To anonymous Referee #2, 01 Jun 2022

General comments for the authors' reference:

(1) Line 32-34: "During the past decades, the increasingly intensified human activities and climate change have significantly changed the hydrological cycles in the YRB and thus accelerated the variation of flood characteristics in this region". This statement seems too general for readers. Please provide relevant citations to support this statement.

Response: As described in Line 59 to Line 62, we have provided relevant citations to support this statement based on your suggestion.

"During the past decades, the increasingly intensified human activities and climate change have significantly changed the hydrological cycles in the YRB and thus accelerated the variation of flood characteristics in this region (Fang et al., 2012; Wang et al., 2011)."

References

Fang, H., Han, D., He, G., Chen, M., 2012. Flood management selections for the Yangtze River midstream after the Three Gorges Project operation. J. Hydrol. 432-433, 1-11.

Wang, M., Zheng, H., Xie, X., Fan, D., Yang, S., Zhao, Q., Wang, K., 2011. A 600-year flood history in the Yangtze River drainage: comparison between a subaqueous delta and historical records. Chin. Sci. Bull. 58 (2), 188-195.

(2) Section 3.1: Please consider adding some additional sentences to describe the difference between these three GRACE solutions used in this study, which are applied to characterize the variations of TWSA in the YRB and its individual basins during the study period.

Response: As described in Line 118 to Line 120, we have added additional sentences to describe the difference between these three GRACE solutions used in this study based on your suggestion.

"As documented in previous studies (Long et al., 2014; Xie et al., 2022), there are slight differences between these three GRACE and GRACE-FO solutions when estimating the variation of regional TWSA. The difference between these three GRACE and GRACE-FO solutions mainly arises from the processing algorithms or constrained solutions."

References

Long, D., Shen, Y., Sun, A., Hong, Y., Longuevergne, L., Yang, Y., Li, B., Chen, L., 2014. Drought and flood monitoring for a large karst plateau in Southwest China using extended GRACE data. Remote Sens. Environ. 155, 145-160.

Xie, J., Xu, Y.P., Guo, Y., Wang, Y., Chen, H., 2022. Understanding the impact of climatic variability on terrestrial water storage in the Qinghai-Tibet Plateau of China. Hydrolog. Sci. J. 67(6), 1-16.

(3) Line 390: When explaining the results shown in Figure 6(a), the authors simply attributed it to the relatively poor relationship between TWSA estimates and hydro-climatic factors for this region that is described in Fig. 5(a). This statement is not convincing enough. If possible, please consider to provide more details to explain the results shown in Figure 6(a).

Response: Thanks for your suggestions. As described in Line 381 to Line 391, we have added more details to explain the results shown in Figure 6(a).

"As documented in previous studies (Liu et al., 2020; Shi et al., 2020), it has long been challenging to accurately perform hydrological simulation across the SYRB because of the complex hydrological processes for this alpine basin. For example, parameter settings calibrated by GLDAS Noah land surface model might not be highly accurate for SMS simulation across the SYRB, because field measurements of SMS in this region are extremely limited. Harsh climatic conditions and limited weather stations can additionally influence the accuracy of meteorological observations such as precipitation and temperature across the SYRB especially for some extreme values. Given the above reasons, there is a relatively poor relationship between TWSA estimates and hydro-climatic factors across the SYRB based on the MLP (shown in Fig. 5(a)). Furthermore, the uncertainty in the observed precipitation and temperature and SMS derived from the GLDAS Noah land surface model can eventually result in some discrepancies between temporally downscaled TWSA at sub-monthly time scales and monthly TWSA estimates derived from GRACE/GRACE-FO satellites data, as described in Fig. 6(a)."

References

Liu, L., Jiang, L., Wang, H., Ding, X., Xu, H., 2020. Estimation of glacier mass loss and its contribution to river runoff in the source region of the Yangtze River during 2000-2018. J. Hydrol. 589, 125207.

