**Responses to Reviewers**

**Reviewer #2:**

The authors presented a study on future flood relief logistics planning based on GIS analysis and mathematical modelling to develop plans for disaster management. The planning methodology is applied to the case of Shanghai, China, to draw conclusions. They found that the supply levels of EFSs and ERWs vary in different coastal flood scenarios. Based on this, a flood relief logistics planning was developed for different storm surge flood scenarios. In general, this study is interesting and complete, which holds practical significance. Most parts of manuscript are well structured and expressed. This study would be helpful for the natural hazards community. I recommend acceptance with minor revisions, as detailed below:

*We greatly appreciate the invaluable feedback provided by Reviewer #2. Our responses are highlighted in blue italic. We have carefully considered each suggestion and made corresponding revisions in the revised version.*

**Comment 1:** The use of examples in the Introduction is good, but given that the case study is in China, I would expect to see some examples from there as well.

*Thank you for your valuable suggestion. We have incorporated an example from China into the Introduction to better align with the context of our case study. Specifically, we have added the sentence as follows:*

*line 42-45: 'Typhoon Mangkhut, which hit Hong Kong in 2018, generated a record-breaking storm surge that caused widespread damage across the city. At least 458 people were injured, and the direct economic losses amounted to approximately HKD 4.6 billion (Choy and Wu, 2018). '*

**Comment 2:** In Figure 2 and Figure 3, it is necessary to add descriptions of the shaded areas. Clarifying what these shaded zones represent will enhance the readability of the maps.

*Thank you very much for the suggestion. We have added descriptive notes to clarify the shaded areas. Specifically, we have included the following explanatory text at lines 346-347: '(The blue-shaded areas represent the flood inundation zone)'*

**Comment 3:** The analysis based on GIS assessed the effectiveness of EFSs and ERWs under two flood scenarios, but did not specifically address their spatial exposure. A discussion on this would

add depth to the analysis and improve the risk-informed perspective of the study.

*Thank you for this insightful comment. We fully agree that understanding the spatial exposure of emergency facilities is crucial for risk-informed decision-making. In response, we have added a more comprehensive spatial analysis of EFSs and ERWs, highlighting their distribution patterns and exposure levels under different flood scenarios.*

*1) Line 323-325: 'Spatially, EFSs are predominantly concentrated in central urban districts, whereas ERWs exhibit a more dispersed pattern. During the 100-year flood scenario, all 25 ERWs and 71 EFSs (96% of the total) available, with relatively low spatial exposure risk.'*

*2) Line 330-332: 'The activated EFSs, primarily located in the central urban and northern areas of Shanghai, have a total capacity of accommodating approximately 146k individuals, representing 47% of the overall available shelter capacity.'*

*3) Line 336-337: 'In terms of critical facilities, only 21 ERWs and 61 EFSs (82% of the total) are available, indicating a higher spatial exposure risk.'*

**Comment 4:** The article emphasizes flood relief logistics planning in coastal cities to cope with different storm surge flood scenarios in the context of climate change. However, when facing a 1000-year flood scenario, existing government resources are insufficient, whether alternative cooperative schemes such as public-private partnerships can be used to supplement resources could be further discussed.

*We sincerely appreciate this insightful suggestion regarding public-private partnerships in extreme flood scenarios. As duly noted, our original analysis identified critical gaps in government resource capacity during 1000-year flood events. In response, we have added a new subsection titled "Analysis of Public-Private collaboration" (Section 3.3.4)*

*Line 461-494: 'As previously indicated, government-held emergency supplies are projected to be insufficient to meet the resource demands of all activated shelters under a 1000-year flood scenario in the 2030s. To address this challenge, an exploratory investigation was conducted into the potential of integrating warehouse clubs in Shanghai as supplementary sources of emergency supplies, with the aim of enhancing the responsiveness and resilience of the emergency supply system. In this context, the proposed resource allocation network comprises a total of 21 available ERWs, 27 WHCs, and 61 activated EFSs. The aggregated supply capacity across these facilities is sufficient to meet the basic resource requirements of all activated shelters.*

