

Interactive comment on “Flood type classification and assessment of their past changes across Europe” by Yeshewatesfa Hundecha et al.

Anonymous Referee #2

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Assessments of flood change and potential classifications of floods across large regions, such as the continental scale analysis used here, are generally highly valuable contributions to the literature and science. Therefore, I believe the topic of the manuscript is relevant to HESS. However, the manuscript itself needs considerable revision to address some confusing parts of the methods, analysis, and presentation of the results. For this reason, I recommend the manuscript be reconsidered after major revisions and re-review.

Major comments:

1. Explanation of the Data and State Variables:

a. Section 2.1 could be better communicated as a table listing the variables and the

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data source. The text can then be used to explain any additional pieces of information of particular note with the data, such as the fact that landuse and soils come from different sources (p. 4, lines 20-21). Also, the acronyms are not introduced before they are used.

b. I assume that the “hydrological model” being referred to on p. 4, line 17 is E-HYPE but that model is not named anywhere in this section. In Section 2.3, the model is discussed in more detail but this information is buried under a heading that indicates only the hydrologic and state variables are discussed. Consider renaming Section 2.3 and adding additional subsections to explicitly discuss the model, its input variables, and how the model is used in the analysis. These important pieces of the methods are currently not clear.

2. The clustering/classification by flood type is a main contribution of the manuscript. However, in Sections 2.4 and 2.5, the description of how the authors arrived at their flood classes needs substantial improvement. Here are examples of where I found these sections highly confusing:

a. Section 2.4 discusses the clustering of flood events and yet there are not details explaining how the clustering was quantitatively carried. No information is given as to how the stations were “clustered in space” p. 8, line 4. What variable was used to cluster? What method was used to cluster? Section 2.4 actually appears to be discussing how sites that may be exhibiting correlation in flood events due to their proximity to one another were filtered out - not anything about clustering of flood events.

b. Section 2.5 opens with a definition of 4 classes of flood events. This would indicate that the flood classes were determined a priori and not by a formal clustering method. If the groups arise from a clustering algorithm, then I would consider them results and not appropriate to be placed in the Data and Methods section. As one reads further down however, there is information about a clustering method utilized but that includes the “hydrological and hydro-meteorological variables defined from the E_HYPE model”

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(p. 9, lines 23-24). In my comments above, I do not think enough information has been given about how the model variables are used in a clustering approach.

c. If the classes resulted from the application of a classification algorithm (in this case, the k-means algorithm), no evidence is given as to how the classification tree was pruned and how these classes were assigned a common behavior such as “short-rain floods.” From the description of the flood types, it seems “short-rain floods” are defined as “a flood event caused by rainfall of duration less than one day” (p. 9, line 11). How was this definition arrived at - by looking at classified events to determine common properties or was this a pre-determined definition applied to the flood events.

d. Following on this, p. 9, lines 30-32 note that after the classification was complete, “manual adjustment” was used to move events around from group to another if they “happened to end up in a group which doesn’t reasonably represent them.” The authors need to provide objective criteria here as to how this was assessed. Since the remaining part of the manuscript centers around this classification, how can a reader be ensured the results are not biased by these initial adjustments? What was the point then of using a classification algorithm in the first place?

3. Because it is unclear how the flood classes were arrived at, the novelty of this work is not apparent. It would be more useful to pose the manuscript as a testing of several hypothesis about flood generating mechanisms or classes using the current state of the literature as support rather than general objective statements such as those found in p. 4, lines 1-4. I am not clear even as to whether the flood typing classes are a contribution because I am not sure if they are determined from the data or imposed by the authors to perform subsequent analysis.

4. Figures 3-7: These figures should be stand-alone. Referring back to previous captions decreases the readability and interpretation for the reader. I think it would also be helpful to show boxplots next to each map of the flood events grouped by region to show the distribution of the flood event types.

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5. Figure 9: This figure is not well-explained and need clarification. Was a regional Kendall test used to obtain the significance values? If so, this is not cited or defined in the methods section. The conclusions made based on this analysis (p. 20, lines 1-8) do not reference any specific figure or evidence for these statements. This needs to be remedied.

6. Section 4: It is very difficult to follow some of the statements made in Section 4 (p. 21, lines 6-13 for example) because Figure 8 is so difficult to understand. I do commend the authors on using the discussion to pull together the literature on flood change and typing from smaller regions within Europe and describe how those studies fit with these results. I recognize synthesizing these results into the text was not a simple task.

Minor comments:

p. 4, line 15: The authors note a variable data period without mentioning how actually variable the periods are. Please note at least the minimum data period allowed.

p. 2, lines 22-24: This sentence is quite confusing as to what is meant here. The use of “different” twice creates most of the confusion.

Figure 8: Show the flood-type names instead of numerical values. This helps the reader to better understand the relation between the variables and the flood types.

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