RED-ACT Report

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

May 10, M6.3 Japan Hyuga-nada Earthquake

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

First reported at 09:30, May 10, 2019 (Beijing Time, UTC +8)

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/software/Real-Time_Report.pdf

1. Introduction to the earthquake event

At 08:48 10 May 2019 (Local Time, UTC +9), an M 6.3 (JMA) earthquake occurred in Japan Hyuga-nada. The epicenter was located at 31.8N 132.1E, with a depth of 20.0 km.

2. Recorded ground motions

44 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 207.50 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.

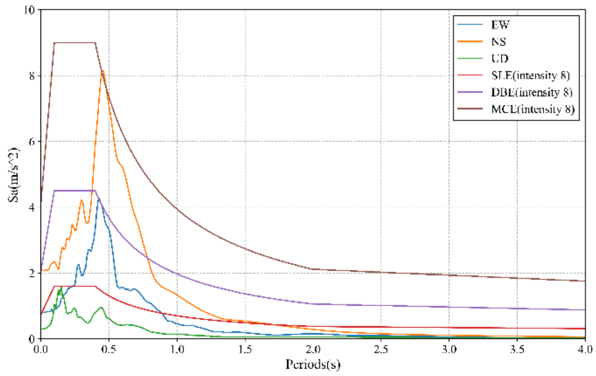


Figure 1 Response spectra of the recorded ground motions with maximal PGA

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.

