Responses to Reviewers

Reviewer #2:

In the context of climate change, more and more extreme events are occurring in coastal cities, increasing disaster risk. Disaster emergency rescue needs are greater, and how to allocate the available rescue resources is an issue worthy of further study. The author combines resource status with allocation management, considering the efficiency of resource allocation and the equity between regions. The flood relief logistics planning framework can be used to guide the allocation of emergency relief materials. Shanghai is a high-risk area for flooding and needs emergency rescue. This paper presents a comprehensive framework for flood relief logistics planning using a combination of GIS network analysis and analysis. The resource allocation optimization model projects the 100-year and 1000-year emergency rescue logistic allocation scenarios in the study area Shanghai, which has important scientific and practical significance for the emergency rescue for Shanghai.

It is suggested accepted with minor revision.

Before the manuscript to be accepted for published, some points should be made clearer.

We greatly appreciate the invaluable and constructive feedback provided by Reviewer #2. Our responses are highlighted in blue italic. We have acted upon all the points raised. The comments were very useful in improving the overall quality and readability of the manuscript.

Comment 1: Line 80~84: Is the motivation for this study due to the lack of research, or the lack of consideration of future climate change scenarios and supplies shortages?

Thank you very much for your valuable comment. The motivation for this study stems from three key gaps in the literature. First, while disaster logistics has been widely studied, there is limited research specifically focused on flood scenarios. Second, these existing studies are based on historical flood scenarios, without considering the potential increased risks posed by extreme weather events under future climate scenarios. Last, these existing studies focus on optimizing efficiency in resource distribution, there is relatively little research on ensuring fairness in the allocation process.

We have revised some sentences as follows:

Line 89-91: 'While considerable research has been performed in the field of disaster relief logistics, less attention has been given to flood relief logistics modeling. Only a few studies consider the impact of floods on resource distribution logistics, particularly the disruption caused by the inundation of emergency facilities and roads.'

Line 99-102: 'However, it is noteworthy that these existing studies are primarily based on

historical flood scenarios and do not adequately consider the potential increased risks posed by extreme flood events under future climate scenarios. Moreover, a majority of these studies focus on optimizing the efficiency of resource distribution, while there is relatively little research dedicated to ensuring fairness in the allocation process.'

Comment 2: Line 16~18: "Considering the fairness of resource allocation, a biobjective allocation model that minimizes the total transportation cost and maximum unsatisfied rate is developed." Why maximum unsatisfied rate?

Thank you very much for your important question. In situations where resources are insufficient, some regions may inevitably receive less than the required amount, leading to an unmet demand rate for each area. The maximum unsatisfied rate refers to the highest unmet demand rate among these regions. By minimizing this rate, we aim to reduce disparities in unmet demand across regions, ensuring that no area experiences extreme shortages. This objective promotes fairness by preventing any region from bearing a disproportionately high burden of unmet needs. We have included an explanation of this concept in the revised version as follows:

Line 217-219: 'The maximum unsatisfied rate refers to the highest unmet demand rate among these regions. By minimizing this rate, we aim to reduce disparities in unmet demand across regions, ensuring that no area experiences extreme shortages.'

Comment 3: Line 110~113: When supply exceeds demand, emergency managers tend to focus on maximizing efficiency to optimally allocate resources. Lack of supply should be considered more in efficiency. It should be said that when supply is plentiful, considering efficiency alone is enough. When supply is shortage, attention should be paid to both efficiency and equity. But is it a scientific and technical issue or a managing issue?

We agree with the comment. We have removed the statement in line 110-113 and added the sentence as follows:

Line 211-213: 'When supply is insufficient to meet demand, emergency managers should ensure that resources are distributed fairly across regions to prevent humanitarian inequalities caused by unbalanced allocation.'

Regarding your question on whether this is a scientific and technical issue or a management issue, we believe that in practice, the decision to balance efficiency and fairness is largely a management decision. Emergency managers must weigh these objectives based on factors such as the severity of the disaster and the availability of resources. However, addressing this balance effectively often requires complex mathematical optimization, which depends on scientific and technical support.

Comment 4: Line 300 and 324: The cyan area in Figures 2 and 3 should be explained (legend).

Thank you very much for the suggestion. We have added an explanation of the cyan area in the legend in the data source section as follows:

line 275-277: 'Based on surveys and the Standard for the Construction of Relief Goods Reserve Warehouses (Ministry of Civil Affairs of the People's Republic of China, 2009), we categorized the warehouses into three levels: city-level (Level 1) warehouses, which can meet the basic needs of 200,000 affected people; district-level (Level 2) warehouses, which can serve 5,000 people; and township-level (Level 3) warehouses, which can support 3,000 people.'

Comment 5: Line 409~439: It is suggested that the conclusion condenses more definite points.

Thank you for your valuable feedback regarding the conclusion of our manuscript. We have revised the last two paragraphs of the conclusion section as follows:

Line 438-454: 'Our work can assist emergency managers in better understanding the inadequacies of existing emergency facilities and highlights the importance of incorporating climate risk informed into exhaustive government flood relief logistics plans. The framework in this study can also be adopted for applications in other coastal cities worldwide. However, to arrive at more robust conclusions, future studies could be directed to the following aspects: First, concerning demand estimation, a more precise methodology should take into consideration the willingness of various individuals affected by flooding to reside in shelters. Second, Future research should incorporate more complex traffic scenarios, such as variable speeds at which vehicles can safely navigate flooded areas, to better simulate real-world conditions. Third, this study has not yet included formal validation of the proposed models. Future work should prioritize comparing model outputs with historical flood event data or other models to enhance the robustness.

Furthermore, in this study, the disaster situation is explored in ArcGIS, and the resource allocation models are developed in MATLAB. Therefore, future efforts could focus on developing comprehensive decision-support systems and large models that integrate disaster assessment with relief resource allocation models. Such systems can offer predictive analytics and scenario-based simulations, enabling proactive decision-making. By filling these research gaps, the future of effective flood relief logistics planning can be ensured, providing more resilient and adaptive emergency responses in coastal cities worldwide.'