RED-ACT Report

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

June 24, M5.5 Japan Chiba-ken Earthquake

Research group of Xinzheng Lu at Tsinghua University (luxz@tsinghua.edu.cn)

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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 09:11 24 Jun 2019 (Local Time, UTC +9), an M 5.5 (JMA) earthquake occurred in Japan Chiba-ken. The epicenter was located at 140.0 34.9, with a depth of 60.0 km.

2. Recorded ground motions

20 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 107 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.

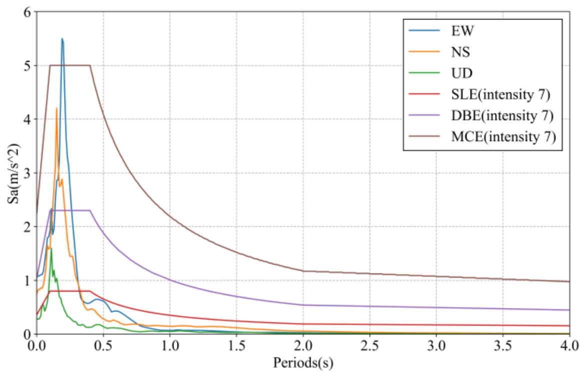


Figure 1 Response spectra of the recorded ground motions with maximal PGA

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 (see the Appendix of this report),** the damage ratios of buildings located in different places can be obtained. The building damage distribution and the human uncomfortableness distribution near to different stations is shown in Figure 2 and Figure 3, respectively. These outcomes can provide a reference for post-earthquake rescue work.

