Reply to the Reviewer#1

Key:

> Review comment.

Response.

> SUMMARY:
>
> This paper looks at the lagged seasonal correlations between the average river flow in antecedent months and, on one side, peak flow for the High Flow Season (HFS), and on the other hand, average flow for the Low Flow Season (LFS). It also looks at what are the possible physical drivers that could explain these correlations. The study is carried out using a large sample of European rivers. It also shows a real-case application of the findings to flood frequency estimation
>
> GENERAL COMMENTS:
>
> The paper is well-written, clear, interesting and attempts more systematically than previous study to attribute the observed correlations to physical drivers. The methods used are adequate and robust, assumptions are being verified. Overall, it contributes to the advance of science in the field, and my recommendation would therefore be for publication.

We gratefully thank the Reviewer for the very positive evaluation of our work and for recommending publication. We are also thankful for the constructive comments, the corrections and suggestions provided which will certainly help improve the manuscript. These are discussed below.

> However, I have a couple of comments for suggested improvement: 1) My major comment is that, although the whole manuscript looks at both high flows and low flows, and analyses both in detail, the practical example at the end is only for high flows. I think a similar case study for low flows is missing there. If there is a really good reason for only giving an application example for high flows, the motivation for this should be clearly explained.

We thank the Reviewer for this comment. Certainly, the application for LFS is also of great importance. We focused on the application for high flows as the relevant methodology for updating the flood frequency distribution using 'river memory' was recently proposed by Aguilar et al. (2017). Therefore, the relevant application for HFS is straightforward. Some modifications are required in order to apply the methodology for the case of predicting average flow in LFS. Following the Reviewer's suggestion, in the revised version, we will present this application too and discuss it.

> Section 2.2 is too long. It would help readability to have a few sub-sections in here. Suggestion of subsections below (could be different, this is just a suggestion): 2.2.1. Correlation analysis 2.2.2. Analysis of physical drivers a) Drivers (catchment descriptors, geological descriptors, climatic descriptors) b) Principal Component Analysis

We thank the Reviewer for this suggestion. We agree and we will adopt the proposed subsections.

MINOR COMMENTS:

Abstract:

line 43: change “in real-world cases” to “in two real-world cases”: otherwise it is misleading and it sounds like you’ve done this to all the 224 catchments

1. Introduction:

Line 63-66: Note that the persistence method described by Svensson (2016) that you cite here, has been used operationally in the production of the UK Hydrological Outlook since 2013 (see Prudhomme et al., 2017)

Reference: Christel Prudhomme, Jamie Hannaford, Shaun Harrigan, David Boorman, Jeff Knight, Victoria Bell, Christopher Jackson, Cecilia Svensson, Simon Parry, Nuria Bachiller-Jareno, Helen Davies, Richard Davis, Jonathan Mackay, Andrew McKenzie, Alison Rudd, Katie Smith, John Bloomfield, RobWard & Alan Jenkins (2017) Hydrological Outlook UK: an operational streamflow and groundwater level forecasting system C2 at monthly to seasonal time scales, Hydrological Sciences Journal, 62:16, 2753-2768, DOI: 10.1080/02626667.2017.1395032

2. Methodology

Section 2.2: see comment earlier in general comments regarding splitting this section

Line 127: change “in terms of catchment, climatic and geological descriptors” to “in terms of catchment, geological and climatic descriptors”, because that is the order in which you list them later in the text.

Line 128-130: add altitude to the list of catchment descriptors (as you present it after percentages of lakes and glaciers).

Line 139: replace “baseflow index” with “BI”

5. Physical interpretation of correlation
Line 365: typo: replace “20-cathcment” with “20-catchment”

8. Discussion and Conclusions
Line 456: typo: replace “There” with “Their” or “These”

We thank the Reviewer for the above list of minor comments and typos spotted, as well as for bringing to our attention an important application of the persistence method. In the revised version, we will include these suggestions and adopt the corrections provided.

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.