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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Assessment of extreme flows and uncertainty under climate change: disentangling the contribution of RCPs, GCMs and internal climate variability" *by* Chao Gao et al.

Anonymous Referee #1

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This manuscript aims to investigate the future changes of mean flows, high flows and low flows under climate change and, in particular, to quantify the contribution of three uncertainty sources from RCPs, GCMs and internal climate variability in these different flows. The innovative thing is that the internal climate variability is mainly reflected by using simulations of the stochastic rainfall model SDRM-MCREM developed by the authors. ANOVA is adapted to estimate the contributions all these uncertainties. The contents of this paper are therefore interesting and fall within the scope of HESS. Although there are no critical problems, there are a few issues that need to be considered and discussed before recommending this paper for publication. 1. Since the internal climate variability in this paper is represented by the simulations of SDRM-MCREM, whether

the contribution of internal climate variability to the total uncertainty is directly relevant with the performances of SDRM-MCREM? For example, in Figure 10, the contribution of internal climate variability in annual maximum 1-day flow for larger return periods is obviously larger than smaller return periods, whether this indicates the poor performance of SDRM-MCREM in simulating extremes? Please explain. 2. Another main usage of stochastic rainfall model is to downscale climate model outputs by adjusting parameters of stochastic rainfall models for climate change impact studies. The future GCMs rainfall data in this study are directly simulated by SDRM-MCREM using the bias corrected GCM future data rather than through downscaling by SDRM-MCREM. Can the authors explain why you conducted like this? 3. Obviously, there also exists uncertainty in the process of hydrological modelling. Why did your study only consider the uncertainty of RCPs, GCMs and internal climate variability and neglects the uncertainty of hydrological parameters that seems can be easily incorporated. Please explain.

Some other minor points to consider are listed below: L36. "responses of" <-> "responses to". L39. "the coupled system" – the atmosphere-ocean coupled system? Please make it clear. L48. "The relative importance" refers to what? Please make it clear. L124. "In this study, we used the distribution mapping (DM) method to correct GCM-simulated climate variable" – at this point in the text, some further explanation about why choosing the DM method is needed in the context. L129. Please check the correctness of Eq. (2). L189. "is" <-> "was". The tense of this paper in the method part is a bit confusing. Please check the whole paper and ensure proper use of the tense. L338. In this paper, when investigating the changes of high flows and low flows, the 5-, 10- and 20-year return periods are adopted. Why not use the larger return periods such 50-year and 100-year return periods that are more useful information for assessment of extreme hydrological events? L421. "account for approximately 54-60% on average" – Does this mean the proportion of the total uncertainty? Please make it clear.

In summary, the manuscript is well-structured, and the methods used and the results

are interesting and useful. I hope this manuscript can be accepted in publication in HESS after minor or moderate revision.

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