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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Evaluating the streamflow simulation capability of PERSIANN-CDR daily rainfall products in two river basins on the Tibetan Plateau" *by* Xiaomang Liu et al.

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Because this Reviewer's Short Comment is extremely in-line with Anonymous Referee #1's comments, in this authors' reply to comment, we replied both Reviewer #1 and Reviewer #2's Short Comment in details with the revised manuscript attached as supplement material.

In our revised manuscript (see supplement material), Blue Contents are the changes made to our original submission according to Reviewer #1 and Reviewer #2's comments.

The following are our replies to both Reviewer #1 and Reviewer #2:

Referee#1: (1) We can get limited knowledge if only one precipitation product is investigated. Considering the special length of precipitation datasets, suggest adding a similar one, the Global Land Data Assimilation System (GLDAS) precipitation for comparision. You may read (but not limited to) the following papers as a reference. Gottschalck et al. (2005), J. Gottschalck, J. Meng, M. Rodell, P. Houser, Analysis of multiple precipitation products and preliminary assessment of their impact on global land data assimilation system land surface states, J. Hydrometeorol., 6 (2005), pp. 573–598 Wang et al. (2011), Evaluation and application of a fine resolution global data set in a semiarid mesoscale river basin with a distributed biosphere hydrological model, J. Geophys. Res., 116, D21108.

Answer: Thank you for the comments. Following your suggestion, we have added the GLDAS precipitation to compare with gauge observation and satellite product. In the revised manuscript, ground-based precipitation, GLDAS precipitation and PERSIANN-CDR precipitation are used as the inputs of HIMS hydrologic model for streamflow simulation in the two river basins over TP. All the figures, tables and descriptions have been updated to the three precipitation datasets. Generally, GLDAS and PERSIANN-CDR precipitation have a good consistency. Please see the revised manuscript for detail. See blue texts in the revised manuscript Introduction, Methodology and Reference Section.

(2) Having better spatial distributions is a big merit of satellite-based precipitation product, comparing to the sparse ground-based observational sites over the Tibetan Plateau. Suggest adding the Figures of precipitation in their spatial distributions if possible.

Answer: Thank you for your suggestion. We have added the spatial distribution of the GLDAS precipitation and PERSIANN-CDR precipitation in the revised manuscript. Please see the new Figure 3 and corresponding texts for details.

(3) It is hard to compare the hydrological model's performance with only the basin integrated streamflows. Suggest adding the comparisons of simulated evapotranspirations (ET) as well, to confirm the improvements of internal processes besides the final discharge outputs. For the ET estimation over the two river basins, suggest reading (but not limited to) the following papers: Zhang, Y. et al. (2007), Trends in pan evaporation and reference and actual evapotranspiration across the Tibetan Plateau, J. Geophys. Res., 112, D12110. Xue et al. (2013), Evaluation of evapotranspiration estimates for two river basins in Tibetan Plateau by a water balance method, Journal of Hydrology, 492, 290-297. Li et al. (2014), Seasonal evapotranspiration changes (1983–2006) of four large basins on the Tibetan Plateau, J. Geophys. Res. Atmos., 119, 13079–13095.

Answer: Thank you for your suggestion. We totally agree that adding evapotranspiration (ET) comparisons can be a good supplement to verify hydrological model's performance. The following figure shows the simulated ET from ground-based precipitation, GLDAS precipitation and PERSIANN-CDR precipitation by HIMS hydrological model and different ET products from Jung (2010), Zhang K. et al. (2010) and Penman-Mentieth-Leuning (Leuning et al., 2008; Zhang Y. et al., 2016). We tried to compare and judge the different ET estimations, but we find that we maybe do not have a reliable reference for ET comparisons, because large-scale ET cannot be measured directly. Generally, large-scale ET estimated by water balance equation is a good reference. However, rainfall gauge information is limited in the TP as we mentioned in the manuscript, and we cannot use the limited ground-based precipitation to calculate basin reference ET based on water balance equation. Similar philosophy applies to other data-sources of precipitation. In other words, we can either use GLDAS precipitation nor PERSIANN-CDR precipitation to calculate basin reference ET based on water balance equation, because it would be unfair to compare these ET values with ET simulation from ground-based precipitation by HIMS hydrologic model. The purposes of this manuscript are to evaluate the streamflow simulation capability of PERSIANN-CDR daily rainfall product. Therefore, we prefer to not present the ET results in the manuscript to avoid using any non-reliable ET estimation as reference to evaluate any

precipitation products. Readers who are interested in the ET simulation can see the following figure, since all the discussion processes are permanently stored online of HESS Journal. Generally, the following figure shows that the simulated ET from the three precipitation datasets by HIMS model have better consistency in the upper Yellow River basin than in the upper Yangtze River basin. ET from Jung (2010) and PML (Leuning et al., 2008; Zhang Y. et al., 2016) are significantly smaller than ET simulated by the three precipitation based on HIMS model.

