Interactive comment on "Improvement of hydrological model calibration by selecting multiple parameter ranges" *by* Qiaofeng Wu et al.

Anonymous Referee #2

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Overview and general comments:

In this study the Authors propose a new methodology for the calibration of hydrological model. The work intends to provide a general framework that can optimize the model calibration in case of multi-parameters that may have different value ranges, as well as different sensitivity and correlation behaviors. The analysis is performed referring to a specific case study, Chaotianhe river in the Southwest China, for which the Xinanjiang hydrological model, characterized by 10 parameters, has been implemented. The study reports the application of the proposed methodology showing an improvement on model performance.

In general, the manuscript is well organized and the methodology is sufficiently described. However, in many parts, the writing is not fluent and with grammatical errors.

In general I can say that the methodology sounds interesting and may be of interest for the hydrological community. Even though I have some doubts on the real effectiveness of the proposed approach (improvements are not really significant; see comment below), I think the paper can be considered for publication after a moderate revision.

Hereafter some general considerations and specific comments:

- My main concern is related to the real impact of the proposed methodology. The benefit in terms of NSE is very small: see Fig. 9. Is this improvement relevant for hydrological application? If we focus exclusively on model performances I do not think this methodology shows a significant improvement. I suggest to emphasize more the physical considerations that may rise from the application, for example in terms of sensitivity of specific parameters in relation to the particular nature of the study area, or regarding the evaluation of parameters correlation. From my point of view this methodology may provide additional insights regarding the interactions among model parameters under different hydrological conditions. In other words: since the improvement in terms of NSE seems to be not relevant, what are the added values of this methodology compare to existing ones?

- Continuing on the effectiveness of the methodology, the Author do not provide any information regarding the initial GA calibration. Are there benefits from the application of the methodology in terms of NSE values? What are the computational/time efforts required for the implementation of the calibration framework compared to other techniques?

- Is there a specific reason for considering the MAXR range interval in addition to MINR (see Figure 3). Why a modeler should consider the range of minimum probability density of the parameter values? If it is not necessary I suggest to consider its removal from the analysis.

- At P7, line 25. Why this is obvious? Looking at Fig. 5 this is not. Do the Authors apply statistical tests to evaluate the statistical distribution of the parameters?

- Concerning the 7 scenarios reported in table 5, how have you defined them? Are there specific reasons behind the use of initial or optimal ranges for cases 5, 6 and 7? In addition, I suggest to keep the same column order for parameters, it's easier to read table 5 in relation to the values of table 4.

- The writing in some part of the manuscript should be improved. I suggest to carefully go through the overall manuscript and check verbs and syntax (here some example: P5,L3; P5,L23; P6,L5, P9,L25-26; . . . ; P10,L17).

Specific comments:

- Abstract: in the last part of the abstract, roughly from line 20 on, the Authors report some specific methodological considerations that may not be really clear to one who has not already read the paper. I suggest to focus more on the scope and aims of the analysis, reporting also that the methodology proposes indexes for the evaluation of parameter sensitivity and correlations, as well as a summary of the main outcomes.

- P1, L29: is "method" appropriate to indicate hydrological process modelling? I would suggest something like "tools" or similar.

- P4, L28: On which base you say that 100 samples are enough? Have you adopted some statistical texts to verify the statistical distribution of the considered parameters.

- P4, L3: " A Genetic Algorithm (GA) was selected"

- P9, L6: why do you say that it is obvious?

- P10,L7: please remove the colon;

-Fig. 2: check "curve"; I also suggest to re-word the caption as: [. . .]; Cumulative frequency and [. . .] distribution for normal (b), exponential (c) and uniform (d) distributions.

-Fig. 6, 7 and 8: is it necessary to report the label "schema"?

- Table 1: is P the average or the max?

- Table 2: the definition of parameter B seems not complete. Also, the column "range" of Table 2 is reported twice (see Table 3).

- Table 3: the main legend is not really clear, I suggest to re-word it. ** "ratio of calibrated parameter . . ."