Strong motion seismology

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After the1995 Hyogoken-Nanbu (Kobe) earthquake, two important topics were brought to study on strong motion seismology. One is the expansion of strong motion observation network and the other is to develop strong motion prediction methodology for scenario earthquakes.

Before the Kobe event, there were about 1500 strong motion stations installed by many organizations in Japan. However, there were only two stations in the damaged area with seismic intensity 7 in JMA scale during the Kobe earthquake. After the Kobe event, the nation-wide networks for research are such as K-net (about 1,000 sites) and KiK-net (about 700 sites) by NIED and Port and Harbour-net (about 100 sites) by PARI. The networks for disaster management are such as JMA-net (about 600 sites) by Japan Meteorological Agency, Prefectures-net (about 2,800 sites) by each prefectural office and MLIT-net (about 700 sites) by Ministry of Land, Infrastructure and Transport (Midorikawa, 2005). Totally, more than 6 thousands stations are in operation. This dense nation-wide networks observed ground motions during e.g. the 2000 Tottoriken Seibu, the 2003 Miyagiken-hokubu, and the 2004 Chuetsu earthquakes, and the 2003 Tokachi-Oki earthquake.During the 2003 Tokachi-Oki earthquake, the observation network gives us the generation of long-period ground motions in Yufutsu plain.

The second issue is started from the quantitative evaluation of strong motions in the source area during the Kobe event. Heterogeneous source model and 3D complex basin structure generate large ground motion area in the edge of the basin. Based on this estimation, strong ground motion prediction methodology has been established and applied to create shake maps for scenario earthquakes. This methodology is confirmed by estimation of strong motions observed by the nation-wide networks during e.g. the 2003 Tokachi-Oki earthquake.

In the future study on strong motion seismology, one of the important themes is to confirm the 3D underground velocity structure model by waveform modeling of small events observed at strong motion networks. This model improvement gives us more reliable results on strong motion prediction. More challenging theme is to constrain source rupture scenarios before the earthquake occurrence. As strong ground motions in source area are mainly controlled by rupture scenarios, cooperation of researchers in seismology, active faults, tectonics, and earthquake engineering fields for developing advanced source models for strong ground motion prediction.