

RED-ACT Report

Real-time Earthquake Damage Assessment using City-scale Time-history analysis

July 25, M5.3 Japan Chiba-ken Earthquake

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Acknowledgments and Disclaimer

The authors are grateful for the data provided by **K-NET** and **KiK-net**. This analysis is for research only. The actual damage resulting from the earthquake should be determined according to the site investigation.

Scientific background of this report can be found at:

<http://www.luxinzheng.net/rr.htm>

1. Introduction to the earthquake event

At 07:14 25 Jul 2019 (Local Time, UTC +9), an **M 5.3 (JMA)** earthquake occurred in **Japan Chiba-ken**. The epicenter was located at **140.0 35.1**, with a depth of **60.0 km**.

2. Recorded ground motions

9 ground motions near to epicenter of this earthquake were analyzed. The names and locations of the stations can be found Table 1. The maximal recorded peak ground acceleration (PGA) is **46 cm/s/s**. The corresponding response spectra in comparison with the design spectra specified in the Chinese Code for Seismic Design of Buildings are shown in Figure 1.

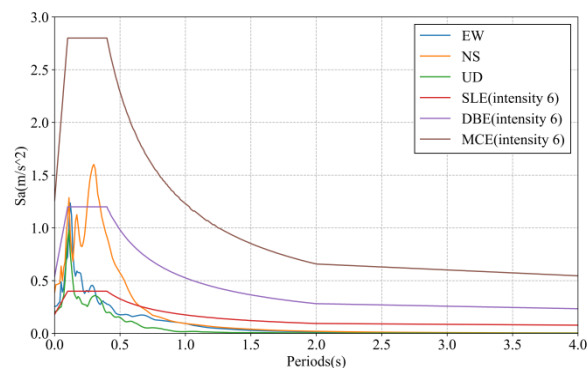


Figure 1 Response spectra of the recorded ground motions with maximal PGA

3. Damage analysis of the target region subjected to the recorded ground motions

Using the real-time ground motions obtained from the strong motion networks and the **city-scale nonlinear time-history analysis**, the damage ratios of buildings located in different places can be obtained. The building damage distribution and the human feeling distribution near to different stations are shown in Figure 2 and Figure 3, respectively. These outcomes can provide a reference for post-earthquake rescue work.

