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Interactive comment on "Positive and negative human-modified droughts: a quantitative approach illustrated with two Iranian catchments" *by* Elham Kakaei et al.

Anonymous Referee #1

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The paper investigates human-modified droughts; an interesting topic in the scope of the journal and at least theoretically well supported by the background literature in the introduction. The analysis is based on a framework recently proposed by van Loon et al. (2016a,b) to distinguish between climate- and human-induced and human-modified drought events and to disentangle the causes for drought, namely climate variability and anthropogenic forcing due to water abstractions from rivers and groundwater. The method differentiates between periods of natural and disturbed streamflow and utilized then a N-A-model (calibrated during the natural period) to calculate natural streamflow during the proposed period of disturbed streamflow. In principle the paper proposes that different drivers of streamflow droughts can be counted against each other to gain

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Discussion paper

a cumulative drought signal. The authors concluded that for the two presented catchments human activities have caused mostly negative human-modified droughts.

Although the research topic is important I doubt that structure of the methodology, the presentation of the results and their interpretation lead to clear conclusions and advanced implications. I missed a clear and structured development and description of the method. I think the editor has to decided whether major revisions and structural and graphical improvements are needed or a new submission of the paper is the better way. I encourage the authors to revise the method description, the analysis and the graphs to gain a more comprehensive paper.

+ STUDY CONCEPT As the study concept (components of droughts) is rather new I suggest to explain the different types in more detail. Why were exactly these two catchments chosen for the analysis and what are the “major concern” (p2l32) in detail regarding the human-modified droughts here? Section 2.2.1 and 2.2.2 could be shorten (well-known statistical tests), but more justification is needed to proof that e.g. Pettitt’s Test is really appropriate to distinguish periods of natural and disturbed streamflow (e.g., change points can also emerge due to climate change). Also the explanation of the anomaly analysis isn’t straightforward for me; what is surplus value of all these equations and subscripts (eq. 8-11) if the concept could be explained with a good overview figure?

+ HBV MODELING For me it is not possible to evaluate whether the model is appropriate to answer the research questions or not. For example Fig.6. shows huge discrepancies in observed and simulated streamflow (btw: Why is the black line here needed if the observed discharge is only compared to the threshold?). The authors stated that the model performance is appropriate, but in my eyes the model performance is rather poor suggesting that the model setup / preparation / calibration has some issues. Is NSE or logNSE used (it’s not clear from the text, p7l6)? However, is NSE really the best OF or would be a measure with more emphasis on volume errors a better choice? How valuable are the results (Tab.2+3) showing mean drought deficits

of 0.7 mm to 4.1 mm if they can easily attributed to model simulation uncertainty? The different thresholds in Tab.5 somehow shows that higher thresholds (50th) are needed to gain significant deficit volumes in respect to drought management. If so, I ask myself if a 50th threshold is really valuable for drought assessment?

+ DATA I understand that these kind of studies in data-scare and semi-arid regions are very important for local water management. However, in this case a relatively novel method is used to investigate different drought types. Would it be better to have a larger (and perhaps better) data set to eliminate all the catchment-specific issues of the two proposed catchments? At least the method could be conducted on a larger data set including the two Iran catchments. However, if it is really important to understand climate- and human-influence in these catchment, then a clear justification for the change points in the time series have to be made (e.g., due to better visualizations of the change).

+ GRAPHS The quality and in-depth information of the single graph is often below average. Fig.2 is hardly readable due to graph quality issues. For me it is not possible with Fig 4. to see how good/or bad the model is performing, the lines are too tick, the axis labels are not appropriate (here more in-depth analysis is needed, e.g. FDCs), Fig.5-7 show examples but no systematic visualization of different drought types, Fig.1 (Annex) try to highlight the change point in the time series, but the reader cannot find any justification for this statement (improvement: remove the points, check if y-log-scale would be helpful, compare annual streamflow series from the period before/after the proposed change point). Overall some synthesis graphs are really missing to support the points the authors want to make.

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