

Dear anonymous referee #2,

Thank you very much for your comments. Please check the following response to your concerns about innovation and structure adjustment. We will modify the paper according to your suggestions.

The manuscript titled "Evaluating climate change impacts on streamflow variability based on multisite multivariate GCM downscaling method" applies a multivariate down-scaling approach to the Jing River Basin. Overall I found the manuscript to be of sound technical quality and does suggest a novel approach of GCM downscaling as inputs to a hydrologic model to investigate hydrologic variability. However, I believe that this manuscript requires additional work to clarify the text to best present this work. Please see my general and specific comments for additional guidance. I found the title to be accurate for the manuscript's content, but would suggest the addition of the words "in the Jing River Basin" or something equivalent.

We added 'for the Jing River Basin in China' to the end of title.

**General Comments:**

- As mentioned, I find the manuscript to be of good technical quality and appears to use industry standard model techniques to explore the effects of this novel downscaling approach.
- The figures seem appropriate for the manuscript topic and seem to support the findings stated in the body of the manuscript.

Thank you for the positive comments. We are still trying to present a systematic study with good quality.

- The first paragraph of the introduction seems to be the weakest of the introduction. The english/grammar should be improved for clarity. My opinion is that the first paragraph should be reworked. The syntax/grammar of the remainder of the manuscript should also be refined before publication, but there are no specific sections to highlight other than the first paragraph of the introduction.

We rewrote the first paragraph to highlight the importance of projecting the potential changes in the hydrological variability.

- Because this work is based on techniques that the author has already published, I found it difficult in to decipher the contributions of this paper from the previous downscaling work. I highly suggest that the authors clearly present the objectives of the manuscript at the end of the manuscript and how this is differentiated from previous work. What are the primary hypotheses of the work? Whether or not these hypotheses are supported should be contained within the discussion section.

We added one section 'Why is the proposed downscaling method used?' in the discussion section to highlight the advantages of the proposed method, and also to show the difference of this study

from our previous work.

Overall, our previous work published in 2014 is for multisite precipitation generation. The model was proposed for stochastic generation of one variable at multiple sites. This study extended that model to multisite and multivariate version for future climate change scenarios development. More importantly, we evaluated the changes of hydrological variability with this improved methodology, which is closely related to extreme hydrological events such as flooding and drought. These changes are crucial to water and hazard management, which is a main focus in this study.

- As it stands, I found the results/discussion section to read like a results section with a very brief discussion at the end of this section. Normally a results/discussion section is needed only when it is difficult to present the results of the paper apart from the greater context of how the results relate to other bodies of work. In this result/discussion section, I found only one location where references are presented, which I found to be insufficient. The most important contribution of this paper will lie on how these results relate to a vast collection of other work completed before this one and what we learned in this paper that can help inform future papers. The core of this manuscript seems to be the attempt to investigate the characterization of hydrologic variability, which has a very long history and should shown in the context of such. It is my opinion that the results/discussion section should be split into separate results and discussion sections, and therefore the authors should provide an indepth discussion section currently absent from the manuscript.

Thank this reviewer for the suggestion. We have separated the discussion from the results following this suggestion. In this version, we strengthened the discussion section with answering three important questions, which are: (i) Why do we use the ESM downscaling method described in the text? (ii) How does climate change influence the streamflow variability? (iii) What are the uncertainties and limitations of the projected hydrological changes? The answer to the first question is to focus on discussing the advantages of the proposed method and the difference of this study from the previous work. The answer to the second question discusses the physical mechanism of how the streamflow variability is influenced by climate change and identifies the climate variables that contribute to the streamflow changes. The answer to the third question focuses on the limitations of this study and how to improve our modeling results in the future.

- The conclusion section should never present new information, however it seems that the authors merged part of a would be discussion section into the conclusions. Based on how the discussion section is written, I might also recommend revising the conclusions section to make sure that new information is not first presented there.

We agree. This version moved that paragraph with the new information to the discussion section, and we also revised the discussion section.

#### **Specific Comments:**

Page 5 Line 7: This sentence is a bit confusing. The phrase "spatially downscaled GCM outputs from the monthly scale to a daily scale" is a bit clumsily worded. I suggest revising for clarity.

We modified the sentence “the second step disaggregated the spatially downscaled GCM outputs from a monthly scale to a daily scale” as “the second step further disaggregated the monthly data to a daily weather series”.

Page 5 Line 10: The first step is to spatially downscale and the second is the temporally downscale. However, you seem to combine them both here to speak specifically about single site GCM downscaling. But then in the same sentence, you only mention the temporal downscaling. Please revise this sentence for clarification.

The following sentence “The first and second steps are for single-site GCM downscaling, and the popular technique is to combine transfer function method for spatial downscaling with weather generator for temporal downscaling.” is revised as “The first and second steps are for single-site ESM downscaling. The popular technique is to use the transfer function method for spatial downscaling, and then employ the weather generator for temporal downscaling.”