<HERE Insert Reply to Comment Fig.1>

Jung M, Reichstein M, Ciais P, et al. Recent decline in the global land evapotranspiration trend due to limited moisture supply. Nature, 2010, 467(7318): 951-954. Zhang K, Kimball J S, Nemani R R, et al. A continuous satelliteâĂŘderived global record of land surface evapotranspiration from 1983 to 2006. Water Resources Research, 2010, 46(9). Leuning R, Zhang Y Q, Rajaud A, et al. A simple surface conductance model to estimate regional evaporation using MODIS leaf area index and the PenmanâĂŘMonteith equation[J]. Water Resources Research, 2008, 44(10). Zhang Y, Peña-Arancibia J L, McVicar T R, et al. Multi-decadal trends in global terrestrial evapotranspiration and its components. Scientific reports, 2016, 6.

(4) Lack of frozen soil parametrization in HIMS may largely affect the simulated seasonal variation of water balance components (e.g., streamflow and evapotranspiration). It may bring certain uncertainties in the discharge comparisons by different precipitation inputs. To address the modelling issue may be out of the scope of this paper, but you can discuss the limitations/uncertainties in the "Summary" section.

Answer: Thank you for your suggestion. We agree that lack of frozen soil parameterization in HIMS definitely will affect the simulated seasonal variation of water balance components. Actually, we find that all the three precipitation datasets generate smaller streamflow in dry season, which probably is due to the lack of proper algorithm in the HIMS model to handle frozen soil. We have added some discussions about the limitations of frozen soil simulation in the conclusion section in the revised manuscript. Please see line 516-521 of the revised manuscript for detail.

(5) Line 233: please add the name of two basins here.

Answer: Thank you for your suggestion. We have added the basin name in the revised manuscript. Please see line 260 of the revised manuscript.

(6) Line 252, "have similar values": please specify the values here.

Answer: Thank you for your suggestion. We have added the values in the revised manuscript. Please see line 262-266 of the revised manuscript.

(7) Line 450: change "are" to "is"; replace "completely" with a more suitable word.

Answer: Thank you for your suggestion. We have improved the grammar in the revised manuscript.

Reviewer #2:

In the manuscript, entitled “Evaluating the streamflow simulation capability of PERSIANN-CDR daily rainfall products in two river basins on the Tibet Plateau”, authors demonstrated an application study of a new satellite-based precipitation database and comparison with the precipitation from gauge-network. The study areas are on the Tibet Plateau and the gauge density is very sparse, which may not be a reliable data source for streamflow simulation and water resources management. The philosophy authors applies is to evaluate the streamflow simulation from both precipitation sources and compare the simulations with streamflow gauge observation, which is believed to be more reliable than rain-gauges with regard to data length, accuracy, and continuity. The experiments are well designed and conducted, and the manuscript reads well. The following comments are suggested for author’s consideration. The previous reviewer #1 made a couple suggestive comments and I agree with most of the comments by reviewer #1. In details, (i) a comparison can be added to further strengthen the comparison. (ii) the evaporation simulation can also serve as the same logic to support

authors’ arguments. After all, the streamflow and evaporation are two of the major components of water cycle. The hydrological model should be able to provide such information. (iii) In author’s reply to reviewer #1, authors also agree to provide the evaporation simulation/comparison in the revised manuscript. I am also interested to see the simulation results and comparison with other data sources.

Answer: Thank you for your suggestions. Your comments are in-line with Reviewer #1, and please refer our reply to Reviewer #1 for details. With respect to your three comments, the detailed responses are lists as follow: As our answers to first referee’s comment, GLDAS precipitation has been added to compare with gauge information and PERSIANN-CDR precipitation. In addition, the spatial distribution is added to let readers have a vivid impression on two precipitation datasets. The following figure shows the simulated ET from ground-based precipitation, GLDAS precipitation and PERSIANN-CDR precipitation by HIMS hydrological model and different ET products from Jung (2010), Zhang K. et al. (2010) and Penman-Mentieth-Leuning (Leuning et al., 2008; Zhang Y. et al., 2016). Readers who are interested in the ET simulation can see the following figure, since all the discussion processes are permanently stored online of HESS Journal. Generally, the following figure shows that the simulated ET from the three precipitation datasets by HIMS model have better consistency in the upper Yellow River basin than in the upper Yangtze River basin. ET from Jung (2010) and PML (Leuning et al., 2008; Zhang Y. et al., 2016) are significantly smaller than ET simulated by the three precipitation based on HIMS model. More discussion about ET simulation please refer our reply to comments of referee #1, and also the corresponding contents in the revised manuscript. We sincerely thank the reviewer’s suggestive comment. The revised manuscript should be more satisfying.

