Hydrol. Earth Syst. Sci. Discuss., 7, C886–C888, 2010
www.hydrol-earth-syst-sci-discuss.net/7/C886/2010/

Hydrology and Earth System Sciences Discussions

Interactive comment on "Possibilistic uncertainty analysis of a conceptual model of snowmelt runoff" *by* A. P. Jacquin

Anonymous Referee #3

Received and published: 17 May 2010

General comment:
This manuscript uses the concept of possibility distributions to deal with epistemic uncertainty in the context of a conceptual hydrological model. In my opinion, this is an interesting approach to deal with this type of uncertainty. However, I still have some remarks about the methods and terms used in this paper.

The main formula (Equation 1, p4), which is the basis of the methodology is used similarly as the probabilistic Bayes' rule in order to update prior possibility distributions. Nevertheless, it is my opinion that the problem at hand in essence is a data fusion problem. Also, why did the author choose for the use of the product in Equation 1, which is very restrictive and in the case of total conflicting information between two sources, one would end up with a zero possibility degree and poorly reliable results

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can be obtained. (see the paper of Destercke et al, 2009 for further information, see below this comment for the reference)

On page 7 (lines 22- 23), the author mentions that "the feasible ranges for the model parameters are defined so that they are wider than the ranges of optimal parameter values found in previous aplications of the model." Why did the author then choose to use uniform possibility distributions instead of trapezoidal possibility distributions with the optimal parameter range as the core of the distribution?

Furthermore, I do not adhere the use of the Monte Carlo sampling strategy, originating from a probabilistic framework, in a possibilistic framework. How well are the 80000 parameter values, which is very small given the 16 dimensional parameter space, distributed in the sampling space?

Throughout the manuscript, the author uses the term possibility bounds, I suppose that the author refers to α-cuts, which is the usual term. Furthermore, the author indicates possibility levels or bounds in percentages (see e.g. p 12 line 14, table 1, etc.). Please note that the meaning of a possibility level is not a frequency, and percentages are hence not used.

Other comments:
p3:
line 26: "the possibility of a discharge prediction" this should probably be "the possibility degree" (also on lines 28, 29) line 27: the symbol α is used, however, conform the usual notation this should be π

p10-11: Alternative possibility distributions are used on the basis of prior knowledge. How do these distributions look like? Are these uniform possibility distributions albeit narrower than the ones described in the previous sections?

p11: In my opinion, figures 2 and 3 are quite redundant, conclusions drawn from these figures are obvious.

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p12: the author introduces the nash and sutcliffe performance index, although already three indices were used. What is the added value of this new performance index, which isn't used in the methodology to obtain the "posterior" distributions, only MSE$_{BC}$, $REVFandREP$.

In my opinion, figures 6 and 7 can be combined in one figure, as it is quite obvious that narrower intervals will be obtained as the possibility degree raises.

Figures 8 and 9, the different linestyles are not clear to distinguish. Furthermore, these figures show the width of the prediction bounds for the verification period, which is smaller than one year (from Julian Day 250-350, if I understood this well). From figures 6 and 7, one can see that the discharge does not show a high frequency of peaks and baseflow, only one discharge peak is observed a year. Furthermore, a large uncertainty is observed for high discharge values (as stated on p13, lines 15-16). Hence, I do not understand this rapid change in the width of the intervals at different possibility degrees? Why is this behaviour so different than the one that can be deduced from figures 6 and 7?

reference: S. Destercke and D. Dubois, 2009, Possibilistic Information Fusion Using Maximal Coherent Subsets, IEEE Transactions on Fuzzy Systems, vol 17, no. 1

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 7, 2053, 2010.