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Hydrology and Earth System Sciences Discussions

Interactive comment on "Effects of intersite dependence of nested catchment structures on probabilistic regional envelope curves" *by* B. Guse et al.

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We would like to thank the Referee#3 for the helpful and constructive suggestions to improve our manuscript. These comments should help us to clarify the core idea of our manuscript. The point-by-point replies to the comments were listed below.

1) First of all, the presentation needs to be improved, both structure and text. Although one should appreciate the authors' attempt to discuss all possible sides of the problem of interest, the red path through the manuscript is sometimes lost in details and repetitions. The authors should therefore try to focus more on the main message of the

study. Below are some comments that might help them in doing so.

This is a very helpful point, which we considered by restructuring the manuscript. Prior to address all Referee#3 main comments, we would like to point out that this general indication was present also in the assessment of Referee#1 and Referee#2. In order to address their comments we decided to include several modifications in the revised manuscript (see also our replies to Referee#1 and Referee#2), which we would like to summarise here:

Firstly, we reorganised the literature review, also according to the comments of Referee#1 and #2. In this way, we clarified the introduction in regional flood frequency analysis (RFFA) by a more structured description of the different methods (index flood, linear regression models). We shortly recalled each method and added relevant references.

We restructured the part, which considered the impact of intersite correlation on RFFA and enhanced the description by referring to several relevant studies.

Then, we clarified our core ideas in the end of the introduction. This should enable one to better understand our main ideas and it should help to follow the red path.

Furthermore, we focused the section 'Results' more on the impact of the different applications of the cross-correlation function on the PREC results. Therefore the results concerning the regional heterogeneity were reduced. We dropped the Figures 10 and 12 and reduce the application of the different thresholds of the heterogeneity measure to H1<1 and H1<2 by dropping H1<4. The reduction should enable us to avoid some repetitions. The revised version was more concentrated on our main outcomes.

2) The number of tables and figures could be reduced. Possible candidates for removal are Tables 5 and 6, Figure 4, and some of the figures 6-13. Figures 12 and 13 seem to give very similar information as some of the earlier figures. Are they all necessary?

We removed the tables 5 and 6 and the figures 4, 6b, 10 and 12.

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3) Sections 4.8 and 4.9 could then be merged, as differences between homogeneity measures are already discussed in 4.8.

We adopted this recommendation.

4) Are both 6a and 6b necessary as 6b shows same information as in 6a, divided by the number of observations?

As mentioned above, we removed the figure 6b (see our reply to Referee's comment 2).

5) I think there are too many sub- and subsub-sections, some of them with misleading names. 2.4 is an example, where almost every paragraph has its own heading. The section also contains lots of repetition, which can be removed by merging some of the sub-sections.

We removed all subsub-sections in chapter 2.3 and 2.4.

6) The description of PREC in 2.2 is not very clear, particularly the last part of it. If I understand it correctly, PREC is a method to regionalize, to different catchment sizes, the flood size with a recurrence interval that is defined from the number of efficient observation years.

The method of probabilistic regional envelope curves (PREC) is an enhancement of the traditional approach of the regional envelope curve by introducing a probabilistic statement to the regional envelope curve (Castellarin et al., 2005). In this way, an exceedance probability (or recurrence interval) can be assigned to each site of a homogeneous pooling group. Therefore, a flood quantile (flood discharge and its associated recurrence interval) is assigned to each site.

According to the comments of all three Referees, we improved the description of PREC to make this method clearer. In this way, we emphasised the main ideas and assumptions of the PREC concept. And we referred to Castellarin et al. (2005) and Castellarin (2007) for the backgrounds of the PREC method.

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7) Where does the 2 come from in Eq. 4? I could not find it in Castellarin (2007). Make it very clear which recurrence interval it is referred to.

This equation was derived from the application of the Hazen plotting position and was shown in Table 3 on p.8 in Castellarin (2007). The recurrence interval is valid for all sites of the homogeneous pooling group.

8) The result section contains parts that would be better in the data section, and parts that would be better as a part of the conclusions. As examples, section 4.2 seems to belong to the data section, parts of 4.3 and 4.8 to the discussion.

