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## **Review on nhess-2021-368**

Anonymous Referee #2

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Referee comment on "The Emergency Accessibility Analysis based on Traffic Big Data and Flood Scenario Simulation in the context of Shanghai Hotel industry" by Qian Yao et al., Nat. Hazards Earth Syst. Sci. Discuss., <https://doi.org/10.5194/nhess-2021-368-RC2>, 2022

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### **The Emergency Accessibility Analysis based on Traffic Big Data and Flood Scenario Simulation in the context of Shanghai Hotel industry**

By Qian Yao, Jiangyang Lin, Yong Shi, Zhihao Chen, and Qingwei Wang

**Recommendation:** Major revision

#### **Summary:**

The study performs an analysis of the accessibility of fire and rescue services (FRS) for hotels in Shanghai in case of a flood event. The authors combine flood hazard maps of a 1 in 100 year flood event with a commercial Big data based routing service to estimate travel times between FRS locations and affected hotels. The model considers in their travel time estimates the inaccessibility for FRS vehicles in flooded areas as well as delays due to traffic at different times during the day. The analysis for Shanghai hotels shows that the main delays from FRS come from traffic congestions even in absence of a flood event. Flood events cause additional delays, which become larger during times when there is more traffic congestion. The paper discusses the results and some of the limitations of the study and outlines future research questions that follow from this analysis.

## General comments:

The study is interesting and covers a relevant topic. The methodology using a commercial Big data based routing service is clever and produces interesting results. My two main points of criticism are the unclear framing and research question of the study as well as the lack of some essential information, which makes it difficult to fully follow the argument the authors are making. I would also recommend restructuring the paper to introduce the Shanghai case study earlier in the manuscript. The paper would also benefit from a thorough English copy-editing.

### *Framing and Research Question*

The paper addresses an interesting and relevant research question, namely "how long does it take an FRS team to arrive at a hotel during a flood in Shanghai?". However, the way the authors frame this question in the introduction and throughout the text makes it difficult to understand the goal of their analysis. Some key questions that should be addressed in the manuscript:

- "Why is it important to know the emergency response time for a hotel?" The authors provide some general statements on avoiding damages, general decline in tourism etc. in the introduction, but I would argue that this information is most relevant for a hotel's own emergency planning and when they can expect emergency responders to arrive. I am not sure if this can be really framed as an economic question as it is unclear to me how this information would be able to a) reduce direct damages as in most cases FRS would be called when e.g. water has already entered a building b) to reduce indirect damages such as higher cancellation rates of hotel bookings/a general loss of attractiveness of a tourist destination after a flood event.
- "What scenarios are considered in the analysis" From reading the manuscript I was not able to fully understand whether the analysis focusses on a case where the FRS route to a hotel is restricted because of a flood but the hotel is not directly affected by the flood (i.e. the hotel has a non-flood related emergency) or a case where the hotel itself is flooded and the access to the hotel is restricted.
- What type of flood events are considered? Figure 1 mentions a 100-y pluvial flood, but most of the maps in the other figures look like the authors use flood maps for a river flood. The choice of flood event has important implications as river floods often have a slower onset than pluvial or surface water floods, which means different emergency planning approaches for FRS. River floods of large rivers often have warning lead times of several days which would mean that FRS would be able to plan ahead while pluvial floods often have very short to no warning lead times. The authors should clarify what type of flood event they are considering and why.

### *Missing information*

The manuscript lacks a few critical information, which should be added to better understand the analysis.

- Chapter 3.1. very briefly describes the flood maps that have been used and while the authors refer to other publications for details, they should at least provide information on the type of flood considered (see previous comment) and the inputs they have used such as the drainage network, rainfall data etc.
- The authors should also provide more detailed information about how the flood maps are considered by the route planning algorithm. Is there any cut-off value for the flood depth that would consider a road as inaccessible or is any flooded street excluded from the route calculation?
- Chapter 4.1. explains how the authors have identified hotels that are located in a flood hazard area. However, it is not described how this information is used in the response time analysis. Is there a distinction in the analysis between hotels that are expected to be flooded in an event and hotels that are only affected by flood-related delays of the FRS?
- In the discussion several limitations of the study are discussed. One aspect that seems to be missing is the interaction between flood events and traffic congestion. Flooding in one area would directly cause more traffic congestion in another area because the same amount of vehicles have less roads they can access. It seems the model the authors use, cannot account for that. Including this interaction is very challenging and I would not expect the authors to include that in their model but would be good if they could discuss this limitation in their study.

### **Other comments:**

P1 L28: The numbers from Hurricane Katrina and the tsunami in Thailand are really interesting and impressive, but I am wondering how that links to your analysis, as none of these damages could have been prevented from FRS arriving faster.

P10 L22: "The statistics show that Shanghai had 361,405,100 of domestic tourists, 8,972,300 inbound tourists and generated over 23 million yuan in 2019." Are these number correct? That would mean each tourist has spent less than 0.07 Yuan (0.01 USD) in 2019.

Chapter 4.1: Most of the information should be provided earlier in the manuscript as they provide important context to the motivation of the study.

Figure 7: Please provide access labels with the units that are used here.

P15 L333ff: The changes in arrival time due to flooding are quite small compared to the changes caused by traffic congestion. Would be interesting to test if these changes are statistically significant compared to changes caused by traffic congestion.

P16 L348ff: "Secondly, the city's emergency response department should be equipped with some special vehicles and hovercraft with better water wading capabilities to ensure that emergency rescue missions are completed in areas with deep water." This is a useful recommendation, but I would think that special vehicles such as boats etc. are pretty standard for the flood emergency response in large cities.