysis and model structure evaluation" presents an application of GLUE and DYNIA for model structure evaluation. Although the presented research covers the title, the use of "incorporating" might be misleading, since the rating curve uncertainty is only used to determine "limits of acceptability" for the former methodologies. It is only in the "discussion and conclusions" section that the effect of the use of the rating curve uncertainty on the model structure evaluation is highlighted.

The topic addressed in this manuscript is quite broad, since a number of different techniques are combined and compared. The focus on dynamic identifiability is certainly attractive for model development and the comparison with the more traditional approach (of an evaluation of the model structure and parameters over the whole calibration period) shows that this methodology can be a great contribution. The use of the rating curve uncertainty additionally overcomes a traditional pitfall of determining the uncertainty on the observations.

In general the manuscript is well written (despite the relatively long list of technical corrections/suggestions) and clear. Nevertheless, the structure is sometimes a little bit awkward, with literature review, methodologies and results mixed in several sections, however still clear enough.

Taking into account the quality and the outcome of the research and the presentation of this research in the manuscript, I would advice minor revisions for this manuscript (as most of the suggested corrections are technical corrections).

Specific comments

p11446, L13: What is the corresponding area of the catchment?

p11447, L7-16: You give the impression that you start describing your work here with respect to the uncertainty envelope, but after reading this whole section 4, it seems that this paragraph just represents the general methodology. Adapt your formulations in a sense that this becomes more clear from the manuscript.

p11448, L2: What do you actually mean with this “uncertain membership region”? Is this a sort of uncertainty band on the calibration measurements wherein the rating curve(s) should fit? Is it possible (and clear) to plot these as e.g. whiskers on Figure 3? The latter would make it already more clear for the reader (although I do understand that you need some differentiation from the terminology “uncertainty bands” on the time series, which are derived from the uncertainty envelope).

HESSD

9, C5504–C5513, 2012

p11450, L17: I would suggest to use the original reference for the Sobol' quasi-random sampling:

Sobol', I.M., 1967. On the distribution of points in a cube and the approximate evaluation of integrals. USSR Computational Mathematics and Mathematical Physics, 7: 86–112.

Sobol', I.M., 1976. Uniformly distributed sequences with an additional uniform property. USSR Computational Mathematics and Mathematical Physics, 16: 236-242.

p11450, L17: Which distribution did you apply for the sampling of the parameters?

p11450, L27: Is the range of -2/2 for the limits of acceptance not too wide? You allow the predicted values to become double of the 95th percentile and half of the 5th percentile. That will result in about a 99% confidence interval for the observations (under the assumption of a standard normal distribution), which you even allow to cross 10% of the time steps. Provide additional information on the choice of this interval and the acceptability in your study.

p11451, L19: Figures 6 and 7 are not really clear, not even in colour. Additionally, the presentation of the results in this paragraph should stick to the results itself. You already start discussing the results and do not highlight the specific observations from the graph (in particular for Figure 7).

p11452, L2: Did you also perform this analysis for the validation period? Adding this to the results could improve the manuscript and would substantiate the findings of the study.

p11452, L4: It is not really clear to me why you have such an extended literature review in this section. In particular, a number of DYNIA applications are discussed in detail without really adding value to this part of your manuscript. It is not really clear to me, where you want to bring us by presenting this. It is not necessary to delete this whole section, but a reduction of both the number and the level of detail of cited articles might

HESSD

9, C5504–C5513, 2012

be appropriate.

p11453, L5-8: If you keep this sentence in the manuscript, you should elaborate on this, because it is not clear what you mean by this statement.

p11454, L8-9: Explain this statement more, because in this way, it is not clear (e.g. do you mean “time” or “parameter space” regions?)

p11455, L4-6: Something is missing in this sentence. What “minimum level”? Can you explain or prove this statement?

p11455, L19: Although you have a discussion section, you start to discuss the result already in this section. Try to avoid this. (Similar remark for p11456, L1-5, p11458, L16-18 and p11459, L1-5)

p11456, L5: Is the compensation of the Lmax parameter by the CKBF parameter only caused by a deficient model structure? Or can this be also related to over-parameterization? How can you distinguish both?

p11457, L9: Is this an application of GLUE or DYNIA? I guess GLUE, because I don’t see how you could get parameter sets for the validation period with the DYNIA approach. Nevertheless, you should make this more clear.

p11457, L16: I don’t think you are underestimating the flow peaks in March! Opposite, you seem to overestimate them!

p11458, L7: Similar as for the remark on p11450, L27: it is questionable if the range of -2.5/2.5 for the limits of acceptance is not too wide?

Technical corrections

General: Look out with the mixing of the past and the present tense. This should be consistent, which is not always the case.

p11438, L21: Add a comma after “system”

HESSD

9, C5504–C5513, 2012

p11438, L24: Add a comma after “essential”

p11438, L25: It should be “their”, not “its”

p11439, L24: Add a comma after “characteristics”

p11439, L18: Aren’t “groundwater level information and isotope data” also measurements? Also the formulation “The use... is preferable, but... not available...” should be corrected. Rephrase this whole sentence (and split it up).

p11440, L4: Add a comma after “functions”

p11440, L13: The starting quotation mark should be added.

p11440, L23: Add “to” after “referred” (=> referred to...)

p11441, L16: Add “of” after “estimation”

p11441, L21: Remove “s” of “suggests”

p11442, L10: This sentence should be rephrased as “explained” is not used in a correct way. (e.g. change it to “which is explained”)

p11442, L12: Also this sentence should be reformulated

p11442, L16: No reference is made to Table 1 describing the model parameters

p11443, L2: Replace “In” by “During”

p11443, L8: Add a comma after “applications”

p11443, L9: Replace “is” by “are”

p11444, L3-4: This sentence should be reformulated

p11447, L3: Replace “as seen” by “represented”

p11447, L23: I would replace “study” by “research”

