Development of EEW system exchanging real-time seismic intensity and seismic waveform

*Shigeki Horiuchi[1], Yuko Sato[1], Taku Urabe[2], Yamaimaiti Nizhamudong[3], Kazuo Sasaki[3]

1. Home Seismometer Corporation, 2. telemetra , 3. Challenge

1. Introduction JMA started to issue PLUM telegram in EEW system, which delivers values of real-time intensity measured at all JMA seismic stations in addition to the values of hypocenter parameters. Since the magnitude saturates when a catastrophic earthquake occurs, JMA recommends to use the PLUM method, which uses the maximum value of intensity within 30 km from user location for the intensity estimation. Horiuchi et al. (2011) proposed a method to estimate the fault area of a catastrophic event in real time by using the spatial distribution of real-time seismic intensities. In this report, we developed a system that estimates the location of fault area, displays it on the screen of user’ s PC, and outputs the sound alarm. This system collects continuous waveform from seismic stations using MEMS sensor and delivers waveform data at a time of earthquake occurrence to users PC.

2. Method of real-time estimation of the fault area of a catastrophic event In the case JMA issues EEW with magnitude 7.7 or more, the present system starts to determine fault area by using the method of Horiuchi et al. (2011) with data of real-time shaking intensities. When values of observed seismic intensity is larger than the estimated values from the empirical attenuation equation by Shi and Midorikawa (1999), their method determines distances from these stations to the edge of the fault and determine the location of fault area from the distribution of the edge locations.

3. System overview The present system consists of center server and seismic observation stations equipped with MEMS sensor and Raspberry pi. The roles of center server are (1) receives the plum telegrams from JMA, (2) accepts user registration, (3) acquires continuous waveforms for observation stations, (4) transmits followings to the windows PC of users, 1) hypocenter parameters from JMA, 2) Real-time seismic intensities from JMA and from observation stations of Raspberry Pi, 3) Waveform data at a time of earthquake occurrence. It is required for the user to register user information such as the coordinates of the user location from the Web screen. When the EEW is delivered, the predicted seismic intensity is outputted on the screen. There is a function to issue EEW for the training. In a case a user generates an earthquake in the web site of center server, the center server sends hypocenter parameters and values of shaking intensity to him. If the testing earthquake is a catastrophic event, his PC computes and displays the spread of the fault area for the testing event.

4. result

(1) Since the present PC software provides shaking intensity data and the real-time waveform from the neighboring observation station, these data may be effectively used for the accurate damage prediction by a strong earthquake.

(2) We checked with using observed shaking intensity data whether the spread of the fault area are correctly obtained by the present system. We use shaking intensity data obtained by K-NET from the 17 major earthquakes for the checking. As a result, it was shown that a nearly correct fault area was estimated.

Keywords: EEW, Real-time estimation of the spread of the fault area of a Catastrophic earthquake, exchange of seismic waveform, Rasberry pi seismic station

