

Response to anonymous reviewer #2

Overall comment:

This manuscript provides a detailed analysis of runoff components and future streamflow projections in the Yarlung Tsangpo River (YTR) basin using a multi-data-constrained cryospheric-hydrological model. The study successfully integrates multiple observational datasets to validate the model, which enhances the reliability of hydrological simulations in a region with complex cryospheric processes. The findings indicate that snowmelt and glacier melt contribute relatively little to the total streamflow compared to previous studies. Here are some suggestions.

Response:

Thank you very much for your high evaluation on our manuscript and the constructive suggestions. We will revise the manuscript thoroughly according to your suggestions.

Comment 1:

The introduction of this study is too general. It is recommended to carefully review existing literature on runoff changes and model simulations in the Yarlung Tsangpo River basin and identify the gaps. After reading through the manuscript, I believe the highlight of this paper is the use of multiple datasets and objective functions to calibrate the model and the comparison of runoff and its component changes under different scenarios.

Response:

Thanks for your suggestion and pointing out the highlight of our study. Actually, there have been many studies on the runoff changes and model simulations in the YTR basin, but there are still inconsistent results among various studies, which are related to differences in hydrological models, data, and analysis methods used, and the understanding and discussion of such differences are not sufficient. Our research provided results with reduced uncertainty by using multiple datasets to constrain the model and other methods, and conducted a detailed analysis on the reason for the differences in the studies on this topic. We will further review the relevant literature and clarify the highlights of our study based on the gaps now. We will add these in the revised manuscript.

Comment 2:

The description of the model section in the manuscript is too brief. Please provide a more detailed explanation of how the model represents glaciers and snow cover, and clearly define the terms snowmelt runoff and glacier runoff.

Response:

Thanks for your suggestion. In the THREW model, the degree-day method was used to simulate snow and glacier melting, assuming that snow and glaciers melt at different rates (i.e., different degree-day factors), and relevant parameters including temperature thresholds were calibrated. The terms snowmelt and glacier melt refer to meltwater from snow and glaciers, which enters the catchment and drives runoff generation processes without having undergone evaporation. We will add more introduction of the calculation module of the model and clarify the definition of the terms snowmelt runoff and glacier runoff in the revised manuscript.

Comment 3:

In the Data and Methods section, please elaborate on how the future meteorological data were bias-

corrected.

Response:

Thanks for your suggestion. We used the bilinear interpolation method to obtain the GCMs data (from 1960 to 2100) from different spatial resolutions to the same resolution (0.1° grid). Then we used the bias correction method (MBCn algorithm), took the reanalysis meteorological data (CMFD for precipitation and ERA5_Land for temperature) as reference values, and selected 1979-2009 as the correction period and 2010-2018 as the validation period to correct the GCMs data. We will add more introduction about the bias-correction methods for the future meteorological data in the revised manuscript.

Comment 4:

Please add a discussion section to explore the impact of uncertainties in the historical and future meteorological data used in this study on the model simulations.

Response:

Thanks for your suggestion. Indeed, the historical and future meteorological data can have some impact on the uncertainty of model simulations, but this is not the main focus of our study. For now we show the uncertainty bands produced by different GCMs in the figure of streamflow projection results and we will consider adding more discussion about it in revised manuscript.