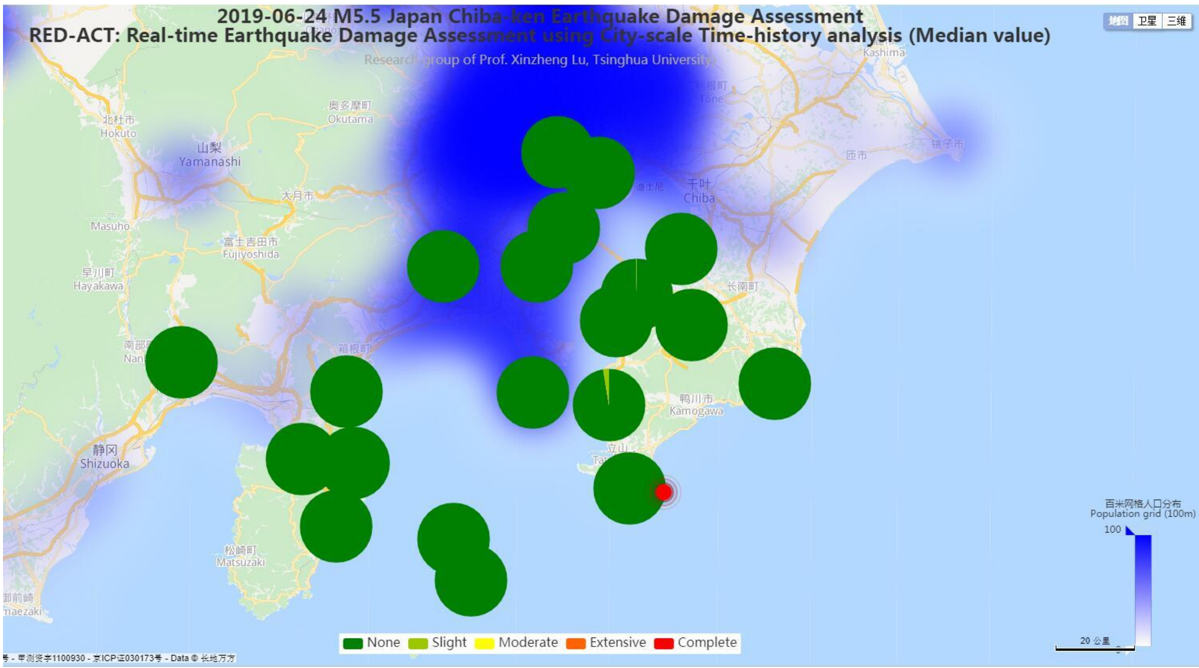


Figure 2 Damage ratio distribution of the buildings near to different stations

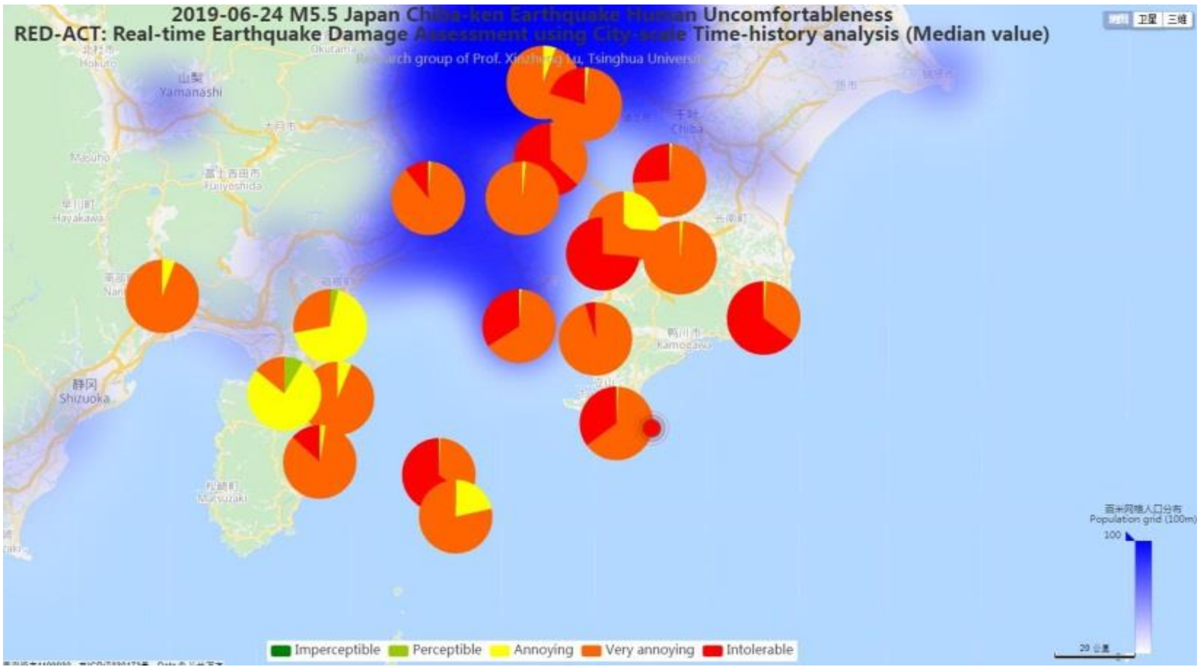
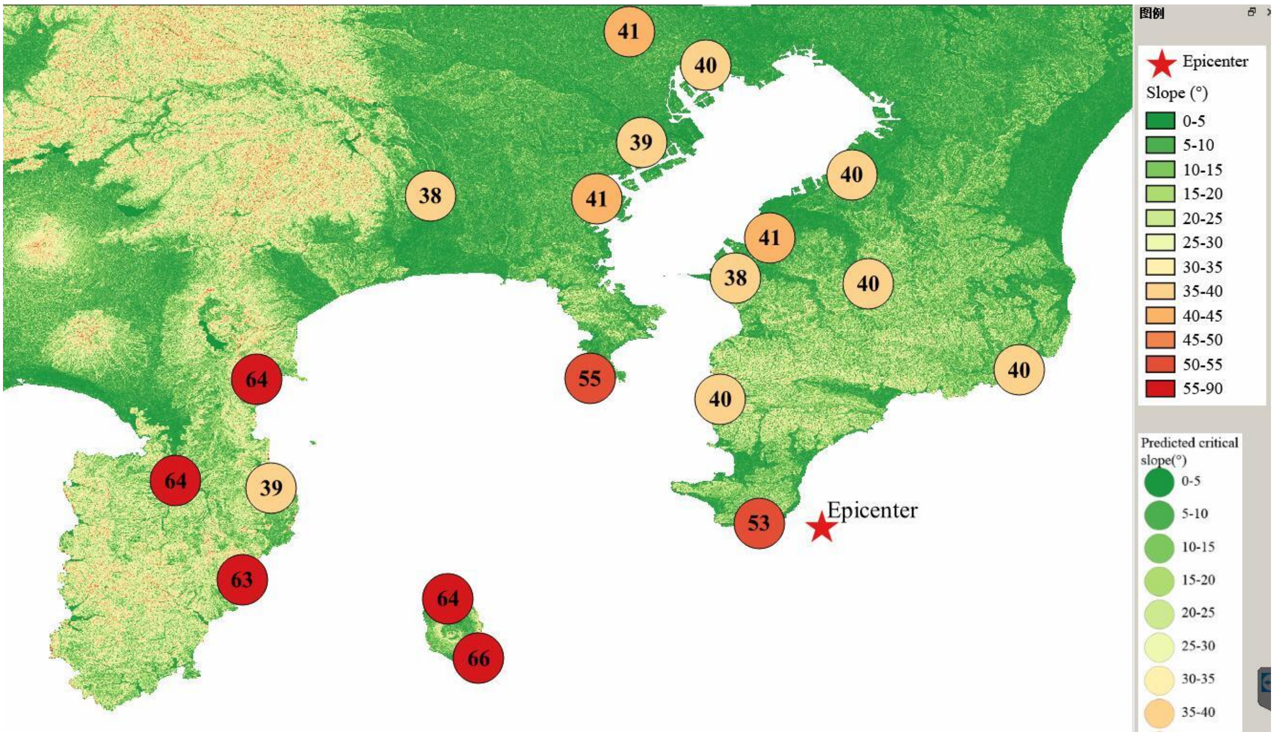


