Hydrology and
Earth System
Sciences
Discussions

Interactive comment on "Seasonal cycles and trends of water budget components in 18 river basins across Tibetan Plateau: a multiple datasets perspective" *by* Wenbin Liu et al.

Wenbin Liu et al.

liuwb@igsnrr.ac.cn

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Review Comments (Anonymous Referee #2): Short summary The paper presents a very interesting study, by which the authors investigated general water budgets and trends in water balance components in 18 river basins in the data-sparse Tibetan Plateau from the perspective of multi-sources datasets. In my opinion, it is a good attempt to understand the hydrological regimes in TP basins in the big data era. The manuscript is overall well-organized and should fall into the aims and scopes of HESS. I do not find major problems with this manuscript and recommend accepting it only after a few minor revisions.

Thank a lot for your invaluable comments/suggestions. We have revised the manuscript

accordingly (please see the point-to-point response below). Also, the following sentence was added in the acknowledgement section [Line 549-550 in the new version]: "We wish to thank the editors and reviewers for their invaluable comments and constructive suggestions to improve the quality of the manuscript".

Major Comments: In the methodology, I suggest to present more detail about "the modified MK method". You may think to add it as an appendix.

We totally agree with you. In the revised version, we have presented more details for the MMK approach as follows [Line 291-306 in the new version], "...Pre-whitening is often used to eliminate the influence of lag-1 autocorrelation before the use of MK test, for example, in pre-whitening, the analyzed time series $(X_1, X_2, \ldots, X_n)$ will be replaced by $(X_2-cX_1, X_3-cX_2, \ldots, X_{(n+1)}-cX_n)$ if the lag-1 autocorrelation coefficient (c) is larger than 0.1 (von Storch, 1995). However, significant lag-i autocorrelation may still be detected after pre-whitening because only the lag-1 autocorrelation is considered in pre-whitening (Zhang et al., 2013). Moreover, it sometimes underestimate the trend for a given time series (Yue et al., 2002). Hamed and Rao (1998) proposed a modified version of MK test (MMK) to consider the lag-i autocorrelation and related robustness of the autocorrelation through the use of equivalent sample size, which has been widely used in previous studies during the last five decades (McVicar et al., 2012; Zhang et al., 2013; Liu and Sun, 2016). In the MMK approach, if the lag-i autocorrelation coefficients are significantly distinct from zero, the original variance of MK statistics will be replaced by the modified one. In this study, we used the MMK approach to quantify the trends of water budget components in18 TP basins and the significance of trend was tested at the >95% confidence level..."

Though an exhaustive literature review has been done. However, some recently published ones are missing, for example, Xiang et al. (2016); Dong et al. (2016).

Xiang, L., Wang, H., Steffen, H., Wu, P., Jia, L., Jiang, L., and Shen, Q.: Groundwater storage changes in the Tibetan Plateau and adjacent areas revealed from GRACE

satellite gravity data, Earth Planet Sc Lett, 449, 228-239, 2016.

Dong, W., Lin, Y., Wright, J. S., Ming, Y., Xie, Y., Wang, B., Luo, Y., Huang, W., Huang, J., Wang, L., Tian, L., Peng, Y., and Xu, F.: Summer rainfall over the southwestern Tibetan Plateau controlled by deep convection over the Indian subcontinent, Nature Communications, 7, 10925, 2016.

Thanks, we have downloaded/read/cited them at the proper places in the new version.

Details points: (1) Language: The language is clear. Throughout the manuscript, I suggest to add "the" before TP or Tibetan Plateau or other proper nouns. Please do check them.

We have double-checked and added "the" before TP, Tibetan Plateau or other proper nouns throughout the manuscript. Thank you very much.

(2) line 84: "locates" to "located"

Done!

(3) Line 131-137: Instead of describing the structure of this paper, you should indicate the aim/objective of this study.

Actually, we have indicated the objective of this study in Line 123-126 in the manuscript.

(4) Line 182: As the mean annual precipitation ranges from 128-717mm, the RMSE (8.34mm/month=100mm/year) seems not so "perfect". Please tone down this sentence.

We have revised this sentence as follows [Line 313-317 in the new version], thank you very much. "Moreover, the CMA precipitation is consistent with TRMM (Corr = 0.86, RMSE = 8.34 mm/month) and IGSNRR forcing (Corr = 0.94, RMSE = 7.15mm/month) precipitation for multiple basins (and also for the smallest basin above Tongren station, Fig.2), which reveals the applicably of CMA precipitation under the TP conditions."

(5) line 238, which interpolation method was used? Linear interpolation or others?

We used the bilinear interpolation. We have described the method in the revised version as follows to make it clearer [Line 222-224 in the new version]. "All gridded datasets used were first uniformly interpolated to a spatial resolution of 0.5 degree based on the bilinear interpolation to make their inter-comparison possible."

(6) line 263, what is the unit for MG? It should also be specified as P and Q.

The unit of MG is mm. We have specified it as P and Q in the new version.

(7) line 330, how did you classify the basins into westerlies-dominated, Indian monsoondominated and East Asian monsoon-dominated basins?

The basins were classified through the locations of the categorized climate zones (Tian et al. 2007; Yao et al., 2012) in which the basin rested. Actually, the boundaries of climate zones are not fixed with the monsoon strengthening/weakening and the extent of certain basin may sometimes not entirely rest in one climate zone. We thus just approximately classified them in order to generally link the basin-scale results to different climate regimes in this study.

References: Tian, L., Yao, T., MacClune, K., White, J.W.C.., Schilla, A., Vaughn, B., Vachon, R., and Ichiyanagi, K.: Stable isotopic variations in west China: a consideration of moisture sources, J. Geophys. Res. Atmos., 112, D10112, 2007. Yao, T.D., Thompson, L., Yang, W., Yu, W.S., Gao, Y., Guo, X.J., Yang, X.X., Duan, K.Q., Zhao, H.B., Xu, B.Q., Pu, J.C., Lu, A.X., Xiang, Y., Kattel, D.B., and Joswiak, D.: Different glacier status with atmospheric circulations in Tibetan Plateau and surroundings, Nat. Clim. Change, 2, 1-5, 2012.

(8) line 836, Unit of RMSE in Figure 3b should be added.

We have added the unit of RMSE (please see the Figure R2 in this file) in the revised version. Thank you very much.

(9) Figure 10, in the subplot for Xining station, the Q/P declined/increased or closed to zero?

Yes, the calculated trend equaled to zero. Say, the Q/P showed no trend at Xining station in Figure 10.

Figure R1. Comparison of different ET products against the calculated ET through the water balance (ETwb) for 18 river basins over the Tibetan Plateau. The boxplot of annual estimates of different ET products for 18 TP basins are shown in (a) while the correlation coefficients and root-mean-square-errors (RMSEs, mm/month) for each ET product relatively to ETwb are exhibited in (b).
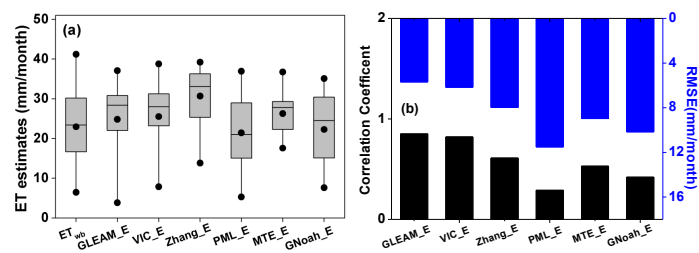

Fig. 1.