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 (including the estimated distribution of seismic intensity and the population exposed
to each seismic intensity level) 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. The first report using data from 5 stations showed that population
exposed to seismic intensity 6 lower or larger was 7,800. 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 by using 1091 strong motion data. The estimated results of building damage
showed that completely destroyed buildings were between 6,000 and 14,000 and partly destroyed were
between 7,000 and 33,000. 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 670,000 by using 2391 strong motion data. The
estimated results of building damage showed that completely destroyed buildings were between 16,000
and 38,000 and partly destroyed were between 18,000 and 88,000. 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. At this time, we are not able to compare these
results with real damage because the whole picture of real damage has not been grasped yet. A
detailed analysis of real damage is to be desired.

Keywords: Kumamoto earthquake, J-RISQ, real-time damage estimation