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Discussions

Interactive comment on "A strategy for "constraint-based" parameter specification for environmental models" *by* S. Gharari et al.

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The authors have done very interesting work in this paper, which describes a strategy to constrain the parameter to be consist with physical meanings or expert knowledge. This paper is novel and worthy of being published, but I think it should be merged with hess-2013-519 because they are actually talking about the same thing and presenting the same approach.

We thank Dr. Gong for his valuable comments on our technical note. In fact this paper is not a research paper but rather a technical note. We strongly believe this work should not be merged with the main FLEX-TOPO paper (HESS-2013-519) because of the following reasons:

1-Although the proposed search algorithm is simply a tool that helped the parameterization of the FLEX-TOPO model, we believe that the issue of constraint based optimization, and the associated challenges of identifying appropriate constraints based on expert knowledge, represent a more general problem which deserves a separate focus. Additionally, we believe that the approach we are taking has the potential to be improved significantly, and will be the basis for further research.
2-We can explain the importance of constraints in hydrological modelling separately from the FLEX-TOPO paper. This explanation in our point of view is wide and at some point redundant to what we have done in FLEX-TOPO framework. So we tried to address it in this technical note separately by adding a brief literature review.

If the authors really feel two papers are warranted, they should make one full research paper and one technical note. I suggest: (1) the method should be presented in the full research paper, along with two or even more case studies. (2) Describe the technical details for implementing the method in the technical note. It should be a comprehensive guide for readers to apply your method to their own models. For an instance, give a list of how to constrain interceptions, ET, runoff coefficients in a table. Here is an example.
(1) Parameter Constraints
1.1 Series Type: 0 < a < b < c < 1
1.2 Linear Type: a = b1*c1 + b2*c2
1.3 Mixture Type: a1 + a2 + a3 = 1
Etc.
(2) Processes Constraints
2.1 Magnitude constrain: ET, runoff
2.2 relationship constrain, e.g. Budyko curve, runoff coefficient Etc.
We understand the concerns of the reviewer but at this stage we prefer not to go into too much detail with the classification of all possibilities, and prefer to stick with the broad classification that was given in the paper. Parameter constraints and processes

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constraints are obviously different, not only from a general hydrological perspective but also in the way they are treated in the algorithm, as the first ones can be assessed without actually running the model, and the other ones require the model to be executed.

We also think that the examples provided by the reviewer can be accommodated in our current formulation. For example parameter constraints can be formulated as:

G(A1) < G(A2), example: A1<A2+b

G(A1,B1) < G (A2,B2), example: A1B1<A2B2, or A1+B1<A2+B2

And process constraints can be formulated as:

G(F1,t1,t2) < G(F2,t1,t2) example: int (T1)[t1 t2] < int (T2)[t1 t2]

We would like to emphasise that the equality cannot be expressed in this framework easily. For mentioned constraints such as "Mixture Type: a1 + a2 + a3 = 1", this search algorithm might not be useful as the chance of sampling a point on a line or hyperplane might be zero.

I would like to see a generalizeable list like this in the revised technical note. The outline in this paper is just over-simplified. To establish a new method, one typical way is to design a synthetic study. Let me suggest three.

(1) A 2-d area like Fig1. Given a uniformly distributed sample covering P' (the yellow one), the proposed method can generate a sample set that can uniformly cover the area of P (the green one).

(2) Three parameters a, b and c, satisfying 0 < a < b < c < 1. Given a uniformly distributed (a,b,c), the proposed method can generate a sample set satisfying the inequality.

(3) Suggest two parameters a and b, and two functions f(a,b) and g(a,b). C1<f(a,b)/g(a,b)<C2. Given a uniformly distributed (a,b), the proposed method can give the constrained (a,b). Plot the constrained (a,b) may be very interesting.

We understand the concerns of the Dr. Gong over the lack of a case study for the technical note. We will introduce two case studies in the revised version of the paper,

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one an arbitrary synthetic case study and one a brief hydrologically relevant case. This will guide the reader to a better understanding of the intention of our technical note.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 10, 14857, 2013.