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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Assessing the temporally dynamic parameters in hydrological models: dynamic operations and evolutionary processes" *by* Tian Lan et al.

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General comments The manuscript identifies the problem of finding the global optimum for dynamic hydrological model parameters and proposes an approach involving the investigation of their evolutionary processes. The study was performed for data from three river basins: Hanzhong, Mumahe and Xunhe. The Authors used hydrological and climatic data from the period 1980-1990. Two clustering operations have been performed on this data. Additionally, both data groups were divided into 4 sub-periods: dry period and three wet periods. The data were analyzed using maximal information coefficient (MIC) and the Principal Component Analysis (PCA). The HYMOD model was

used. The parameters used in this model were analyzed in the paper (5 parameters). The model has been calibrated. Moreover, the Authors used the Shuffled Complex Evolution algorithm from the University of Arizona (SCE-UA) as an evolutionary algorithm for dynamic parameters. The combination of the Nash-Sutcliffe Efficiency index (NSE) and its logarithmic transformation (LNSE) was used as the function of the object. The simulation performance with dynamic parameters was assessed using seven performance metrics including NSE, LNSE, a five-segment flow duration curve (5FDC) with the Root Mean Square Error (RMSE). A fitness landscape was used to visualize the evolutionary processes, and violin plots were used to visualize the distribution parameters. The Authors collected a large number of results that are presented in the charts. These charts are clear and interesting. Such studies are undoubtedly needed because finding the global optimum for dynamic hydrological model parameters is an important practical issue. In my opinion, the novelty of this work is in the developed framework for the dynamic operation of parameters. The Authors might also consider expanding the discussion to the case of single- and multi-parameter spaces. In my opinion, the supplement (Supporting Information), could contain: equations, codes, details of used parameters or the names of used programs. I am interested in how the data were prepared for the determination of distributions and for the MIC and PCA analyzes. Were the data logged in the PCA analysis?

I have a few more questions / suggestions, which I include as specific comments: Line 17, page 2: The concept of an evolutionary process described in the introduction is not very clear. Please consider a more detailed description. Line 22, page 3: Please consider using "hydrological and climatic data" instead of "daily streamflow and climatic data". Have the authors considered including water temperature and air temperature in the analyzes? Line 6, page 4: I suggest that the methodology for performing PCA and MIC analyzes should be described. Line 9, page 4: What do the Authors understand by total precipitation? Is it the annual rainfall? Line 4, page 5: if the code is open, please consider making it available in a supplement. Line 12, page 5: A description or explanation of the 5 parameters mentioned would be desirable. [reference to the

supplement] Line 2, page 20: The use of the CDF (cumulative distribution function) is mentioned. If these results are not presented in the article, I suggest that they should not appear in the conclusions.

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