Data Sharing at the National Research Institute for Earth Science and Disaster Resilience

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Summary. After the 1995 Kobe Earthquake, National Research Institute for Earth Science and Disaster Resilience, NIED, established the nation-wide seismograph networks as a part of Japanese government policy. Ground motions observed at each station are automatically sent not only to the NIED data management centre at Tsukuba but also to the Japan Meteorological Agency, JMA, universities, and other related research institutes in real-time. By using the data, JMA announces the earthquake early warning (EEW). JMA also constructs the detailed hypocentre catalogue and open it to the public. NIED has responsibility to accumulate seismic waveform data and to open them to the public via the Internet. In order to check how much of these data are used for research activities, NIED has just started to discuss to apply the Digital Object Identifier (DOI) to them.

Keywords. Seismograph networks, data exchange, quality check, data citation, Digital Object Identifier.

1. Introduction

National Research Institute for Earth Science and Disaster Resilience, NIED, is pursuing research activities in a wide range of natural hazards, disaster mitigation, and effective disaster response and recovery to improve the level of science and technology for disaster risk reduction. To achieve these research subjects, NIED is operating several kinds of nation-wide observation networks for monitoring earthquake, tsunami, volcanic and meteorological activities [1]. Most of stations were constructed with premise to open the observed data to the public. Earthquake observation networks are one of them. In this report, NIED's recent activities about sharing the seismic observation data are introduced mainly.

2. NIED Seismograph Networks

NIED is currently operating three kinds of seismograph networks in the land area [2] and two networks at the ocean bottom. To detect weak signal from micro-earthquake and estimate precise locations of hypocentres, the high-sensitivity seismograph network, Hi-net, is operated. F-net is the broad-band seismograph network to observe ground motions in broad frequency range, and used for the research of earthquake mechanisms. K-NET and KiK-net are strong motion seismograph networks that accurately observes strong ground motions. These networks were newly constructed or expanded after the 1995 Kobe Earthquake to monitor earthquake activity and ground motion for the whole nation. Recently, two ocean bottom seismograph and Tsunami observation networks are established: S-net for the Pacific coast of the eastern Japan and DONET for the Nankai area. According to the policy determined by the Headquarters for Earthquake Research Promotion, NIED has responsibility to accumulate all seismic waveform data observed by these networks, to store them for long time and to open them to the public via the Internet. Everyone can download the data from the NIED's websites for non-commercial use.

3. Data Exchange in Real-Time

In Japan, not only NIED but also the Japan Meteorological Agency, JMA, universities, and other related research institutes operates their own seismograph networks. To maximize the use of limited data, all related organizations are sharing the observed high-sensitivity and broadband seismograph data in real-time. JMA uses these data to monitor the earthquake activity and to construct the precise nation-wide hypocentre catalogue. Moreover, JMA announces the earthquake early warning (EEW) by using both Hi-net and JMA data. Universities use the data for their research and educational activities. As each K-NET station has a function of the JMA-scale seismic intensity meters, observed seismic intensity is sent to JMA immediately once a large earthquake occurs. JMA integrates them with its own data, and announces as earthquake information to the public.

4. Introduction of DOI and Problems

About 20 years have passed since the operation began, NIED seismograph networks have become essentials for earthquake disaster mitigation and seismological research. In order to maintain the networks in the future, it is important to show the significance of the networks, especially in the research field.

In 2017, NIED organized a new group named 'Administration Office for Information Integration'. This group discusses how to open the NIED data to the research group and/or the public efficiently and effectively, and how to show the importance of the NIED data. For the latter point, number of research papers in which the data are used would be a useful index. Therefore, the group concluded that introduction of the Digital Object Identifier (DOI) to the data is one of the good answers to visualize cited performance of the data.

NIED seismograph networks are working now and their data are increasing every second. Each seismograph network is composed by 100 - 1000 stations. Each station has observation parameters and repair histories individually. For the field of earthquake observation, it is difficult to classify the waveform data to "good" or "bad" as a result of quality check. For example, fine three-component seismograms are needed to get the JMA-scale seismic intensity, although even only one-component data is appropriate for use to know the arrival time of earthquake motion. Unit for the DOIs to the seismic waveform data should be determined while considering efficient metadata management and user's convenience.

5. Conclusions

NIED operates several kinds of observation networks. Especially seismograph network data are open to the public since the network has established. Waveform data by NIED, JMA, universities, and other institutes are shared in real-time and used for their own activity. NIED receives and stores all of them.

To maintain the NIED networks, it is required to visualize effectiveness of their data. To answer this requirement, it is necessary to show the cited performance of the data based on the reliable database. Introduction of the data DOI would be one of the key answers in the future.

The seismograph networks have to continue to provide effective information for earthquake disaster mitigation. Although there are some difficulties to apply the data DOIs to waveform data of the NIED seismograph networks, the DOIs would play an important role to maintain the nation-wide networks in long-term.

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