Shi, R., Yang, H., Yang, D., 2020. Spatiotemporal variations in frozen ground and their impacts on hydrological components in the source region of the Yangtze River. J. Hydrol. 590, 125237.

(4) The section of Conclusion could have been improved by mentioning more informative results. For example, as stated in Section 5.5, the proposed NDFPI can reach the threshold values earlier than that of daily streamflow observations for the 90th, 95th and 99th percentile floods, which has not been mentioned in the section of Conclusion.

Response: As described in Line 569 to Line 573, we have added additional sentences to describe the findings shown in this study based on your suggestions.

"(3) By jointly using daily average precipitation anomalies and temporally downscaled TWSA, the proposed NDFPI can effectively detect the flood events at sub-monthly time scales occurred in 2020 for the entire YRB;

(4) The comparison analysis indicates that different types of flood events including the 90th, 95th and 99th percentile floods can be monitored by the proposed NDFPI earlier than traditional streamflow observations with respect to the YRB and its individual subbasins, which is very vital for flood forecasts and warning across this region."

Minor comments:

(1) Line 29-30: There is no need for citing so many papers only to explain the topic of monitoring extreme flood events. Please keep the most relevant ones.

Response: As described in Line 30, we have deleted the unnecessary references shown in this sentence and only keep the most relevant ones based on your suggestions.

"Therefore, monitoring extreme flood events has long been a hot topic for hydrologists and decision makers around the world (Tanoue et al., 2020; Tellman et al., 2021)."

References

Tanoue, M., Taguchi, R., Nakata, S., Watanabe, S., Fujimori, S., Hirabayashi, Y., 2020. Estimation of direct and indirect economic losses caused by a flood with long-lasting inundation: Application to the 2011 Thailand flood. Water Resour. Res. 56, e2019WR026092.

Tellman, B., Sullivan, J.A., Kuhn, C., Kettner, A.J., Doyle, C.S., Brakenridge, G.R., Erickson, T.A., Slayback, D.A., 2021. Satellite imaging reveals increased proportion of population exposed to floods. Nature 596, 80-86.

(2) Line 171-173: This sentence seems a bit confused. Please rewritten it to avoid ambiguity.

Response: As described in Line 174 to Line 177, we have rewritten this sentence to avoid ambiguity.

“As pointed out by previous studies (Humphrey and Gudmundsson, 2019; Khorrami et al., 2021; Shah et al., 2021), long-term changes in TWSA are primarily caused by frequent human activities such as persistent groundwater overexploitation and massive construction of large reservoirs.”

(3) Line 312: Remove the word of “different” in this sentence.

Response: Based on your suggestions, we have deleted this word from the sentence as described in Line 298.

“This phenomenon can be explained by the discrepancies resulted from the components of SMSA and TWSA.”

(4) Line 347: Please replace the “shows” by “show”.

Response: Based on your suggestions, we have replaced the “shows” by “show” as described in Line 333.

“Taking the entire YRB as an example (Fig. 5(j-l)), GRACE/GRACE-FO derived TWSA estimates show a RMSE of 10.9 mm/month for the MLP-derived TWSA estimates, which is lower than that of 15.1 mm/month for the LSTM-derived TWSA estimates (~39% difference) and that of 13.3 mm/month for the MLR-derived TWSA estimates (~22% difference).”

(5) Line 408: This sentence is confused. Please clarify.

Response: As described in Line 408 to Line 410, we have rewritten this sentence in order to clarify it.

“To better monitor severe flood events over the YRB, we propose a new index, i.e. NDFPI, by jointly using the temporally downscaled TWSA data and daily precipitation data as introduced in Section 4.5.”

(6) Line 510: This sentence can be removed since it repeats information from the section of Method.

Response: Based on your suggestions, we have deleted this sentence to avoid repetition.

(7) Figure 9 and Figure 10: Please add the meaning of acronyms, such as NDFPI in the captions of these figures.

Response: As described in Figure 9 and Figure 10, we have added the meaning of these acronyms in the captions of these figures based on your suggestions.

