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Hydrology and Earth System Sciences Discussions

HESSD

Interactive comment

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.

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Review Comments (Anonymous Referee 1): Short summary Liu et al., presented an excellent study that investigates water cycle at Tibetan Plateau. Comparing multiple datasets (model derived product, satellite derived product, in situ observations) is challenging, because of scale mismatch, methodology inconsistency, data quality. Sometime, it's hard to extract consistent and insightful information from multiple datasets. But this study is doing quite good to this end. The major finding is that Tibetan Plateau is becoming wetter as the climate warming up, indicated by both model and data products. This is a high impact finding, which will potentially foster lots of discussion in terms of e.g., ecological consequences, soil biogeochemistry alteration, and green

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house gases (particularly CH_4 in TP region) emissions in response to the regional wetting.

Strengths First of all, the paper is well written. Data, method, results, evidences and literature supports are clearly presented. Secondly, the storyline is logistically consistent. Finally, the results are scientifically significant. I like this study very much. Below, I listed a few comments that might help to improve the presentation and results interpretation. But, overall, this study is a well done.

Thanks for your invaluable comments. We have revised the manuscript accordingly (please see the point-to-point responses below) based on your suggestions. The following sentence was also added in the acknowledgement section: “We wish to thank the editors and reviewers for their invaluable comments and constructive suggestions to improve the quality of the manuscript”. [Line 540-541 in the new version].

Weaknesses Major comments The trend of westerly, Indian monsoon and East Asian summer monsoon (Figure 9) seems not significant. At least, by visually checking, there is no positive trend at all. Is there a rigorous way (or statistical test) to show that the positive trend is detectable and statistically significant?

Thank you very much. We have also detected the non-parametric trends for the indices of westerly, Indian monsoon and East Asian summer monsoon by modified Mann-Kendall test in the revised version based on the reviewer’s suggestion (Figure 9 in the new version and Figure R1 in this file). However, the trends for the indices of Asian Zonal Circulation Index and East Asian Summer Monsoon Index were still insignificant. The true trends may be very small (or unchanged) during only the 30 years. Actually, by using these indices, we only want to see the variability of the Indian summer monsoon (not focus on if the trend is significant or not), the westerly and the East Asian summer monsoon and then try to relate to the trends in water balance components in 18 TP rivers. The insignificant trends are also true just like the changes of some water balance components are insignificant as well in such a relatively short period.

As climate warming, we expect to see more water coming from glacier-melt. As a result, the contribution of glacier-melt to discharge might go up. While in the Table 3, they are fixed numbers, which may bias the estimate of ET (eqn. 2). I guess to estimate the change of “contribution of glacier-melt to discharge” is technically difficult. But at least, the paper should discuss the uncertainty associated with this particular issue.

We totally agree with you. Accurate quantification of the contribution of glacier-melt to discharge is very difficult, especially for multi-basins. We have discussed the uncertainty associated with this particular issue in the new version, as suggested by the reviewer, as follows [Line 470-476 in the new version], “. . .we obtained the contributions of glacier-melt to discharge in some basins from the literatures and took them as fixed numbers. It may inherit considerable uncertainty from varied studies using different approaches such as glacier mass-balance observation, isotope observation and hydrological modeling, and the contribution rates would also change under a warming climate. However, accurate quantification of the contribution of glacier-melt to discharge is technically difficult nowadays, especially for the data-sparse basins...”.

Specific comments L35. Insights -> dynamics L37 land surface water cycle L38 list the components, e.g., precipitation, runoff : : :: : : L38 through the use of -> using L38 through the water balance -> remove L47 corresponded to -> consisten with

Revised, thanks!

L47 The general hydrological regimes : : : complex modeling approaches. Not sure need this sentence or not.

We have removed this sentence in the new version.

L55 environments -> regions L55 benefit -> beneficial L65 with ->, from which L67 , which -> It L85 to some extend -> remove L86 due to the lack of quantitative observations of the land surface processes -> remove L87 break -> overcome L88 point scale -> in situ L90 the harsh environment and is often difficult to be applied to -> remove

L91 more popular way -> workaround

Done!

L95-97 it is also limited : : : complex terrains. -> sentence change the active voice

We have revised this sentence as active voice as follows [Line 90-92 in the new version], "... it is still difficult to use land surface models to multiple basins especially to the relatively smaller ones under complex terrains due to the lack of adequate data for model calibration and validation..."

