

Interactive comment on “Investigating basin-scale water budget dynamics in 18 rivers across Tibetan Plateau through multiple datasets” by Wenbin Liu et al.

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Responses to review comments (Anonymous Referee 1)

General comments: This manuscript investigates the seasonal cycles and trends of water budgets over 18 river basins in the Tibetan Plateau using a wide range of datasets from satellite-observed, land-surface-models simulated, reanalysis and upscaled results of in-situ observations. Prior to seeking the general hydrological features over 18 basins under the Budyko framework, they first assessed the accuracy of six ET products using the water-balance-method derived ET values. They also found that P, Q and ET generally increased in past 30 years in most basins, demonstrating an

C1

overall moistening trend in TP. While a quantitative illustrating the uncertainties in the results is very difficult due to the lack of in-situ observation over this remote area, the authors indeed documented the possible uncertainties in the selected datasets, providing a helpful clue for future research. In my view, this MS describes interesting results, which contributes to advancing our understanding of the hydrological cycle regime over such a hydro-meteorologically important but sparsely-instrumental area. Overall, the MS is nicely structured and presented, and is of a topic that should be of interest to the readers of HESS. I think it is publishable after addressing the comments below. My recommendation is minor revision.

Thanks for the invaluable comments. We have revised the manuscript accordingly (please see the point-to-point responses below) based on your suggestions.

Major comments: I think some analyses over the westly-controlled basins need to be revised because of its special climate patterns compared to other basins. L356-357: “more snow melt contributions” may be due to its special seasonality of precipitation in the westlies-controlled basins rather than its “colder” status.

Thanks for the nice suggestions. We totally agree with you. We have revised the analyses in the westlies-controlled basins as follows (Line 350-354 in the new version), “...For example, in the westerlies-controlled basins, more glaciers developed due to their relatively colder air temperature and special seasonality of precipitation. Therefore, there are more snow melt contributions to total river streamflow with global warming during the period 1983-2006...”.

By the way, could you show the annual mean temperature for each basin in Figure 6 to support they are indeed “colder”?

Actually, the annual mean temperature for each basin has been exhibited in Table 1. It showed that the basin-averaged air temperature in the westlies-controlled basins were relatively colder than that in other monsoon-dominated basins.

C2

Also, I think the (limited) water availability plays a more important role than the heat stress (i.e. colder status) in leading to a relatively less vegetation over such basins. From Figure 4 c and d, it appears that R2 between ET and NDVI (0.76) is much higher than that between T and NDVI (0.35).

We agree that, thanks. In the revised version, we have revised the related descriptions as follows (Line 338-347 in the new version), "...Overall, from the westerlies-dominant, Indian monsoon-dominant to East Asian monsoon-dominant basins, the annual mean air temperature (-5.68 0.97 oC) and ET (and thus runoff coefficient gradually decreases) increases while the multiyear mean glacier area (and thus the glacier melt normalized by precipitation) gradually decreases (Fig. 4 and Table 2). Moreover, the vegetation status (NDVI range: 0.05 0.43; LAI range: 0.03 0.83) tends to be better. The R2 between basin-averaged NDVI and ET (0.76) is much higher than that between T and NDVI (0.35), which indicates that the water availability plays a more important role than the heat stress (i.e., colder status) over such basins...".

Specific comments: L3: "river basins" may be more appropriate than "rivers"

We have revised the title of this manuscript for "Investigating water budget dynamics in 18 river basins across Tibetan Plateau through multiple datasets" based on the reviewer's suggestion. Thanks.

L67: Most stations are located only in eastern TP and few of them situated in the western part. It would be better if you can highlight such a challenge.

We have highlighted the unevenly distributed pattern in the revised version in Line 68-69 as follows, "...at relatively low elevation regions (most station are located in the eastern TP and few of them situated in the western parts)...".

L71: It seems that "snow depth" is recorded by these stations. I suggest deleting such a term.

Done! Thanks.

C3

L77: labor and/or technical support for maintaining in-situ observation is also a great challenge in addition to the high cost.

We have added these aspects into the sentence in the revised version in Line 77-78 as follows, "...the overall cost, labor and technical support for running the operational sites would be substantial...". Thank you very much.

L419: reword "attributed to the ascending P exceed the increase in PET" as "due to the higher rates of the increase of P than that of PET"

Based on the reviewer's suggestion, we have revised this sentence accordingly in the new version in Line 419-420 as follows, "...the PET/P declined due to the higher rates of the increase of P than that of PET".

L426: change "precipitation" to "rain"?

Changed! Thanks!

L463: The increase of PET/P may be consistent to the changes in moisture flux of TP, as illustrated by Gao et al. (2014). Reference: Gao, Y., Cuo, L., Zhang, Y. 2014. Changes in Moisture Flux over the Tibetan Plateau during 1979–2011 and Possible Mechanisms. J. Clim., doi: 10.1175/JCLI-D-13-00321.1

We totally agree with the reviewer. We have downloaded/read/cited this paper in the revised version as follows (Line 461-463). "...The increased PET/P in Brahmaputra River basin may be consistent with the drying moisture flux in the southeastern TP, as illustrated by Gao et al. (2014)..."

L553: change "; receded at some tributaries" to "with the exception of some tributaries of"

Changed!

L555: revise "a decrease trend" and change "corresponded" to "corresponds"

C4

Done!

L562: change “indicated” to “indicates”

Changed!

L567: delete “under global warming”

Done! Thanks!

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