Array observation of strong ground motion for the estimation of current wavefield in real time

*Masashi Ogiso[1], Naoki Hayashimoto[1], Mitsuyuki Hoshiba[1]

1.Meteorological Research Institute, Japan Meteorological Agency

We aim to construct next generation of Earthquake Early Warning (EEW) system with (a) grasp of current wavefield in real time using data assimilation technique and (b) real-time ground motion simulation with current wavefield as an initial condition.
In Hoshiba and Aoki (2015), they used an amplitude distribution of dense seismic network to estimate the current wavefield. However, other observation value should be able to use for estimating current wavefield. Array observation can reveal slowness vector of the wavefield at the observation site. To utilize the array observation for the EEW system, we construct an array network using six acceleration seismometers and conduct some studies using them. Our array size is less than 300 m so that we use 500 Hz for sampling frequency.
Here we adopted semblance analysis (Neidell and Taner, 1971) for estimating slowness vector. Real-time (less than 1 s) semblance calculation is required for making use of analysis result for the EEW system. Oct-tree search (Lomax et al., 2009) enabled us to calculate slowness vector within 1 s using time window of 4 s of 6 stations.
Comparison of estimated backazimuth values and those from the earthquake catalogue showed that backazimuth residual had clear azimuthal dependency. This feature could be explained by the dipping layer beneath the array, and estimated backazimuth values became consistent with those of catalog values through dipping layer correction (Niazi, 1966; Maki et al., 1987).
In addition to the evaluation of estimated slowness vector, we have considered that how the estimated slowness vector affects to the EEW system. In a simple 2-D case, backazimuth information prevents the underprediction of seismic ground motion in the early stage of prediction (i.e. seismic waves have arrived in only one or a few stations). We will further discuss the effects of array observation to the EEW system through some numerical simulations.

Keywords: Earthquake Early Warning, Array observation, real-time calculation