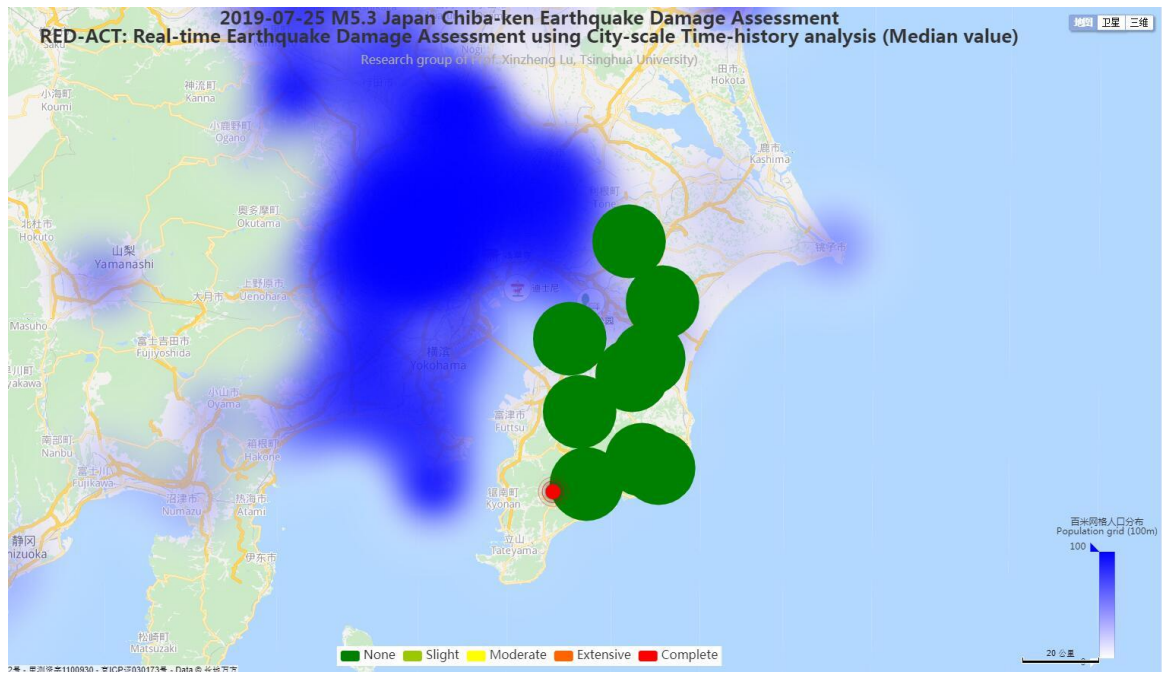


Figure 2 Damage ratio distribution of the buildings near to different stations

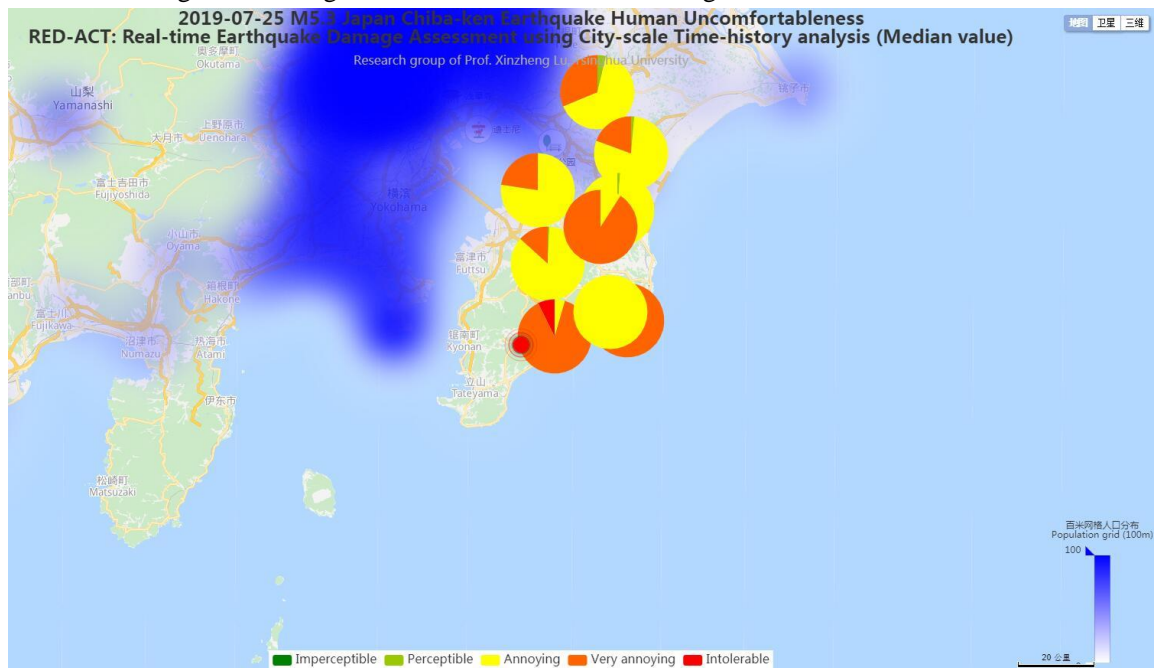
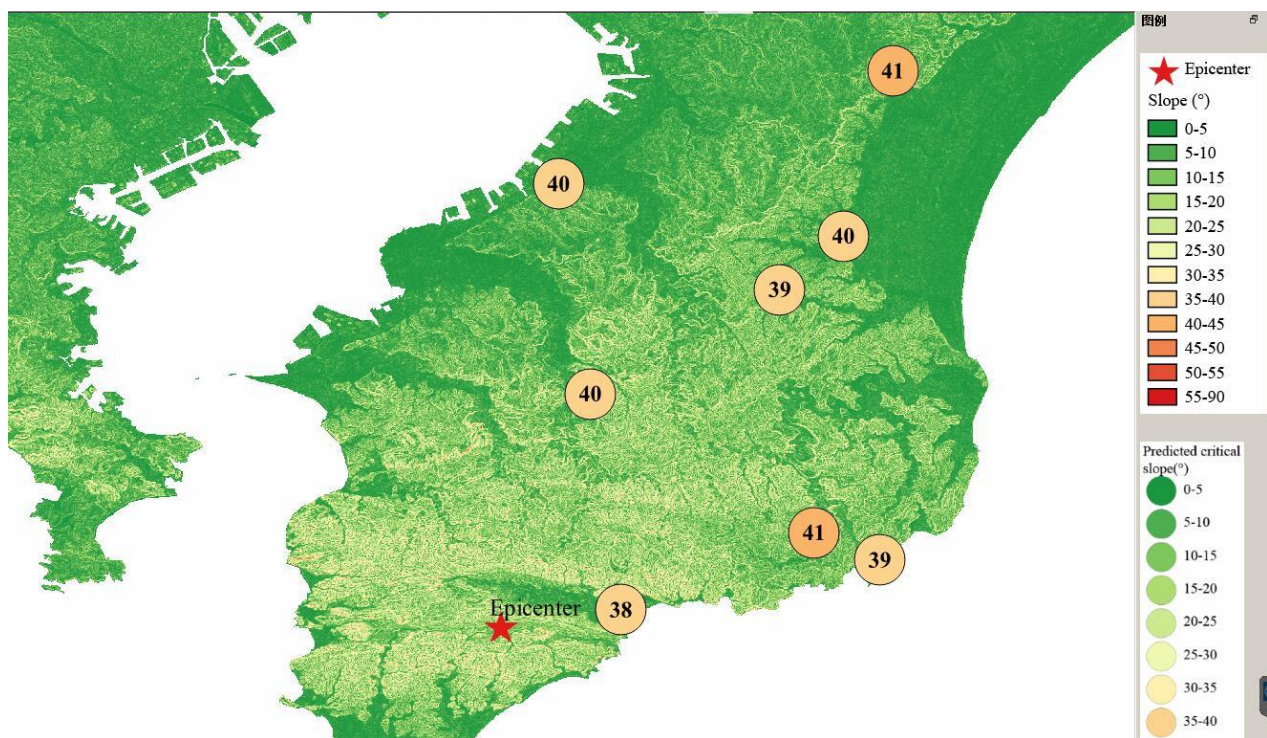


