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Hydrology and Earth System Sciences Discussions

Interactive comment on "A generic method for hydrological drought identification across different climate regions" *by* M. H. J. van Huijgevoort et al.

Anonymous Referee #1

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The paper proposes a method for identification of hydrological droughts that can be applied in global studies regardless of the climatic differences of the various regions. That method would be especially important in transition climatic zones which are more vulnerable to climate change and where runoff is intermittent. The suggested method is a merge of the so called the threshold level method (TLM), more applicable to regions with perennial runoff, and the consecutive dry period method (CDPM), more applicable to regions with no runoff. The paper also presents applications on real streamflow data of four rivers and results from global land surface models (LSM) that show the advantages of the proposed method. Thus, the paper attacks a relevant issue, presents a way to deal with it and shows good results, so it should be published. However, there

are some minor revisions that need to be addressed before publication, mainly related to the justification of the methods applied.

The first point that requires a stronger justification is why a single metric for drought identification is needed. Instead, a proper identification of a drought demands a more comprehensive approach that looks at various aspects of drought manifestation rather than just runoff (Kallis, 2008). That results from the fact that the very definition of a drought event is still a subject of controversy. As mention by the authors and other conceptual papers, droughts are perceived differently according to the many study fields involved (Dracup et al, 1980, Mishra & Singh, 2011, for a review). Thus, a uniform metric necessarily leaves out important aspects of the phenomena. On the other hand, a multi-metric approach leads to different drought identification results that convey more clearly the complexity of the drought phenomena. Therefore, although the proposed uniform identification approach provides for gains in terms of automatic identification of drought events across different regions, the paper does no present a convincing justification of why different methods should not be applied in different regions.

Moreover, it should be justified why use only the monthly percentile to identify a drought when many other metrics that are useful for drought identification can be derived from the methods TLM and CDM. For example, by using the same threshold approach, one can identify as droughts only those events that reach certain duration, severity or magnitude. Also, the spatial coverage of drought events, extensively explored by Andreadis et al (2005), could be analyzed with both TLM and CDPM for identification of droughts.

Besides the justifications, some minor specific points need to be better explained in the paper. Firstly, a more clear explanation is needed about how the proposed method combines the information from both methods to derive a new percentile statistics for each time step. Specifically, the scaling procedure used to obtain those percentiles mentioned in section 3.2 is not clear. That is a key information to understand how the proposed method classify a period as a drought and should be better described.

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Secondly, it should be justified why the results for perennial rivers should be presented since they are exactly the same of the TLM results, as can be readily notice from the methodology. Also, since the advantages of the method are only clear for the rivers with intermittent flows, it should be justified why the proposed method should be used in perennial rivers. Additionally, it was not clear why the median of the runoff values resulted from five different LSMs was used, since each model use a different method to compute the runoff. If they were applied individually, each LSM would lead to the identification of different drought events. It should be noted that the range of runoff values resulted from an ensemble of LSM runs has no relation with the natural variability of runoff values, but it is just a result of the differences between methods. Therefore, if it is runoff the variable of interest, it would be more reasonable to compare each LSM result with historical observations and just use the model that better reproduce the observed runoff values. Thus, a justification for the use of the ensemble median should be presented.

Finally, I suggest the inclusion of some references that discuss related issues and could improve the paper such as Dracup et al (1980), Mishra & Singh (2011), Kallis (2008) and Andreadis et al (2005).

In conclusion, the proposed method identifies important difficulties that arise in drought analysis in transition zones and offers basis for further advancement in drought identification. However, some important justifications and minor revisions are recommended before publication.

References

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