

## Reply to the Reviewer#2

---

### Key:

Review comment.

Response.

---

### Recommendation:

This is a very interesting paper, investigating the drivers of seasonal streamflow correlation for both high and low flows, using a wide range of physical drivers including catchment, geological and climatic descriptors. The paper is very well structured, easy to follow, concise and clear throughout with a well explained methodology and clear contribution to the field. Limitations and assumptions are also discussed well. I would recommend this paper for publication subject to minor revisions based on the comments below.

We are grateful to the Reviewer for providing very positive remarks on the contribution and quality of our work and for recommending publication. We also wish to thank her/him for all the thoughtful suggestions and comments provided which will certainly help improve the manuscript and highlight its contribution. These are discussed below.

### General Comments:

1. It may be apt to mention that this analysis is for Europe, in the title of the paper

Thank you for this suggestion. We will consider a modification of the title in the revised version.

2. I agree with reviewer 1 that the readability of section 2.2 would improve if it were split into subsections.

Thank you for this suggestion. We agree as well and we will adopt Reviewer's 1 suggestion on that.

3. It is not clear from the methods or from section 7 why you are doing this technical experiment and what you hope to gain from it. There is a brief explanation of this in the abstract, and it would be beneficial to further describe what the purpose of this experiment is within the manuscript.

Thank you for the comment. Our intention is to also highlight the practical applicability of this work, besides its importance for improving the physical understanding of river memory. Providing more reliable flood estimates is a fundamental hydrological task and we want to provide a relevant case study showing how the identified correlation explicitly serves such a purpose by exploiting the methodology recently proposed by Aguilar et al. (2017). Following the Reviewer's suggestion, in the revised version, we will elaborate on the purpose of the technical experiment and extend the relevant discussion on the main body of the manuscript as well.

4. Again, I agree with reviewer 1 that I was expecting to a case study / technical experiment for low flows as well, and would like to see this included in the revised manuscript as it would certainly be of interest.

Thank you for the comment. Indeed, this is a very important application too. In the revised version, we will include a relevant case study and discuss its importance as Reviewer 1 has also requested.

5. While I find the discussion to be thorough, with comparison to the literature and interesting points made, the conclusions seem to be very rushed and do not do the paper justice. I would recommend including a separate conclusions section and expanding significantly on this, including for example the wider implications of your work, how the findings could be applied and used, what further work could be done from this, etc. The conclusions imply that all of your results agree with the literature that was already out there, when in fact I believe this paper has done more than this. This is also the first time data assimilation is mentioned so there is no context here. It would also be interesting to further mention section 7 as an example of use.

We sincerely thank the Reviewer for the suggestions on how to improve the conclusions section in order to better convey the research findings of this work. This is an important issue raised and we will consider the suggestions provided thoroughly. We will include a separate conclusions section and discuss areas of practical applicability as well as directions for further research. We also agree with the mentioning section 7 as an example of use and in this section, we will also introduce the data assimilation concept.

6. There are a lot of figures included in this manuscript - is it necessary to include all of these, or could some of them be provided in supplementary material for further interest? Some are barely discussed in the paper, for example 15a,b,c,d.

We thank the Reviewer for the comment. We will consider the possibility to include some of these figures as supplementary material in the revised version.

– Minor Comments and Clarifications:

Line 33-34: it should be mentioned that the study covers 6 countries in Europe, the abstract implies that the whole of Europe is included

Line 78: Remove "in fact"

Lines 87-89: This is repetitive of information stated just above

Line 105: "employed" is used a lot in this paragraph - maybe just use "used"?

Line 110-111: Why do you not take into account the minor HFS after identifying it? This could be interesting to discuss; but at least should be justified.

Line 123: Why do you look for correlation with mean flow in the previous months? This is fine, but the reason should be included.

Line 134: basing -> based

Line 155: A very brief explanation of flysch and karstic formations would be helpful for those of us with no geological background.

Line 161: Remove "of" ("because of geology...")

Line 165: What type of data is this?

Line 166: What is this in km (approx.)?

Lines 164-170: You don't mention here how this relates to snow, which is discussed a lot in the results

Line 233: Where is this data from? is it observations? please clarify

Lines 242-243: Please clarify what Cfb and Dfc climatic types are

Lines 251: This is indeed interesting, could you expand on which rivers are regulated?

Line 257: Is the regulation really mild; what do you define as mild regulation?

Line 287: indexes -> indices

Line 289: available for "a" few countries only.

Line 204: "it looks that" implies that you are unsure, maybe rephrase this

Lines 349 & 352: again, "looks" implies you are unsure

Line 359: "having" -> "with"

Line 378: summarize -> summarizing

Line 378: PCA analysis - analysis is included in this acronym, so reads oddly

Line 385: remove "majorly"

Line 391: indexes -> indices

Line 393: remove "also"

Line 407: add "(see sect. 2.3)" after technical experiment

Line 435: "within this respect" is odd phrasing, consider rephrasing

Line 456: there -> their

Line 473: associated to higher -> associated with higher

Figure 2: Are the boxplots of all the gauging stations? Please clarify in the captions.

Figure 8: Very nice figure, but you have red dots on top of a green map which should ideally be avoided

Figure 9: Again, a very nice figure, but it's very hard to see the yellow dots

We thank the Reviewer for the above list of minor comments and suggestions provided as well as for all the errors spotted. In the revised version, we will correct the wording where indicated and provide all the clarifications requested by the Reviewer. We will also improve the readability of Figures 8 and 9 and provide more details on the issue of regulation for the rivers in question.

### **References**

Aguilar, C., Montanari, A., and Polo, M.-J.: Real-time updating of the flood frequency distribution through data assimilation, *Hydrol. Earth Syst. Sci.*, 21, 3687-3700, <https://doi.org/10.5194/hess-21-3687-2017>, 2017.