RED-ACT Report

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

Feb. 13, M7.0 Etorofuto Nanto-oki 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 19:34 13 Feb 2020 (Local Time, UTC +9), an M 7.0 (JMA) earthquake occurred in Etorofuto Nanto-oki. The epicenter was located at 148.9 44.7, with a depth of 160.0 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 waveform and corresponding response spectra in comparison with the design spectra specified in the Chinese Code for Seismic Design of Buildings are shown in Figure 1.

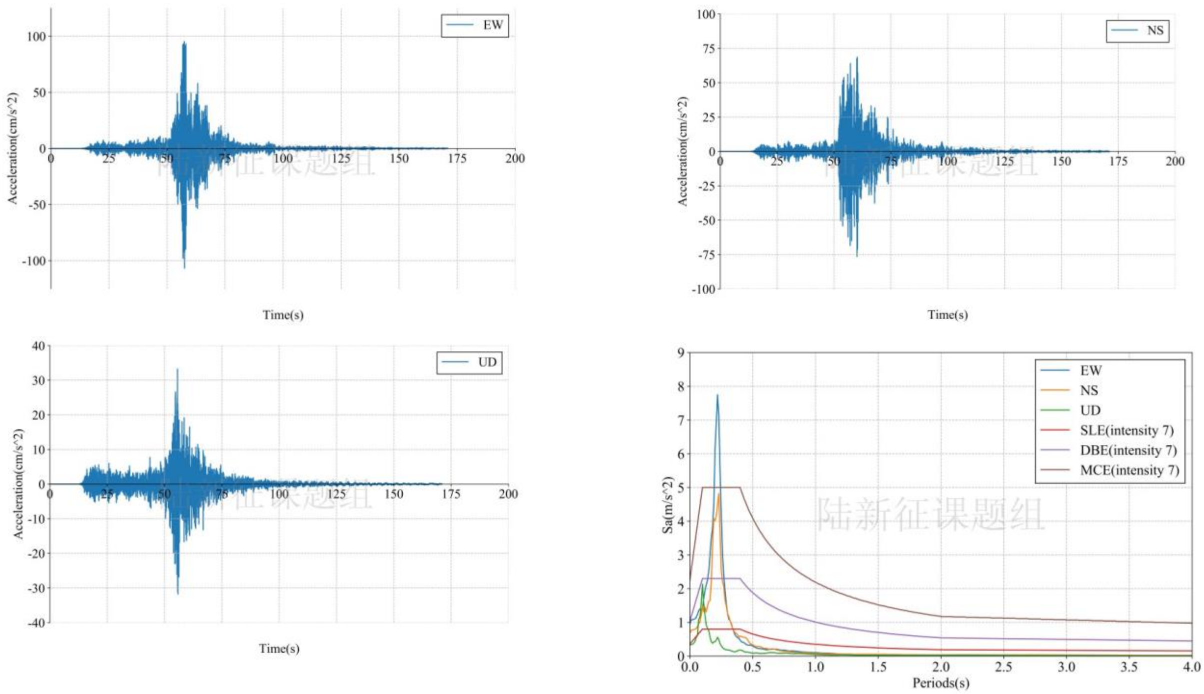

Figure 1 Waveform and response spectra of the recorded ground motions with maximal destructive capacity

