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Hydrology and Earth System Sciences
Discussions

Interactive comment on "A copula-based assessment of Bartlett–Lewis type of rainfall models for preserving drought statistics" *by* M. T. Pham et al.

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0.1 General comments

This paper presents a thorough analysis of statistical properties related to droughts. To my knowledge, this is the first paper which is dedicated to the reproduction of drought statistical properties by stochastic point process rainfall models. Papers usually investigate the reproduction of proportion of dry periods (e.g. proportion of dry hours or dry days) and sometimes the frequencies associated to periods of several days [Cowpertwait et al., 1996; Evin and Favre, 2013]. In this paper, drought analysis is

completed with an assessment of extreme drought values (determined via drought indexes) and the dependence between drought severity and duration. The presentation of the methodology is concise and clear, which is an achievement in itself considering the high number of technical points in this kind of analysis (different versions of Bartlett-Lewis models, parameter estimation, drought index, copulas).

From these results, it seems clear that 'usual' versions of Bartlett-Lewis are unable to reproduce adequately the frequency of extreme drought events. They all underestimate the frequency of extreme events in both their severity and duration (Fig. 3, 4 and 7). This result is, in my opinion, the main achievement of this paper. It is clear that it is important to be aware of this potential defect during applications of cluster point processes (e.g. if simulated rainfall is used as an input in rainfall-runoff models).

In addition to the assumptions made by the authors, I think these defects could also be attributed to the fact the Poisson process might not be adequate in regards to drought properties. Applying a distribution with a longer tail than the exponential distribution to simulate intervals between successive storm events might resolve these defects.

0.2 Additional comments:

1. The title seems to put the emphasis on the use of copula for this study. I do not really find that application of copulas is a central point of the paper. Conversely, the analysis of drought properties is. I would suggest removing 'copula-based' from the title or rearrange the title.
2. P. 7471, l.9: similar statistics as -> similar statistics to
3. P. 7472: Only one time series is simulated for each version of the Bartlett-Lewis model. Why not simulating, say, 100 time series in order to assess the variability of the statistical properties. This would avoid also obtaining bad or good results just by 'chance'.

4. How the authors calculate the severity S is well described. However, there is no details about the calculation of the duration D. For example, is there a threshold below which rainfall intensity is just considered as noise? Is the treatment different for observed and synthetic data?

5. P.7482, l.26: “It is clear from the figure that all BL models simulate less lower EDI values” -> not so clear for models TBL and TBLG.

6. P.7484, l.18: Consider removing “found in the fact”.

7. P. 7487, l.19: closest -> close to.

8. P. 7489, l.1-3: The probability of extreme events seems to be underestimated by all BL models (Fig. 3, 4 and 7), not overestimated. The conclusions are a bit confusing in terms of under/overestimation of the marginal distributions and under/overestimation of the probability of extreme events.

P.S.P. Cowpertwait, P.E. O’Connell, A.V. Metcalfe, J.A. Mawdsley, (1996) “Stochastic point process modelling of rainfall. I. Single-site fitting and validation” *Journal of Hydrology*, 175(1–4), p. 17-46. G. Evin, A.-C. Favre (2013) “Further developments of a transient Poisson-cluster model for rainfall” *Stochastic Environmental Research and Risk Assessment*, 27(4), p. 831-847

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