<HERE Also Insert Reply to Comment Fig.1>

Jung M, Reichstein M, Ciais P, et al. Recent decline in the global land evapotranspiration trend due to limited moisture supply. Nature, 2010, 467(7318): 951-954. Zhang K, Kimball J S, Nemani R R, et al. A continuous satelliteâĂŘderived global record of

land surface evapotranspiration from 1983 to 2006. Water Resources Research, 2010, 46(9). Leuning R, Zhang Y Q, Rajaud A, et al. A simple surface conductance model to estimate regional evaporation using MODIS leaf area index and the PenmanâĂŘMonteith equation[J]. Water Resources Research, 2008, 44(10). Zhang Y, Peña-Arancibia J L, McVicar T R, et al. Multi-decadal trends in global terrestrial evapotranspiration and its components. Scientific reports, 2016, 6.

Is there a diagram or figure to illustrate the flow chart/conceptual configuration of the used HIMS hydrological model? By only reading text, reviewer finds it not intuitive on the model configuration.

Answer: Thank you for your suggestion. We have added the conceptual configuration of the used HIMS hydrological model. Please see line 227.

In addition, the manuscript still has minor and few editing issues that should be fixed before publication. In details: 1. Line 208-209: should be "There are two stopping criteria used in the SCE-UA algorithm " Answer: Fixed

2. Line 212-213: suggest to add population size. Answer: Added

3. Line 231: there is an extra period. Answer: Deleted

4. Line 236: should be "the runoff coefficients are 0.29 for both PERSIANN-CDR and Gauge. . ." Answer: Fixed

5. Line 251: missing comma after "Aug." Answer: added

6. Line 254: missing "the" before "average annual amounts" Answer: added

7. Line 281: should be "two data sources". Basically, two datasets are same type as precipitation measures. Answer: Fixed

8. Line 301: replace "two basin" with specific names since it is the first sentence of a paragraph. Answer: Fixed

9. Line 360: there is an extra period Answer: Deleted

10. Line 360: should be "the bias between simulated and observed streamflow". Answer: Fixed

11. Line 411: do authors mean "partially"? Answer: Yes and Fixed

12. Line 413: replace "the calibration period" by "calibration" Answer: Fixed

13. Line 416: replace "flood and drought conditions" by "extreme conditions, such as flood and drought" Answer: Fixed

14. Line 418: add parentheses to Figure subplot citations Answer: Added

15. Line 422: Last sentence maybe change to "Therefore, using such a product with long-term records as forcings to hydrological models, the confidence of simulated streamflow over the TB area will correspondingly increase." Answer: Changed.

Please also note the supplement to this comment:
http://www.hydrol-earth-syst-sci-discuss.net/hess-2016-282/hess-2016-282-AC2-supplement.pdf

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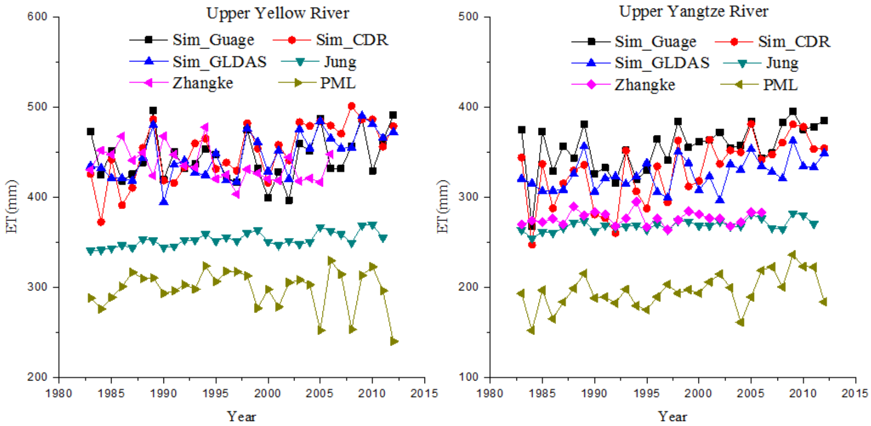

Fig. 1. Authors' Reply to Comments Figure 1