

## **Response to Comments by Anonymous Referee #1 (RC C820)**

Title: **An elusive search for regional flood frequency estimates in the River Nile basin**

### **General comments**

**1.** I find the article excessively long. The authors give a lot of details on each aspect of their research. It makes it sometimes difficult to see the most important aspects of their research and results. Although it is difficult to remove full parts of the article, I would suggest that the authors try to go straighter to the point and reduce as much as possible the less important parts of their paper.

**Response:** We tried to reduce as much as possible the less important parts of our paper.

**2.** The article is generally clear and well written, but some spelling/grammar mistakes should still be corrected (not detailed here). Some sentences would require rephrasing.

**Response:** Further proof reading is currently being handled by the authors such that the spelling and grammar will greatly improve.

**3.** A few sub-titles could be added to better structure the discussion (e.g. in sections 1, 3.3 or 4).

**Response:** Sub-titles have been added to the stated sections - as the reviewer suggested, improving the paper structure.

### **Specific comments**

**4. p. 2677, lines 8-9:** This sentence is unclear.

**Response:** The sentences were made more clear.

**5. p. 2681, lines 9-10:** The fact that various record lengths are available is a source of instability of the clustering process. This is not discussed in the article (only the impact on flood estimation is discussed). Could the authors further elaborate on this aspect?

**Response:** The stability of the clustering is mainly affected by the sample size and other flow variables as compared to the record lengths of the gauged catchments and the influence of record lengths is much stronger on the flood estimation. This is why emphasis was put on the impact of record lengths on the flood estimation. A statement on the influence of record lengths and the use of various record lengths on the results of the clustering process was added.

**6. p. 2681, lines 19-20:** Why only mean annual rainfall was used as climatic descriptor? Is it the most relevant meteorological variable to characterize floods on the Nile basin? One could expect that quantiles of rainfall over a given period may also be relevant. Could the authors shortly discuss this point and possibly add other climatic variables in their analysis?

**Response:** The mean annual rainfall (MAR) was used as the main climatic descriptor to support characterizing similar catchments despite the fact that it is not the only meteorological variable (climatic descriptor) to characterize floods. The influence of Maximum Annual Rainfall on characterizing similar flood homogeneous region was compared with that of Mean Annual Rainfall and the findings showed negligible difference. This result was added and also a discussion was added on the fact that more climatic indicators can be studied.

**7. p. 2681, line 28:** Why this number of catchments? Was it obtained after defining some specific constraints, e.g. on size?

**Response:** This was an automatic digital delineation of catchments in which outlet nodes are automatically provided and later validated with previous information and gauged catchments to extract catchments characteristics. The constraint on size was specified based on the number of cells required to form a stream.

**8. p. 2682, lines 9-15:** One could expect that geology, soil or vegetation types may play a role. Do the authors consider that this is not the case on the Nile basin, or was this information not available for their study?

**Response:** During clustering soil and landuse types were included and omitted, respectively. Either omission or inclusion of soil and landuse types in the clustering process was found to be insignificant for the Nile basin. This is now added to the paper.

9. p. 2683, lines 4-6: This sentence is unclear.

**Response:** The sentence has been restructured to make it clear.

**10. p. 2690, lines 20-22:** One objective is actually to identify climatic or physical characteristics that could explain the contrasts between regions. Did the authors investigate other climatic characteristics (aridity index, potential evapotranspiration, quantiles of rainfall amounts over a few days, variability of monthly rainfall within the year, etc.)?

**Response:** The authors agree with the reviewer that aridity index, potential evapotranspiration, quantiles of rainfall amount over a few days and variability of monthly rainfall within the year are parts of the climatic or physical characteristics that could also explain contrasts between regions. However, the physical/geographical characteristics used in this study such as elevation, slopes were thought to be of primary influence and were therefore considered in this study. A discussion on this has been added to the paper.

**11. p. 2690, lines 24-26:** I found it unclear what the authors mean here.

**Response:** The sentence means that several physical characteristics were considered and the most influential ones were required in the delineation process. The sentence has been restructured.

**12. p. 2692, line 9:** Which interpolation procedure was used?

**Response:** Different interpolation techniques were tested but results for ordinary Kriging were used. The advantage was that it adds the ability to determine some evaluation of accuracy of the resulting predicted surface. This information has been added to the paper.

**13. p. 2694, Eq. 6:** Please check the numerator of the equation (index  $j$  is not used and the lower bound for  $i$  appear as 1).

**Response:** This numerator in Equation 6 has been corrected in the revised paper.

**14. p. 2696:** Practically, what does it mean that 40-year long records should be used? Shall we install new stations on the basin and wait for 40 years? Or do the authors mean that there are other existing records that were not available for this study and that could complement the existing data set?

**Response:** Some flow records (recent data) indeed were not available for the available stations used and could be updated to improve on the record length. In addition, some flow data of some stations with expected longer record lengths could also not be available for the study and could improve the density of the stations used and the results as well.

**15. p. 2697:** At the beginning of the article, the authors mention other studies on the Nile basin. A short discussion could be introduced on the extent to which their results corroborate/contradict previous findings.

**Response:** Such discussion has been added to the revised manuscript.

**16. p. 2703, Table 1:** What is velocity? Write "Mean annual flood". What is the difference between Len1 and RhL? The various elevation indices are probably related. Was a prior analysis on cross-correlation between variables done to check their relative independency?

**Response:** We divided Mean annual flood with catchment area and we called it velocity. Len1 is the longest path within the subbasin or river catchment length while RhL is the longest path within the subbasin or river catchment width. Each has different influence on the type of a stream or a river. We clarified this in the revised manuscript.

**17. p. 2704, Table 2:** I found this table unclear. Please make more explicit the column headings and the content (add in the caption the meaning of letters).

**Response:** Captions were added under the table to provide explicitly the meaning of the letters.

**18. p. 2706, Fig. 1:** Add a scale in the location map on the left. Write "Atbara". The Jur River is mentioned in the text but does not appear here. The resolution of the maps is poor. Could it be improved?

**Response:** The word Abara is replaced with Atbara. Although Jur River is mentioned in the text as the main river it was not considered spatially as one of the main catchments. This confusion was corrected.

**19. p. 2710-2711, Figs. 5 and 6:** Indicate in the figure caption what the acronyms stand for.

**Response:** This was included in the revised manuscript.