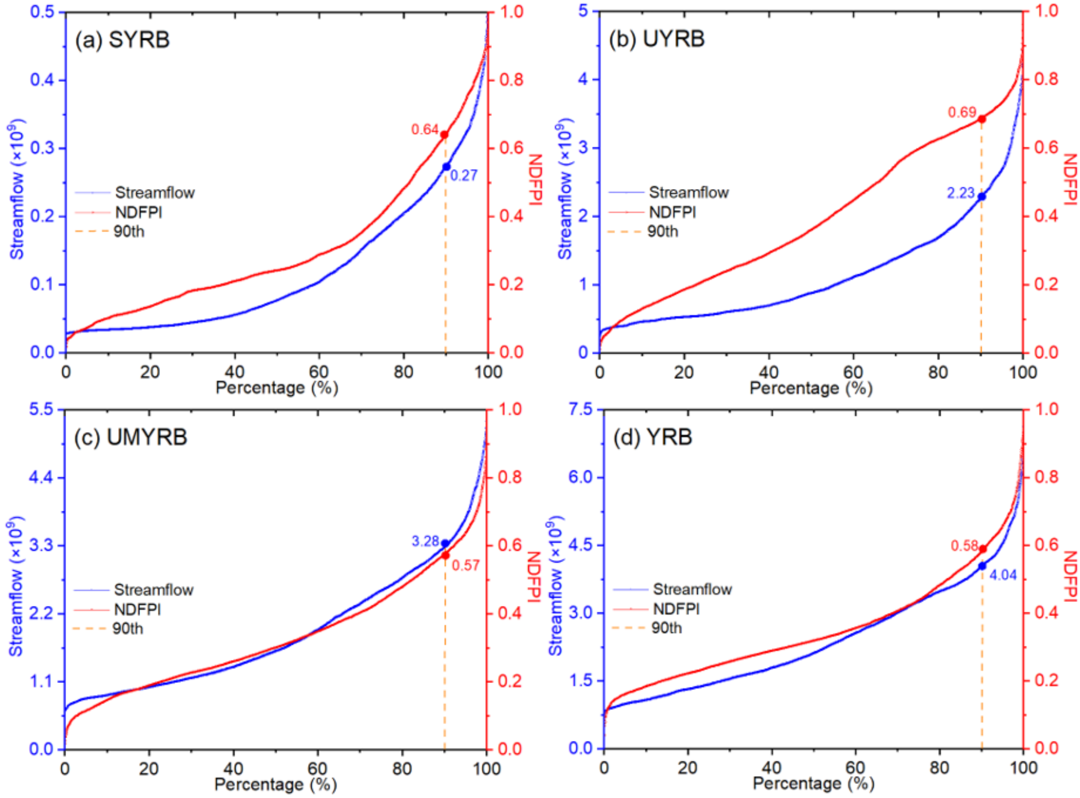

Figure 9: Percentile duration curves of daily streamflow observations and NDFPI for the 90th percentile floods across (a) the SYRB, (b) the UYRB, (c) the UMYRB and (d) the YRB respectively during 2003-2020. The red dots and blue dots represent threshold values of daily streamflow and NDFPI for the 90th percentile floods across different regions. SYRB = Source regions of Yangtze River Basin; UYRB = Upper regions of Yangtze River Basin; UMYRB = Upper and middle regions of Yangtze River Basin; YRB = Yangtze River Basin; NDFPI = Normalized daily flood potential index.

