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Hydrology and Earth System Sciences Discussions

Interactive comment on "Calibration of hydrological model parameters for ungauged catchments" *by* A. Bárdossy

Anonymous Referee #1

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Interactive Comment on Bardossy's paper.

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The author is to be congratulated for offering a surprising innovation which holds pragmatic promise of helping to solve the problem of ungauged basin modeling. I confess it took me more than one reading (and a visit to the quoted literature) to grasp the import of the paper. My comment is therefore in three parts: my understanding of the main thrust, some suggestions and then some minor corrections.

My understanding of the main thrust

Consider the situation where a conceptual model (the choice here is the HBV model) were to be used to model the continuous streamflow at a set of ungauged locations

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in a region where some good streamflow records exist. One might wish to emphasize high flows in the modeling procedure. The author explores the usefulness of transplanting candidate vectors of selected parameters from gauged locations (controls) to ungauged ones (targets). For calibration and validation, he uses the same set of 13 records.

The HBV model boasts 13 (?) parameters (from Table 1 of Hundecha and Bardossy, 2004) from which a subset of 5 were selected to constitute the candidate vectors theta in order to make a preliminary investigation manageable; (I assume that theta = {alpha , k1, k2, perc and MAXBAS}). The remainder of the set of parameters at a target site was obtained by regionalization using previous work.

Conscious of the non-linear relationship between the parameters in theta (their collective effective linear dimension estimated by principal component analysis and more generally by exploring their "true" dimensionality using Hausdorff sets is between 2 and 4), the elements of theta were randomly, independently chosen from uniform distributions. With the complementary HBV parameters fixed by regionalization, the chosen theta vectors were used in the HBV model to simulate streamflow records at each of the control sites. For each historical record at these sites i = 1 to13, those theta were selected which gave good fits of the records; this set was called D(i).

These theta in D(i) were used to simulate the records at target sites j (not = i) = 1 to 13 and those theta(j)| D(i) accepted on condition they produced good means and standard deviations compared to their regional estimates, as determined by equations (5) & (6).

It turned out that some theta(i) did not transfer satisfactorily, presumably because the records at site i & j are hydrologically dissimilar. However the message is that sensible groupings of parameters can be found by accepting those which satisfy two criteria: they yield good hydrology at their control sites (i) as well as their target sites (j), constrained overall by regionalization techniques.

Some suggestions

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The paper as it stands leaves too much to the imagination - the reader needs more help with understanding the unusual approach. The paper as it stands is relatively short - it would be acceptable to include more material. The consequence is that the author should consider making the following additions to get the ideas over more easily, perhaps bringing forward from previous work those parts which are germane to this paper. For example, a map of the region with control and target sites indicated would help conceptualization; consider including a sketch of the HBV model structure and a table of its parameters, indicating the model parameters selected as the randomized subset theta; possibly tabulate the physical catchment characteristics used to regionalize the mean and standard deviation defined in equations (3) & (4) in the paper; emphasize the unusual combination of parameter sources and the reason for their choices - a flow-chart would help.

Some minor corrections

p. 1109, l. 23: “complementary”

p. 1111, l. 17: “the effective linear dimension”

p. 1113, l. 1 & 2: “Elements of D(i), the good .. catchment i, are ..”

l. 4: define the “mean discharge and standard deviation”

p. 1114 l. 1: “4 Summary and Results”

l. 14: “was added to the set D(i) and applied to catchment j.”

l. 15: “series Qj(theta) and Sj(theta) corresponding”

l. 21: “was calculated for each acceptable candidate theta(j)|D(i).”

l. 25: “1 to 11, as a result of step 2 before considering”

p. 1115, l. 2: “correctly by the criterion of step 4.”

l. 13: “is quantitatively very good.”

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p. 1116, l. 21: “292, 281-295, 2004.”

p. 1117, l 1: “Robust”

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 3, 1105, 2006.