# Real-time Damage Estimations for the 2016 Kumamoto Earthquakes by J-RISQ

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The National Research Institute for Earth Science and Disaster Resilience (NIED) is developing a real-time earthquake information system for damage estimation and situation assessment (J-RISQ) as a Cross-ministerial Strategic Innovation Promotion Program (SIP). J-RISQ is able to immediately estimate earthquake damage by combining methods for predicting ground motion using amplification characteristic data for subsurface ground, basic information on population and buildings, damage assessment methods for buildings using fragility functions, and observation data such as real-time strong motion data obtained by K-NET, KiK-net, local governments, and JMA. A part of J-RISQ information is published as a “J-RISQ Report” on http://www.j-risq.bosai.go.jp/ immediately after the occurrence of an earthquake. In this study, we describe the estimations by J-RISQ for the 2016 Kumamoto earthquakes (M6.5 event and M7.3 event) with maximum seismic intensity of 7 caused great damage to human beings, buildings, and infrastructures.

J-RISQ issued the first report 29 seconds after the M6.5 event occurred and a total of seven reports for about 10 minutes. Finally the system estimated that population exposed to seismic intensity of 6 lower or larger was 620,000 and that of 6 higher or larger was 290,000. The estimated results of building damage showed that completely destroyed buildings were between 6,000 and 14,000. The distribution of estimated completely destroyed buildings spread 7 km long by 1 km wide in Mashiki town.

For the M7.3 event occurred about 28 hours after the M6.5 event, the system distributed the first report 29 seconds after the M7.3 event occurred and a total of eight reports for about 11 minutes. Finally the system estimated that population exposed to seismic intensity of 6 lower or larger was 1,130,000 and that of 6 higher or larger was 660,000. The estimated results of building damage showed that completely destroyed buildings were between 12,000 and 31,000. The distribution of estimated completely destroyed buildings spread in Mashiki town similar to the result of the M6.5 event and Kumamoto city. However, this result of damage building is out of consideration of the effect of the earthquakes including M6.5 event before M7.3 event.

The estimated spatial distribution of the belt-shaped region at Mashiki town qualitatively agrees with the actual damage status; however, the estimated results tend to overestimate the actual damage. Therefore, we aim to verify the precision of the estimated damage through a detailed investigation of damage to buildings and to make improvements to enhance precision. Building damage caused by the Kumamoto earthquakes may be attributed to the decreased strength of buildings because of repeated strong motion originating from the large foreshock, mainshock, and subsequent active seismic activity. We also plan to investigate real-time damage estimation methods taking into account such changes in building strength.

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