Hydrol. Earth Syst. Sci. Discuss., 7, C2727–C2733, 2010
www.hydrol-earth-syst-sci-discuss.net/7/C2727/2010/
© Author(s) 2010. This work is distributed under
the Creative Commons Attribute 3.0 License.

Hydrology and Earth System Sciences Discussions

Interactive comment on "Introducing empirical and probabilistic regional envelope curves into a mixed bounded distribution function" *by* B. Guse et al.

B. Guse et al.

bguse@hydrology.uni-kiel.de

Received and published: 6 October 2010

We thank Attilio Castellarin for his helpful and very detailed review. He indicates relevant suggestions which should enable us to improve our manuscript significantly. We note our replies to his remarks point-by-point below.

3. SPECIFIC POINTS

Remark 1) p. 4260, l.18-19 Regional homogeneity in the classical index-flood hypothesis (constant Cv and higher order moments) and scaling of the index-flood with catch-

ment area are two separate hypotheses, the manuscript is not clear on this point.

Answer 1) We will clarify and improve this section and also include the recommendation of the other referee (see remark 2). The two different hypotheses are clearly distinguished in the revised manuscript.

R 2) p.4260, l.22-23 The REC intercept is fixed by the largest standardized record flood (flood of record at a given site divided by the index-flood of that very site) and not by the largest unit flood of record (which is defined in the text as the flood of record divided by the drainage area of the catchment of interest).

A 2) We will clarify this issue.

R 3) p.4260, l.27 Consider substituting "cross-correlated sites" with "cross-correlated and concurrent flood sequences"

A 3) We will change it.

R 4) p.4262, l.22-24 "given that the EC has an exceedance probability of zero". This is actually an assumption of the study, and the authors should highlight this point also in this statement.

A 4) We will add a remark that we assume an exceedance probability of zero for the empirical EC in our study.

R 5) p.4263, l.1 "PRECs approach the ECs with increasing catchment size. PREC discharges which were larger than the upper bound derived by the Stanescu envelope curve sites were removed." These are two important aspects that, in my opinion, need to be further discussed in the text.

A 5) We consider these aspects in our replies to the remarks 5a-c below.

R 5a) How meaningful are the considered EC for the study region?

A 5a) In Section 3.2 we compared three envelope curves. Finally, we selected the EC

from Herschy (2002) in order to be certain that the upper bound is not too low. We assumed that the European empirical envelope curve from Herschy (2002) could be used as an upper bound with an exceedance probability of zero, because catchments from the Mediterranean region with very high unit floods of record were included (see p. 4260, lines 5-12 in the HESSD-manuscript). The Stanescu EC which is used as the second envelope curve is based on a larger number of German gauges and is a representative envelope curve for Germany. Since this EC estimates higher discharges than the Saxon EC, the Stanescu EC is assumed to be a useful EC for Saxony. The Saxon EC was not further used in this study, since it was not considered as a meaningful EC.

R 5b) How depended on the catchment area is the hypothesis of upper-bound coincident with ECs?

A 5b) The three envelope curves are supported by a large number of floods of record. In Figure 2 we included the Saxon ones only. This figure clearly shows that the number of sites with a large catchment size is low. Hence, the PREC analysis is dominated by sites with smaller catchments. The ECs from Stanescu (2002) and Herschy (2002) are certainly supported by a larger number of sites. Therefore, we think that the assumption of an upper bound discharge is valid along the whole range of catchment sites for these two envelope curves.

R 5c) Can the site removal be considered an element of subjectivity?

A 5c) Here, we introduced a misunderstanding in the HESS-manuscript which is eliminated by removing the word “sites” in the sentence of remark 5. We removed the PREC flood quantiles whose discharge exceeded the Stanescu envelope curve. However, we did not remove the site itself from the following analyses. For these sites, we used the PREC flood quantiles with the smaller discharges only.

R 6) p.4265,l.14-4266,l.4) The illustration of this original procedure should be crystal clear in the manuscript, as it may be of interest and useful for other case studies. The authors may consider to include a flow-chart or a bulleted list or a figure to improve the

clarity of the presentation.

A 6) We will illustrate our procedure by a graphical presentation which explains our procedure step-wisely.

R 7) p.4266,l.16 “The GEV was fitted to the new flood series, denoted as GEVsim−prec”.

R 7a) Is the GEV still a good candidate parent distribution for the new series (sim-prec)? It would be worth testing (e.g., in an L moment framework).

