Summary of the Ground Motion Prediction Project for Osaka Sedimentary Basin

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We have worked on a ground motion prediction study for the Osaka sedimentary basin, southwest Japan, to develop a method for a high quality prediction by incorporating geological, geographical and geophysical survey data. We constructed a detailed 3D subsurface structure model of the basin compiling the latest geophysical survey data. For rupture scenarios, we perform dynamic rupture simulations under constraints of geological data about active faults.

The Osaka sedimentary basin structure is modeled by a whole basin 3D model and a shallow sediment model. The whole basin model consists of mesh data of 100 m and 50 m intervals in horizontal and vertical directions, respectively. Vertical offset of the sedimentary layers at faults and gradual variation of medium parameters due to depth are realistically expressed. Details of shallow sediment (alluvium and diluvium) are modeled based on boring data (GIbase).

We have proposed a method to estimate fault-specific, heterogeneous rupture models for scenario earthquakes from distributions of cumulative displacement measured along active faults. We assume a slip distribution model that varies along fault strike in a similar way to the cumulative displacement of the active fault. The slip distribution is then converted to static stress drop and incorporated into the dynamic rupture simulation. Spontaneous rupture propagation on the fault plane is simulated by the finite difference method assuming slip-weakening friction law on the fault plane.

Ground motion in lower frequency components (less than 1Hz) are first computed in the whole basin structure model by the 3D finite difference method excluding the shallow sediment above the engineering basement (Vs = 0.55 km/s). Higher frequency components (larger than 1Hz) are computed by the stochastic Green' s function method. Effects of the shallow alluvium layers are calculated by 1D multi reflection theory considering nonlinear effect by equivalent linear technique using a computer code DYNEQ.