

Reply on RC1

Xiaodan Zhang et al.

Response to reviewer 1

We greatly appreciate the valuable comments and suggestions. Below is a list of individual comments and questions followed by our responses, with the comments colored in blue and the responses in black:

Reviewer 1: comment 1

The Introduction is too long and has no focus. This section should write based on the first words in Abstract. Some paragraphs are not related to the topic of this paper, and some could be moved to the Discussion. For example, the sixth paragraph just give some results of previous studies, and has no meaning. The second to the last paragraph should be put in the front of the Introduction. Generally, this part should be organized based on the logic of your Abstract.

Author: response to comment 1

Thank you for pointing this out. We will briefly describe the practical and theoretical significance of the research in the introduction section, delete less relevant paragraphs to this work, and move some content related to the results of previous studies to the discussion section, in the next version of our manuscript, as you suggested. A more focused introduction would be very important.

Reviewer 1: comment 2

Line 145-146: how do you get this result, it is from previous studies or you're your own analysis? I suggest the authors to give some analysis of extreme droughts and floods based on the instrumental data. It is important to support your results obtained from historical records, especially when you make comparisons between your series with ENSO events. Is there significant relationship between instrumental extreme events and ENSO events?

Author: response to comment 2

Thank you for this comment and apology for the lack of clarity. In the revised version, we will add citations for this conclusion as follows:

“Since the 1990s, the HRB has been experiencing continuous drought, severely impact the

ecological environment, the rational allocation of water resources, and water supply in the basin (Yin et al., 2015)."

In the revised manuscript, we will also calculate and plot the precipitation anomaly percentages from May to September in the Han River basin since 1951, applying the instrumental data, and then compare with the drought and flood rating spacing maps in this period to verify the applicability of the procedure used in this study. However, because another reviewer indicated that the arguments in section 3.2 on ENSO and volcanoes are not very convincing, we decided to move this section to the discussion section and discuss them only as possible influential factors, without performing a specific analysis. Due to the length limit of this manuscript, we will not provide a specific analysis of the relationship between extreme drought/flood events and ENSO during the instrumental measurement period, so that we can more focus on the in-depth analysis of historical change. Meanwhile, the previous studies on changes of precipitation in instrumental period and their association with ENSO (e.g. Yin et al., 2015; Wang et al., 2013) will be cited to discuss the possible influence of ENSO on extreme drought/flood events on inter-annual to decadal scales in the basin in the Discussion section.

Reviewer 1: comment 3

Figure 2: from this figure, it is obvious that drought and flood records in early periods are fewer than recent periods, and this may result from the fewer documents in early periods. Do you consider some correction method or give different weight for different periods?

Author: response to comment 3:

Thank you for this comment. We considered this issue, and made an explanation of the method to solve it in Line 238-251. We may need to make a further illustration to clarify this in the next version of our manuscript, including adding a few sentences as given below. Overall, the methods used to delineate the time nodes of the historical period and to homogenize the data series are as follows:

The time uniformity of the historical documentary sources within the study period (1426-1950) was first analyzed to determine whether there were systematic deviations in the sources, and the sources were divided into different time phases according to their temporal changes. It was then determined whether the data in each phase met the data documentation rate required for the study (i.e., the ideal frequency criterion of 20% was required for extreme events). The key to this method is a phased evaluation approach, which constructs a platform for comparison between different historical periods, and historical documents and instrumental data. That is, the "record only disasters but not normal conditions" character of the historical literature leads us to believe that even the period with the lowest average documentation rate in this study (42.6% of the Ankang site during 1426-1812) is still sufficient for the study because the extreme events frequency reaches greater than 20%.

Of course, the method itself suffers from uncertainties that are unavoidable in reconstruction work using surrogate sources. In the study, the uncertainties are mainly in the subjective description of historical information that is unavoidable in grading. Because historical materials include a variety of information, there are complex relationships between different carriers and different records, which leads to subjectivity and ambiguity that cannot be avoided entirely even if we do not base the grading on the linguistic descriptions of historical materials alone when selecting the available historical materials.

The limitations of the methodology used in this study will be addressed in the discussion section of the planned revision.

Reviewer 1: comment 4

Section 3.2.2: this section is difficult to read. It is better to give a table presenting the corresponding ENSO and droughts/floods events in history. ENSO is a complicated phenomenon, and its interaction with Asia monsoon is also complicated, the discussion in this part is too simple.

Reviewer 1: comment 5

Line 445-448: “However, the correlation between extreme droughts/floods and large volcanic eruptions are not significant in the other eras.”, Why? Are there any other factors influencing the extreme droughts/floods? Why the large volcanic eruptions influence extremes at the 1430s-1450s and 1640s-1660s? I think the authors should carefully consider this section, you can not compare for the sake of compare.

Author: response to comment 4&5

Thank you for the comments. After considering your and another expert's comments on section 3.2, we decided to move this section to the discussion section and replace section 3.2 with an analysis of the spatial distribution of extreme droughts and floods in the Han River basin. We will also add some words in the discussion section for the analysis of the relationship between extreme droughts/floods in the Hanjiang River basin and decadal to multi-decadal variability of East Asian summer monsoon.

References

Yin, S.: Research on Extreme Climate and Hydrological Events and Their Social Impacts in the Upper Hanjiang River Since Historical Periods, Science Press, Beijing, China, 2015 (in Chinese).

Wang, T., Yan, J., Zhang, T., and An, H.: Analysis of the impact of solar activity and ENSO events on droughts and floods in the Hanjiang River valley, *Journal of Arid Land Resources and Environment*, 27.07, 107-112, 10.13448/j.cnki.jalre.2013.07.025, 2013 (in Chinese).