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Strong-motion seismographs at a turning point -- to meet a wide variety of need --

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After the 1995 Hyogoken-nanbu earthquake, the development of 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 put a lot of effort to improve the quality and quantity of the seismic observations in Japan. Since 1996, NIED has been in charge of the construction of two strong motion networks, the K-NET and KiK-net. These dense seismograph networks have successfully recorded many near source ground motions, and near 290,000 digital records from more than seven thousands events are now available though a public access web-site.
NIED is a pioneer institution in Japan to freely releasing all digital data though the Internet immediately after an earthquake, and nowadays this open-data policy is becoming a common practice. Although our initial policy was to release all data within one week after the occurrence of an earthquake, the request for a quicker earthquake information from many local governments who are responsible for the initial response after an earthquake, prompted us to update our network. Based on these requests, we conducted the replacement of the all the instruments of about 1700 stations of K-NET and KiK-net (excluding the downwhole sensors) between 2003 and 2008. NIED developed the K-NET02/K-NET02A and KiK-net06 which are state of the art strong motion instruments capable of measuring up to 4000 gal with higher resolutions than the original instruments. K-NET02/K-NET02A has been officially approved as a seismic intensity meter by the Japan Meteorological Agency (JMA). Seismic intensity is automatically measured and sent to JMA within two minutes after being triggered. This information is expected to significantly contribute to the decisions and actions of agencies in charge of the response after an earthquake. From the viewpoint of disaster mitigation, it will become necessary in near future to provide the data that is required to estimate the spatial distribution of not only the hazard (ground motion) but also the risk (damage) of the earthquake in real-time. To meet this need, more rapid data transmission and denser network may be required.
Because of the low frequency of 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 achieve more rapidity, 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 estimate the 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 in real time and thus directly contribute to mitigate seismic disasters. Our strong motion network capability lies currently somewhere in between these two observation systems.
It may be difficult to obtain denser network only by constructing new stations because of their huge cost. In Japan there exist more than six thousands stations operated by public organizations such as JMA, the local governments and the research institutes. Each of them have their own purposes and are individually operated. Corporation of these networks could make possible to construct virtual dense networks of decentralized administration. To achieve the construction of

such a network, it is indispensable to make common rules for sharing data and construct a standard protocol for its decentralized administration. Another approach is the use of low cast sensor such as MEMS sensor.
Unfortunately a large earthquake will certainly occur sometime in future. We hope that the data from the network which has been constructed based on the lessons learned from the Kobe earthquake contribute to mitigate the disasters from future earthquake.

Keywords: Strong motion seismograph network, K-NET, KiK-net,
real-time strong motion seismograph, Earthquake early warning