

# Review for manuscript “Assessment of probability distributions and minimum storage draft-rate in the equatorial region”

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## Summary

The study by Hasan et al. focuses on low flows, drought, and minimum storage draft-rates in seven catchments in the Selangor region in Malaysia. The study consists of four types of analyses: (1) a non-parametric trend analysis on annual mean, minimum, and maximum flows using the Mann-Kendall and Sen’s slope tests; (2) a low flow frequency analysis on annual minimum flow using the Lognormal 2P distribution; (3) an analysis of drought characteristics determined using a fixed drought threshold at the 90<sup>th</sup> flow percentile; and (4) the determination of minimum storage draft rates necessary to ensure sufficient water supply during low flow periods.

## General remarks

The revised version of the manuscript in my opinion hardly addresses the major points risen by the two reviewers and highlighted by the editor and does not show significant improvement compared to the earlier version. I therefore have to re-iterate my previous criticism: (1) the study still does not seem to follow a clear aim and motivation and lacks the specification of a research question; (2) it still has an unclear structure and shows elements belonging to Introduction, Methods, Results, Discussion, Conclusions all over the place (i.e. not all introductory material is in the introduction,...); (3) the method descriptions are still confusing and it is hard to tell how the analysis was exactly done; (4) the trend analysis has been performed on sub periods instead of on the whole period which leads to the detection of spurious trends, which are probably rather attributable to internal variability/oscillations; (5) a novel aspect is missing, which leads to insignificant conclusions. I still do not think that this study is publishable in NHESS.

I again discuss some major points, which I feel have not been properly addressed in the revised version of the manuscript.

## Major points

- **Abstract:** The abstract is missing a clear problem statement. The study region of interest should be mentioned. I would give it a clear structure by listing the four elements of the analysis: (1) trend analysis, (2) low flow frequency analysis, (3) drought analysis, and (4) storage draft rate analysis. The abstract should also include a short summary of the main findings and end with a concluding statement (this requires a clear problem statement at the beginning).
- **Introduction:** The introduction needs a clear research question and should introduce the problem and some background knowledge related to this research question (or questions). Currently, the introduction lists various statements related to low flows and droughts but does not tell a compelling story. The introduction would profit from a clear distinction between low flows, droughts, and water scarcity (for a discussion on these different concepts

see e.g. [Van Loon et al., 2016]). In addition, a short introduction to the concept of 'storage rate' should be provided (e.g. does storage refer to reservoir storage or another type of storage?). I suggest to restructure the introduction as follows: (1) introduce why are droughts, low flows, and water scarcity important and what is the relationship between the three, (2) introduce factors influencing drought and water scarcity characteristics, (3) introduce the storage-draft rate concept and how this is related to drought, (4) provide a short introduction of study area and the problem you are trying to solve, (5) state research question, and (6) provide a short overview of methods used to answer this question.

- **Data:** The following specification is necessary: Are the streamflow time series natural or influenced by water abstraction and storage (at least some of them seem to be influenced)? It is still unclear whether reservoirs are present in the study region. None of them are indicated in Figure 1 as pointed out by both reviewers.
- **Methodology:** In my understanding, the analysis consists of four main steps: (1) Trend analysis of annual mean, maximum, and minimum flows, (2) low flow frequency analysis based on annual minimum flows, (3) analysis of drought characteristics for individual events, and (4) storage draft analysis. Is this correct. If this is what was actually done, I would restructure the methods section accordingly. It is unclear which types of variables are used for which type of analysis. I only figured out e.g. which variables were of interest in the trend analysis when I started to look at the tables presented in the Results section. The methods descriptions are confusing and unclear and include a lot of unnecessary detail instead of providing essential information. I do for example not understand why a detailed description of Flow Duration Curves is necessary (these were just used to determine the drought threshold, right?). In my opinion, the detailed description of the Mann-Kendall test can be removed and be replaced by an appropriate reference (l. 131-157). Instead, it should be specified (a) for which variable/events return periods were determined, (b) which drought characteristics were analyzed in the below threshold drought analysis, (c) I would add the informative illustration and description provided in the responses to the reviewers to illustrate the storage draft rate concept. Furthermore, the trend analysis should be performed on the whole period 1971-2017 instead of on sub periods of 8 years to avoid the detection of spurious trends.
- **Results:** The results section contains several paragraphs actually belonging to the methods and introduction sections (e.g. l. 323-327, 360-365 (in my opinion not necessary at all as it can be assumed readers know what a boxplot is)). There is even a statement that belongs to the introduction describing the 'primary purpose' of this study (l. 336-337). I would restructure according to the restructuring also suggested for the Methods section: (1) Results of trend analysis, (2) results of low flow frequency analysis, (3) results of drought characteristics analysis, and (4) results of storage rate analysis. And also here, it always needs to be clear which variables the results refer to.
- **Discussion:** The discussion presents a lot of material that in my opinion belongs to the introduction and the methods section (l. 459-484). I would instead discuss the implications of your findings for water management in the region.
- **Conclusions:** Instead of providing a summary of the methods, focus on the insights we gain from this study. Currently this seems to be: 'Based on the analysis of the study, the estimated minimum storage-draft rates for each station cannot meet the water demand during low

flow at specific return periods, which is 10-year recurrence interval for this research.’ (l. 514).  
Formulating conclusions will be easier once you have identified a clear research question.

- **References:** Should again be carefully checked. I would consistently use lower caps for nouns (e.g. Bakanogullari et al. 2014).
- **Language:** I appreciate that the authors had their manuscript checked by an editing service. However, I think that the article needs another round of editing with respect to the use of tense and sentence structure.
- **Figures and Tables:**
  - **Most figures:** Increase legend font, provide one legend for all subplots not per subplot. Increase size of axis labels.
  - **Figure 1:** I would indicate the locations of the dams mentioned in l.90-99 if they are important for the analysis. But I am still unsure whether the storage-rate refers to reservoir storage or something else.
  - **Figure 3:** Indicate that outliers are not displayed?
  - **Table 6:** The p-values should lie in the range of [0,1]. Were the column names mixed up? I would indicate for which distributions and catchments, H0 of ‘the distribution of the sample corresponds to the theoretical distribution’ was rejected.
  - **Table 8:** can in my opinion be removed as you just focused on a threshold of Q90. By the way, I would talk about Q10, to consistently refer to non-exceedance probabilities throughout the paper.

### Minor points

No further editing suggestions are provided as the manuscript in my opinion needs to be completely revisited.

### References used in this review

Van Loon, A. F. et al. (2016), Drought in a human-modified world: Reframing drought definitions, understanding, and analysis approaches, *Hydrol. Earth Syst. Sci.*, 20(9), 3631–3650, doi:10.5194/hess-20-3631-2016.