Natural Hazards
and Earth System
Sciences

Discussions

Interactive comment on "Risk Zoning of Typhoon Disasters in Zhejiang Province, China" *by* Yi Lu et al.

Yi Lu et al.

luyi_cool@126.com

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Dear Editor and the reviewer,

We do appreciate your constructive, thoughtful, careful, and helpful comments and suggestions. After careful discussions, calculations, and analyses, we finished the preparation of responses to you. The responses are structured in 3 sequence: (1) comments from Referees, (2) author's response, (3) author's changes in manuscript. If there are any new comments or suggestions, please let us know.

Best Regards

Yi Lu and the coauthors

Response to Reviewer 1

1. In the "2. Study Area" section, it is better to give a background introduction of typhoon disasters in the study area; otherwise, it is not unstoodable why you use Zhejiang Province as a case.

Reply: We do appreciate the helpful suggestion. Mainly according to the suggestion, some modifications have been done. The modifications include:

(1) The structure of the paper has been changed. Considering that Section 2 is so thin and unbalanced to other sections, "2 Study Area" is merged into "3 Data and Methods" and then the Section numbers hereafter are changed.

(2) In the last paragraph of "Introduction", a sentence "In this study, Zhejiang province, which is frequently affected by the strongest landfall typhoons (Ren et al., 2008) and experiences most serious typhoon disasters (Liu and Gu, 2002) in the mainland of China, is selected as the study area." has been added.

The following two new references have been added:

Liu, T. J. and Gu, J. Q.: A statistical analysis of typhoon disasters in Zhejiang province, Journal of Catastrophology, 17 (4): 64-71, 2002. (in Chinese)

Ren, F. M., Wang, X. L., Chen, L. S., and Wang, Y. m.: Tropical cyclones landfalling on mainland China, Hainan and Taiwan and their correlations, Acta Meteorologica Sinica, 66 (2): 224-235, 2008. (in Chinese)

2. For the meteorogical data, how many stations are there in Zhejiang Province? The authors said 2419 stations provided by NMIC; it is not clear if they are distributed throughout China or only in Zhejiang province. It needs to be clarified.

Reply: Thanks so much for the comment. In this paper, the OSAT method need to identify typhoon wind and precipitation from wide range than Zhejiang province, so 2419 stations of precipitation data and 2479 stations of wind data over the mainland of

China are used, which all contained 71 stations corresponding to counties in Zhejiang province.

We add following sentences at the end of L80 in section 3.1.1. "In addition, the OSAT method need to identify typhoon wind and precipitation from a wider range than Zhejiang province (please see detail in section 2.2.1), so 2419 stations of precipitation data and 2479 stations of wind data over the mainland of China are used, which all contained 71 stations corresponding to counties in Zhejiang province."

3. Canonical Correlation Analysis is the main tool for this study, which is however not introduced to readers at all. It is necessary to give an introduction of this method and how it is applied in this study.

Reply: Thanks for your suggestion. According to the suggestion, we have added introduction and application of Canonical Correlation Analysis (CCA) in this paper. We add following sentences at the end of L102 in section 3.2.2. "In statistics, canonical correlation analysis (CCA) is a way of inferring information from cross-covariance matrices. If we have two vectors X = (X1, ..., Xn) and Y = (Y1, ..., Ym) of random variables, and there are correlations among the variables, then CCA can find linear combinations of the Xi and Yj which have maximum correlation with each other (Hardoon et al., 2014). The method was first introduced by Hotelling in 1936 (Hotelling, 1936). The main point of CCA is to separate linear combination of new variables from the two sets of variables. In this case, the correlation coefficient between new variables reaches the maximum. In this paper, we chose factors causing typhoon disasters as a set of variables, and typhoon disaster as another. Under the maximum canonical correlation coefficient, the linear combination coefficients (typical variable coefficients) of factors causing typhoon disasters can be used as weight coefficients of this group of variables. Then we can determine the impact of factors causing typhoon disasters."

The added references are as follows:

Hardoon, D. R., Szedmak, S., and Shawetaylor, J.: Canonical Correlation Analysis:

An Overview with Application to Learning Methods, Neural Computation, 16(12):2639-2664, 2014.

Hotelling, H.: Relations between two sets of variates, Biometrika, 28(3/4), 321-377, 1936.

4. In Section 3.2.4, it is necessary to introduce how the so-called SoVI is used to calculate the population vulnerability index.

Reply: Thanks very much for the suggestion. According to the suggestion, we have added introduction and application of SoVI in this paper.

