Comment on nhess-2021-176
Anonymous Referee #3
Referee comment on "Hydrological Drought across Peninsular Malaysia: Implication of drought index" by Hasrul Hazman Hasan et al., Nat. Hazards Earth Syst. Sci. Discuss., https://doi.org/10.5194/nhess-2021-176-RC3, 2021.

General Comments
The manuscript is investigating hydrological drought in Malaysia employing the Streamflow Drought Index and the run theory, which is of interest to the Journal's audience. However, since both techniques are established, the authors should emphasize the significance and the contribution of their work. In addition, there are technical issues that the authors need to rectify in order for the analysis to be accurate. The language of the manuscript needs some improvement. My evaluation is that the manuscript does not meet NHESS's scientific quality standards and I suggest rejection of the manuscript or conditional acceptance after major revisions.
Response: We are grateful to the reviewer for their time and suggestions in helping to improve the manuscript.

Specific Comments
In the introduction, the authors need to create a narrative, based on pertinent literature, that explains the contribution of their study to the reader. Lines 71-80 do not contribute towards this goal. Information about SDI in different regions does not need to be included with such detail. On the contrary, the authors need to cite and elaborate on drought studies for Malaysia in order to establish what is the new knowledge that this study is offering.
Response: Thank you for your comments. We agree with the reviewer. We have revised the manuscript based on your recommendation in Page 3 (line 75-84) and Page 4 (line 103-120).

Malaysia has a high hydropower potential and several dams (including ones for storage) constructed since the 1960s until recently. The authors also mention at lines 91-93 that seven dams had significantly lower water levels due to drought conditions in 2016. Have the authors performed flow naturalization to remove the effects of upstream flow regulations for the gauges that have a dam upstream? If no, why? For the provided figures it is not clear if there are dams upstream of the gauges. Anthropogenic interventions need to be excluded if the authors intend to evaluate how hydrological drought characteristics have changed throughout the study period. In addition, this comment is critical for the spatial analysis of hydrological drought characteristics across Malaysia.
Response: We thank you for your suggestion. We have improved Figure 1 and include the location of the dams in Peninsular Malaysia. However, the naturalisation procedure of the streamflow indices is essentially intended for the regionalisation analysis of hydrological drought. This method is not addressed in this study. We focus on historical hydrological drought in individual watersheds and determine the relationship between hydrological drought and the spatial-temporal analysis using data collected from a specific river in the catchment of interest. The relationship between spatial-temporal was represented in Figure 4-6.

Based on run theory and the authors' definition of drought characteristics, drought severity is equal to the shaded area below the threshold --- here set to −1 --- (Yevjevich 1967), not the shaded area below the horizontal axis. Equation 4 should reflect that. The analysis needs to be redone.

Response: Thank you very much for your comments. Once the SDI is calculated, specific criteria must be used to identify drought events. In this study, the ToR originally proposed by Yevjevich (1967) was applied to determine hydrological drought characteristics (Razmkhah, 2017). Following Nalbantis and Tsakiris (2009), the successive sequence of months with SDI values (X_t) below the threshold (X_{-1}) is defined as a hydrological drought event (Figure 2).

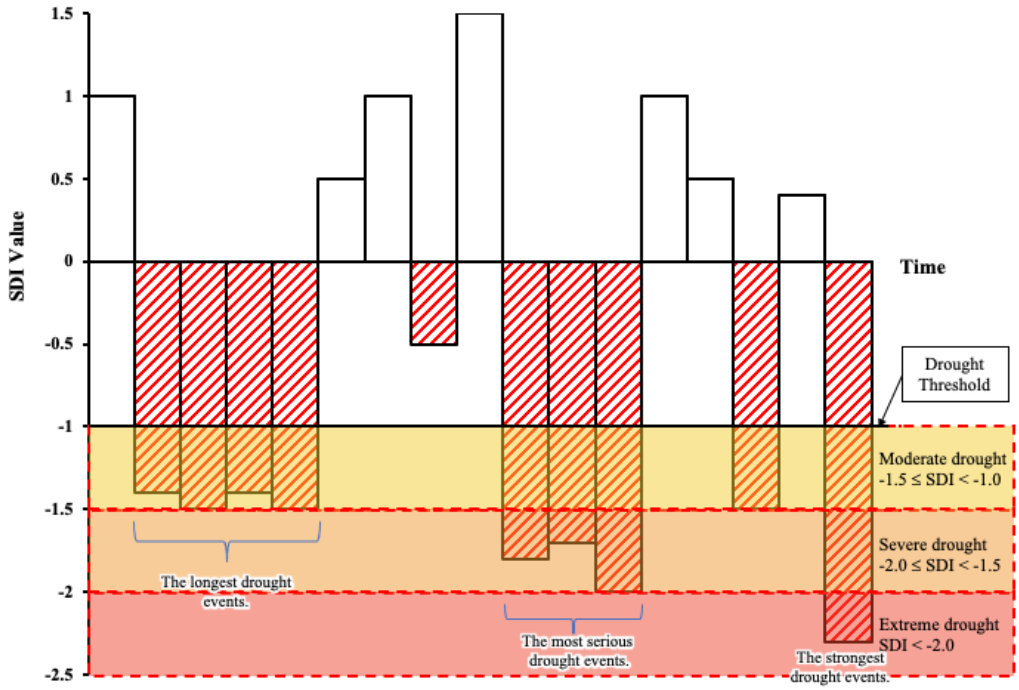

Figure 2: The determination of hydrological drought characteristics using theory of runs.

The drought period is the month when SDI values fall below -1.0, indicating the beginning of a drought episode. The drought period is the time between the occurrence of the drought and the time of its end. The cumulative drought index defines the severity of the drought during a drought event. The onset of the drought was determined at the beginning of the period when the SDI was negative for an extended period. The end of the drought was expected for the first month in which the SDI became positive.

The authors at Line 135 state that they include in their analysis 42 gauge stations with 40 years of continuous streamflow data. In line 141 the authors state that 17 of those have a record of less than 40 years. However, Table 2 indicates that there are 12 stations with less than 30 years of record, with the smallest time series being just 12 years. It is recommended to have a record of 30 years or more to accurately compute a standardized drought index (e.g. SPI, SDI, etc.). Nalbantis & Tsakiris (2009) used a record of 30 years. The gauges with data less than 30 years need to be dropped from the analysis.

Response: Thank you for your comments. Some studies use streamflow record data that are less than 30 years old. For example, Yeh et al. (2015) used 28 years of streamflow record, Sardou and Bahremand, (2014) used 25 years of record data, and Sohoulande Djebou, (2019) used 19 years of streamflow data to derive SDI values. Furthermore, this study uses the 10-

year interval method for spatial and temporal analysis. Therefore, stations less than 30 years are not removed for IDW analysis due to drought variability between 10-year intervals.

I second the comment of Anonymous Referee #2 about what the results section is missing.
Response: Thank you for your suggestion. We have improved the results sections to meet the objectives of the study.

References

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