L99 In recent years, remove L100 have been released recently L156 used for water balance calculation for 18 TB basins, remove L164, which is -> This dataset is L176 used, remove L179 applied -> used L218 Two vegetation parameter datasets, remove L247 also, remove L258 traditionally, remove L272 concluded -> derived L273 existing studies -> literatures L284 for 18 basin, remove L315 monthly performances of, remove L315 in 18 TP basins against our calculated ET at a monthly basis. L316 which was calculate through : : : water storage change, remove L335 the perspective of, remove

Revised, thanks!

L148 Is it necessary to mention gauging station here? What's the purpose?

We totally agree with the reviewer. This sentence has been removed in the new version.

L169 The VIC$_{I}GSNRR$ :::::: $isabove0.65.belongstoresultsection.L182TheCMAprecipitation$ ::: $TPconditions.Belongstoresultsection$

We have removed them to the results section as suggested by the reviewer [Line 299-308 in the new version], thanks.

L344 The figure also shows a clear vegetation control on ET. higher ENVI -> higher ET. The R2 is highest among those linear regressions.

We totally agree with you. We have detailed explained this phenomenon in the re-

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vised version as follows [Line 337-340 in the new version]: "...The R2 between basin-averaged NDVI and ET is 0.76 which shows a clear vegetation control on ET in 18 TP basins. The result is in line with Shen et al. (2015), which indicated that the spatial pattern of ET trend was significantly and positively correlated with NDVI trend over TP..."

L404 dryness declined in all basins. This is one of the most significant findings of this study, I guess it warrant more discussion about implications?

We have added more discussions for this finding in the new version as follows [Line 400-405 in the new version]: "...Although P and PET were found both increase since the 1980s (Shi et al., 2003; Yao et al., 2014), the declined PET/P is, to some extent, attributed to the ascending P exceed the increase in PET for these basins (except for the Yulongkashi basin). The climate moistening in the headwaters of these inland rivers would be beneficial to the water resources and oasis agro-ecosystems in the middle and lower basins....".

L308 Did you use the same method (MM) to quantify the the trend of westerly, Indian monsoon and East Asian summer monsoon (Figure 9)? L408. Linear trend 0.21. Is this trend statistically significant? What's the p value?

Thanks, we have also detected the non-parametric trends for the indices of westerly, Indian monsoon and East Asian summer monsoon by modified Mann-Kendall test in the revised version. Also, we have revised this Figure (Figure R1 in this file) by adding both the linear and non-parametric trends as well as their corresponding P-values. However, the trends for the indices of Asian zonal circulation index and East Asian summer monsoon index were still insignificant. The true trends may be very small (or unchanged) during only the 30 years. Actually, by using these indices, we only want to see the variability of the Indian summer monsoon (not focus on if the trend is significant or not), the westerly and the East Asian summer monsoon and then try to relate to the trends in water balance components in 18 TP rivers. The insignificant trends are also true just like the changes of some water balance components are insignificant as well in such a relatively short period.

Linear thrend is 0.0006, which is tiny.

We have recalculated the linear trend at the annual time scale in the revised version and also redrawn the figures (Figure R1 in this file). The linear and non-parametric trends are both 0.01. The linear trend is insignificant while the non-parametric trend is significant at the 0.05 level. âĂČ

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Figure R1. Linear and non-parametric trends of westerly, Indian monsoon and East Asian summer monsoon during the period 1982-2011 revealed prospectively by the Asian Zonal Circulation Index, Indian Ocean Dipole Mode Index and East Asian Summer Monsoon Index.

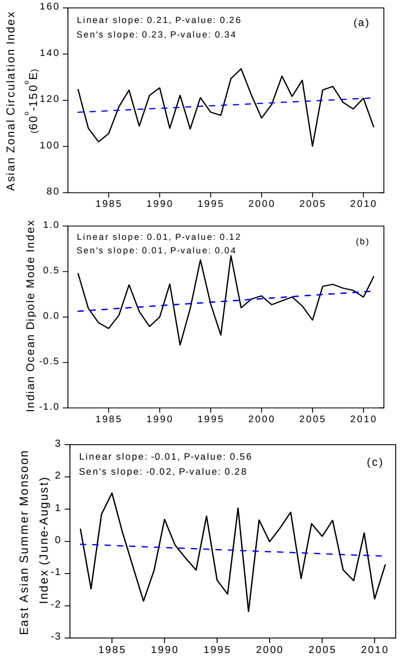

Fig. 1. Figure R1