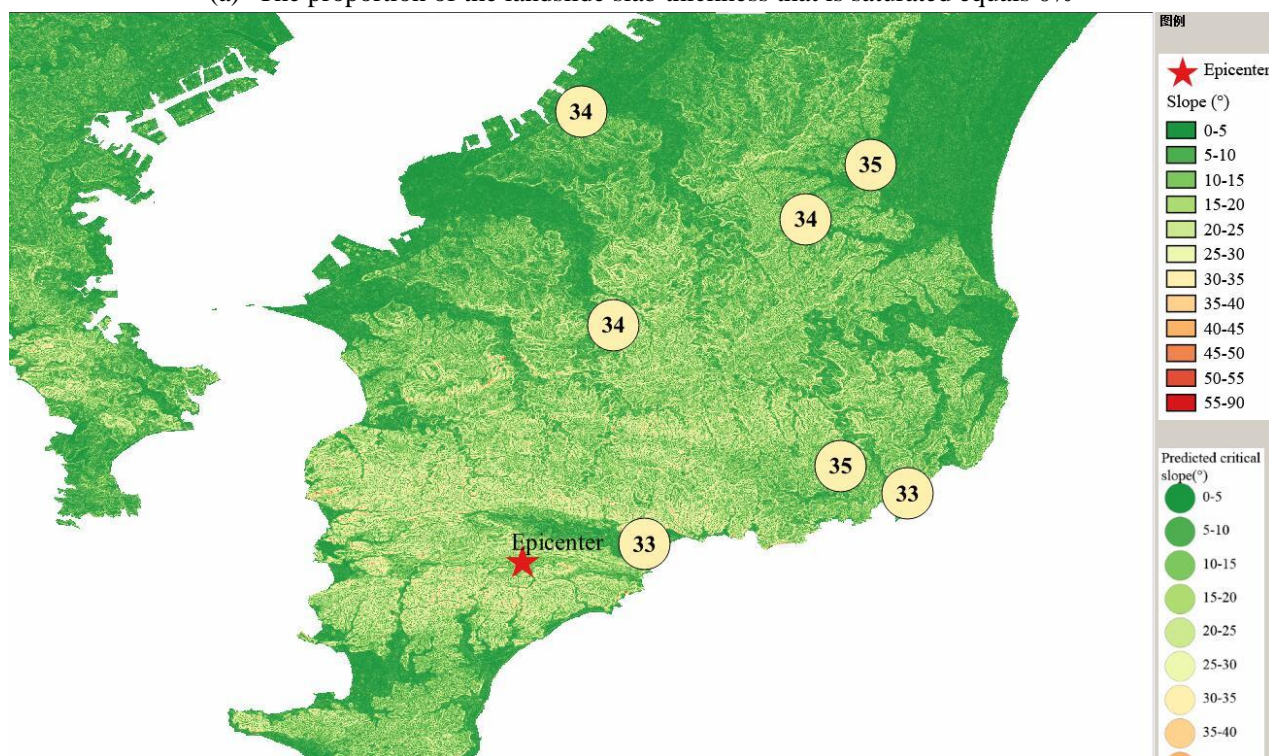
Figure 3 Human feeling distribution near to different stations

4. Earthquake-induced landslide of the target region subjected to the recorded ground motions

According to local topographic data, lithology data and ground motion records, the distribution of earthquake-induced landslide near to different stations under the different proportions of the landslide slab thickness that is saturated can be calculated, as shown in Figure 4. The basemap shows the distribution of the local slope. The number in the circle represents the critical slope of the landslide. The earthquake-induced landslide tends to occur with a higher probability when the slope near the station is larger than this threshold value.



(a) The proportion of the landslide slab thickness that is saturated equals 0%



(b) The proportion of the landslide slab thickness that is saturated equals 50%



(c) The proportion of the landslide slab thickness that is saturated equals 90%
 Figure 4 Distribution of earthquake-induced landslide near to different stations

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Table 1 Names and locations of the strong motion stations

No.	Station Name	Longitude	Latitude
1	CHB007	140.227	35.7234
2	CHB012	140.333	35.5727
3	CHB013	140.291	35.4327
4	CHB014	140.049	35.4769
5	CHB017	140.076	35.2988
6	CHB018	140.322	35.1577
7	CHB020	140.102	35.1155
8	CHB026	140.237	35.3872
9	CHB027	140.266	35.181