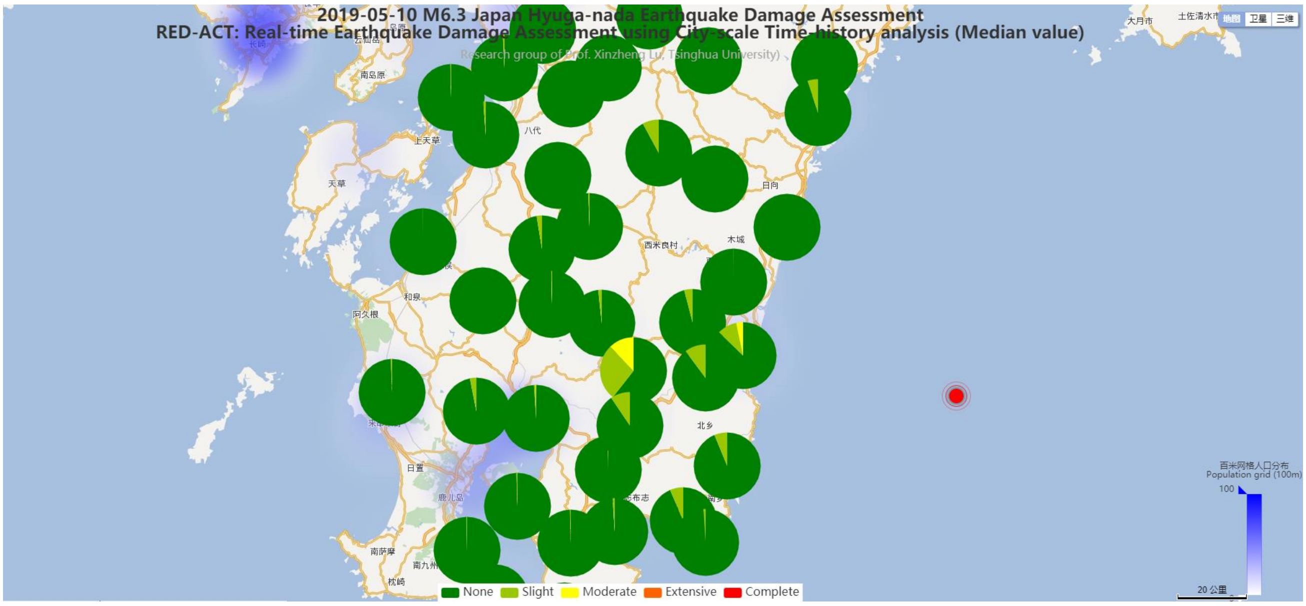


Figure 2 Damage ratio distribution of the buildings near to