Development of Earthquake Information Distribution System

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1. Introduction

After the occurrence of an earthquake, the effective resumption of train operation and early restoration of facilities will be feasible if the shake map can be accurately determined in areas where no seismograph is installed.

To achieve this objective, we have developed the Earthquake Information Distribution System for railways which estimates vibration distribution and disseminates the data immediately after an earthquake occurs.

2. Overview of the System

Figure 1 illustrates the flow of processing in the earthquake information distribution system. This system starts the processing by using the earthquake early warning (EEW) issued by the Japan Meteorological Agency as a trigger. Subsequent to receiving the trigger, the system automatically obtains the K-NET (nationwide strong-motion seismograph network in Japan) seismic wave data from the National Research Institute for Earth Science and Disaster Prevention. Then, by using the obtained seismic wave data as well as the data pertaining to ground amplification characteristics that have been provided in advance, the shake map is estimated by taking the nonlinearity of ground deformation into consideration. After the estimation, the system updates the website and sends the information to the users by e-mail.

An example of the website image is shown in Figure 2. An estimated shake map is displayed at the left of the website. The shake map can indicate three kinds of railway alarming seismic motion indicators, namely, acceleration, SI (Spectral Intensity) value and measured seismic intensity, each of which can be displayed by switching. In addition, measured values of the seismic motion indicator observed through K-NET are listed at the right of the website.

3. Estimation Precision and Processing Time

We have verified the accuracy of estimation by comparing the estimated value given by this system and the observed value. Figure 3 shows an example of the verification results. From this figure, the estimated error for this earthquake is verified to be approximately 0.5 in the scale of seismic intensity. Further, by using the time recorded in the system log, we verified that the processing time from earthquake occurrence to publicizing the information was 8 to 9 minutes.

4. Future Development

The accuracy of seismic motions can be further improved by processing the seismograph data and ground data of trackside areas measured by railway companies. We will continue to improve the system to achieve even more practical solutions.

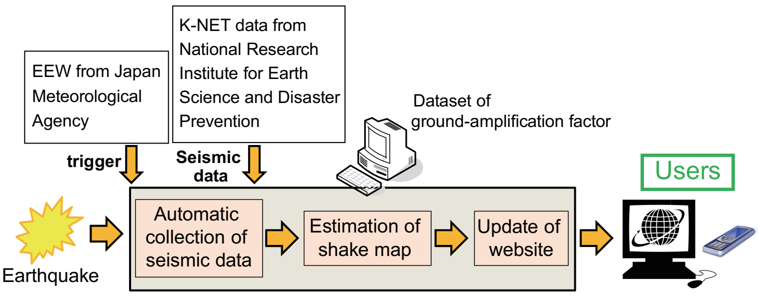

Fig.1 Processing flow in the Earthquake Information Distribution System

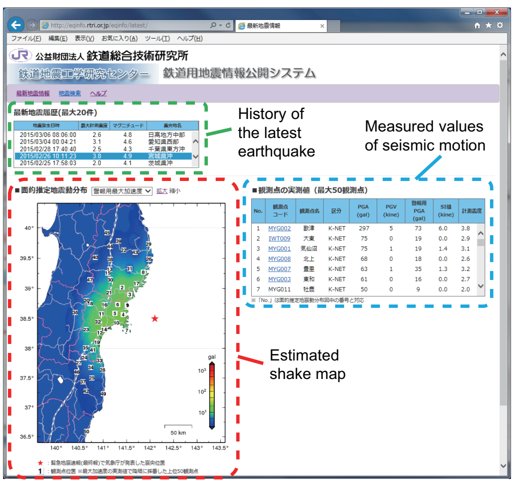

Fig.2 Example of a website image

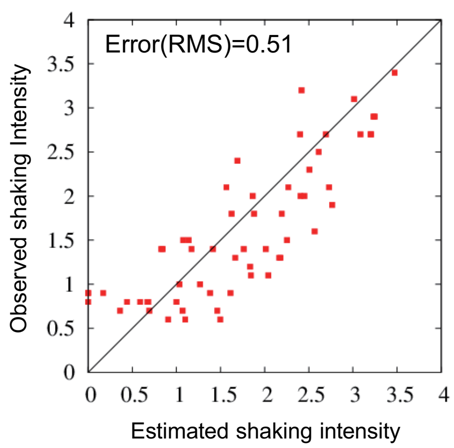

Fig.3 Comparison of Observed and Estimated Shaking Intensities for KiK-net* stations(* another observation network for seismic motion in Japan) (Off Miyagi Earthquake, Feb. 26, 2015)