Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)

HDS030-P05 Room:Convention Hall Time:May 26 14:00-16:30

Expectation of seismic intensity for EEW using amplitude spectral ratio of surface and borehole

Kazuhiro Iwakiri[1*], Mitsuyuki Hoshiba[1]

[1]Meteorological Research Institute

JMA is preparing to utilize acceleration records in borehole (depth from 500m to 3510m) and on surface at the KiK-net stations (installed and operated by NIED) in Kanto district for the earthquake early warning (EEW). Iwakiri et al. (2010) picked the onset of P- and S-phase, and obtained the results that the arrival time differences between borehole and surface sensors are 1.2 sec for P-phase and 3 sec for S-phase. In the current EEW of JMA, the seismic intensity is expected using some empirical relations such as an attenuation relation based on hypocenter and magnitude. In this study, we suppose that seismic intensity on surface is expected from borehole observation data using the empirical amplification factor at surface with respect to borehole sensor without hypocenter and magnitude. As the empirical amplification factor, we evaluate maximum amplitude ratio, seismic intensity difference, and amplitude spectral ratio of surface and borehole for P- and S-wave portions.

Acceleration data recorded in borehole and on surface were obtained from NIED web site. The dominant frequency of the most earthquakes analyzed in Iwakiri et al. (2010) was high-frequency because of short epicentral distance. Therefore we add earthquakes of magnitude 6 or larger without limitation of epicentral distance, for which dominant frequency is low-frequency.

Noise level in borehole is lower than that on surface at all stations for especially high-frequency. Signal to noise ratio (S/N) in borehole is lower in all frequency than that on surface at all stations. The spectral ratio is evaluated for frequency band of S/N more than 3. The maximum amplitude ratios of surface and borehole for P- and S-wave portions are comparable at most stations. However, while the spectral ratio for P-wave portion is larger in high frequency than that for S-wave, the spectral ratio for S-wave portion is larger in low frequency than that for P-wave. The spectral ratio for S-wave portion is larger than that of P-wave portion at all stations for frequency range (0.5Hz - 1Hz) which affects JMA seismic intensity. The difference of the ratios between P- and S-wave portions is a problem in automatic processing for EEW, because it is difficult to distinguish completely between P- and S-wave. In this presentation, we will compare the accuracies of expected seismic intensity using the seismic intensity difference, and also using the spectral ratio as the empirical amplification factor.

Acknowledgment: We used KiK-net observation data operated by NIED.

Keywords: earthquake early warning, expected seismic intensity, borehole, spectral ratio