# Response to RC2 Comments

Dear reviewer,

We highly appreciate your valuable comments and suggestions. It has greatly improved the quality of our manuscript.We have made revisions one by one according to your comments and suggestions.

The answers for the suggestions and comments are as follows.

Q1: Line 15: Vulnerability is a key concept for both disaster risk and climate change adaptation. By analyzing the potential factors causing losses, it is possible to predict the extent to which a disaster will impact society in the future (Vincent 2004). The author mentions “factors contributing to losses”; are they referring to the concept of “root causes of a disaster”? Further clarification of this matter is required.

Authors’ responses:

Thank you very much for your comments.
This study suggests that the causes of disasters and disaster losses come from both natural hazards and social conditions/social factors. The degree of damage caused by disasters is influenced by factors such as the exposure, sensitivity, and resilience of the social system to hazards. Certain social groups in some circumstances are prone to be impact towards hazards. Therefore, the factors that cause disaster losses we mentioned are not primarily focused on the hazard itself, but rather on the potential socio-factors that may cause damage in the hazard environment.

We have revised in the introduction section as follows:
Warming has become a predominant feature of the Earth’s climate system, which has brought about changes in precipitation patterns and have increased in frequency of extreme weather such as heatwaves, droughts, forest fires, heavy rains, and floods. In recent years, these extreme weathers are continual to impact the vulnerable sections of society, bringing severe disaster losses around worldwide. By analyzing the potential socio-factors causing losses, it is possible to predict an extent to which a disaster will impact the society in the future (Vincent 2004). In order to reduce disaster losses and to improve disaster prevention capabilities, from the 1960s onward, vulnerability has formed an important research topic such as in the International Biological Program (IBP), the International Geosphere-Biosphere Programme (IGBP), the International Human Dimensions Programme on Global Environmental Change (IHDP), and the Intergovernmental Panel on Climate Change (IPCC) and so on (Zhang et al. 2008).
In urban areas, the emergence of social vulnerability is mainly determined by the instability of local society. Especially in the context of rapid urbanization, the continuous increase in population mobility poses severe challenges to local infrastructure, environments, and social structures. Socio-economic inequalities among the inhabitants are represented as a “mosaic” in the geographical space as a result of urban transformation. In addition to social-spatial isolation, such “mosaic” also leads to a redistribution of risk. Many studies on extreme events show that disastrous consequences do not only depend on a

hazard risk itself, but also are closely related to physical environments, social structures, and demographic characteristics of a geographic place (Perrow 2007; Bolin 2007). If one place is physically exposed to hazard risk, it will impact the population who live here in uneven ways (Huang et al. 2020). Although urban population mobility itself does not lead to vulnerability (Donner and Rodriguez 2008), the population are marginalized when the market and/or the government cannot provide adequate employment, water and sanitation facilities, housing, and medical services.

As the result of population dynamics and diverse demands for location, leading to the gradual decrease in the availability of safer lands, it is almost inevitable for human endeavors to be located in potentially dangerous places (Lavell 2003). For example, many migrants in Jakarta, Indonesia live in informal settlements called “Kampung” that are prone to flooding (Alzamil 2018). Ghana’s capital Accra has 92 percent of migrants living in Old Fadama, a slum without tap-water or sanitation facilities (Awumbila 2014). The push to commercialize urban housing in China throughout the past 40 years of urbanization has widened disparities in living conditions. While existing old communities with poor living environments have not much improved, the living quality of new gated communities has significantly increased. This process has also created many marginal places, a hybrid of rural and urban systems characterized by high building density, unclear management rights and duties, and insufficient social infrastructure. The people who live there take the brunt of many urban disaster. Spatial and social differentiations in the city, resulting in the formation of new socially vulnerable groups based on various kinds of local community.

China is currently one of the most disaster-plagued countries in the world. There are many different kinds of disasters, and in recent years, their frequency, intensity, spatial scope, and duration has further expanded. As China is undergoing rapid urbanization, land expansion has created different types of community within and around the cities; the population, economy, and society are experiencing structural changes, making the society unstable. It is imperative to mitigate the impact of disasters on urban populations and communities, and case studies are expected to provide the policy bases for disaster risk reduction. The main purpose of this paper is to determine the degree of social vulnerability at the local level, and to identify the most vulnerable groups by focusing on the characteristics of social vulnerability within Chinese urban society from the micro perspective.

