Hydrol. Earth Syst. Sci. Discuss.,
doi:10.5194/hess-2016-619-RC3, 2017

Hydrology and Earth System Sciences Discussions
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Interactive comment

Interactive comment on "Comparative study of flood projections under the climate scenarios: links with sampling schemes, probability distribution models, and return level concepts" *by* Lingqi Li et al.

Anonymous Referee #3

Received and published: 4 January 2017

General comments:

In the submitted paper authors compare different methods that can be selected to perform the flood frequency analysis (FFA). Both stationary annual maximum (AM) method and peaks over threshold (POT) method are tested using the daily discharge data from the Huaxian station (Weihe basin) in China. Further, a nonstationary methodology is also applied and compared with the stationary approach. Several interesting and important aspects of the flood frequency analysis approach are analyzed and discussed: application of the expected-number-of-events (ENE) method, selection of different distribution functions in the AM method, evaluation of the suitability of the Poisson and negative binomial (NB) distributions to model the annual number of exceedances above the threshold, comparison between the stationary and nonstationary approaches using both AM and POT methods, sensitivity analysis regarding the influence of the precipitation and temperature on the nonstationary flood frequency analysis results.

The paper is relatively well written and the presented topic is interesting for the hydrological society due to the importance of the flood frequency approach for the design of different hydro-technical structures. The paper is in the scope of the journal. However, I would suggest that authors try to put more focus on next points related to the practical applications of the FFA, because the presented paper does not develop a new theory but compares different aspects of the FFA approach:

1) The authors have performed detailed analysis and comparison of different methods that can be used to carry out the flood frequency analysis. Is it possible to point out which method should be used by practitioners to determine the design flood (taking into account the larger sensitivity of the nonstationary AM method compared to the POT, more complicated POT analysis compared to the AM method and other conclusions stressed in this paper)? Should the standard procedures to perform the FFA in China be modified after the results of this study? What is the trade-off (if any) between the model complexity and uncertainty in the flood frequency analysis results?

2) Related to the previous point, different methods yielded diverse FFA results. For example, the 50-year flood was estimated to be between approximately 4000 and 8000 m3/s with the consideration of the confidence intervals (Fig. 5). Can the authors suggest some guidance for selection of the most appropriate method to carry of the FFA?

3) Looking at the results of the nonstationary approach (AM method) shown in Fig. 5 it seems that the return level increases to about 30-year return period and then it is almost constant for larger return periods? Does this means that the 50-year flood is the same as the e.g. 200-year flood? Please explain.

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Discussion paper

4) It would be interesting to make a comparison of the nonstationary approach where the model parameters change with time (e.g., Obeysekera and Salas, 2014; Salas and Obeysekera, 2014; Sraj et al., 2016; Vogel et al., 2011) and not only with P and T.

The English is understandable, but it could benefit from some improvements, therefore I recommend editing for English language.

Specific comments and technical corrections:

Page 13, line 257: I would suggest adding a reference for the GAMLSS package.

Page 16, lines 313-314: I would suggest rephrasing this sentence.

Page 16, line 321: What is “dramatic” or “pointless” for the authors? This can be very subjective, thus I would suggest avoiding such statements.

Page 19, line 387: Which Sensitivity package (a reference should be added)?

Page 21, line 408: Replace “134,800” with “134 800” (and also in some other parts of the manuscript).

Page 21, line 414: Upstream and not downstream?

Page 22, line 422: Replace “Thiessen polygon” with “Thiessen polygons”.

Page 24, lines 487-488: Any particular physical reason for this negative trend? It would be interesting to see the discharge data used in study.

Page 24, line 492: Again, what does “dramatically” means?

Page 25, lines 499-503: Is this the case for all 22 analyzed stations?

Page 26, lines 526-529: I would suggest rephrasing this sentence.

Page 26, line 537: “much lower” this is subjective; I would suggest using the % to show the difference.

Page 29, lines 569-570: What is reason for this large difference and what does this mean from the perspective of the practitioners?

Page 29, lines 583-585: These are relatively large differences. Which POT threshold is suggested by the authors and why?

Page 30, line 618: Dot is missing at the end of the sentence.

Page 31, line 642: Replace "shows" with "show".

Page 32, line 652: "there is not much difference" looking at Fig. 5 I would say that differences are relatively large for some cases?

Page 33, line 672: Replace "if we allowing" with "if we are allowing".

Page 33, line 679: Replace "requires" with "require".

Page 36, line 748: Reason for this difference?

Page 36, lines 748-751: What does this conclusion means for the practical application of the FFA?

Page 37, lines 760-763: This is very important conclusion but is it true only for this case study or there is a theoretical background for it?

Page 39, lines 807-810: But this "relatively complicated sampling criteria" still exists and if we compare the POT sampling methodology with the nonstationary approach used in this study I would say that it is even more complicated (than the stationary approach) and it requires additional knowledge?

Page 40, 820-823: What does this means from the practical perspective?

Page 40, lines 830-832: Does this hold for this case study or in general?

References:

Obeysekera, J., Salas, J.D. 2014. Quantifying the uncertainty of design floods under nonstationary conditions. Journal of Hydrologic Engineering, 19, 1438–1446.

Salas, J.D., Obeysekera, J. 2014. Revisiting the concepts of return period and risk for nonstationary hydrologic extreme events. Journal of Hydrologic Engineering, 19, 554–568.

Sraj, M., Viglione, A., Parajka, J., Blöschl, G. 2016. The influence of non-stationarity in extreme hydrological events on flood frequency estimation. Journal of Hydrology and Hydromechanics, 64, 426–437.

Vogel, R.M., Yaindl, C., Walter, M. 2011. Nonstationarity: Flood magnification and recurrence reduction factors in the United States. Journal of American Water Resources Association, 47, 464–474.

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