HESSD

Interactive
comment

Interactive comment on "On the Flood Peak Distributions over China" *by* L. Yang et al.

Anonymous Referee #2

Received and published: 30 August 2019

The authors present an extensive study on exploring flood peak distributions in terms of stationarity, seasonality, scaling property, spatial heterogeneity and the effects of land-falling tropical cyclones across the China. Their results are mainly based on several statistical methods (e.g. Pettitt's test, Mann-Kendall test, GEV distribution, etc.) using annual maximum peak discharge from over 1000 gages with a record of at least 50 years. To my knowledge, their study is the first to analyze the characteristics of annual maximum flood peaks on a nation-wide scale in China, highlighting the importance of both streamflow dataset and treating them not only as numerical values but as real world physical events.

Overall, this study is organized and well-written. However, I do have some major concerns, which are listed below, about the structures and certain elements of the study that need to be addressed before the work can be considered for publication. Typographical errors (e.g. line 255, "Tainhang Mountains" should be "Taihang Mountains")

in the paper can be addressed in the second round of review because some of them might be removed during author's revision.

Specific comments: 1. The main objective or scientific question of this study are not adequately addressed that causes each part of analysis does not connect logically. Authors have applied several statistical approaches with peak flood data but the explanation of the necessity and connection of each test need to be more explicitly addressed. I understand that similar study was done by Villarini and Smith (2010) US but the authors need to demonstrate why Villarini and Smith's analysis are also necessary in this study. For example, why do authors decide to explore the role of tropical cyclone rather than snowmelt in characterizing the upper tail of flood peaks?

2. Although authors conclude that abrupt changes in flood magnitude and seasonality are mainly due to anthropogenic influence, I would suggest them to investigate (or even focus on) climate induced nonstationarity. The anthropogenic induced changes imply stationarity after changing point (e.g. the built of reservoir, urbanization), which is not valid in this study, as shown in Figure 5, highlighting the existence of climate driven changes. The author's explanation for Figure 5c is vague, such as these negative trend might be due to soil conservation or decreasing rainfall intensity. That is why I suggest authors to separate climate-induced changes from anthropogenic-induced one when discussing the violation of stationarity in China. The other reason is that climate-induced changes around the world has already been unearthed, and author's contribution might provide such understandings in China. For example, Blöschl et al. (2017, 2019) found changing climate derives changes in flood seasonality and magnitude over Europe using streamflow data. Blöschl, Günter, et al. "Changing climate shifts timing of European floods." Science 357.6351 (2017): 588-590. Blöschl, Günter, et al. " Changing climate both increases and decreases European river floods." Nature 1476. 4687 (2019): https://doi.org/10.1038/s41586-019-1495-6.

A minor relevant suggestion is to modify the label in Figure 7b, indicating clearly which trend represents flood seasonality shifting to earlier or later time in a year.

3. Despite the significance of flood seasonality as authors addressed, the section 4.2 of this paper and other relevant parts failed to present how flood seasonality is distributed across the country and how to link them to flood generating mechanisms. I would suggest authors to add two maps: average seasonality of all maximum annual floods and of only the three (or two) biggest floods for all gages across the country. These two maps can indicate the regional patterns of flood seasonality and how flood processes may change as one moves from moderate to extreme floods. They can also help authors demonstrate some of their arguments, such as line 240-242, "Frequent occurrence of annual..." Without a map, it is very difficult for reader to envision how flood seasonality is distributed across the country.

4. An interesting finding in this paper is that tropical cyclones (monsoon-controlled storms) plays key role in determining upper tail of flood peaks in northern (southern) China (line 252-264), but needs to be well defended. Figure 6 only shows that flooding happens more frequently around June (July) in southern (norther) China, but fails to present their severity (magnitude). For instance, is it possible the most frequent floods in June over southern China associate with low or moderate severity (i.e. magnitude)?

5. Line 54-56 ("Annual flood peaks resulted..."): I suggest being more careful in your wording here. I would respectfully disagree with authors that conventional flood frequency analysis (FFA) requires a homogenous flood population with respect to flood-generating mechanisms. Instead, a flood series at any gage is a mixture of different flood-generating processes but they are just one sample not the population. Conventional FFA assumes peak discharge measured at a gage over a finite period is a sample from the population of all possible floods (representing different flood generating mechanisms) during an undefinable length of time.

6. The authors should provide a brief description of the quality control procedures in section two rather than just state they have done so. This procedure is important in this study since datasets are from different sources and inaccessible to public. For instance, what is the time interval for the "instantaneous" peak discharge and are they

the same value for all gages? If the instantaneous peak discharge data were from US Geological Survey (USGS), I would expect they are all in the 15-minute interval but have no clue here.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2019-322, 2019.