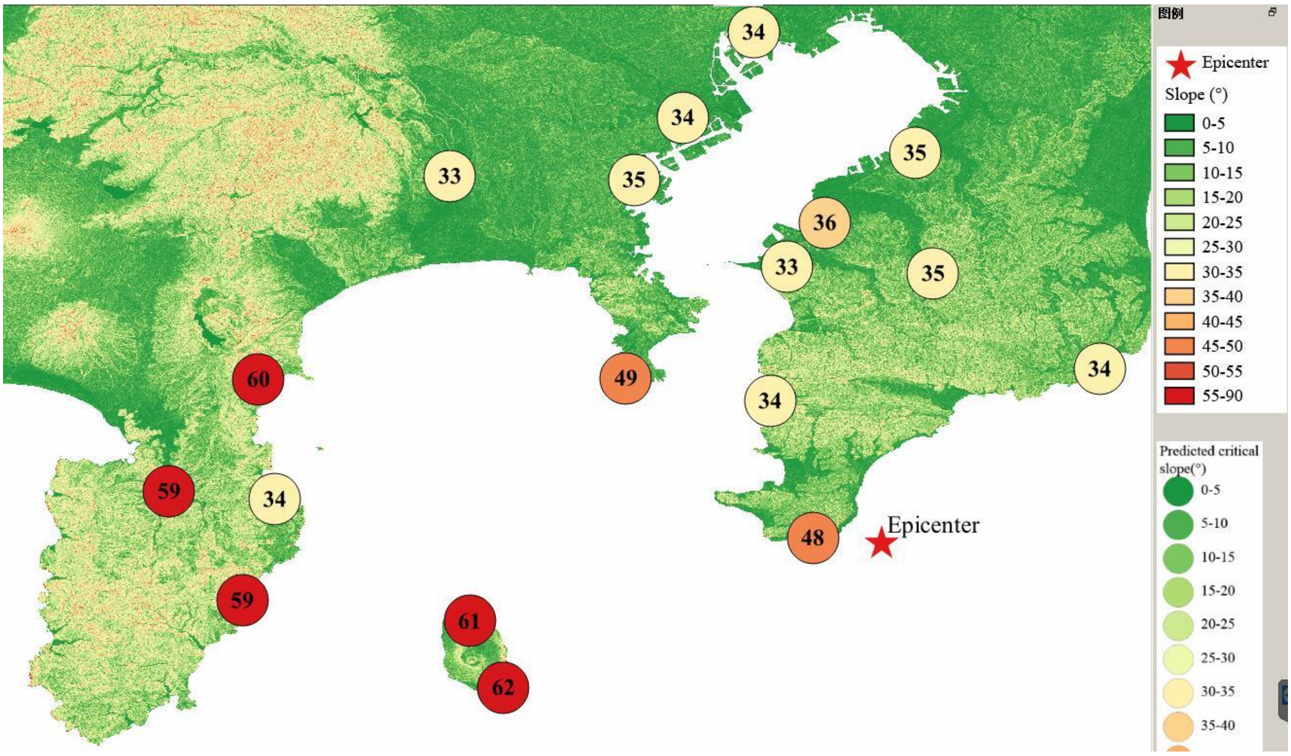
Figure 3 Human uncomfortableness distribution near to different stations