*A single-objective optimization model was employed to determine the optimal distribution strategy for emergency supplies. The results indicate that, despite the occurrence of road disruptions following the flood event, transportation constraints did not significantly impede access to essential supplies for the activated EFSs. The activation of all 21 ERWs and 26 WHCs was identified as an effective strategy to ensure the adequate provisioning of resources to all shelters. Figure 6 presents the spatial resource allocation scheme after incorporating WHCs under the 1000-year flood scenario in 2030, while table 6 outlines the service capacities of the activated ERWs and WHCs within this context.*

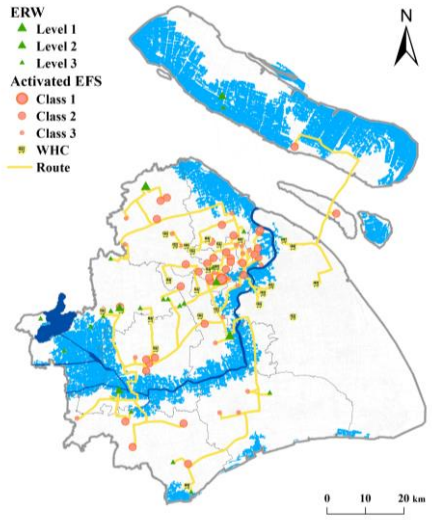


*Figure 6. Resource allocation scheme for a 1000-year flood scenario in 2030 under public-private collaboration.*

*Table6. Service capacity of the activated ERWs and WHCs under public-private collaboration*

| *Facility type* | | *EFSs served* | *Supplies (^10$^2$)* |
|---|---|---|---|
| *ERWs* | *Level1* | *21 (34.4%)* | *869.19 (30.9%)* |
| | *Level2* | *9 (14.8%)* | *250 (8.9%)* |
| | *Level3* | *20 (32.8%)* | *390 (13.9%)* |
| *WHCs* | | *52 (85.2%)* | *1300 (46.3%)* |

*As illustrated in Figure 6, warehouse clubs—primarily located on the periphery of the central city—serve as effective supplementary sources of emergency supplies for shelters situated within the central urban area. This spatial configuration reduces the transportation burden on*

*government-operated ERWs. Specifically, WHCs supplied a total of 130k units of emergency resources, accounting for 46.3% of the total supply, to 52 shelters. This indicates that nearly half of the demand for emergency resources can be met through these facilities. Meanwhile, government-operated ERWs provided the remaining 54% (see Table 6).*

*The integration of public and private supply chains into a collaborative distribution model not only alleviates pressure on government-held emergency resources but also enhances the flexibility and responsiveness of the overall logistics system during disaster response. However, the risk associated with long-distance transportation remains significant in areas with limited supply infrastructure, such as the southern districts of Shanghai and Chongming Island. Therefore, future contingency planning should place particular emphasis on pre-positioning emergency supplies in these vulnerable regions.'*

**Comment 5:** The conclusion reads more like a discussion. The author emphasizes future research directions. This section needs to be expanded by including research findings.

*Thank you very much for your suggestion. In the updated version, we have added the sentence in Conclusion to better reflect the key findings as follows:*

*Lines 502-508：'A number of conclusions can be drawn from the results. First, the current spatial distribution of ERWs and EFSs in Shanghai shows exposure risks under extreme coastal floods. Second, while existing facilities can meet elderly needs during a 100-year flood, they would serve only about half the elderly population in a 1000-year event. Furthermore, although an equity-based model reduces humanitarian risks under shortages, a supply gap of approximately 6% remains in EFSs. Integrating private warehouse clubs via public-private partnerships can enhance emergency supply assurance and distribution efficiency.'*

*We have also updated the abstract to reflect the main findings of the study:*

*Lines 2-8：'The case study indicates that the current spatial distribution of Emergency Reserve Warehouses (ERWs) and Emergency Flood Shelters (EFSs) in Shanghai may be vulnerable to extreme flood events. Under a 1000-year coastal flood scenario, the existing emergency resources are insufficient to meet the needs of the affected elderly population. In situations of resource scarcity, reducing the maximum unsatisfied rate can help improve the equity of resource allocation.*

*Furthermore, incorporating private warehouse clubs (WHCs) into government emergency logistics through public-private collaboration could reduce governmental burden and improves system efficiency and resilience.'*