Attenuation Characteristics of Strong Motions during the 2016 Kumamoto Earthquake

*Hongjun Si[1], Kazuki Koketsu[1], Hiroe Miyake[1], Rami Ibrahim[1]

1.Earthquake Research Institute, The University of Tokyo

Two major earthquakes occurred near the Mashiki-machi, Kumamoto, at 21:26 on 14 April, 2016 (M_w 6.2, GCMT), and at 1:25 on 16 April, 2016 (M_w 7.0, GCMT). Serious casualties and damages are reported during the earthquakes. A large number of strong ground motions were recorded during these two earthquakes. In order to understand the correlation between damages and the strong ground motion, we discuss the attenuation characteristics of the strong ground motions observed during the earthquakes.

The data used in this study are observed by K-NET and KiK-net. The 5% damped acceleration response spectra (GMRotI50) are calculated based on the method proposed by Boore et al. (2006). PGA and PGV is defined as the larger one among the PGAs and PGVs of two horizontal components. The PGA, PGV, and GMRotI50 data were corrected to the bedrock with Vs of 1.5km/s based on the method proposed by Si et al. (2013) using the average S wave velocity (Vs30) and the thickness of sediments over the bedrock. The thickness is estimated based on the velocity structure model provided by J-SHIS. We use a source model derived based on the waveform inversion by Koketsu et al. (2016). Based on the source model, we calculated the median distance (MED) which defined as the closest distance from a station to the middle line of the fault plane.

We compared the observed PGAs, PGVs, and GMRotI50 with the GMPEs developed in Japan using MED (Si et al., 2014). The predictions by the GMPEs are generally consistent with the observations during the two Kumamoto earthquakes. The results of the comparison also indicated that, (1) strong motion records from the earthquake on April 14th are generally consistent with the predictions by GMPE, however, at the periods of 0.5 to 2 seconds, four or three records closest to the fault plane greatly exceeds the predictions by GMPE. KiK-net station Mashiki (KMMH16) is included in these stations. (2) for the earthquake on April 16, the PGAs and GMRotI50 at periods from 0.1s to 0.4s with short distance from the fault plane are slightly smaller than the predictions by GMPE. On the other hand, for the PGVs and GMRotI50s at periods longer than 2.5s with MED larger than about 100 km, the observations are generally larger than the prediction by GMPE, showing smaller attenuation.

Reference: Asano (2016): Private communication; Boore et al.(2006), BSSA; Koketsu et al.(2016):Private communication; Si et al.(2014), Proceedings of the 14th JEES.

Keywords: The 2016 Kumamoto Earthquake, Attenuation Characteristics, GMRotI50