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Editorial: Earthquake Reconnaissance – Building the Risk and Resilience Evidence Base

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Editorial on the Research Topic

Earthquake Reconnaissance – Building the Risk and Resilience Evidence Base

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Understanding risk from earthquakes requires estimates of both the hazard and the vulnerability of the built environment to this hazard. Each new earthquake highlights errors in our understanding of both hazard and vulnerability as well as how failures in the built environment inevitably result in social and economic disruption, influenced greatly by government policies and capacity to respond. Earthquake reconnaissance plays an important role in understanding the deficiencies in our knowledge and is the ultimate source of data for the validation of our structural models and design solutions, as well as the risk modeling tools used by governments, NGOs, and insurance interests to manage financial and response alike. Reconnaissance is clearly vital for resilience.

The phrase "Disruptive technology" has come into popular usage to describe the human challenges that accompany rapid technological advancement. As with most endeavors, rapid advancements in technology have changed reconnaissance substantially. It is now feasible to deploy data collection techniques that many of us have long anticipated. With each substantial event, additional data collection capabilities arise from researchers and entrepreneurs eager to help, but these new capabilities are accompanied by new research challenges. How can we assure that the data is obtained and disseminated in a scientifically credible manner? What new research opportunities arise from reconnaissance technologies? And ultimately, how can we exploit the technologies and data to boost resilience through better policy decisions, mitigation priorities, or risk allocation?

This collection of papers begins to explore these important questions by examining methods of collecting and disseminating data and lessons, data and damage statistics from previous earthquake reconnaissance missions as well as sharing experiences in conducting these missions and showcasing new ways of collecting earthquake data. In particular, Lin et al. present their Real-Time Individual Asset Attribute Collection Tool. This paper highlighted a number of technologies for collecting damage information, before presenting their own real-time collection and archiving tool. They have already used it and presented 6 case studies with a wide range of applications from Dam surveys, earthquake damage surveys, tsunami, and even collecting information from cyclones. There are many useful references in this paper that give more details of the survey and it will be interesting to see how this App develops.

Continuing on this theme, Bray et al. present some of GEER's developments in geotechnical earthquake reconnaissance. Once expensive survey equipment has become much cheaper and in the case of UAVs, hobbyist priced equipment can be used to conduct detailed photogrammetry surveys. A number of GEER missions were presented as case studies to highlight the use of UAVs and LIDAR and data from satellites as well as the software used to visualize this data. As the prices of this equipment will only become cheaper and data remotely sensed via satellites becomes even high resolution, we can look forward to more detailed data sets that will inform us of the impacts and consequences of earthquakes.

Roeslin et al. present an excellent example of collecting building damage and vulnerability information using the Pueblo 2017 earthquake as the case study. The information was collected using a paper based form that used the GEM Building Taxonomy v2.0 to define the buildings and EMS-98 for the damage definition. The tables and graphs presented in this paper show that you do not necessarily need to use phones, tablets, and apps to get good data and it also highlights the importance of training to obtain good data. It will be interesting to see how this work progresses.

Chian et al. provide the results of three earthquake reconnaissance missions made by EEFIT between 2009 and 2016. While we all think about the different and similar effects that earthquakes have, it is not often that we see this information methodically compared in a paper. For the earthquakes compared, these mission identified soft-storey failure as the biggest failure mechanism for buildings and landslides being a significant feature of all the earthquakes.

Stone et al. investigate how omnidirectional cameras may be used to collect information in earthquake reconnaissance missions. These 360 degree cameras have the potential to collect a lot of information very quickly that can then be analyzed remotely at a later date. But how good is this data? Well that is what this paper addresses and while this technology has some short comings (mainly relating to distance the camera is from the object of importance) they are a very quick and simple way of collecting a lot of data and we are likely to see these used more in future earthquake reconnaissance missions.

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Conflict of Interest: CH was employed by company ImageCat.

The remaining authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.