We carefully checked whether we should replace parts of the result section to the data section or the discussion. While restructuring the manuscript, we followed these recommendations.

We agree that the second part of section 4.2 (p2859, lines 8-12) belongs to the data section. This part was moved to the data section in the revised manuscript.

We see that the section 4.3 contained some discussion. The part on 2859 (lines 22-25) was moved to the discussion. The passage on p2860 (lines 6-10) was explicitly related to the correlation-distance plot (Fig. 5 in the original manuscript). Therefore we maintained this passage in the result section.

In our opinion, there was only a small discussion part in section 4.8 (p2864, 1-3). This part was directly related to the results and this aspect was not pointed out in the discussion. Therefore we decided to maintain this part in the result section as it is.

9) The language needs to be improved.

We are improving the English language of the text, also with the help of an expert.

Below are some suggestions, general ones first:

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10) Remove unnecessary words, such as “in order to”, where “to” would be enough.

We carefully checked the manuscript and removed unnecessary words.

11) “Next” is overused.

We reduced the use of "next” and replaced it by similar words.

12) Many places in the text, it is necessary to add “number of”, for example to “total observations” on P2861, L15. Other places it would be helpful.

We followed the recommendation and wrote "number of total observations“ and "number of effective observations“ instead of "total observations“ or "effective observations, respectively.

13) The following is an example of a sentence construction appearing several places in the manuscript (this is from P2867, L4) “Only gauges were used, which . . .” I am not sure if this is formally correct English, anyway, it does not read well. A possible reformulation could be “We only used gauges that . . .“

We followed the recommendation and checked the sentence constructions of our text. At several places, we changed the sentence constructions according to this suggestion.

14) Maybe a matter of taste, but I prefer to see equations immediately after they have been described. As an example, Eq. 2 appears almost a paragraph after it is mentioned.

In the revised version of the manuscript, we presented the equations immediately after their description.

Detailed comments (-> means a suggestion to replace)

15) P2848 L2 “. . . pointed out that quantile estimates are already affected by a relatively low intersite correlation. . .” -> pointed out that quantile estimates are affected

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by intersite correlations as low as. . .

Changed

16) L6 affirm -> confirm

Changed

17) L6 must not -> should not

Changed

18) L11 is negatively related -> decreases as a function of

Changed

19) L28 unnested conditions -> unnested catchments

Changed

20) P2850 L19 “An information content . . .” This is for the information content definition of Matalas and Langbein, this is not clear.

We improved the description of the information content in the revised version. Therefore we replaced the Eqs. (5) and (6), which were used to calculate the information content for different catchment structures by the general equation of the information content. This equation was reported when describing the information content at the beginning of section 2.1. That should be helpful to understand the information content.

21) P2852, L 11 “. . . was estimated by a regression analysis of the index flood. . .” -> “. . . was estimated by regression analysis.” – remove unnecessary text.

We followed the recommendation.

22) P2853, L13 I do not understand what “predictor space” refers to. Could it be physiographical space? The use of Euclidian distance for a non-geographical distance is a bit confusing. The text should mention that variables need to be standardized to reach

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values in the magnitude of the possible thresholds.

We reorganised the description of the pooling method, according to the recommendations of all three Referees. In the revised manuscript, we mentioned that a standardisation of the variables was required. We changed "predictor space“ to "physiographical space“. The similarity to the site of interest was calculated in this physiographical space by using the Euclidean distance between each site to the site of interest. The use of the Euclidean distance in the physiographical space was adopted for example by Zrinji and Burn (1994), Pfaundler (2001) and Ouarda et al. (2008).

23) P2854, L2 “. . . in the test deemed to be independent . . .” -> “. . . in the test are independent . . .”

Changed

24) P2854, L7 “All regions below two are seen . . .” -> a bit confusing

We presented a clear sentence in the revised manuscript.

25) P2854, L17 This paragraph contains repetition.

We used this paragraph to explain our application scheme. That led to some repetitions. Anyway, we agree with the Referee and avoided the repetitions.

26) P2855, L12 Remove subheading, replace the complete paragraph with something like: “This can also be described through T:”

We agree with the Referee and removed the subheading.

