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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Streamflow characteristics from modelled runoff time series – importance of calibration criteria selection" *by* Sandra Pool et al.

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Review of the manuscript "Streamflow characteristics from modelled runoff time series – importance of calibration selection criteria" by Pool et al.

In this article, Pool et al. investigated the benefit of using streamflow characteristics (SFC) for model calibration and showed how the model calibration can be improved in comparison to the use of the Nash-Sutcliffe-Efficiency (Reff). They proposed a joint approach of using several SFCs and the Reff. Hereby the selection of the specific SFC depends on the goal of the study.

I like the idea of the article and see its potential after revision.

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Major comments:

In its current state, the article is in my opinion mainly related to hydrology (also by the selection of the journal). At several parts the authors emphasized its ecological importance (e.g. Page 1, Line 10, P.2, L.1-2, P.11, L.14-16). However, I do not really see a connection to ecology. Thus, either the article has to be fully focused on hydrology or it is required to emphasize its ecological relevance

In this article, the Nash-Sutcliffe Efficiency is used as an example for a traditional calibration approach. However, in recent studies the use of several performance measures related to different parts of the hydrological system is recommended. In particular the use of typical performance metrics such as Reff or Kling-Gupta-Efficiency (KGE) in combination with signature measures is recommened (see eg. Van Werkhoven et al., 2009). Thus, I think that a comparison only with the Reff is not sufficient. I recommend to use two or three performance measures such as PBIAS or KGE to show that SFCs also outperforms a calibration approach based on NSE in combination with PBIAS (or other performance measures).

Moreover, it needs at least to be discussed how a calibration approach based on these SFCs is related to recent studies using hydrological signatures such as segments of the FDC (see Yilmaz et al., 2008, Pfannerstill et al., 2014).

P. 1, L. 24-27: I do not fully agree with this statement. There are different ways of how to calibrate a discharge time series. Certainly there are studies which are focused on certain parts such as on high or low flows. However, other studies aim to represent the whole hydrological system at best without neglecting or emphasizing certain parts. In the way towards a good representation of the hydrological system, the latter one should be the general goal and a strong focus on certain parts of the hydrological system should be a specific case.

P.2, L. 21: Here, SFCs are defined "as equivalent to hydrological signatures“. In this case, I do not understand the use of SFC. It is stated before that hydrological signatures

are a more common term in hydrology. It is certainly required to justify why you used the term SFC since I do not really see the strong relationship to ecology.

I think that the article would benefit from a more detailed interpretation of the results. For example on P. 7. L. 12-15; P.8, L.17-18: Can you explain these results or more specifically the behaviour of these SFCs?

It could be interesting to analyze the relationship/correlation between the SFCs.

The combination of different metrics might outperform in general single-metric approaches. However, the more metrics are included, the more a trade-off might occur and the equifinality problem arises. In this context, can you give a recommendation for a good number of required SFCs? In the best case, a systematic way of how to select the best SFCs will be provided. Even though when I expect that it is difficult to find a precise number, it is worth discussing this point.

The figures 3-8 are very similar (at least visually). I think that the article would benefit from emphasizing the relevance of each figure. It is partly difficult to differentiate them. Maybe you can also thinking about reducing the number of figures to improve the overall message. For example, the figures 6 and 8 have almost the same figure caption. To summarize this point, it is easier to detect the whole message in the case of a more distinct presentation of the results. One example for this is the figure 9 which can be clearly distinguished from the other figures. These results are easier to understand.

P. 8, L.12-13: Could you specify how you can here differentiate between error dependence on time period or objective function?

P.8, L.14-15: I do not understand this statement that the SFCs are neither related to flow components nor to flow conditions. Hydrological signatures (as an equivalent term) are known to be of special importance to explain the hydrological behaviour. Thus, what can we learn from using these SFCs in terms of the hydrological behaviour in the catchment. And how is this related to the general idea of the hydrological signa-

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tures?

P.8, L.26 to P. 9, L.21: I agree with this part which is clearly understandable, but certainly also not surprising. It is mostly existing knowledge of hydrological modelling. What can we learn here except of using several and different metrics. I recommend to shorten this part and emphasize the most important points from this study. In contrast, I really like to following passage (P. 9, L.21-31).

Please also discuss the impact of a SFC-based calibration for the process representation. Can you state that the hydrological system is overall better represented by using several SFCs?

Please discuss the benefit of optimizing one specific SFC. This leads to a modelled hydrograph which is able to represent a very specific condition but probably not the overall hydrograph. This implies that the part of the hydrological system which is not in the focus of this SFC is probably not adequately considered. This might be of particular relevance when using very specific SFCs such as MA26.

Minor comments:

P.1, L. 12: maybe "optimization“ instead of "minimization or maximization“.

P.1., L.16: Are these over- and underestimations a general aspect of these SFCs or are they case-specific?

P.2, L.16-19 and L. 30: I recommend to include the study from Yilmaz et al. (2008).

P.2, L. 34: The meaning of "esoteric and subtle aspects of the flow regime“ is unclear.

P.3, L. 19: Please think about renaming the section to "Methods and materials“, since a catchment is not a method.

P.5, L.31: Why you have used 0.2 and 0.25 as weights?

P.6, L. 9: Could you specify "median parameter set“?

P. 11, L.15: Could you specify "later application of simulated SFCs related to flow alteration – ecosystem change relationships“. This aspect was up to now neither in the focus of the article nor emphasized as an overall aim.

Table 1: TA1: runoff with two f

Table 1: Why you have named the SFCs FH6 and FH7 and not FH3 and FH7.

Fig. 5: Can you explain the outlier TL1?

References:

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