Interactive comment on "Comparative evaluation of rainfall-runoff modelling against flow duration curves in semi-humid catchments" *by* Daeha Kim et al.

Anonymous Referee #1

Received and published: 18 May 2017

Review summary:

This study evaluates the predictive performance of a rainfall-runoff model when it is calibrated against flow duration curve (FDC), and compares the results with those obtained with conventional hydrograph-based approaches. Authors focus on 45 gauged catchments in South Korea and derive FDCs and streamflow indices using regionalization. Their results show that even though FDC calibration yields promising performance in predicting low flows, it could generally lead to noticeably weaker performance and higher uncertainty in streamflow predictions (in comparison to hydrograph-focused calibration), potentially due to the absence of flow timing. In ungauged catchments, their results demonstrate that the proximity-based parameter regionalization (i.e., not using

FDC) performs better than the calibration against regional FDCs estimated by a geostatistical method. I have found this study valid from the scientific and presentation quality, however, I have a number of major issues with its scientific contributions, which I am elaborating on in this review. Overall, I recommend re-submission after major revisions.

Major comments:

The first objective in this study, as stated on page 4 lines 8-10, is to evaluate predictive performance of the hydrograph calibration and the FDC calibration as well as their uncertainty for gauged catchments. I think this idea has been addressed extensively in the literature (some of which are cited in the present manuscript), and therefore, it does not need any further examination. The fact that this study finds FDC-based calibration less promising than hydrograph-based approach (as stated on page 11 lines 13-15) is not of a big surprise, e.g., due to different challenges in FDC estimation and that timing is not handled by FDC, as authors point out in the manuscript as well. Probably, what is more worth studying is how FDC can help to reduce equi-finality. As a result, I suggest that authors remove the first part of the study, or consider FDC as an additional criteria in model calibration and show how its use would improve parameter identifiability (e.g., posterior ranges) and reduce uncertainty (e.g., uncertainty ratio of hydrograph+FDC to only hydrograph).

Authors claim that FDC calibration performs promising for low flow prediction. I would argue that FDC-based approach performs only better than hydrograph-based approach, not good overall. Looking at figure 9, I see that there are several large deviations between simulated and observed BFI (up to 90%) which means that FDC-based method is not that reliable. The reason why it performs better than hydrograph-based approach is that the latter only focuses on high-flows as the Nash metric is biased on large values. So, this claim is of a sort of concern to me.

My other major issue is with how authors set the experiments related to streamflow

predictions in ungauged catchments. They first mention three classes of parameter regionalisation in lines 26-30 on page 8, but then mention that they chose the proximity-based approach due to its simplicity. I think, given than the first part of the paper can be removed according to my view, authors should focus more on this part and compare different regionalization approaches. Also, why not considering the proximity-based transfer of FDCs from donor catchments as am additional approach? Then, a potential topic for the paper can be "comparative evaluation of different regionalization approaches for model calibration in ungauged catchment".

Page 7 line 15 says that "Synthetic runoff time series were generated by GR4J for the same 45 catchments by treating each catchment as ungauged.

Introduction needs to be shorter. Objectives are stated after 6 very long paragraphs in the introduction section. Moreover, discussions sub-sections are too long. I think authors can make them briefer, but still transfer the message to readers.

Minor comments (for improving manuscript quality):

I suggest continuous line numbering in the next version of the manuscript.

Page 3, line 34: I suggest that a little explanation is provided here about the proximity-based approach. It is not clear up to this point what that approach actually is. Authors provide a brief description on page 7 line 17. Also, I suggest removing "in truth"

Also related to the description of proximity-based approach, section 3.3.2 is not fully understandable. I suggest rewording the paragraph so that the approach is explained in a clearer way. Moreover, please explain at the beginning of this section that when you talk about parameters in the proximity-based approach, you actually mean the parameters of the hydrologic model. Because one can also estimate the parameters of a parametric FDC using this approach.

Page 9 line 1: what do you mean by "synchronizing" donor catchments?

Page 4 line 3: define "orthogonal"

Please explain why Monte Carlo is used for parameter estimation, whereas SCE has been used by authors in one of the catchments. I believe that there is the possibility of quantifying uncertainty bounds using the solutions sampled by SCE.

Page 12 line 26-28: the sentence is not understandable. Please reword.