27) P2856, L3 “All pairs of catchments . . .” -> unnecessary sentence, remove

Removed

28) P2857, L13 “ time length” -> “record length”? “by using 453 stations” -> “from 453 stations”

Corrected

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29) L14 “and endured at least up to 2002” -> “and still existed in 2002”

Modified, also according to Referee#1.

30) L15 “it is useful to include this year” – say why it is useful. The presentation in this paragraph is generally a bit confusing, see if it is possible to clarify.

We reworked this paragraph. By doing so, we explained that it is useful to include the year 2002 in the time series, because the largest regional flood in the last decades occurred in August 2002. Therefore it was important to include the precipitation values of this event (this year), e.g. to calculate the maximum daily precipitation.

31) P2858, Section 3.1 This section is unclear, please rewrite

In the revised version, we resolved this section and removed it to the section 3 and 2.3 (of the submitted manuscript). According to the recommendation we rewrote both parts to clarify our idea.

32) P2859, L2 “In this context, this study” unnecessary sentence, remove

We removed this sentence.

33) P2860 The example could be clarified.

We removed the example according to the recommendation of Referee#1.

34) P2862, L24 “. . . lower than 0.2, and therefore, for pooling groups . . .” -> “. . .lower than 0.2, i.e., for pooling groups. . .”

Changed

35) L25: a couple -> a few

Changed

36) L25 “A closer look at the calculation” -> unclear, rewrite

This is a very important comment of the Referee, because this paragraph represented

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an interesting aspect of our work. We followed the recommendation and clarified this paragraph to improve the understanding of our results. We changed the unclear expression mentioned by Referee#3.

37) L18 “The estimation of. . .” -> unclear, rewrite. The rest of the paragraph should be shortened. The rest of the subsection is also unclear,

We agree with the Referee and clarified this paragraph as mentioned in our reply to Referee’s comment 36 (see above).

38) P2863, L10 “checked in” -> “examined in”?

Changed

39) P2865, L15 It is not clear what NRC means by consideration here. Also, make sure that the use of apostrophes is consistent.

NRC stands for National Research Council, which could be found in the reference list of the submitted manuscript. We wrote NRC in its full meaning in the revised manuscript.

We checked the use of apostrophes and make them consistently. We always used ‘.

40) L23 “hydrological parameters” -> “hydrological variables”?

Corrected

41) P2866, L1 “distinction in” -> “ separation in”?

Changed

42) L3 First two sentences are not clear, particularly “a more detailed consideration . . . was realised”

In our opinion "a more detailed consideration of the spatial correlation structure was realised“ by the specific consideration of the river network structure because of the separation in nested and unnested catchment relationships. In the revised manuscript, we clarified these sentences.

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43) L9 “The result is comprehensive” -> Unclear

This sentence has dropped in the revised version of our manuscript while focusing the discussion more on the main aspects of our study.

44) L21 “In regions, which are . . .” -> “In regions that are . . .”

Changed

45) P2867, L6 and 7 Write “local floods” and “widespread floods” before citations

Changed

46) L9 “were affected” -> I think “have been affected” is more correct in this context

Changed

Table and figure captions

47) Table 2. unclear, consider: “Correlation coefficient (COR) between the index flood of the annual maxima series of all gauges and the subsets of catchment descriptors (CD).

Changed

48) Fig 1. Should it be “probabilistic regional envelope curve” also in the key?

We made the description of the figure consistently.

49) Fig 2. Unclear caption. The figure show gauging stations, not catchments. What does “extended until the last available gauge” mean?

We improved the caption. We agree with the Referee that the figure show gauging stations and not catchments. The passage "extended until the last available gauge“ was related to the catchments borders illustrated in red lines. The borders of these catchments were extended until the last available gauge in this figure.

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50) Fig 4. (If not removed) Change differentiation to separation

The figure was removed.

51) Fig 5. “Cross-correlation functions using different . . .” -> “Cross correlation functions fitted to global, . . .”

Changed

52) Fig 6. “. . . in relationship to the total observations . . .” -> “. . . as a function of the total number of observations . . .”

Changed

53) Fig 7. “. . . between different cross-correlation functions . . .” -> “. . . between a single cross-correlation function (global) and separated cross-correlation functions (nestedunnested)”

Changed

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