Responses to Reviewer 2

The authors feed a hydrological model implemented in the Yarlung Tsangpo-Brahmaputra River basin with climate projection provided by the CORDEX project. The CORDEX projections were simulated with regional climate models with grid-spacing of 0.44◦, were driven by some global climate projections, and are uncertain. The manuscript aims at reducing the impact of this uncertainty in runoff projections. Uncertainty reduction is tried with the application of bias reduction methods and by combining the different bias corrected projections using the Bayesian model averaging (BMA) method. The combination of methods and the brief review of existing studies in the area makes the manuscript potentially interesting, but there are substantial open questions left:

Response: We would like to express our sincere thanks to the anonymous reviewer for the insightful and detailed comments on our submitted manuscript. We have revised the manuscript thoroughly based on these comments, and address them below on a point-by-point basis.

(1) Daily simulation data from five regional climate models (RCMs) are used. The information about the driving global data is not given. Which global climate projections/models drive the RCMs? The GCMs are essential because the uncertainty chain is initiated at global scales already. If, for example, all five RCMs were driven by the same global projection, then the uncertainties are substantially underestimated. Additionally, application of BMA at daily basis needs temporal coincidence between simulations and observational reference data. Therefore, at least reanalysis-driven RCM simulations have to be applied.

Response: The Coordinated Regional climate Downscaling Experiment (CORDEX) for East Asia (Domain 7) contained 5 RCMs, which were HadGEM3-RA (denoted by RCM1), RegCM4 (RCM2), SNU-MM5 (RCM3), SNU-WRF (RCM4) and YSU-RSM (RCM5). We used them all in our research. All the RCMs were driven from the historical run of the Atmosphere-Ocean coupled Hadley Center Global Environmental Model version 2 (HadGEM2-AO) GCM simulation of the National Institute of Meteorological Research (NIMR) (Baek et al., 2013). Here we are not focused on the reproduction of the observed streamflow time series, but on the

climatology over a long-term period. RCM simulations driven reanalysis are not required here. Additionally, spatial and temporal coincidence between RCM simulations and WFD observational reference data has been accomplished. Climate model integrations were interpolated to the grid of the WFD using the bilinear interpolation method. Temporal resolution of RCMs and WFD were all at daily scale. Thanks!

(2) The data used in the three bias correction methods are not seasonally stratified. This lack of stratification is on one hand sub-optimal as the authors found seasonally dependent biases (which is not surprising given the different precipitation generating mechanisms in winter and during the monsoon period). On the other hand, the sample size of precipitation days in non-monsoon seasons is limiting the quality of bias correction methods (Dobler and Ahrens, 2008). Figure 6, bottom row, illustrates this bias correction challenge very well: the non-corrected RCM5 provides much better input into the rainfall-runoff model than the with bias correction. Also, the other panels show bias correction difficulties. There is a tendency that corrected input yields a change of sign in bias from non-monsoonal to monsoonal periods. Therefore, the question is if bias correction introduces systematic errors into the precipitation and temperature data and what can justify the application of bias correction in this basin for future projections?

Response: We cannot agree with this too much because there is clear evidence that native simulations substantially overestimate streamflow in dry seasons, but perform reasonably well for streamflow in wet season. The opposite tendency is found for bias corrected simulations. As a consequence, simulations with and without bias correction seemly have comparable performance. Considering that the THREW model underestimate high flows (Figure 5), the good performance of native simulations in reproducing wet season streamflow is very likely a result of the offsets of two errors. Under this case, one should not say that bias correction does not work. What's more, the value of bias correction for assessing the impacts of climate change on water resources depends to certain extent on the adopted impact models. In our study, the projected streamflow is 1466 mm/a during 2020-2035 under RCP8.5 at Bahadurabad, which is substantially higher than the findings of Masood et al. (2015) at the same location, which is 1244 mm per year during 2015-2039 under RCP8.5. The projected streamflow is 692 mm per year during 2020-2035 under RCP8.5 at the upper YBR outlet. This result is quite close to the

findings of Lutz et al. (2014), which is 727 mm per year during 2041-2050 under RCP8.5. Bias correction is implemented for the whole study period but not separately for each season or month. Our data series is too short to separate for each season or month, which will cause higher level of uncertainty because of insufficiency of sample size. Thanks!

(3) I like the idea of an optimal combination of projections. I am skeptical that BMA is the best choice and this should be investigated much more in depth as a selling point of this manuscript. First of all, it would be an add-on to include the output of the driving global models in the multi-model ensemble (enlarge the ensemble and at the same time show the added value of RCMs). However, BMA needs coincidence in time, and thus the weights of global climate projections cannot be estimated. Second, the bias-corrected output still has a bias (see above). Bias hinders the application of BMA. Third, there are much simpler and more robust methods (like equal weighting or weighting with some simple skill measure which does not need coincidence, e.g. Casanova and Ahrens (2009)).

Response: It is true that regional climate simulations are not designed to reproduce the time series of the observations but the climatology. We will do this work in the revised manuscript. Thanks!

(4) In general, the data and methods applied should be described much more apprehensively and esp. the weighting method also in more depth. Some parts of the text and figures are not easy to follow. For example, Fig. 11 is very confusing: what RCP, what period, what basin, what author? I also suggest doing much more literature research: what is done in other basins and even for the Yarlung Tsangpo-Brahmaputra River there is more literature to be considered.

Response: The revised manuscript will give expressions to the Reviewer's suggestions. What's more, we will do more literature, like Su et al. (2016) and Warwade et al. (2017), for the Yarlung Tsangpo-Brahmaputra River Basin. Thanks!

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