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Interactive comment on "Examination for robustness of parametric estimators for flood statistics in the context of extraordinary extreme events" *by* S. Fischer et al.

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General comments

This note describes a simulation experiment devised to assess the performance of some classical and "robust" estimators for Gumbel and GEV distributed data with and without the presence of few "extraordinary" observations. Even though the paper is classified as a research paper, actually it looks like a short technical report, but I'm not sure that the material is enough to justify publication in HESS.

Specific comments

When I see papers dealing with “robustness” my mind goes back to a section of “Tall tales about tails of hydrological distributions. II” by Klemeš (2000) called “Just L-Moment!–Or, has the “prayer of the stochastic hydrologist” been finally granted?” where Klemeš, with his typical thought-provoking and lively style, highlights a dichotomy that seems to be widespread in hydrology: on one hand, we are “hungry” of extreme observations to be incorporated in extreme value analyses, while, on the other, there is an endless search for “robust” estimators that give less weight to extreme observations, which should be the most informative, but tend to be discarded when they are deemed “too extreme”.

Even though I understand the rationale of this note, such a type of “robust” analyses and consequent recommendations should be taken with great care, as they can lead for instance to overlook the presence of different physical mechanisms generating different populations of extreme events, which imply mixed distributions. So, moving from purely numerical experiments to real-world (hydrological) problems, the key point is not the robustness but the attribution: if the nature of extraordinary events is known, they can be safely separated from the bulk of data and/or treated accordingly; if not, applying robust methods simply means neglecting (to some extent) the information provided by the most extreme events: this can prevent updating the underlying distribution (likely saving money for prevention), but it does not prevent that we can face again such events (spending money for recovery). In any case, weighting/discarding extraordinary events provides just an apparent reduction of the uncertainty, whereby the risk is implicitly assumed by the analyst/hydrologist when (s)he decides to assign a “weight” to such observations.

From a technical point of view, if I understand, the extraordinary observations (2% in the simulated samples) are assumed to be equal to the theoretical 99.9%-quantile. If so, when the number of extraordinary values is >1 in a given sample, we should have a few statistical ties (which are rather unlikely in real-world samples), and samples

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simulated from the same distribution will always show the same extraordinary value. Now, dealing with continuous random variables, the probability of such samples is zero, as the probability to observe exactly the theoretical 99.9%-quantile (or whatever fixed value) in a random sample is zero. In my opinion, a more sound simulation strategy would be to replace the 2% of observations with a random value drawn from the tail of the distribution, say, > 99.9%-quantile; in this case, we can obtain more realistic samples, controlling their probability as well. Indeed, the probability of observing at least a data point x such that $x > x_{0.999}$ in a sample of size N is $p = 1 - 0.999^N$, which yields about 3% for $N = 30$, and 18% for $N = 200$. This makes the extraordinary observation possible real values coming from the tail of the underlying model.

I may have missed something, but in my opinion, results in Tables 2, 4, and 6 tell us quite a different story. Highlighting the “weight” estimator for each column (see attached manuscript with annotations), TL(1,1)-Moments is never the best one in presence of extraordinary observations. In more detail:

- Table 2: TL(0,1)-Moments and MD always outperform the other methods under correct model specification (Gumbel); the same holds under model "misspecification" (GEV... which is not a true misspecification), apart from small samples ($N = 30$, and 50), for which L-moments outperform the competitors in terms of RMSE.
- Table 4: L-moments and ML always outperform the others under model misspecification (true misspecification), while, under correct specification, L-moments work in terms of RMSE, and TL(0,1)-Moments in terms of bias for small samples; for larger samples TL(0,1)-Moments and MD dominate.
- Table 6: similar to Table 4.

Dealing with regular samples:

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- Table 1: symmetric trim works only in 4 cases and robust estimators only six times out of 32 cases (as expected).
- Table 3: ML and L-moments dominate (as expected)
- Table 5: TL(1,1)-Moments outperform the competitors only for small samples under model (true) misspecification.

From the above "alternative" reading of the tables, it seems to me that TL(1,1)-Moments cannot be recommended at all in any case. On the other hand, the good performance of TL(0,1)-Moments is expected as they trim only the highest extremes, which are the only extraordinary values introduced in the regular samples (there are not extraordinary low values). Some possible source of confusion in the interpretation can arise from the two different types of misspecification: as GEV implies Gumbel, fitting GEV to Gumbel samples is not truly wrong; on the other hand, Gumbel cannot describes GEV heavy tail behaviour. Thus, taking into account the possible concealing effect of these aspects, in my opinion, the simulation results do not say much more than expected.

Editing remarks

P8557L16: "identically Gumbel (respectively GEV) distributed"

P8560L11: "approximate"

P8563L23: typo "and and"

P8565L21: "They"

P8566L1-9: This paragraph is not much informative, and not directly related to the topic discussed in the manuscript.

Sincerely,

Francesco Serinaldi

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References

Klemeš V. (2000): Tall tales about tails of hydrological distributions. II. Journal of Hydrologic Engineering, 5(3), 232-239.

Please also note the supplement to this comment:
http://www.hydrol-earth-syst-sci-discuss.net/12/C4192/2015/hessd-12-C4192-2015-supplement.pdf

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Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 12, 8553, 2015.