different stations

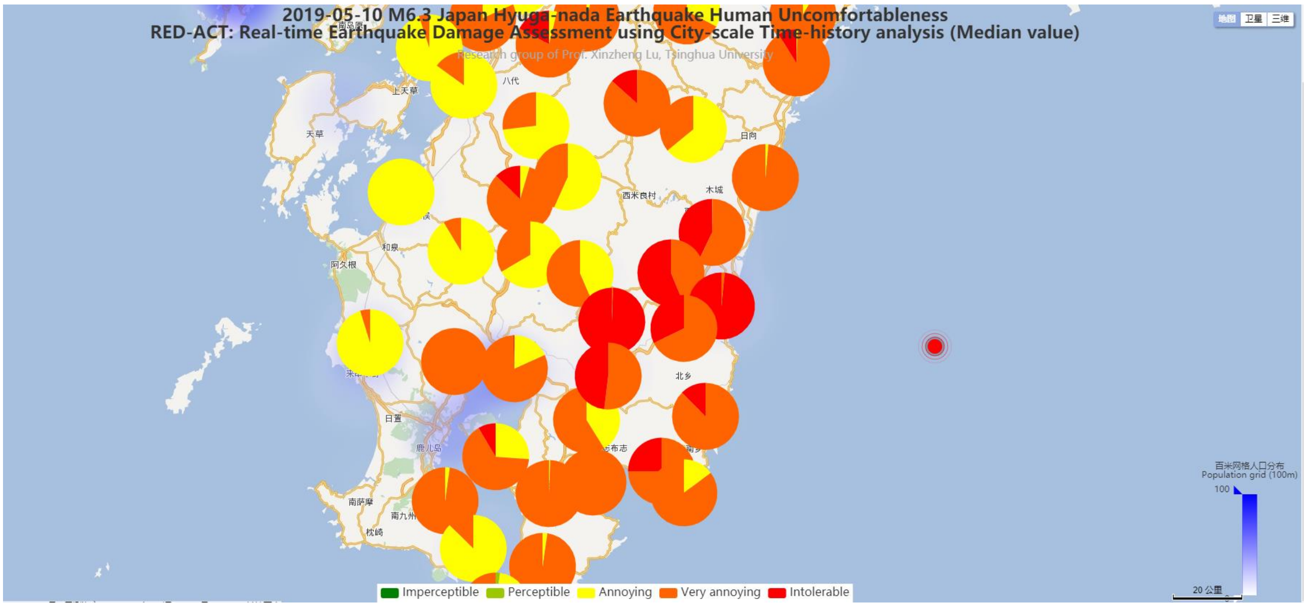
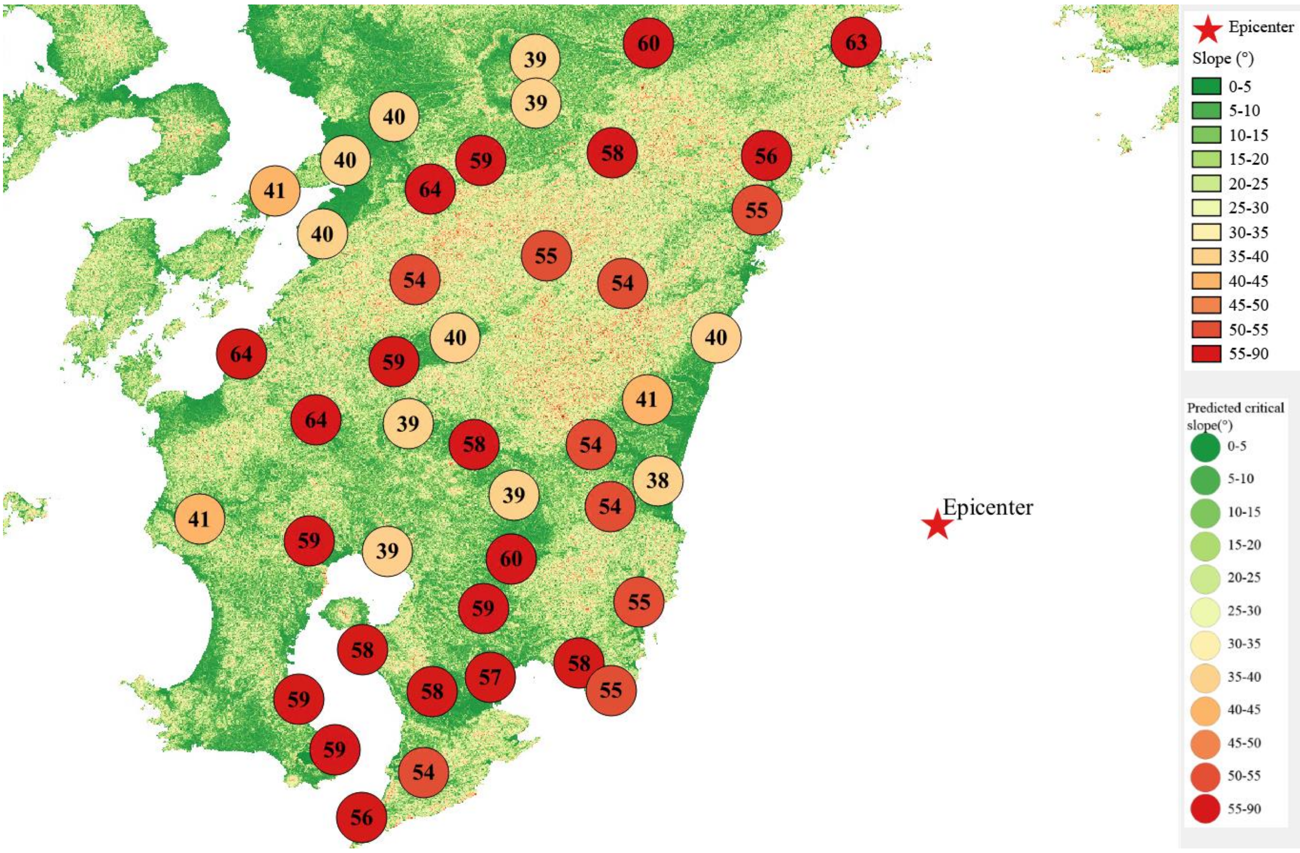