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

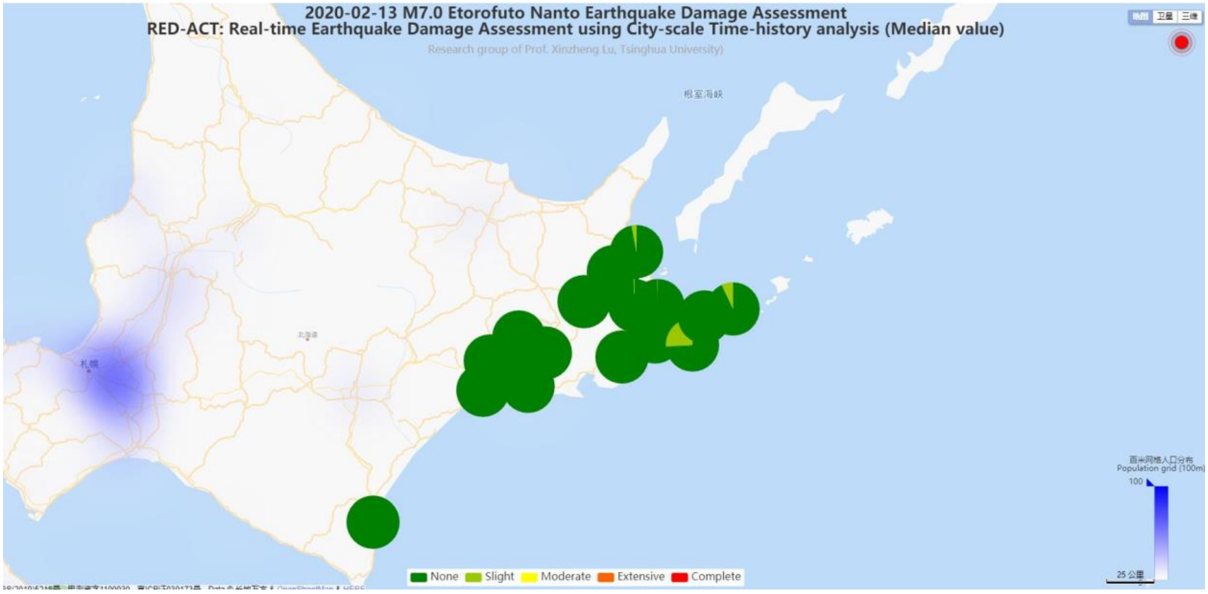

Figure 2 Damage ratio distribution of the buildings near to different stations

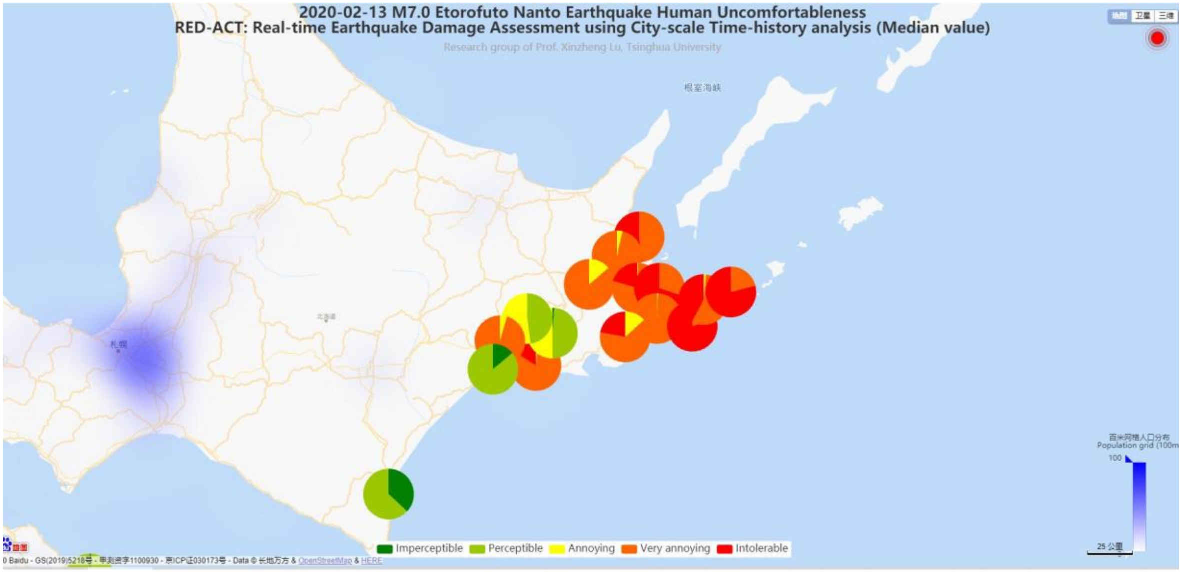

Figure 3 Human feeling distribution near to different stations

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 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	Latitude	Longitude
1	AOM010	141.142	40.8721
2	AOM012	141.481	40.5138
3	HKD066	145.131	43.6619
4	HKD067	144.973	43.555
5	HKD068	144.77	43.4108
6	HKD069	145.117	43.3941
7	HKD070	145.284	43.3852
8	HKD071	145.26	43.2326
9	HKD072	145.521	43.1948
10	HKD073	145.6	43.3327
11	HKD074	145.803	43.368
12	HKD075	145.029	43.1309
13	HKD077	144.382	42.9845
14	HKD078	144.498	43.1486
15	HKD083	144.325	43.233
16	HKD084	144.123	43.1141
17	HKD085	144.07	42.9581
18	HKD100	143.312	42.2864
19	HKD158	141.141	41.8345
20	HKD159	141.002	41.7162