Hydrology and
Earth System
Sciences
Discussions

Interactive comment on "The application of new distribution in determining extreme hydrologic events such as floods" *by* Łukasz Gruss et al.

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Dear Referee, after our last response, we add additional corrections and information suggested by the Referee.

Referee: The introduction is too large and does not focus on the problem: application of the 4 parameter distribution using two sampling methods. The new in this paper is the use of mixed (extended) distributions. Unfortunately, the goal or the idea behind mixing is not outlined. For example, it is the case when the origin of maximum floods can be different from year (event) to year (event). So the physical meaning behind mixing is not noticed in the beginning of the paper (as in line 85). However this is the spirit of the work of Szulczewski and Jakubowski, 2018). Extended distributions would

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be a key word, because it was presented in this manner in the principal reference used (Nascimento et al. 2016).

Reply: Thank you very much for your suggestion. We will shorten the text on lines 81-109 (choice from distribution) and on lines 110-124 (choice from the fitting method).

Referee: A section on model comparison is missed. Because authors compare 3 parameter distributions to 4 parameter, specific criteria should be adopted such as BIC and AIC.

Reply: After re-examining, we believe that the Referee's suggestion was justified. The AIC and BIC criteria will allow the comparison of the studied distributions. Therefore, instead of a separate chapter, we suggest adding the following changes. The full text including the revision to methods, results and discussion, and conclusion is in pdf file attached.

Referee: Abstract line 13 : it is not clear that authors discussed the parameter accuracy, later in this paper.

Reply: We propose in line 138 to add at the end of the sentence: This method searches the parameter space separately for each component. Hence, the computation time is relatively long.

We propose in line 142 to add at the end of the sentence: As reported by Szulczewski and Jakubowski (2018), it is much more difficult to estimate the doubled number of parameters in a mixed distribution.

Referee: Line 160 why this hypothesis of the"best"? Authors may just say that they study the adequacy of GGEV

Reply: We wanted to supplement our answer. We put forward two hypotheses. First hypothesis: In our study we hypothesized that the GGEV distribution is the best-fitted distribution for samples, in the Upper Oder basin, for which the flow phenomenon was caused by anthropogenic activity in the catchment. Second hypothesis: Additionally

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the GGEV distribution is the best suited empirical distribution irrespective of sample independence.

Referee: Line 225 GEV and Pareto are linked if one considers the POT model. This should be noticed somewhere because authors selected GEV (exponentiated GEVs) while using POT. In general with POT we use Pareto.

Reply: Thank you very much for this suggestion. We will consider this possibility in the introduction.

We wanted to supplement our answer and propose to add the justification at the end of the sentence on line 74 (is below):

As reported by Bezak et al. (2014) in the POT method the Exponential and generalized Pareto distributions can be used. Instead of these distributions, one can also use the LN distribution (Adamson and Zucchini 1984, Rosbjerg 1987), and the Weibull (Bačová-Mitková and Onderka 2010, Dimitrov 2016,) distribution functions. Also, Wong and Li (2010) use the Weibull and gamma distributions in the POT method. Likewise, Xu et al. (2019) applied 3W and GEV in POT method. The 3W distribution provides a very good estimation of short-term extreme value. They applied two assumptions: the selected peaks are Poisson distributed, and the exceedances should be approximately independent. In their study, the dispersion index is applied to select clusters and check the Poisson character. In turn, Dimitrov (2016) used 3W in the POT method. He points out that in the POT method, all independent response peaks, which exceed a certain high threshold level, are included in the analysis. Addition, make sure that each peak corresponds to an independent event.

References: Dimitrov N.: Comparative analysis of methods for modelling the short-term probability distribution of extreme wind turbine loads J Wind Energy, 10.1002/we.1861, 2015.

Xu S., Ji C.Y., Guedes Soares C.: Estimation of short-term extreme responses of a

semi-submersible moored by two hybrid mooring systems, Ocean Eng, p. 190106388, https://doi.org/10.1016/j.oceaneng.2019.106388, 2019.

Wong T.S.T., Li W.K.: A threshold approach for peaks-over-threshold modeling using maximum product of spacings. Stat Sini 20(3):1257–1272, www.jstor.org/stable/24309490, 2010.

Adamson, P.T. and Zucchini, W., 1984. On the application of a censored log-normal distribution to partial duration series of storms. Water SA, 10 (3), 136–146.

Rosbjerg, D.: On the annual maximum distribution in dependent partial duration series. Stochastic Hydrology and Hydraulics, 1 (1), 3–16. doi:10.1007/BF01543906, 1987.

Referee: Line 259 Gamma is not listed line 246. This sentence should be removed line

Reply: We propose to correct the sentence in line 259: In the Pearson DS package developed by Becker and Klößner (2017), the 3P3 distribution allows negative scale parameters to allow for negative skewness.

Referee: Line 314 A section on model comparison is missed. Because authors compare 3 parameter distributions to 4 parameter, specific criteria should be adopted such as BIC and AIC .

Reply: We propose adding the AIC and BIC criteria to the article, which we have supplemented in response to general comments (in attach).

Referee: Line 318 are they significantly different from zero? If not, it is not a trend

Reply: We agree with the Referee, the sentence is incomplete. We propose to change the sentence from line 318 and add a second one. Based on the test statistics, the BB and O samples show a negative trend, because trend statistic (Z) is negative.

Referee: Line 330 in POME application, to what extend are finding related to the level of the selected threshold? This could be more discussed.

Reply: We propose to delete the entire paragraph on SNHT on the line 239-243 and the results and discussion on the line 329-334.

Referee: Line 383 to compare fitting results of distributions involving a different number of parameters I believe that AIC or BIC criteria are more appropriate.

Reply: Our standpoint on the issue of presenting a comparison between models using the AIC and BIC criteria is given in the reply in the general comments.

Referee: Line 430 "This indicates that the K-S test is stronger than the $\chi 2$ 430 test." this is not clear. Why is it stronger? Is thre a physical reason for rejection?

Reply: We did not calculate test power for the K-S and $\chi 2$ test. Therefore, we would like to delete this conclusion (conclusion # 2)

Please also note the supplement to this comment: https://hess.copernicus.org/preprints/hess-2020-173/hess-2020-173-AC4-supplement.pdf

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