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Discussions

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Interactive comment on "Climate change and its impacts on river discharge in two climate regions in China" *by* H. Xu and Y. Luo

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Anonymous Referee #1: We appreciate the Referee #1's comments and suggestions on our manuscript. Our responses are as follows. Comment 1: Uncertainty assessment is of utmost importance for climate impact studies. Current paper assesses the uncertainty caused by climatic scenarios, but has not given enough consideration on the uncertainty resulted from parameterization process of hydrological model. In section 2.2.1, it was pointed out Nash-Sutcliffe efficiency of SWAT model are only reached 0.44 and 0.57; 0.64 and 0.67 for two river basins for simulation of monthly runoff. Therefore, it was needed to take uncertainty from model performance into account.

Response 1: Thanks for this suggestion. There are difference sources for the uncertainties of climate change impacts on discharge lined to GCMs, emission scenarios, downscaling method, hydrological model structure, hydrological model parameters and the internal variability of the climate system. Generally, GCMs are considered to be the largest source of uncertainty for quantifying the impacts of climate revealed by several previous researches. Our manuscript is based on our previous publication which quantified uncertainties constrained by GCMs, emission scenarios and pre-described warming. In this manuscript, we would like focus on the greatest source of uncertainty from GCMs for difference catchments for three time horizon and in mean flow and extreme flow. Our experience working with decision maker suggested that it is better for decision making if each different source of uncertainty was done individually rather than in combination with each other. We would like to clearly state the reason why we just quantify the uncertainty constrained by GCMs in revised manuscript. Firstly, the hydrological model evaluation was based on the graphical techniques with hydrographs and percent exceedance probability curves for monthly time scale. The results showed a general visual agreement between observed and simulated discharge. Then, the evaluation was performed with the statistics included coefficient of determination (R2), and Nash-Sutcliffe efficiency (Ens). Model performance was evaluated as "satisfactory" if Ens > 0.50 and R2> 0.58 (Moriasi et al., 2007). The performance statics Ens and R2 are "satisfactory" except for River Xiangxi in the calibration period with 0.43 and 0.44 respectively. Anyway, the evaluation of hydrological model performance also depends on the project scope and magnitude. As mentioned above, our manuscript focus on the uncertainty constrained by GCMs for catchment located in difference climate region, so we didn't take uncertainty from model performance into account. Comment 2: With the deepening of our understanding on climate change and its possible triggers, emission scenarios have been updated several times, such as IS92, SRES, RCPS and SSPS. Current paper projects the possible changes of hydrological regime in two river basins based on SRES A1B for three time periods (2020s, 2050s and 2080s). My suggestion to authors is to update their research results by referring IPCC AR5 report.

Response 2: SRES scenario are based on assumptions about driving forces such

HESSD

12, C4616–C4618, 2015

as patterns of economic and population growth, technology development, and other factors. They assist in climate change analysis, including climate modelling and the assessment of impacts, adaptation, and mitigation. The RCPs are not a complete package of socioeconomic, emissions, and climate projections. They are consistent sets of projections of only the components of radiative forcing that are meant to serve as input for climate modelling. In this manuscript, we emphasis the heterogeneity of climate change and its impacts on annual and seasonal discharge, and the difference between mean flow and extreme flow in different climate regions in China. We think it is of utmost importance and relative to successful water management and climate change adaption in different catchments in China. We would like to clearly state the criteria used to select the climate scenario and datasets used in the study in the revised manuscript according the reason mentioned above.

Additionally, we have already quantified the uncertainty of climate change on river discharge for more catchments in China under RCP scenarios and CMIP5 datasets recently. Basically, the finding almost like the deduction of Referee J. Ngaina that there are no substantial difference in results about uncertainty under the RCP scenarios and CMIP5 datasets comparing with that presented and assessment in this manuscript. We have prepared a draft paper to update their research results by referring RCP scenarios and models of CMIP 6.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 12, 7099, 2015.