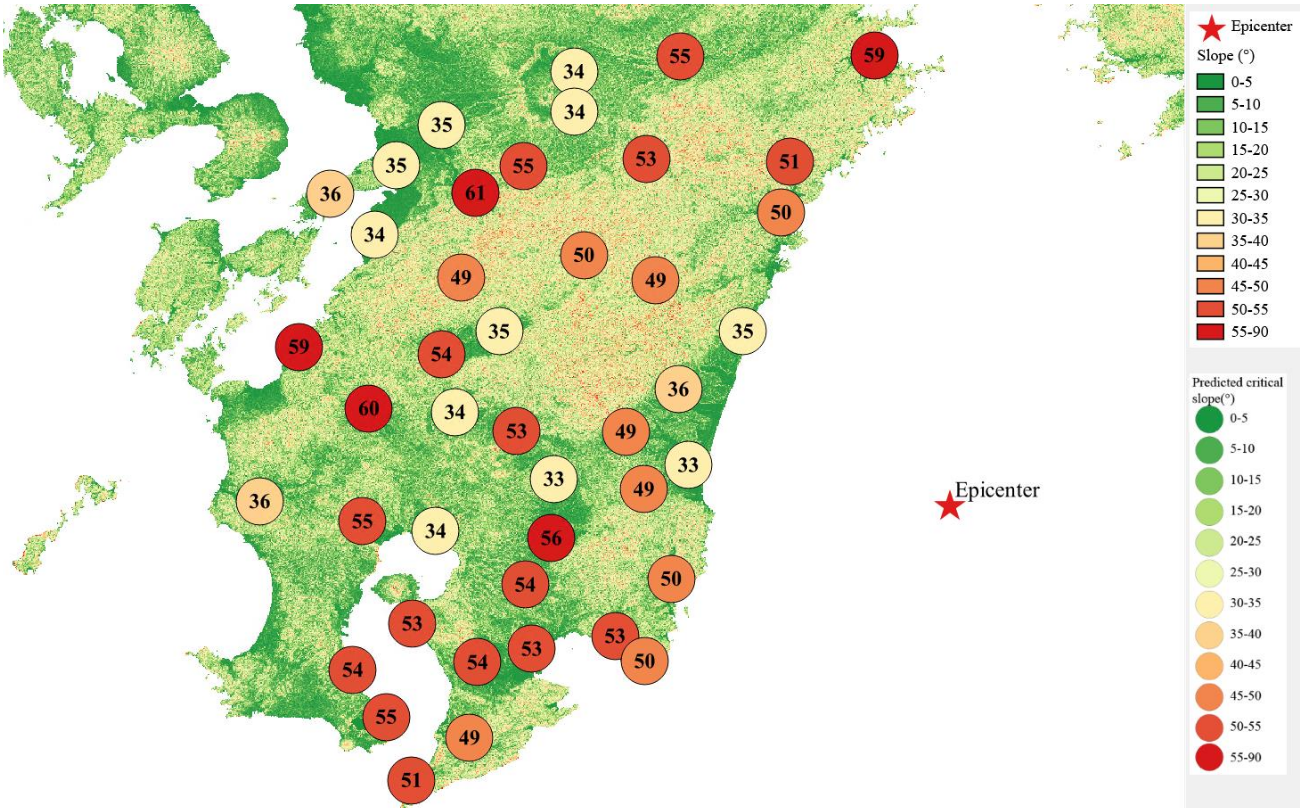
Figure 3 Human uncomfortableness distribution near to different stations

