Reply to Reviewers' comments (Reviewer#2)

Legend

Reviewers' comments

Authors' responses

Direct quotes from the revised manuscript

We thank the reviewer for his/her time in reading our manuscript and detailed comments on our manuscript. Point-by-point replies to the comments or suggestions made can be found below.

Reviewer #2: The paper addresses a critical aspect of water cycle analysis by developing a water-balance based global ET dataset. It assesses uncertainties of multiple open access datasets on precipitation, runoff and storage change and performs water balance analysis on their combinations to derive ET by major river basin. This ET data is then compared with four auxiliary datasets developed through different methods.

Response: We thank the reviewer for his/her time in reviewing our manuscript, providing comprehensive suggestions for improvement, and recognizing the potential for publication of the ET-WB dataset.
Revisions for texts and datasets have been made in the new version, as suggested. Please find our specific response to your comments below.

The input data, methods and results are described in details and presented in clear and well-structured way. The dataset is only provided in MATLAB proprietary format, which may limit its accessibility.

Response: We thank the reviewer for the valuable suggestion. We have re-processed the ET-WB dataset in spatially distributed formats like NetCDF （nc） and ArcGIS shapefile （shp）formats and provide the geospatial database of global river basins and global land considered in our study. So now there are a total of three formats available for ET-WB (i.e., nc, shp, and mat). The updated link for this data is: https://zenodo.org/record/8151534

Specific comments:

(1) Data redundancy and circularity implications could be discussed. For example, runoff models are likely calibrated on GRDC archive, which is also directly used as input data;

Response: We thank you very much for the suggestion. We have added a discussion about the redundancy and circularity implications in the new version as below:
Another potential source of uncertainty is the redundant use of specific variables among datasets. For example, the G-RUN ENSEMBLE dataset also applies the station discharge from the GRDC archive. Such circular application of GRDC discharge in comparison with G-RUN might overestimate its true performance, and a similar situation may occur in the resulting ET-WB as the in-situ discharge also serves as its direct input.

(2) While results are also presented geographically in the paper, the output dataset is only distributed as matrix in mat file. Providing access to the dataset in different formats, including spatially distributed formats, would probably increase its usability;

Response: As suggested, we have re-distributed the ET-WB dataset into three different formats, including the widely used NetCDF format （nc）, ArcGIS-friendly shapefile format (shp), and the

original matrix format (Mat), of which the former two are specially designed for geographical applications. The updated link for ET-WB is: https://zenodo.org/record/8151534

(3) The temporal extent of datasets used in the study (Table 1) could be explained. For example, the auxiliary ET datasets are used over a shorter temporal span without a clear justification;

Response: We have added explanations for the inconsistent spatial and temporal resolutions among datasets (e.g., water balance factors and auxiliary ET products) in the Data Section and the caption of Table 1 as below. Please note that Table 1 has been moved into the supplementary file according to the *Specific Comment #7* from Reviewer 1.

Table 1 (Table S3 in the revised manuscript) Caption:

Various datasets with different spatial resolutions are processed as area-averaged values over 168 river basins worldwide and global land for spatial consistency. For convenience in calculations, all the constituent water balance variables for calculating ET-WB are necessarily extended to the study period 2003-2021, with the missing months (temporally not covered) replaced with NaN values. However, only the overlapping period between ET-WB and four auxiliary ET products are extracted for comparisons, i.e., 02-14 for MODIS, 02-15 for FLUXCOM, 02-21 for GLEAM, and 02-16 for WGHM, respectively.

(4) Line 252, CHIRPS data is a combination of remote sensing and stations data, should it be considered as a combined product?

Response: Thank you very much for the comment. As indicated by the reviewer, the CHIRPS algorithm incorporates remote sensing and stations data. However, it is basically built on the long-lasting infrared satellite Cold Cloud Duration (CCD) observations (Funk et al., 2015). The stations data are only merged for post-processing, including bias-correction and spatial interpolation. Thereby, the CHIRPS precipitation database is classified as a satellite-based dataset in our study, unlike other combined products that equally apply the multi-source precipitation data from reanalysis, in-situ stations, and satellites (e.g., MSWEP).

Reference:

Funk, C., Peterson, P., Landsfeld, M. et al. The climate hazards infrared precipitation with stations-a new environmental record for monitoring extremes. Sci Data 2, 150066 (2015). https://doi.org/10.1038/sdata.2015.66

(5) Line 35, typo, "for" should read "four";

Response: Corrected in the new version.

(6) Line 96-97, consider rewording for better clarity.

Response: We have re-organized this sentence as suggested:

Previous studies used the water balance approach that either relies on single datasets (e.g., precipitation and/or runoff) (Gibson et al., 2019; Liu et al., 2016) or focuses on the regional scales (Castle et al., 2016; Pascolini-Campbell et al., 2020; Rodell et al., 2004; 2011; Swann et al., 2017; Wan et al., 2015).