

## ***Interactive comment on “Projected Climate Change Impacts on Future Streamflow of the Yarlung Tsangpo-Brahmaputra River” by Ran Xu et al.***

### **Anonymous Referee #2**

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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  $0.44^\circ$ , 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:

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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.

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 & 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?

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

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or weighting with some simple skill measure which does not need coincidence, e.g., Casanova and Ahrens 2009).

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.

Casanova, S., B. Ahrens (2009). On the weighting of multi-model ensembles in seasonal and short-range weather forecasting. *Mon. Wea. Rev.*, 137, 3811-3822, DOI: 10.1175/2009MWR2893.1

Dobler, A., B. Ahrens (2008). Precipitation by a regional climate model and bias correction in Europe and South-Asia. *Meteorol. Zeitschrift*, 17(4), 499-509. DOI: 10.1127/0941-2948/2008/0306

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