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

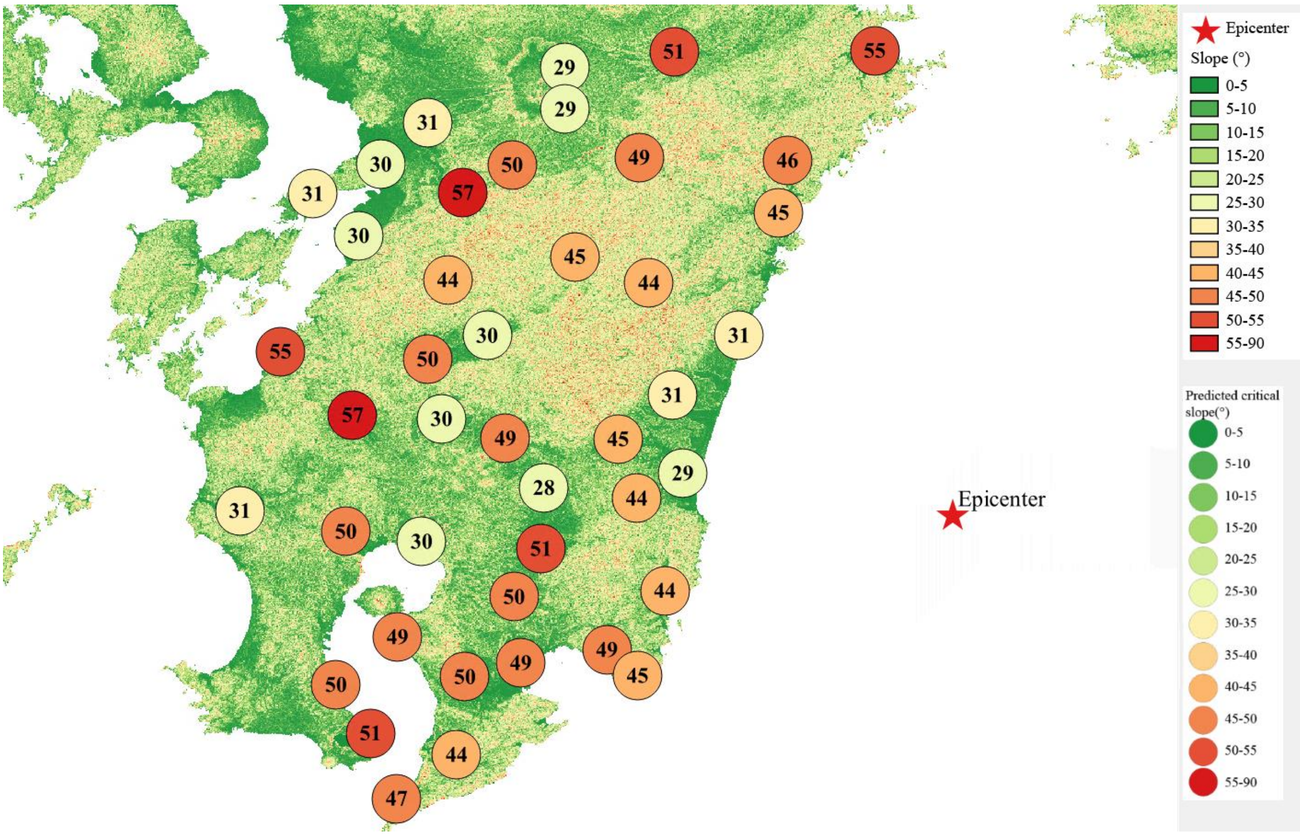
According to local topographic data, lithology data and ground motion records, the distribution of earthquake-induced landslide near to different stations under the different proportions of the landslide slab thickness that is saturated can be calculated, as shown in Figure 4. The basemap shows the distribution 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

Scientific background of this report can be found at: http://www.luxinzheng.net/software/Real-Time_Report.pdf

Table 1 Names and locations of the strong motion stations

No.	Station Name	Longitude	Latitude
1	KGS003	130.587	32.056
2	KGS007	130.303	31.814
3	KGS008	130.570	31.762
4	KGS009	130.761	31.737
5	KGS013	130.994	31.597
6	KGS014	130.700	31.496
7	KGS015	131.011	31.430
8	KGS017	130.87	31.395
9	KGS018	130.545	31.376
10	KGS021	130.632	31.254
11	KGS023	130.849	31.199
12	KGS024	130.698	31.089
13	KMM004	131.121	32.932
14	KMM006	130.777	32.793
15	KMM007	131.123	32.827
16	KMM008	130.658	32.688

17	KMM009	130.989	32.686
18	KMM010	130.487	32.614
19	KMM011	130.865	32.617
20	KMM012	130.602	32.508
21	KMM014	130.827	32.396
22	KMM015	130.405	32.216
23	KMM016	130.776	32.197
24	KMM017	130.926	32.256
25	MYZ001	131.309	32.705
26	MYZ002	131.683	32.698
27	MYZ003	131.660	32.566
28	MYZ004	131.334	32.389
29	MYZ006	131.561	32.257
30	MYZ008	131.393	32.106
31	MYZ009	130.811	32.046
32	MYZ010	130.972	31.997
33	MYZ011	131.256	31.995
34	MYZ012	131.069	31.872
35	MYZ013	131.419	31.909
36	MYZ014	131.303	31.845
37	MYZ015	131.062	31.719
38	MYZ016	131.374	31.613
39	MYZ017	131.228	31.464
40	MYZ018	131.305	31.399
41	MYZ020	131.147	32.455
42	OIT009	131.344	33.257
43	OIT015	131.397	32.972
44	OIT016	131.903	32.975