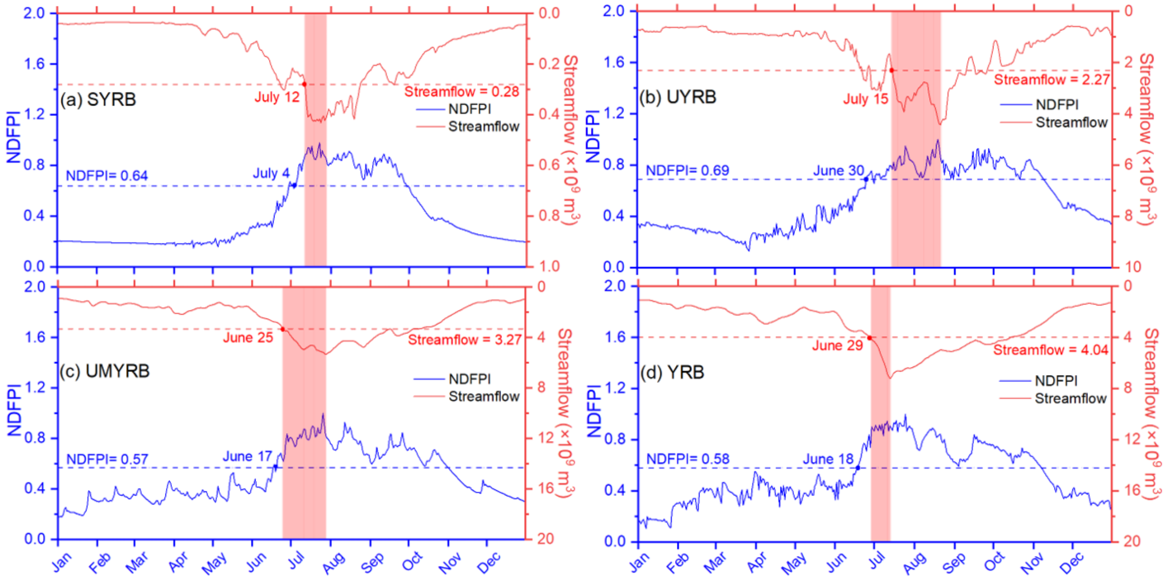

Figure 10: Comparison between basin averaged NDFPI and daily streamflow observations for the 90th percentile floods in 2020 across (a) the SYRM (observed at Shigu station), (b) the UYRB (observed at Yichang station), (c) the UMYRB (observed at Hankou station) and (d) the YRB (observed at Datong station). Pink rectangles denote the duration period between the thresholds of daily streamflow for the 90th percentile floods and peak streamflow observed at the controlling hydrological stations over different regions. The thresholds of daily streamflow and NDFPI for the 90th percentile floods are represented by the red dash lines and blue dash lines respectively. Note that the scales of streamflow shown in each figure are not always same. SYRB = Source regions of Yangtze River Basin; UYRB = Upper regions of Yangtze River Basin; UMYRB = Upper and middle regions of Yangtze River Basin; YRB = Yangtze River Basin; NDFPI = Normalized daily flood potential index.

(8) Table 2: Please carefully check the abbreviations of all items shown in this table.

Response: Thanks for your valuable suggestions. As described in Table 2, we have carefully checked the abbreviations of all items shown in this table and made the corresponding corrections.

Table 2: An overview of all datasets used in this study.

Data	Source	Temporal resolution	Spatial resolution	Time span
Terrestrial water storage	GRACE/GRACE-FO CSR	Month	0.5°	2002 - 2022
anomaly (TWSA)	GRACE/GRACE-FO JPL	Month	0.5°	2002 - 2022
	GRACE/GRACE-FO GSFC	Month	0.5°	2002 - 2022
Soil moisture storage (SMS)	GLDAS 2.1 - Noah	3 hours	1°	2002 - 2022
Precipitation (P)	CMA	Day	/	2003 - 2020
Temperature (T)	CMA	Day	/	2003 - 2020
Streamflow	In situ	Day	/	2003 - 2020

Note. GRACE = Gravity Recovery and Climate Experiment mission; GRACE-FO = Gravity Recovery and Climate Experiment Follow-On mission; CSR = Center for Space Research; JPL = Jet Propulsion Laboratory; GSFC = Goddard Space Flight Center; GLDAS = Global Land Data Assimilation system; CMA = China Meteorological Administration