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Estimation of Strong Motion Generation Area during the 2008 Iwate-Miyagi Nairiku earthquake using broadband strong groun

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1.Introduction

The 2008 Iwate-Miyagi Nairiku earthquake was an Mw6.7 reverse-fault crustal earthquake that occurred at Iwate prefecture, Japan. Surface ruptures associated with the earthquake were found to distribute near the eastern edge of the southern part of the aftershock zone. Strong ground motions were observed at three stations very near the fault area in addition to the Kik-net and K-NET stations. It is important that strong motion generation areas are estimated using broad-band ground motions to find out the source mechanism generating low-frequency ground motions as well as high strong ground motions.

In this study, we attempt to determine the strong ground motion area (SMGA) of the 2008 Iwate-Miyagi Nairiku earthquake using the broad-band ground motions from the earthquake.

2. The previous studies of the source model for strong ground motions

We presented the SMGA model of this earthquake by forward modeling using the empirical Green's function method by Irikura (1986) in 2008 and 2013.

The model we presented in 2008 was determined to reproduce the observed waveforms around the fault area of the mainshock. We found the first SMGA was located coinciding with large slip area in the southern part of the fault plane obtained by several authors from the waveform inversion analyses using teleseismic body wave data. We clarified to require one more SMGA in the northern part from the hypocenter. However, we realized that the location and geometry of the fault plane we assumed are not so accurate enough according to the aftershock distribution determined from temporary aftershock observation network deployed just after the occurrence of the earthquake (Okada et al., 2012).

We reanalyzed the SMGA model in 2013 using the fault plane determined by the aftershock distribution from the high dense network. In particular, we attempted to simulate the strong ground motions at IWTH25 located very near the fault plane. We obtained one of the best-fitting SMGA models from which simulated and observed ground motions agreed well including the ground motions at a very-near-field station IWTH25. However, it shall be examined whether this model can explain the broad-band ground motions at other near-field stations.

3. Estimation of SMGAs for broadband strong ground motions

In this study, we try to estimate the SMGAs using not only the strong motion records at IWTH25 but other near-field stations, Aratozawa Dam. The observed records at Aratozawa Dam show distinctive strong-motions. This suggests that one of the SMGAs possibly exists near Aratozawa Dam site. On the other hands, the observed records at Aratozawa Dam may have near-field-terms because of very-near-fields from the source area. Therefore, in order to reproduce the mainshock waveform we need to use the empirical Green's functions including the near-field terms, that is ground motion records from an element earthquake occurring very near a source in the fault area. When there is no element earthquake satisfying the near-field condition mentioned above, we use the hybrid Green's functions that have low frequency motions theoretically simulated and high frequency motions empirically obtained. We have no aftershock records at the Aratozawa Dam sites. Therefore, we attempt to simulate the broad-band strong motions at Aratozawa Dam site using only numerically calculated Green's functions to precisely estimate the SMGAs.

Keywords: Iwate Miyagi Nairiku earthquake, Strong Motion Generation Area, broad-band Strong Ground Motion