

# ***Interactive comment on* “Natural hazard risk of complex systems – the whole is more than the sum of its parts: II. A pilot study in Mexico City” by Marcello Arosio et al.**

## **Anonymous Referee #1**

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Natural hazard risk of Complex Systems Part II offers a pilot case study of how graph theory can be used to assess the holistic risks of a system. Focusing on Mexico city, the authors build a model of the interconnections between 6 typologies representative of emergency management phase and long term impacts of emergencies – blocks, fuel stations, schools, fire stations, hospitals, and crossroads. The authors are able to extrapolate DRR interventions from the findings presented in the model. In doing so they seek to present the feasibility of their new risk assessment approach, show the benefits of how it can be used for DRR, and suggest future research.

As with the first article, this article is based on the premise that graph theory is a new

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and unexplored mechanism for assessing risk in complex systems. As I described in the review of the theory paper, there is a significant literature on the topic. It should be discussed, as should the gap that this research fills.

The authors also need to clarify how representative their case is to the reality of flooding in Mexico city. What is the role of other schools, hospitals, police stations, etc. outside the research area? Can they pick up the slack or offer alternative services if the components inside the boundaries of the modeled system fail? Are there ways to bypass the road network if it is compromised, such as going by foot or, if flooded, by boat? The cascades described in the article may be less severe than the model shows given these connections and human adaptability/ingenuity. This is a challenge to all risk assessment techniques that purport a holistic, systems level overview of risk—assumptions and limitations should be made explicit.

Answering these questions and tying the article to the literature could improve this paper, which has the potential to be a useful contribution to the research on network analysis and risk.

Below are some references that the authors can use for their literature review:

Clark-Ginsberg, Aaron. "Participatory Risk Network Analysis: A Tool for Disaster Reduction Practitioners." *International Journal of Disaster Risk Reduction* 21 (2017): 430-37.

Clark-Ginsberg, Aaron, Leili Abolhassani, and Elahe Azam Rahmati. "Comparing Networked and Linear Risk Assessments: From Theory to Evidence." *International Journal of Disaster Risk Reduction* (2018).

Gill, Joel C., and Bruce D. Malamud. "Reviewing and visualizing the interactions of natural hazards." *Reviews of Geophysics* 52, no. 4 (2014): 680-722.

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Lewis, Ted G. Critical Infrastructure Protection in Homeland Security: Defending a Networked Nation. John Wiley & Sons, 2014.

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