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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Transferability of climate simulation uncertainty to hydrological climate change impacts" *by* Hui-Min Wang et al.

Anonymous Referee #1

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The manuscript is about the transferability of the climate model uncertainties, introduced by the selection of climate models, to hydrological impacts. To this end, two envelope-based selection methods, K-means clustering and the Katsavounidis-Kuo-Zhang (KKZ) method, are used to select subsets from an ensemble of 50 climate models over two watersheds with different climate characteristics. The transferability of the climate model uncertainties is evaluated by comparing uncertainty coverage between 31 climate variables and 16 hydrological variables that are simulated by the hydrological model GR4J. In addition, also the importance of choosing climate variables properly while selecting subsets is investigated by in- and excluding temperature variables. The manuscript is well structured and written. The manuscript covers a topic that is original and novel, and might interest a large amount of readers, including climate scientists

and hydrologists. To my opinion, this manuscript needs some minor revisions. I have added a few comments/suggestions that need to be addressed before acceptance.

General Comments

I would rephrase the title a bit. In the title, the authors are referring to the transferability of climate simulation (model?) uncertainty to "hydrological climate change impacts", whereas in the Abstract and other parts of the manuscript the authors write about the transferability to "hydrological impacts". I would change the "hydrological climate change impact" into "hydrological impacts". In this way, the authors can put more emphasis on the transferability of uncertainties to "hydrological impacts" specifically, and the title has a better connection with the Abstract and manuscript or vice versa.

Two watersheds with different climate characteristics are selected for this study. It would be good to spent some text in the Discussion explaining what the potential effects of transferability are in other climatic regions, such as high-mountain regions.

Specific Comments

1. Introduction; L4-9: the authors indicate that the selection methods inherit the potential flaws of the past-performance approach, when the emphasis is on model performance. What are the potential flaws of the past-performance approach? Combining envelope coverage criteria and past-performance would, to my opinion, be better since not only the models are selected to represent a full range of climate conditions, but also are tested in their performance to simulate regional (historical) climate characteristics, especially in those regions where, for instance, monsoon systems prevail.

1. Introduction; L20-25: To my opinion, the number of variables that is chosen for a selection approach depend on what the scope is of the study. If a study has only a focus on projecting changes in water availability or changes in the water balance it would, to my opinion, not be necessary to take indices into account that represent climatic extremes, whereas a study with a focus on hydrological extremes needs to include

these indices in the selection approach. Therefore, the authors need to elaborate more on why a certain number of variables should be selected or not.

2.2.1 Climate Simulations; L9: Why did the authors select 50 models? The authors mentioned before that the CMIP5 archive includes 61 models. Is there a reason why the other 11 models are excluded from the selection approaches? In addition, each climate model has one or more ensemble member. Did the authors select the first ensemble member or did they select random ensemble members? The authors need to include this information in the method description, for instance by adding extra information to Table 1.

2.2.2 Observations; L17: Where are the data from the 100 rain gauges, 8 temperature gauges, and 1 streamflow gauge obtained? The authors have to include some references to the sources where they obtained the meteorological and discharge data.

3.2 Generation of Climate Scenarios: Why did the authors use the DS method to downscale GCMs and not a method such as the Advanced Delta Change approach or the Quantile Mapping approach that also take changes in extremes into consideration? It might be interesting to discuss potential uncertainties that are introduced by the downscaling approaches in the Discussion.

3.3.1 Hydrological Modelling; L15-21: I would recommend replacing and to discuss this part in more detail in the Results Section, for instance under a separate subsection "Calibration and Validation"

3.4 Data Analysis: It would be good to an additional sentence on what it means when a PSC is high or low. For the reader, it might be more difficult to image the meaning of a high or low PSC.

Figure 1: The longitude axes are given, but the latitude axes are missing. Further I think the figure does not contain a lot of information. I would add a digital elevation model or another topographic/geographic info to give the reader more valuable information

on the characteristics of the catchments. In addition, I would add the positions of the discharge gauging stations used for the calibration/validation. Finally, I recommend making inlets, including the catchment maps, larger.

Technical Comments

Abstract; L16: "...the importance of choosing climate variables properly while selecting subsets..." instead of "...the importance of properly choosing climate variables in selecting subsets..."

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