This paper mainly attempts to solve the following three questions:

- What differences are in the vulnerability collectively for different types of urban communities?
- What kinds of mosaic is seen in the urban areas? That is, how vulnerable populations are distributed across communities, and what are underlying reasons for this distribution?
- Who are the most vulnerable groups in the city, and what characteristics do they have?

Q2: Line 34: Social vulnerability is influenced by various factors beyond social and economic status. There are as well as political conditions that affect an individual’s or group’s position and power in society and additionally, people’s level of vulnerability may differ based on their life circumstances, age, and the time of year. Why the study did not consider the potential interactions between different social vulnerability indicators, which may affect the overall level of vulnerability?

Q3: Line 13: At the same time, the results also show that about 50% of urban registration holders are also at high and medium levels of social”. Despite the quantitative results, did the author examine/documented urban social vulnerability from a more optimistic viewpoint, such as the innovative use of existing neighborhood groups for preparedness or the utilization of hazard and

vulnerability mapping? Additionally, did the author investigate cases of excellent coordination between municipalities and NGOs/CBOs regarding improvements in risk communication or increased sensitivity to the needs of population, both legal and illegal?

Authors' responses:

Thank you very much for your comments.
The main purpose of this paper is to determine the degree of social vulnerability at the local level, and to identify the most vulnerable groups by focusing on the characteristics of social vulnerability within Chinese urban society from the micro perspective. Our research refers to the Hazards of Place Model of vulnerability (as developed by Cutter, 1996) in the USA context, and applied the model to identify the vulnerability of persons living in risk zones. Vulnerability is conceived of in this model as both the biophysical and the social, but within a specified geographic domain. The HOP model integrates prospective exposures and societal resilience with a special focus on specific locations or areas (Kasperson et al. 1995; Cutter et al. 2000). It emphasizes that hazards should be the product of a specific region operating at the level of natural and social structures, and the vulnerability of a specific society to hazards. In terms of model reference and indicator selection, subjectivity is inevitable, which is one of the limitations of this manuscript.

Q4: Why did the study not consider the potential role of cultural and social factors in shaping social vulnerability and disaster risk?
Q5: Did the author recognize any limitations of this study? If so, it may be advantageous to incorporate these limitations in the manuscript.

Authors' responses:

Thank you very much for your valuable suggestions.
The current research does have limitations, and we apologize for not emphasizing them before. We have made a statement in the conclusion section.
The current research provides collective vulnerability of community. It compares the differences in vulnerability between different communities. However, the community referred was limited to administrative institutions with Chinese characteristics (*Shequ*). Although it also includes geographical and social meanings to some extent, in the Chinese context it is more inclined to the administrative dominion. Therefore, the discussion is mainly considered according to the administrative jurisdiction and does not involve the discussion of social networks, or social capital. The second limitation is in indicator selection and weight determination. The selection of different indicators and the adoption of different methods to calculate weights will produce different vulnerability results. Since there is still a lack of unified standards in the academic community, this study, although the selection is based on previous studies, still cannot avoid adding some subjective judgments. Future studies should explore suitable methods for determining indicators and weights.

Technical corrections: Given the dynamic nature of vulnerability, it would be advantageous to delineate a timeline that specifically identifies periods of heightened vulnerability over the course of the year,

particularly in relation to the influence of hazards. Such an approach would enable a more comprehensive appreciation of the "mosaic" of vulnerability within the research site.

Authors' responses:

Thank you very much for your comments. We strongly agree that the vulnerability you proposed is dynamic, but this dynamic nature is difficult to measure using quantitative methods, especially the quantitative methods used in this study. We conducted a questionnaire survey in June and July 2021. Although summer is indeed the peak period for disasters in the studied area, the questionnaire did not require respondents to only answer the situation during this time period, making it difficult to conduct dynamic vulnerability analysis on the timeline. We believe that the impact of different time periods on residents' vulnerability may have a greater impact on the exposure dimension. Your suggestion has indeed provided great insights, and we will continue paying attention to the temporal variation patterns of disaster occurrence time, frequency, intensity, and vulnerability in future research.