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

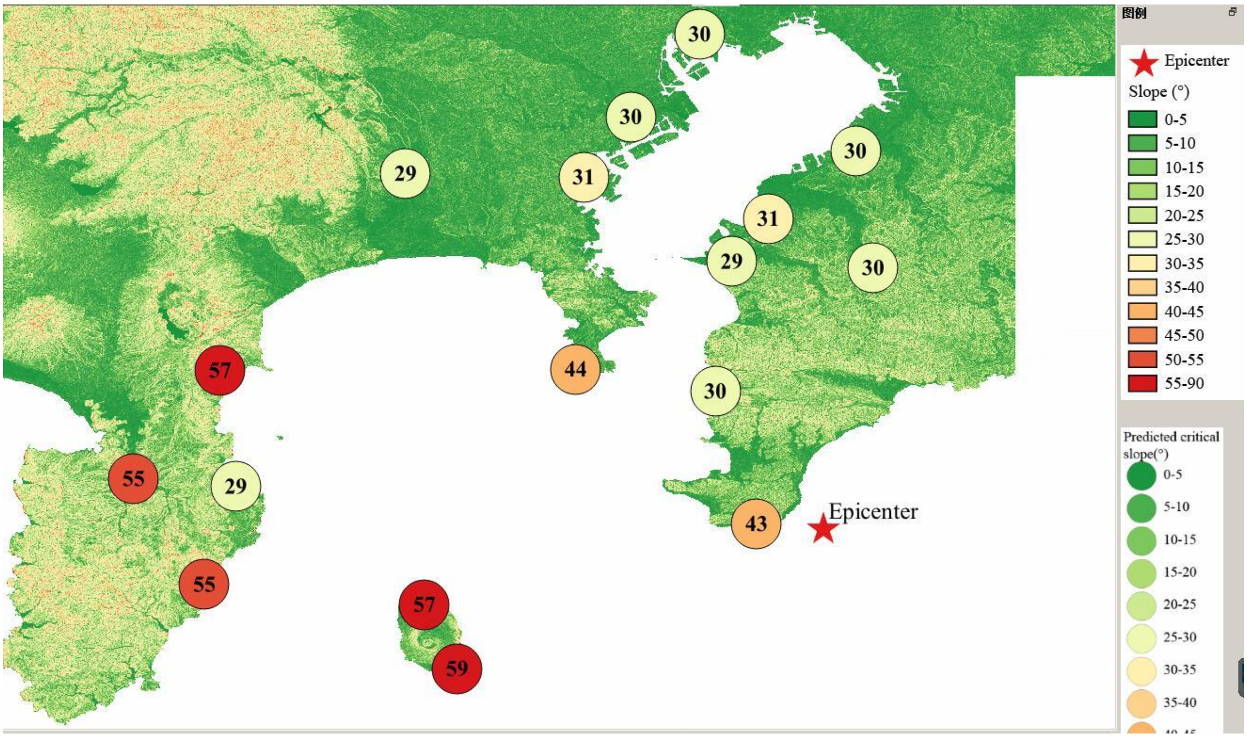
According to local topographic data, lithology data and ground motion records, the distribution of earthquake-induced landslide near to different stations under the different proportions of the landslide slab thickness that is saturated can be calculated, as shown in Figure 4. The basemap shows the distribution 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	CHB014	140.049	35.4769
2	CHB015	139.916	35.3738
3	CHB017	140.076	35.2988
4	CHB018	140.322	35.1577
5	CHB019	139.835	35.1105
6	CHB021	139.898	34.9083
7	CHB022	139.86	35.3083
8	KNG001	139.706	35.5291
9	KNG002	139.634	35.4371
10	KNG004	139.622	35.1441
11	KNG009	139.362	35.4424
12	SZO001	139.079	35.1424
13	SZO002	139.103	34.9652
14	SZO003	139.055	34.8158
15	SZO007	138.947	34.9771
16	SZO011	138.602	35.2128
17	TKY007	139.686	35.7107
18	TKY008	139.391	34.7852

19	TKY009	139.441	34.6874
20	TKY018	139.811	35.6551