We add following sentences at the beginning of L109 in section 3.2.4. "County-level socioeconomic and demographic data are used to construct an index of social vulnerability to environmental hazards named the Social Vulnerability Index (SoVI). Principal Component Analysis (PCA) is the primary statistical technique for constructing the SoVI. The PCA method captures multi-dimensionality by transforming the raw dataset to a new set of independent variables. Then a few components can represent the dimensional data, and underlying factors can be identified easily. These new factors are placed in an additive model to compute a summary score—SoVI (Cutter et al., 2003)."

The added reference is as follows:

Cutter, S. L., Boruff, B. J., and Shirley, W. L.: Social Vulnerability to Environmental Hazards, Social Science Quarterly, 84(2):242-261, 2003.

5. The data source of typhoon disaster losses?

Reply: Typhoon disaster losses used in this paper are obtained from the National Climate Center who collected these disaster data from local meteorological departments. The data source can be seen in L82 of section 3.1.2.

6.How is "typhoon rainstorm" defined? Its probability is an important issue in this study. How the probability is determined? It is not introduced at all.

Reply: Thanks very much for the comment and suggestion. According to the suggestion, we have added a definition of "typhoon rainstorm" and "typhoon torrential rainstorm". In section 4.1, we did some research about risk of typhoon rainstorm. Typhoon rainstorm in this study means daily typhoon precipitation over 50mm, and typhoon torrential rainstorm means daily typhoon precipitation over 100mm. The probability is the annual possibility of the occurrence of typhoon rainstorms. The probability denominator is the total number of years, and the numerator is the annual frequency of typhoon precipitation. If a station experiences typhoon precipitation in one year, the numerator increases by one.

We add following sentences at the end of L133 before "Based on". "Typhoon rainstorm in this study means daily typhoon precipitation over 50mm, and typhoon torrential rainstorm means daily typhoon precipitation over 100mm. The probability is the annual possibility of the occurrence of typhoon rainstorms."

7. In Eq(1), it is not clear how population and economic loss are both included. Only for population or economic loss? Why in the form of "Ax+By", not a "multiplying" form?

Reply: Thanks for the comment. As we explained in question 3, the main point of CCA is to separate linear combination of new variables from the two sets of variables. In this paper, we chose typhoon disaster-causing factors as a set of variables, and typhoon disaster as another. Typhoon disaster-causing factors (typhoon wind and precipitation) and typhoon disasters (affected population and economic loss) are both contained. When the typical correlation coefficient pass the significance test, weight discrimination can be made to determine A and B. Both typhoon rainstorm and high wind will bring certain disasters. When reaching a certain critical value, they will have a superposition effect. However, the effects of wind and rain on disaster are different. Therefore, it is necessary to determine their influence through typical correlation analysis, which is a typical variable coefficient. So the form is "Ax+By", not a multiplier.

8. P12 L205, it says, after "performing factor analysis"..... How is the factor anal-

ysis performed? In the title of Table 3, principal component analysis is mentioned. How is the principal component analysis performed? Factor analysis is the principal component analysis? If these methods are used, they need to be introduced in the methodology section.

Reply: Thanks very much for the comment and suggestion. The factor analysis performed here is Principal Component Analysis (PCA), which is the primary statistical procedure for constructing the SoVI. According to the suggestion, we have added detailed explanations of PCA in section 3.2.4, which have been answered in question 4.

We add following sentences at the beginning of L109 in section 3.2.4. "County-level socioeconomic and demographic data are used to construct an index of social vulnerability to environmental hazards named the Social Vulnerability Index (SoVI). Principal Component Analysis (PCA) is the primary statistical technique for constructing the SoVI. The PCA method captures multi-dimensionality by transforming the raw dataset to a new set of independent variables. Then a few components can represent the dimensional data, and underlying factors can be identified easily. These new factors are placed in an additive model to compute a summary scoreâĂŤSoVI (Cutter et al., 2003)."

9. In Table 4, the derived disaster risk index are divided into 5 grades. How are the thresholds are determined? It is not mentioned.

Reply: Thanks for the comment. The classification of typhoon disaster risk index is based on the natural breaks method (Jenks) provided by Arcgis. Then we divide disaster risk index into 5 grades, which represent five risk zones for typhoon disasters in Zhejiang province.

We add following sentences at the end of L248. "The classification of typhoon disaster risk index is based on the natural breaks method (Jenks) provided by Arcgis."

Please also note the supplement to this comment:
https://www.nat-hazards-earth-syst-sci-discuss.net/nhess-2018-14/nhess-2018-14-AC2-supplement.pdf

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