20 Years of K-NET

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Strong motion observation in Japan has been operated since 1950's together with the development of the SMAC strong motion sensors, which succeeded in recording the ground motions of the 1968 Tokachi-oki and 1978 Miyagi-oki earthquakes. Near-fault ground motions were observed during the 1995 Hyogoken-nanbu (Kobe) earthquake, however, several problems were posed regarding initial response. After the 1995 Kobe earthquake, the Japanese strong motion observation was drastically stimulated. Many Japanese organizations such as the National Research Institute for Earth Science and Disaster Prevention (NIED) have made a lot of efforts to improve the quality and quantity of the seismic observations in Japan. Since 1996, NIED has been in charge of the operation of two strong motion networks: K-NET and KiK-net. K-NET consists of about 1000 stations with 3-component acceleration strong-motion seismographs on the ground surface. KiK-net consists of about 700 stations with 3-component acceleration strong-motion seismographs both on the ground surface and at the bottom of the boreholes. NIED is a pioneer institution in Japan to releasing all digital data for free through the Internet immediately after an earthquake, and nowadays this open-data policy is becoming a common practice among the seismological field. NIED also developed new instruments of K-NET and KiK-net for upgrade with new technology. The first, second, and third generations of NIED accelerometers are capable of measuring up to 2000, 4000, and 8000 gals, respectively. The first generation, K-NET95 (Kinoshita, 1998) and SMAC-MDK (Aoi et al., 2004), adopted a dial-up system in which the Data Management Center (DMC) of NIED called to stations and collected data via telephone line after earthquakes. The second generation, K-NET02/K-NET02A (Fujiwara et al., 2007) and KiK-net06 (Aoi et al., 2011), adopted a dial-out system in which stations automatically sent data to DMC after triggered. Real time seismic intensity (Kunugi et al., 2008, 2013) is also calculated at stations. The third generation is K-NET11/K-NET11A and KiK-net11/KiK-net11A (Kunugi et al., 2014). K-NET02/K-NET02A has been officially approved as a seismic intensity meter by the Japan Meteorological Agency (JMA). Step-wise noise was improve by using the JA40GA sensor with quarts hinge, which can measure the long-period components. In the third generation, 4-component sensors are installed to ensure the accuracy of the acceleration measurement based on lessons from severe situation in the 2011 Tohoku earthquake. K-NET and KiK-net have recorded the JMA seismic intensity of 7 four times, intensity 6+ and 6- 188 times, and over 1000 gals 42 times including 4022 gals during the 2008 Iwate-Miyagi earthquake. Because of the low-frequency occurrence of large earthquakes, strong motion has been commonly observed by event triggering system, which requires connection of the telephone-line only during the data collection. To advance the rapidity and reliability, continuous observation is one of the most likely options. Data recorded by an event triggering system provides important information of past earthquake and helps to assess the seismic hazard and risk of a future earthquake. With a continuous observation system, owning to the rapid progress of information technologies, we would soon be able to fully monitor ground motions in real time and thus directly contribute to mitigate seismic disasters. Strong motion observation has been operated over years due to selfless efforts of our frontrunners. Even though recent trend regards the short-range research progress as important, it is also quite important to incorporate with new technology to ensure recording of less frequent but very important events occurring once per years or decades, such as the 1995 Kobe or 2011 Tohoku earthquakes.

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