Interactive comment on "Spatiotemporal patterns and driving factors of flood disaster in China" *by* Pan Hu et al.

Anonymous Referee #1

In general, this manuscript mainly focuses on presenting the spatiotemporal properties of some environmental driving factors that may be relevant to flood disasters. This paper is more like a data report rather than a research article, because of the lack of quantitative analysis. It is also hard to find any methodological novelty.

Reply: Thank you for your insightful review and professional suggestion. Actually, we did quantitative analysis between flood disaster and relevant driving factors. Here I briefly introduced Geodetector. At first, spatial stratified heterogeneity (SSH) refers to the phenomena that within strata are more similar than between strata, such as well known landuse types and climate zones and those yet to be known, is ubiquitous in universe. As a set of information or patterns, *SSH has been a window for humans to recognize the nature and to understand its mechanisms behind since Aristotle time*. Geographical detector (or simply GeoDetector) used in this current study is a novel tool to identify SSH and to attribute the spatial patterns (Fig. 1): (1) measure and find SSH of a variable Y; (2) *test the association between two variables Y and X*, according to the coupling between their *spatial distributions*, without assumption of linearity; and (3) *investigate interaction between two explanatory variables X1 and X2 to a response variable Y*, without any specific form such as assumed product in econometrics (Fig. 2). Therefore, we used *novel quantitative analysis* method in our current study.
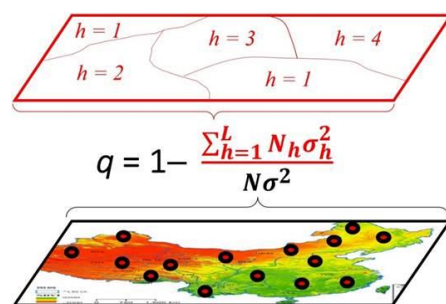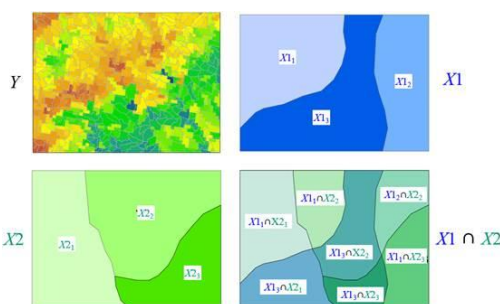
Fig. 1   Fig. 2

My major concerns for this paper are given as below: (1) The effects of these driving factors concerned in this study on flood disasters are not quantified. The authors displayed numerous data of the so-called driving factors, but they failed to explicitly give some quantitative relationships between these driving factors data and flood disasters. Without a well-defined relationship (even statistical relationship), it would be untenable to say that flood disasters are related to these driving factors.

Reply: Thank you for your insightful review and professional suggestion. GeoDetector used in this study is just a quantitative analysis method and was widely used in

attribution analysis from spatial pattern perspective. Thank you for your professional comments.

Wang, J., Hu, Y.: Environmental health risk detection with GeogDetector. Environ Modell Softw., 33, 114-115, 2012.

Onozuka, D., Hagihara, A.: Extreme temperature and out-of-hospital cardiac arrest in Japan: A nationwide, retrospective, observational study. Sci Total Environ., 575, 258-264, 2017.

Li, X., Xie, Y., Wang, J., Christakos, G., Si, J., Zhao, H., Ding, Y., Li, J.: Influence of planting patterns on fluoroquinolone residues in the soil of an intensive vegetable cultivation area in northern China. Sci Total Environ., 458, 63-69, 2013.

(2) This paper mentions both flood event and flood disaster. How are these two terms defined? What's the difference between these two terms?

Reply: Thank you for your insightful review and professional suggestion. Flood event here should refer to flood disaster event. You are right. All related terms were modified to keep the consistency. Thank you so much for your careful review.

(3) It is unclear how GeoDetector for attribution analysis used in this study.

Reply: Thank you for your insightful review and professional suggestion. We have to say that our current study does not focus on detailed introduction of the application of GeoDetector method, but we just used it in our analysis. We assume that it is not necessary to make more detailed introduction of GeoDetector method. However, we briefly introduced fundamental analysis procedure of the GeoDetector method in the Methods section. We also listed necessary reference so that readers interested in this method can consult with the reference for more information. Thank you so much for your insightful viewpoints.

(4) The authors performed an analysis for the changes of flood frequency. But the study data used in this paper are from 1984 to 2007. The results from such a limited length of data may be questionable in terms of hypothesis testing in the statistical analysis.

Reply: Thank you for your insightful review and professional suggestion. You are technically and scientifically correct. Besides, your good statistical knowledge will also be appreciated greatly. We firmly accepted your suggestion and updated the dataset to 2015. Now the sample size is 31 years. Now it can be analyzed in a statistical way. Also, because of updated dataset, we also updated all the results presented in our paper. Thank you so much for your professional suggestion.

(5) The manuscript claims that the spatial pattern of precipitation extremes and that of flood disasters did not match well, while it is also concluded that rainfall changes play the overwhelming role in driving occurrences of flood disasters, and topographical features and spatial patterns of socio-economy also have considerable impacts. The

above statement seems to be an apparent paradox.

Reply: Thank you for your insightful review and professional suggestion. Your question is pretty important for us. Based on your suggestion, we further checked our results based on our updated datasets. Now we can well confirm that spatial pattern of precipitation extremes and that of flood disasters match well in both space and time. We also checked the original flood disaster records and also compared these matches event by event. Now the results, findings and conclusions are confirmative. Thank you so much for your careful review, insightful viewpoints and your kind help.

Your professional suggestions and your insightful review greatly help to improve the quality of our manuscript. Thank you again for your hard work, your valuable time and your patience in reviewing our manuscript.