HESSD

9, C5504–C5513, 2012

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p11447, L26: Add a comma after “(2010)”. I would also suggest splitting this sentence up into 2 (or even 3) parts.

p11448, L3-5: Reformulate this sentence, because now it doesn’t make sense at all.

p11448, L8: Move “allowed” after “functions” and make “is allowed” out of it.

p11448, L16: I would replace “uncertain measurement bounds” by “measurement uncertainty bounds”

p11448, L24: Add “was applied” after “0.8 m3 s-1”

p11448, L25: Add “an” before “approximation”

p11449, L4: Replace “criteria” by “criterion”

p11449, L9: Add a comma after “if”

p11449, L10: Add a comma after “values”

p11449, L13: Replace “or” by “and”

p11449, L19: Split this sentence

p11449, L24: Add a comma after “observations”

p11449, L25: Remove the comma after “predictions”

p11450, L22: Replace “requiring” by “the requirement”

p11450, L22: Add “that” after “steps”

p11451, L1: Add “that” after “time”

p11451, L9: Add a comma and “in order” after “boundaries”

p11451, L13: Add “periods” at the end of the sentence

p11451, L13: What about “quick and slow”?

HESSD

9, C5504–C5513, 2012

p11451, L17: Readers might think that in addition to the segmentation between driven and non-driven and the quick and the slow periods, you also split this up further in seasonal clusters. Make sure it is more clear from the manuscript that this is not the case.

p11451, L19: Add a comma after “whole”

p11452, L12: Replace “the” by “a” before “moving window”

p11452, L13: Add “the” after “with”

p11452, L14: Add a comma after “approach”

p11452, L22: Add a comma after “evaluated”

p11453, L2: Split this sentence

p11453, L12-15: Reformulate this sentence

p11453, L16: Specify “of DYNIA compared” after “difference” and delete “mentioned”

p11454, L18: Add a comma after “parameters”

p11455, L2: Add a comma after “(2003)”

p11455, L10: Replace “as well as” by “and” (since you used “both” at the start of the sentence)

p11455, L15: You talk about the “convergence” here, but in my opinion, the convergence cannot fluctuate. The parameter value can!

p11455, L16: Remove the “s” from “yields”

p11455, L21: Similar to the remark on p11455, L15, I think it is better to change “converges” into “evolves”

p11455, L29: Add a comma after “months”

HESSD

9, C5504–C5513, 2012

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p11456, L6: As you have several parameters, you had several “analyses”. Change this in this sentence and remove the “s” of “shows”

p11456, L11: Add an “s” to “towards”

p11456, L14: Remove “may”

p11456, L21: Add a comma after “model”

p11456, L24: Add a comma after “catchment”

p11456, L26: Replace “gets” by “becomes”

p11457, L4: Add a comma after “kb”

p11457, L6: Add a comma after “identifiable”

p11458, L6-9: Split this sentence and reformulate the second part

p11458, L12: Replace “sets” by “distributions”

p11458, L13: As mentioned before, “the non-driven slow” does not say anything. Something is missing.

p11458, L13-15: Reformulate this sentence

p11458, L19: A verb is missing in the second part of the sentence

p11458, L22: What do you mean with “posterior convergence”?

p11458, L26: Add “distribution” after “posterior”

p11458, L28: Add a comma after “results”

p11459, L1: Replace “to” by “for”

p11459, L15: It is not “the uncertain rating curve” that you use as limits. It would be better to formulate this as “the resulting uncertainty band of the flow time series”

HESSD

9, C5504–C5513, 2012

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p11459, L15: Add a comma after “limits”

p11459, L26: The proper formulation is “aiming at”, so change this sentence accordingly

p11460, L4: Add an “s” to “limitations”

p11460, L8: Replace “where” by “as”

p11460, L10: Add some specifications on the catchment, pointing towards this importance of the groundwater (lowland? Sand dominated?)

p11460, L11: Replace “in” by “of”

p11460, L13: Remove “s” of “suggests”

p11460, L14: Add a comma after “model”

p11460, L18: Split this sentence

p11460, L25: Add “the work of” before “Blazkova”

p11460, L27: Add a comma after “optimization”

p11460, L29: Remove “ly” of “consecutively”

p11461, L4: Split this sentence

p11461, L5: Add a comma after “time”

p11461, L10: Delete “applying”

p11461, L11: Delete “shown”

p11461, L14: Add a comma after “multiple” and after “evaluation”

p11461, L24: Reformulate this whole sentence

p11462, L10: Add an “s” to “models”

HESSD

9, C5504–C5513, 2012

Interactive Comment

p11462, L12: Add a comma after “time”

p11462, L13: Remove “s” of “changes”

p11462, L22: Add a comma after “evaluation”, delete “is” and replace “by the use of” with “when using”

p11462, L25: Split this sentence

p11474: Delete “based” from the first sentence of the caption

p11475: “Score” should become “Scores” on the 6th line of the caption

p11476: Add an “s” to “parts” on the 2nd line of the caption

p11478: Add a specification which of the two variables is represented in grey/black in the lower graph. In my opinion, the last sentence should also be deleted, since this provides already an interpretation of the graph.

p11479: Similarly, the last sentence should also be deleted, since this provides already an interpretation of the graph.

p11480: Similarly, the last sentence should also be deleted, since this provides already an interpretation of the graph.

p11481: Similarly, the last sentence should also be deleted, since this provides already an interpretation of the graph.

p11482-11483: I think the readability of these graphs will improve if you adapt the colours.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 9, 11437, 2012.