A 7a) We checked the suitability of distribution functions in an L moment framework using a moving window approach (window of 21 sites). As mentioned in the manuscript, the Generalised Extreme Value distribution (GEV) has the best performance for the synthetic flood series. In the case of the new series (sim-prec), the moving window approach (window of 21 sites) indicates that the generalised logistic (GL) is the best choice. It is worth mentioning that the differences between GL and GEV are relatively small in the L-moment ratio diagram, especially for high values of L-skewness and L-kurtosis. Hence, the application of the GEV is also okay. Because of that, we continue our analysis with the GEV. A major point of the manuscript is an investigation of the effect of an inclusion of PRECs on the quantile estimates. For an adequate comparison, it is indispensable to use the same parent distribution for the whole analysis. In this context, it is also worth mentioning that the L moment framework is only a test of distribution functions and does not provide the “real” unknown parent distribution. For Germany, the application of the GEV is often recommended (e.g. Schumann, 2005).

R 7b) Also, the sim-prec series is constructed from a series of data generated from a GEV estimated using at-site information only (on average 50-60 years of observation) and then mixed with flood quantiles retrieved from PREC that can be associated with T as large as 500 and 1000 years or more. I believe that the manuscript would benefit from the inclusion of a brief additional discussion (maybe in the “discussion” section) on the representativeness of the synthetic sim-prec series of the true and unknown

frequency distribution for intermediate recurrence intervals.

A 7b) Our analysis is based on three types of information (observed flood series, PREC flood quantiles, upper bound from empirical envelope curves) that are representative for different parts of the distribution function. Hence, in particular, these points are supported by the additional information. The hypothesis of our work is that the three points of additional information are sufficient for an accurate estimation. In this context, it is worth mentioning that our study is explicitly tailored to an improved estimation of discharge with recurrence intervals of T=1000 years. And this part of the distribution function is certainly supported by the PREC flood quantiles. However, our analysis also improves the intermediate recurrence intervals in comparison to the at-site analysis. We will briefly discuss this aspect as proposed in the discussion section of the revised manuscript.

R 8) p.4266, l.23: I suggest to repeat here “Tt = 1000 yr”.

A 8) We will change it.

R 9) p.4267, l.9: “higher” than what?

A 9) We will rephrase this sentence in order to make this context clear.

R 10) p.4267, l.17: Why do the authors use the term “optimization”? Given that three equations in three unknowns can be written using the three constraints it would be probably be more accurate to say a numerical solution method, if the analytical solution is not viable.

A 10) We will clarify this aspect and use the proposed terms.

R 11) p.4270, l.1-4: This sentence could probably be anticipated at the end of section 4.2.

A 11) We do it.

R 12) How many k were positive for the at-site estimation?

A 12) Ten sites have a positive k for the at-site estimation. This means that the sign changes from positive to negative for three sites due to the inclusion of PREC flood quantiles.

R 13) p.4270 and Fig. 5 and 6: Authors may consider to use directly the at-site distribution in the figures as a reference instead of GEVsim. Differences among the two are very limited by construction (less than 3

A 13) We think that it is important to show the small differences in Figure 5. However, we can use GEV instead of GEVsim in Fig. 6.

“Discussion” section

R 14) Probably some repetitions with other parts of the manuscript could be removed without detriment of the presentation.

A 14) We carefully checked the "Discussion" section and removed repetitions which were not clearly important for the discussion (page 4274 in the HESSD-manuscript, lines 16-18, 21-25).

R 15) Also, the section could discuss how the proposed procedure relates and compares to traditional regionalization approaches (advantages/ disadvantages, complementarities, etc.), which would be a common choice among practitioners for estimating the 1000-year flood also for a gauged site. At-site analysis is definitely not a good reference approach for this task.

A 15) We will include a brief comparison between our approach and traditional regionalisation approaches in the discussion section.

R 16) p.4275, l.11-12: “recurrence intervals of 1000 years” would probably be more accurate. The procedure can evidently be generalized relative to other (high) T values, but this should be stated in the text.

A 16) Our method is not restricted to a recurrence interval of 1000 years. However, we

agree that our study was focused on this specific recurrence interval. Hence, we will consider this aspect in the conclusion.

R 17) Fig.4-6: [a] should be replaced with [yr] or [years] in the y-axis label

A 17) We will replace [a] by [years].

R 18) Fig.10: The meaning of the fraction reported in the y-axis should be better clarified in the caption and also in the text p.4272.

A 18) We will explain the results shown in Fig. 10 in detail in the revised manuscript and improve the understanding of Fig. 10 in the text as well as in the caption.

REFERENCES

Herschy, R.: The world's maximum observed floods, Floow Meas. Instrum., 13, 231-235, 2002.

Schumann, A.H.: Flood statistical assessment of the event from August 2002 in the Mulde river basin, based on seasonal statistics (in german), Hydrol. Wasserbewirts., 49, 200-206, 2005.

Stanescu, V.A.: Outstanding floods in Europe; A regionalization and comparison, International Conference on Flood Estimation, Berne, Switzerland, 697-706, 2002.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 7, 4253, 2010.