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Hydrology and Earth System Sciences Discussions

Interactive comment on "Multiobjective calibration of the MESH hydrological model on the Reynolds Creek Experimental Watershed" *by* A. J. MacLean et al.

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General comments

The study describes an application of multiple objective calibration used for constraining a distributed hydrologic model. The focus is given to derive a non-dominated parameter solution set, which will balance the model performance between streamflow and snow water equivalent. The approach is evaluated using data from a well instrumented experimental catchment.

Overall, the study addresses a relevant scientific problem focusing on how to find optimal model parameters for a distributed hydrologic model. This topic is interesting and

definitely within the scope of the journal. However, in present form, the paper needs to undergo some revision in order to clarify/support following points.

1) The novelty and scientific contribution should be absolutely clear. There are numerous studies focusing on multiple objective calibration in general and common runoff-snow optimization in particular (e.g. Grayson and Blöschl 2000, Udnaes et al., 2007, Parajka et al. 2007, 2008). What is novel here? The ambition to have a benchmark assessment for a particular model and region is fine, but it has a limited attraction for the international community.

2) The methodology section should be extended. In order to support and clarify some of the interpretations, more detailed information about the model inputs, simulation time step, parameter ranges and initial parameters, etc. will be very helpful. Also, more information on how the model simulates snow accumulation and melt and how are these processes parametrized are essential. (Please avoid just to refer to a Msc Thesis.)

3) Most importantly, I'm not sure to what extent are the interpretations and conclusions supported by applied methodology. I'm wondering whether optimization of 88 model parameters over a short (2 years) period by using just 2000 parameter combinations provides a basis for robust conclusions. Will it be possible to analyse the sensitivity of model parameters (with respect to runoff and snow), and subsequently to focus only on relevant/sensitive snow and runoff parameters (to reduce the overall number of model parameters)?

Specific comments

1) p. 2127, l.25: please correct distributed (distributed?)

2) p. 2128, l.21: please provide more specific about the interpolation methods.

3) Model calibration section: Is the NS efficiency a robust measure to describe the snow model performance?

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4) The selection of the two periods for calibration and validation (1986-88 vs. 1990-92) is not clear. Please make some comment on this. Are these periods typical (wet, dry, cold, etc. . .why?)

5) Multiple-objective calibration: Does the equal weighting of runoff and snow model efficiencies (NS) provide an optimal (non-dominated) solution? How is the tradeoff changing by using a different weighting scheme?

6) Uncalibrated results: Please provide more information and comments on the selection of initial model parameters. What is learned from this transfer of literature-based model parameters? What are the reasons for large errors in model simulations?

7) Table 2. What is the scatter in model efficiency between the runs? Please clarify also how is the best result identified?

References:

Grayson RB, Blöschl G. 2000. Spatial Patterns in Catchment Hydrology: Observations and Modelling. Cambridge University Press, Cambridge, UK, 404 pp.

Udnaes, H.Ch., E. Alfnes, and L.M. Andreassen, (2007), Improving runoff modeling using satellite-derived snow cover area? Nordic Hydrology, 38(1), 21-32.

Parajka, J., R. Merz, and G. Blöschl (2007) Uncertainty and multiple objective calibration in regional water balance modelling - Case study in 320 Austrian catchments. Hydrological Processes, 21, 435– 446.

Parajka, J., and G. Blöschl (2008), The value of MODIS snow cover data in validating and calibrating conceptual hydrologic models. Journal of Hydrology, Volume 358, Issues 3-4, 5 September 2008, Pages 240-258, doi:10.1016/j.jhydrol.2008.06.006

Summary: 1. Does the paper address relevant scientific questions within the scope of HESS? Yes.

2. Does the paper present novel concepts, ideas, tools, or data? See general com-

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ments.

3. Are substantial conclusions reached? No.

4. Are the scientific methods and assumptions valid and clearly outlined? See general comments.

5. Are the results sufficient to support the interpretations and conclusions? No.

6. Is the description of experiments and calculations sufficiently complete and precise to allow their reproduction by fellow scientists (traceability of results)? No. See the comments.

7. Do the authors give proper credit to related work and clearly indicate their own new/original contribution? See the comments.

8. Does the title clearly reflect the contents of the paper? Yes.

9. Does the abstract provide a concise and complete summary? Yes.

10. Is the overall presentation well structured and clear? Yes.

11. Is the language fluent and precise? Yes.

12. Are mathematical formulae, symbols, abbreviations, and units correctly defined and used? Yes.

13. Should any parts of the paper (text, formulae, figures, tables) be clarified, reduced, combined, or eliminated? Yes.

14. Are the number and quality of references appropriate? No.

15. Is the amount and quality of supplementary material appropriate? Yes.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 7, 2121, 2010.