Answer to the comments by anonymous reviewer #1

I reviewed the original submission of the two companion papers, and raised a major concern of seemingly overlapping between these two. Now I believe that this concern has been adequately addressed therefore recommend acceptance as is.

We would like to thank you for your positive comments. Your (past) comments helped us significantly to improve this manuscript.

Answer to the comments by anonymous reviewer #2

The article is clear and well presented. I have only a few minor comments:

We would like to thank you for your positive comments on our manuscript.

- The link with the companion paper could be improved, especially in the titles of the two articles that could be presented as Part 1 and Part 2 of a common objective. The sequence between the two papers would be clearer (I guess this article would be Part 1 and the other would be Part 2).

Thanks for this suggestion/comment which reinforces and helps to indicate clearly the considerable potential value of such approaches.
We presented the papers as companion papers which refer to each other, however we avoid presenting the papers as part one and two; we believe that the papers are not aligned on one specific objective. The FLEX-TOPO paper is about the importance of hydrological constraints in hydrological modeling, and in this paper, we propose a general constraint-based search algorithm, which can be applied to any hydrologic model. We used this proposed algorithm to technically solve the questions raised in the FLEX-TOPO paper.

- Introduction of Section 2: This mostly repeats the content of the companion paper. Is it really useful? At least this part could be made shorter.

Some of our colleagues might be more interested in the proposed search method rather, than in our modeling concept (which is the focus of the other paper). We, therefore, try to provide a brief but sufficient explanation of the FELX-TOPO (model) paper to give the reader - opportunity of catching up with the modeling approach, without going into much detail.

- Page 5, Line 16: “normalized difference vegetation index (NDVI)”

The text was changed accordingly.

- Page 7, Line 18: “illustration of the steps”

The text was changed based on your suggestion.

Answer to the comments by anonymous reviewer #3

This article presents a constraint-based method for parameter identification and a stepwise search strategy. It is clear and well-written. I have no any correction.

We would like to thank you for your positive comments.

I have one suggestion. The improved search strategy is the major contribution of this article, so the article should focus on this strategy and provide substantial materials to prove the efficiency of this strategy. The advantages of using constraints based on expert knowledge have been discussed in the companion paper. In this article, the authors apply this method in one case, and present a comparison between the proposed method and the M-C method. The big difference (8000 vs none) is impressive, but the evidence remains thin. Is this strategy tested in other cases? It will be better if the discussion on the efficiency of the search strategy is more substantial and convincing. I advise publication after minor revision.

We agree with you that the proposed search method can be explained and backed with more case studies and comparison with alternative methods. Our main objective in this paper was not to propose a "*perfect*" constraint-based search method, rather to devise a method that enabled us to find parameter sets, satisfying all the imposed constraints. To our knowledge this has never been done in presented format at least in hydrological studies. We don't claim our search strategy being the most efficient way of solving the problem of parameter identifiability. The generation of this type of search strategies (or algorithms) can definitely be set up, improved and tested by hydrologists focusing on developing mathematical tools facilitating the hydrological studies. Nevertheless, some of our colleagues are currently testing the constraint based search algorithm in other hydrologically relevant problems (see papers from Gao et al. (2014) and Hrachowitz et al. (accepted); these references are mentioned in the current paper). Nevertheless, in the conclusion part we made a short note on testing this search algorithm to other case study area.

References:

Gao, H.; Hrachowitz, M.; Fenicia, F.; Gharari, S. & Savenije, H. H. G. Testing the realism of a topography-driven model (FLEX-Topo) in the nested catchments of the Upper Heihe, China Hydrology and Earth System Sciences, 1895-1915, 18(5), 2014.

Hrachowitz, M.; Fovet, O.; Ruiz, L.; Euser, T.; Gharari, S.; Freer, J.; Savenije, H. H. G.; Gascuel-Odoux, C.: Process Consistency in Models: the Importance of System Signatures, Expert Knowledge and Process Complexity, Water Resource Research, accepted.