

Comparison of source areas of the 2005 (M7.2) and 1978 (M7.4) Miyagi-Oki earthquakes, NE Japan, by seismic waveform inversions

Tadashi Yaginuma[1]; Tomomi Okada[1]; Kenichi Kato[2]; Masayuki Takemura[3]; Yuji Yagi[4]; Akira Hasegawa[1]

[1] RCPEV, Graduate School of Sci., Tohoku Univ.; [2] Kabori Research Complex, Kajima Corporation; [3] Kabori Res. Comp., Kajima Corp.; [4] Univ. of Tsukuba

A magnitude 7.2 interplate earthquake occurred on August 16, 2005 in the Miyagi-Oki region (offshore of Miyagi Prefecture), northeastern Japan. A maximum seismic intensity of just under 6 in JMA scale was observed in Kawasaki, Miyagi Prefecture, and the damage by this earthquake was reported that 91 people were injured and 1 house was completely destroyed. Around the focal area of this event, about M 7.5 interplate earthquakes have repeatedly occurred at an interval of about 37 years. The last Miyagi-Oki earthquake (M 7.4) occurred on June 12, 1978, killed 28 people, injured 1325 people and destroyed 1183 houses completely, and 5574 houses partly. The public have concern over the occurrence of the Miyagi-Oki earthquakes, in consequence of the scale of their damage and the intervals of their occurrence. Now therefore, it is important to investigate the relationship between the 2005 Miyagi-Oki earthquake and the 1978 Miyagi-Oki earthquake not only for the understanding of the detailed asperity map and the mechanism of the earthquake occurrence in the off-Miyagi region, but also for the disaster mitigation.

In this study, we first determined the slip distribution by the seismic waveform inversion method of Yagi et al. (2004) to estimate the rupture area of the 2005 Miyagi-Oki earthquake. Results of seismic waveform inversion strongly depend on the station distribution and the assumed earth structure; so we need to estimate slip distributions under the same conditions as far as possible when we compare slip distributions of more than one earthquake (Nagai et al., 2001; Okada et al., 2003). In this case, to compare results for both events under almost the same condition, structure model and regional stations were compliant with those of Kato et al. (2003) which estimated the distribution of the asperities in 1978 Miyagi-Oki earthquake. Also, we adopted the hypocentral location, 38.175N, 142.206E, 39.8 km depth, from Yamamoto et al. (2005) obtained by using OBS data, and the geometrical parameters of the fault model, strike 198.2 degree, dip 22.2 degree, from the AQUA-CMT values of the National Research Institute of Earth Science and Disaster Prevention.

The result shows that large coseismic slip during the 2005 Miyagi-Oki earthquake occurred in and around the hypocenter and extends westward from the hypocenter. On the other hand, Kato et al. (2003) estimated three asperities, which correspond to the large coseismic slip areas, for the 1978 Miyagi-Oki earthquake, and one of the asperities (AS1) he estimated was located around the hypocenter. The separation between the hypocenter of the 2005 Miyagi-Oki earthquake and that of the 1978 event is a few km (Okada et al., 2005), and the rupture area of 2005 event almost overlapped with AS1. This result strongly suggests that 2005 Miyagi-Oki earthquake was the rerupturing of one of asperities in 1978 Miyagi-Oki earthquake.