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A study for improvement of the single station EEW (B-delta) method

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1. Introduction
Recently, the technology of earthquake early warning system has achieved an amazing development. However, the earthquake early warning system still has some difficult problems. One of the important problems is accuracy of location of hypocenters estimated in real-time. Shinkansen earthquake early warning systems use a single station method to estimate the epicentral location. The single station method estimates the epicentral distance and the back-azimuth by using the B-delta method (Odaka et al., 2003) and the Principal component analysis (Meteorological Research Institute, 1985), respectively. Noda et al. (2009) indicated that the precision of the back-azimuth estimated from the Principal component analysis improved about 30 % by using the variable time window.
The B-delta method estimates the epicentral distance by fitting the function B*t*exp(-A*t) to the envelope of UD-component. We can see good correlation between the B and the delta, epicentral distance, however, some data show large errors.
In this study, we investigated the characteristics of B in order to improve the accuracy of the B-delta method.

2. Data
In this study, we used 52,557 waveform (3,433 events) data observed at K-NET from 1996 to 2009. All events had at least 5 stations data within 100km in epicentral distance.

3. Result and Discussion
We investigated the error of B. At first we made the formula of the relationship between the B and hypocentral distance D, LogB=-0.83*LogD+1.77, by using the least squares method. Then we calculated the average error of B, dLogB_ave, for every event.
As a result, dLogB_ave strongly depends on the hypocentral depth. It means the estimated hypocentral distance gets smaller comparing with the hypocentral distance calculated from the JMA catalogue. This may be explained by the observed fact that the small incident angle of the deeper event produces the steep amplitude in the initial P-wave.
We evaluate the effects of radiation pattern and so on for the improvement of the B-delta method.

Keywords: Earthquake Early Warning