

Responses letter

We are very grateful to the reviewers for his/her constructive suggestions for this manuscript, which is a great help and guidance for this study and our future research. Here are our replies for these comments, the detail can be seen in our Revised Manuscript.

Responses letter for Anonymous Referee #2

1. Figure 1 shows the workflow of the model, but both clarity and aesthetics need to be further optimized. Whether some special connecting lines have special meaning, it is suggested to add notes.

Thanks to reviewer for the careful review of this manuscript. We have updated a new figure and a more detailed explanation of proposed model framework in the Manuscript. There is no special meaning of the connecting lines, and we use the black rectangle to denote different calculation modules and use the blue one to represent the results obtained by the VFS-IEM-IDM model.

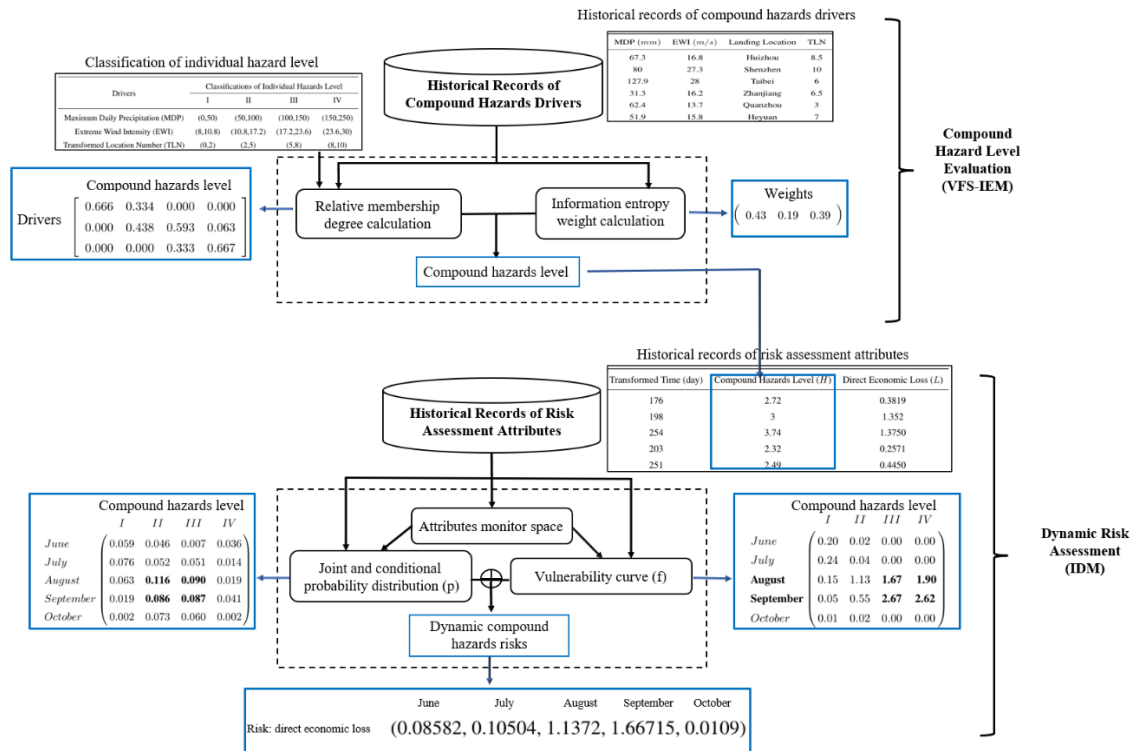


Figure 1. Workflow and illustration of the VFS-IEM-IDM dynamic compound hazards risk assessment model based on case study for Typhoon-rainstorm hazards. Based on the historical records of compound-Typhoon-rainstorm hazards, our proposal provides two parts procedures: firstly, an enhanced implementation of the compound hazards level evaluation is proposed to assess the Typhoon-rainstorm hazards level; and then estimates the probability distribution and the corresponding loss vulnerability curve of compound-hazards-attributes Typhoon-rainstorm are estimated to calculate the dynamic compound-hazards risk. We use the black rectangle to denote different calculation modules and use the blue boxes one to represent the results obtained by the VFS-IEM-IDM model

2. There are some unclear or awkward sentences throughout the manuscript. It is suggested that the authors conduct a thorough check to improve the readability of the manuscript.

Thanks to the reviewer for the careful grammar checking of this manuscript. We have improved the grammar writing and the detailed can be seen in our Manuscript.

Abstract. Global warming has led to an ~~increasing~~ increased occurrence of compound hazards and an accurate risk assessment of such hazards is of great importance to urban emergency management. Due to the interrelations between multiple hazards, the risk assessment of a compound hazard ~~is facing~~ faces several challenges: (1) the evaluation of hazard level needs to ~~take into account~~ consider the correlations between compound hazards drivers, (2) usually only a small number of data samples are available for estimating the joint probability distribution of the compound hazard drivers and the loss caused by the hazards, (3) ~~the temporal dynamics of the occurrences of compound hazards needs to be considered in the process of the risk assessment~~ the risk assessment process often ignores the temporal dynamics of compound hazard occurrences. To deal with these challenges,

4 Case Study

In this section, we evaluate VFS-IEM-IDM with a case study of typhoon-rainstorm compound hazards that occurred in Shenzhen, China. Shenzhen is located ~~in on~~ on the east bank of the Zhujiang River and is surrounded by Daya Bay and Dapeng Bay, where the climate is subtropical and maritime. Typhoon-rainstorms are the most frequently ~~occurred~~ occurring hazards in Shenzhen. According to the collected data, as shown in Table A1, ~~from 1980 to 2016~~ the direct economic losses of the Typhoon and Rainstorm hazards in Shenzhen on average exceeded 360 million RMB per year. Also, Zhou has investigated the number of death caused by investigated the Typhoon and Rainstorm hazards was 3.4 annually and about 149,000 that caused the number of death 3.4 annually, and about 149,000 people were affected (Zhou et al., 2017)(Zhou et al., 2017). Accurate assessments of the typhoon-rainstorm risk are crucial to determine whether or not the early warning systems are working and implemented effectively.

3. Refer to the requirements of the journal, check and modify the formatting of the references.

Thanks for your suggestions. We have checked and modified the formatting of the references and the detailed can be seen in our Manuscript.

Copernicus style files

- EndNote® Output Style File and example library
- CSL style (for Zotero, Mendeley, Papers, etc.) and example library
- Bibtex Bibliographic Style File

The risk of a hazard is defined as the potential consequences brought by the ~~disasters~~ disaster and can be quantified by the probability of losses (~~He et al., 2020~~)(He et al., 2020). Risk assessment is a technique that uses the relevant hazard data to estimate the likelihood that natural hazards may occur and further assess their economic losses (~~Huang et al., 2018~~)(Huang et al., 2018). Traditional methods of risk assessment mainly utilize geographic information systems to get risk maps (~~Gigovic et al., 2017~~)(Gigovic et al., 2017) or rely on information diffusion methods to deal with the problem of data sparsity (~~Gong et al., 2020~~)(Gong et al., 2020). These risk assessment methods (~~Julia et al., 2021; Zhou et al., 2020~~)(Julia et al., 2021; Zhou et al., 2020) are mainly applied to individual hazards, while the risk assessment of compound

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30