Hydrology and Earth System Sciences Discussions

Interactive comment on "A multiple threshold method for fitting the generalized Pareto distribution and a simple representation of the rainfall process" *by* R. Deidda

Anonymous Referee #2

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This paper considers the problem of describing the probabilistic structure of daily rainfall amounts (including zeroes) via a Generalized Pareto distribution (GPD) which is fitted to amounts exceeding a specific threshold. It advances the idea of choosing the threshold in such a way that one obtains a threshold-invariant fit which can then allow the interpretation of the parameters of the fitted GPD in terms of regional climatic signature. Along these lines, a method called Multiple Threshold Method (MTM) is proposed. Numerical experiments to demonstrate the performance of the MTM compared to standard fitting techniques are presented.

Overall the idea presented in the paper is good and appropriate for HESS. The paper can be considerably improved in terms of English and I suggest that the authors do a thorough reading with this in mind (I have marked some edits on my manuscript but hard to transmit in this review). Some comments follow:

1. The authors have previously published work (Deidda and Puliga, 2009) on the fitting of the GPD to rainfall records irregularly sampled (tipping bucket data above a threshold) which as they claim shows that none of the standard fitting methods give "acceptable results" when the threshold is above 1mm. The acceptable results are judged in terms of the inability to differentiate site-to-site variability of the parameters with respect to the large errors of the estimates. The MTM is shown to overcome this limitation. This is based on the simple fact that for a sample truly coming from a GPD with shape parameter ksi and scale parameter u, any sub-sample obtainied by considering the values above a threshold will not change the value of the shape parameter (since the tails are not affected anyway) and will change linearly the value of the scale parameter u. This fact forms the basis of the MTM method for finding a threshold-independent set of parameters for a data set by "searching" for that "optimal" threshold value. Within the above, I found that the presentation of sections 3 and 4.1 are a bit too tedious. One can argue for keeping the material for the sake of clarity for the unfamiliar reader, so I leave this up to the author and editors.

2. The numerical simulation analysis presented in section 5 is exhaustive, which I guess is fine to keep.

3. I wonder whether the results of this research can lead to methodologies for regionalization, in the sense that a threshold-independent shape parameter (given that the threshold identified by the MTM is reasonable) can be used as a diagnostic of "similarity", in the same vein as the Hosking regionalization methodology.

Overall the paper is well researched and adds to the literature in a constructive way.

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