

Application of the AQUA system to the 2005 off NW Fukuoka Pref. Earthquake

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1. Introduction

It is important for seismology and disaster prevention to obtain source parameters of large earthquakes immediately and accurately. We developed the Accurate and Quick Analysis, AQUA, system for source parameters using waveform data from NIED high sensitivity seismograph network (Hi-net) and broadband seismograph network (F-net) stations. Hypocenter, amplitude magnitude, and moment tensor solutions are calculated as possible as accurately and quickly in the AQUA (Matsumura et al., 2005, this issue). The AQUA was running and calculated hypocenters and moment tensor solutions for the main shock and many aftershocks when the 2005 off NW Fukuoka Pref. Earthquake occurred. This study investigated the validity of the results obtained by the AQUA. We compared the AQUA solutions with other solutions obtained by the NIED routine or other systems.

2. Method

The AQUA is developed for large or intermediate earthquakes. The process flow of the AQUA system is following. First, hypocenters and amplitude magnitudes are calculated using P first arrival time evaluated from RMS amplitude on every 1 second at the NIED Hi-net stations (AQUA-HYPO). Next, moment tensor solutions and centroid depths at the fixed epicenters of AQUA-HYPO are calculated by waveform inversion using the waveform at the NIED F-net stations (AQUA-MT). Finally, moment tensor solutions, centroid locations and centroid time are calculated (AQUA-CMT).

3. Results

In 10 days from March 20 when the main shock occurred, 19 events with magnitude exceeding 3.6 were calculated at the AQUA-HYPO stage. The hypocentral parameters of the main shock were estimated within 28 seconds from the origin time. The parameters (latitude, longitude, depth, magnitude) of the main shock are following: (33.71N, 130.20E, 13.2km, 5.6). On the other hand, the first result of the main shock, calculated by the Hi-net automated routine, is obtained after 80 seconds from the origin time. Hypocentral parameters calculated from P and S arrival times picked manually are following: (33.74N, 130.17E, 9.8km, 6.9). Hypocentral parameters of the main shock are almost same as those calculated manually, and they are obtained more quickly than the Hi-net automated routine, although its magnitude is underestimated at the AQUA-HYPO stage. Hypocenters and magnitudes of aftershocks are almost identical to those calculated by the Hi-net routine. The underestimation of the magnitude of the main shock may be caused by the time window with 2 seconds, which is shorter than the source duration time of the main shock, to calculate the magnitude from the maximum RMS amplitudes.

At the AQUA-MT and CMT stage, 14 events in the same period of 10 days were analyzed. The AQUA-MT and AQUA-CMT solutions of the main shock are estimated within 4 minutes and 11 minutes, respectively. The source parameters (strike, dip, rake, M_w) of the AQUA-MT and CMT are following: (302, 80, 7, 6.6) and (302, 85, 13, 6.6). We compared them with those listed in the NIED F-net MT and the Harvard CMT catalogues, and their parameters are following: (122, 87, -11, 6.4) and (122, 89, 8, 6.6). The moment tensor solutions of the AQUA-MT/CMT are comparable with those of other systems. The moment tensor solutions of aftershocks are calculated within about 3 minutes and 7 minutes at the AQUA-MT/CMT stage and their focal mechanisms are consistent with those calculated from the distributions of P first polarities around NIED Hi-net stations.

4. Conclusion

We compared source parameters obtained by the AQUA system with those obtained by other system in the focal area of the 2005 off NW Fukuoka Pref. Earthquake. The hypocenters and the moment tensor solutions are usually

obtained within 30 seconds and 4 minutes, respectively. We conclude that source parameters obtained by the AQUA are valid because they are consistent with those by other systems.