Improvement of the P-wave detection method in real time by using kurtosis statistics

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The current the earthquake early warning system uses ST/lT algorithm (Allen, 1978), to detect seismic waves. Recently, Saragiotis et al,(2002) suggested a method to identify P-waves by using kurtosis statistics which was more robust than the STA/LTA. The method was used to create seismic catalogs, and designed for off-line process. To apply this method for an earthquake early warning, we need a modification to make the calculation acausal and enable the real-time processing by getting a little creativity with data length and noise rejection. Here, we propose a real-time P-wave detection method using kurtosis. an d We use strong motion records for earthquakes which record seismic intensity greater equal to 6 in the JMA scale between April,2005 and July, 2015. We selected the records with hypocentral distance within 100km. We tested various P-wave detection algorithm; STA/LTA, off-line kurtosis algorithm(Baillard et al,2014)), and real-time kurtosis algorithm (this study). We compared manual detected P-wave arrival times with P-wave arrival times detected by those methods, and evaluated the performance of our method. As a result, we can determine P-wave arrival time more precisely and earlier than STA/LTA and manual pick time by using kurtosis(this study) because our method is more robust and more sensitive to small changes in amplitude. Our approach will contribute to increase the accuracy of location determination of earthquakes, and improve the estimation of the shaking intensity of earthquake early warning.

Keywords: kurtosis, P-wave picking, earthquake early warning