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Reply on RC4

Wei Li et al.

Author comment on "Spatial Distribution of Vulnerability to Extreme Flood: in provincial scale of China" by Wei Li et al., Nat. Hazards Earth Syst. Sci. Discuss.,
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The author present the paper "Spatial Distribution of Vulnerability to Extreme Flood: in provincial scale of China". They apply Cloud-improved Entropy Method to calculate used indexes weight, and the Fuzzy Variable Theory to calculate the total vulnerability. A small-scale map of China vulnerability was produced.

Below some considerations and suggestion.

Comment 1:

Vulnerability is an essential component of risk analysis and, as such, it has to be deeply investigated. In the manuscript the terms "risk" and "vulnerability", are often used as synonymous and in other cases they are used together (see e.g. row 20: "...spatial distribution of the EF risk vulnerability...", row 99:(..."risk indicator of EF vulnerability..."), row 237:(..."factors of flood risk vulnerability"), and many others. I suggest to review the terminology.

Response:

Sorry for the inconvenience caused by our writing habits. What we want to express is just vulnerability. Thank you for your suggestion. We have removed "risk" from the word "risk vulnerability".

Comment 2:

In the flow diagram of Fig. 1 reference is made to "Stability analysis". What does it refer to? To the stability of adopted model? This analysis process should be described in the manuscript.

Response:

Thank you for your suggestion. Stability analysis is aimed at variable fuzzy model. When using the variable fuzzy model, the general formula has four changes ($a=1, p=1$; $a=2, p=1$; $a=1, p=2$; $a=2, p=2$). When the calculation results of the four parameter combinations differ greatly, it means that the stability of the calculation results is poor,

and the model needs to be adjusted. When the calculation results are similar, it is considered that the stability meets the requirements and the calculation results of vulnerability have good applicability. The process of stability analysis is to compare whether the results of four parameter combinations are similar.

Comment 3:

The matrix (2) is formally incorrect (see last row and last column).

Response:

According to your suggestions, we have modified matrix (2).

Comment 4:

"H", listed for each province/city in table 5, is described from the authors (equation 7, row 148) as "level eigenvalue of the evaluation sample". From these values, the vulnerability map (fig.5) is derived. If "H" is the vulnerability, why call it "level eigenvalue"? If not, how do the authors get the map from value of H?

Response:

Thank you for your hard work. As written in Table 5, H is the average characteristic value of the evaluation sample, and it is the premise and basis for classifying the vulnerability level. After an average and second average analysis of H, we get the vulnerability level, which is why we do not directly call H vulnerability.

Average and secondary average analysis is a commonly used mathematical method, which can solve the problem that individual data is too scattered, resulting in the evaluation results being too concentrated and falling into a certain level, and the grading is unreasonable and not smooth. For example, the data [1, 2, 3, 4, 5, 21] are divided into three grades: slight, moderate and serious. If the traditional grading method is used to divide the thresholds into [1, 7], [8, 14] and [15, 21], then the evaluation results are basically "slight", and the differences between them cannot be effectively distinguished, making the evaluation ineffective. Therefore, we use the average and second average analysis to solve this problem. As it is an existing method and not the focus of our research, so we only pointed out the method used and explained its role, but did not write its application steps in the manuscript.

Comment 5:

The vulnerability is divided into four levels: "slight", "moderate", "severe" and "extremely serious", passing from numerical analysis to a purely qualitative data. In the text should be indicated the criterion of numerical thresholds choosing and, the thresholds value indicated.

Response:

Thank you for your professional advice. The reason why we did not specify the threshold value of the grade standard is that it is not a fixed value and has no practical significance. Just like a cake, we can divide it into four smaller portions, but when the size of the whole cake changes, the size of each smaller portion will also change, so we only indicate the division method (average and second average analysis), but not the threshold value.

Comment 6:

Conclusions are sparse and, in many respects, obvious. They should be integrated.

Response:

According to your suggestion, we have integrated the results in the discussion and supplemented the rationality analysis of the results.

Comment 7:

Both to complete and improve the paper, and to support the reliability of the procedure adopted, a validation of the vulnerability map produced, could be useful.

Response:

According to your suggestion, we have added the analysis of the rationality of the results. The revised contents are as follows□

Although Beijing, Shanghai Tianjin, Guangdong and Jiangsu have strong comprehensive disaster reduction and prevention capabilities, but their economies are the most developed and their population density is very high (their GDP per capita and population density are among the top seven in China all the year round), which leads to their extremely serious vulnerability. Provinces in the Yangtze River, Yellow River and Huaihe River basins (Hebei, Henan, Shandong, Sichuan, Chongqing, Hunan, Hubei, Anhui, Zhejiang and Fujian) are the main producing areas of grain in China, with relatively developed economy and large population, so their vulnerability is severe. In the northwest, southwest and northeast of China, although the traffic network density is low, once a serious EF disaster occurs, it is difficult to transfer the affected people and property, and may cause indirect losses due to ineffective relief and slow recovery. However, due to the terrain and geographical location, its population density is low, it is a gathering area of most ethnic minorities in China, and its economy is underdeveloped, so the vulnerability level of these provinces (Jilin, Liaoning, Inner Mongolia, Shanxi, Shanxi, Ningxia, Qinghai, Gansu, Xinjiang, Tibet, Yunnan, Guizhou, Jiangxi and Guangxi) is moderate. Heilongjiang province has become the only province with slight vulnerability to EF disasters. The reasons include low population density (bottom three in China all the year round), high proportion of labor force (top six in China all the year round), and strong disaster prevention and relief capacity (Heilongjiang, known as the "Great Granary of China", is the location of the Great Xing'an Mountains and the Small Xing'an Mountains. It is rich in forests, minerals, animals and plants. Therefore, the local government attaches great importance to disaster prevention). The vulnerability assessment results are highly consistent with the distribution laws of population, economy and natural environment in China, which verifies the rationality of the results.