The study uses the VIC-Glacier hydrological model to examine historical and future runoff changes across six sub-basins, highlighting significant differences in rainfall, snowmelt, and glacier runoff contributions. The findings provide critical insights for water resource management and adaptation strategies in this important region. The manuscript is well-organized and provides a comprehensive analysis of research question. I believe the manuscript is suitable for publication on HESS after some minor revisions.

Reply:

Thanks for the comments. At the same time, we have carefully addressed the reviewer's comments point-by-point in the revision.

1. The manuscript will benefit from a more detailed introduction to the forcing data and the accuracy of the datasets from the authors' previous studies. Especially, how snowfall is estimated and whether the undercatch is corrected.

Reply:

Thanks for the comments. We have added more details about forcing data in the revised version.

"The daily precipitation data with a spatial resolution of 10×10 km for 1961–2020 was reconsructed by correcting gridded estimates from the ERA5 precipitation of the European Centre for Medium-Range Weather Forecasts (ECMWF) based on 580 rain gauges in the monsoon-dominated TP region (290 rain gauges in the YZ basin, Figure 1) and the Random Forest-based (RF) machine learning algorithm (Sun et al., 2022). Inputs of the RF algorithm selected in this study include: 1) geographical features (e.g., longitude, latitude, elevation, slope gradient and aspect), which influence precipitation distribution, and 2) climatic features derived from the ERA5 (e.g., convective available

potential energy, lifting condensation level, and total column water vapor), which represent the potential for the generation and development of precipitation. The corrected precipitation data set was evaluated at a point scale by comparing it with gauge observations, and has been inversely evaluated by the hydrological model, which demonstrates its suitability for hydrological simulation (Sun et al., 2022)."

The daily precipitation records from 150 meteorological stations inside China for 1961–2016 were collected from the China Meteorological Administration (CMA, http://data.cma. cn/), and extra monthly observations from 118 meteorological stations outside China are collected from the Global Historical Climatology Network (GHCN, https://www.ncdc.noaa. gov/ghcn-monthly) for 2005–2013. In addition, monthly precipitation data for 2014–2016 from 312 rain gauges in the southeastern TP were collected from the governmental hydrometeorological agencies. These obtained gauge estimates have undergone quality control procedures to preprocess (validated, corrected, or removed) erroneous data (e.g., daily precipitation values less than 0 mm, and undercatch), and only monthly records that are derived from at least 3 years of consecutive observation are used in this study. We have made this point clear in the Sun et al. (2022).

Reference:

Sun, H., Yao, T., Su, F., He, Z., Tang, G., Li, N., et al., 2022. Corrected ERA5 precipitation by machine learning significantly improved flow simulations for the Third Pole basins. J. Hydrometeorol. 23. https://doi.org/10.1175/JHM-D-22-0015.1.

2. I suggest adding more discussions about the generalizability of the methods, results, and conclusions in this study.

Reply:

We have added more discussions about methods, results, and conclusions in the revision.

3. Please discuss the potential impact of land cover and land use change on the conclusions in this study.

Reply:

Thanks for the comments.

"Liu et al. (2023) studied the effect of vegetation growth induced by climate change to runoff variation during 1981–2010 in the YZ basin with the Variable Infiltration Capacity (VIC) model, suggesting that implanting grassland effectively reduces flash flood runoff in the short term and balances groundwater runoff in the long term. Broad-leaved and coniferous forests, with their longer growth cycles, also play a key role in adjusting soil moisture. Ji et al. (2023) explored the effect of vegetation growth on runoff changes in the YZ basin by computing the functional equation for the Normalized Difference Vegetation Index (NDVI) and Budyko parameter, suggesting that the NDVI and discharge both presented an increasing trend, and the contributions of NDVI on streamflow change in the 1998–2015 were about 43.04%."

References:

Liu, X., Lu, H., Yang, K., Xu, Z., Wang, J. 2023. Responses of runoff processes to vegetation dynamics during 1981–2010 in the Yarlung Zangbo River basin. Journal of Hydrology: Regional Studies, 50, 101553.

Ji, G., Yue, S., Zhang, J., Huang, J., Guo, Y., Chen, W. 2023. Assessing the impact of vegetation variation, climate and human factors on the streamflow variation of yarlung

zangbo river with the corrected budyko equation. Forests, 14(7), 1312.

4. Section 5.2 provides very general implications. I wonder whether this part is necessary since the water management recommendations are just loosely and conceptually linked to the findings in this study.

Reply:

Thanks for the comments. We have deleted Section 5.2 in the revision.

5. Please add more details in the "Data availability" section.

Reply:

"Daily precipitation, maximum and minimum temperature, and wind speed estimates with a spatial resolution of 10×10 km during 1971–2100 were adopted from Sun et al. (2022), and were downloaded from the National Tibetan Plateau/Third Pole Environment Data Center (TPDC, https://doi.org/10.11888/Atmos.tpdc.272885). Daily transient climate estimates, at a spatial resolution of 10×10 km for 1971–2100 under 20 scenarios (10 GCMs × 2 SSPs) used in this study were from Sun et al. (2024). Observed streamflow was from the Ministry of Water Resources, China. Two shapefiles of glacier inventory were downloaded from the "Environment & Ecological Science Data Center for west China" (http://westdc.westgis.ac.cn/glacier) and Randolph Glacier Inventory (RGI) 6.0 (https://www.glims.org/RGI/rgi60_dl.html). Observed annual glacier mass balance data from Gurenhekou and Parlung No.94 glacier sites since 2005 were downloaded from the TPDC. The snow cover fraction (SCF) estimates during 2006–2018 were form the Moderate Resolution Imaging Spectroradiometer (MODIS) 10CM (https://nsidc.org/ data)." We have added it in the revision.