Response to Reviewer #2

(1) This study analyzed the floods in eastern China from a regional perspective. The authors developed a novel approach for identifying the regional floods and attributing these floods to their driving factors. Compared to isolated floods, like flash flooding in a small watershed scale, regional floods often cause more catastrophic disasters. Such studies, like this one, are always encouraged to improve our understanding of characteristics and generating mechanisms of regional (i.e., substantial) floods. However, a minor revision is needed before the manuscript can be recommended for acceptance.

Response: Thank you for appreciation of our study. We carefully address all your concerns, and provide a point-by-point response below. Thanks!

(2) For the Identification method, the transition from step 3 (DBSCA clusters; Figure 2c) to step 4 (largest convex-hull polygon within a 15-day window) is very confusing. If multiple clusters have been identified in step 3, will you merge them to a bigger one in step 4? Please revise this part to make it clearer.

Response: Small clusters that are overlapped with a big cluster are deemed a single regional flood. This is related to the development and decay of flood process in accompany with rainfall propagation and soil moisture replenishment. We choose the biggest cluster to represent the extent of regional flood, ignoring its evolving process (Line 151-154). We revise the flow chart in Figure 2 to better illustrate our method. Thanks!

(3) The statistical modeling and its associated results are not central to the main content of this manuscript. I suggest removing these elements and considering expanding them into a separate paper.

Response: Thank you for this suggestion. We prefer to keep this section in the revised manuscript, since the statistical modeling analyses highlight the importance of different factors in discerning severity of regional floods in a quantitative way. This is a complement to previous empirical attribution analysis. We do not modify the text. Thanks all the same!

(4) In line 181, please briefly explain “flood ratio” as the way how you explain the “unit peak discharge”.

Response: Done. Thanks!

(5) Consider changing the subtitle 2.3 from “Empirical analyses” to “Regional floods attribution”.

Response: Done. Thanks!

(6) In section 3.2, please further explain “the role of orographic lifting in enhancing rainfall

intensity." Is there any strong relationship between elevation and rainfall intensity? Also, consider citing the following paper in Section 3.2.

Houze Jr, Robert A. "Orographic effects on precipitating clouds." Reviews of Geophysics 50, no. 1 (2012).

Response: The relationship between elevation and rainfall intensity has been detected in previous studies, including the northern China region. This is mainly through enhanced moisture convergence that leads to updraft over the windward region. We add this statement and references (including Houze Jr, 2012) in the revised manuscript (Line 277-281). Thanks!

(7) Consider changing "Mild RegFls" to "Moderate RegFls".

Response: Done. Thanks!

(8) In figure 9, it shows that rainfall peaks in about 2 days in advance of soil moisture and peak flow. My interpretation is that extreme rainfall caused the increase in soil moisture. In other words, the watershed antecedent soil moisture does not matter in extreme floods. Please defend it.

Response: Thank you for raising this critique. We absolutely agree that the replenishment of soil moisture is mainly through rainfall process. However, the depletion of soil moisture may through evaporation and/or lateral exchange, and is thus less correlated with rainfall. Here we focus on antecedent soil moisture prior to flood peak discharge by following basic hydrological assumption that soil moisture condition regulates runoff-generation processes. Previous studies (e.g., Sharma et al., 2018) also confirm the role of antecedent soil moisture in dominating nonlinear flood response to rainfall changes. We hope our reasoning can address your concern. Thanks!

References:

Sharma, A., Wasko, C., & Lettenmaier, D. P. (2018), If precipitation extremes are increasing, why aren't floods?, *Water Resources Research*, *54*(11), 8545-8551. https://doi.org/10.1029/2018wr023749