

Improvement of P-wave detection algorithm using kurtosis statistics

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The current earthquake early warning (EEW) system in Japan uses the STA/LTA algorithm (Allen, 1978) to detect P-wave arrivals. Recently, Saragiotis et al (2002) proposed a method to identify the P-waves by using kurtosis statistics, which was more robust to a noise than the STA/LTA method. The method was used to create seismic catalogs, and designed for off-line process. To apply this method for the EEW system, we need a modification to make the calculation causal and enable the real-time processing and evaluate the performance of this method.

To test this kurtosis method, we use continuous waveform of the Hi-net and JMA strong motion records for 17 earthquakes between March 11, 2011 and April 16, 2011, which recorded the seismic intensity greater equal to 6 lower in the JMA intensity scale. An attached figure shows the time difference between the P-wave arrival time determined by this kurtosis method or the STA/LTA method and JMA manual picking time. The mean and standard deviation are 0.07 ± 0.19 sec for this kurtosis method and 0.29 ± 0.29 sec for the STA/LTA method, respectively. It shows that this kurtosis method tends to determine the P-wave arrival time more accurately than the STA/LTA method.

One of the disadvantages of this kurtosis method is that it is also sensitive to the pulse-like noise, so applying a noise filter is necessary to achieve the sufficient performance of the signal triggering.

The kurtosis method will contribute to improve the accuracy of source location determination of the EEW system and improve the shaking intensity estimation for EEW system.

Keywords: kurtosis, P-wave detection, earthquake early warning system

