Numerical shake prediction for Earthquake Early Warning: Introduction of attenuation structure

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

1.Meteorological Research Institute

In many strategies of the present EEW systems, hypocenter and magnitude are determined quickly, and then the strengths of ground motions (PGA, PGV, seismic intensity) are predicted based on a ground motion prediction equation (GMPE) using the hypocentral distance and magnitude, which usually leads the prediction of concentric distribution of ground shaking. However, actual ground shaking is not always concentric, even when the difference of site amplification is corrected. Even after correction of site amplification factor, the strengths of shaking may be much different at stations having the same hypocentral distances. For some cases, PGA differs more than 10 times, which leads to imprecise prediction of ground shaking in EEW.
Recently, innovative approach was proposed for EEW (Hoshiba and Aoki, 2015), that is Numerical Shake Prediction. In the method, the present ongoing wavefield of ground shaking is estimated using data assimilation technique, and then future wavefield is predicted based on physics of wave propagation. Information of hypocentral location and magnitude is not required. Because future is predicted from the present condition, it is possible to address the issue of the non-concentric distribution. Once the heterogeneous distribution is actually monitored in ongoing wavefield, future distribution is predicted accordingly to be non-concentric. We will indicate examples of M6 crustal earthquakes occurred at central Japan, in which strengths of shaking were observed to non-concentrically distribute. We will show their predictions using Numerical Shake Prediction method.
The heterogeneous distribution may be explained by inhomogeneity of attenuation/velocity. If attenuation/velocity structure is introduced, we can predict the future shaking more rapidly and precisely. The information of attenuation/velocity structure leads to more precise and rapid prediction in Numerical Shake Prediction method for EEW. We will show examples of precise predictions of the M6 crustal earthquakes at central Japan using the attenuation structure.

Keywords: Earthquake early warning, ground motion , real-time , prediction

