A subsurface structure modeling in all over Japan for strong-motion evaluation

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The structure of sediments from the seismic bedrock up to an engineering bedrock layer with a shear velocity of 400m/s-700m/s, strongly affect the low-frequency strong-motions and is an important factor for the evaluation of low-frequency strong-motions. We have made a three-dimensional subsurface structure model in all over Japan.

In modeling of the structure of sediments, we use various profiles of deep boreholes, reflection and refraction surveys, data from microtremor surveys, as well as data from the gravity surveys. We need to use an optimized modeling technique for available data sets in a target area because quantity and quality of information on underground structure are not uniform in all areas. In the modeling of underground structure for the strong-motion evaluations, seismic velocity structures are most important parameters. It is expected that the accuracy of the modeling is proportional to the quantity and the quality of data. In an ideal case we can use all data to be required. We use various available data in all of Japan. These are including using deep-borehole profiles for accurate structure at some sites, refraction profiles for boundary shapes in large sedimentary basins, reflection profiles for determination of the boundary shapes of basin edges, data from microtremor surveys, gravity surveys and geological information for spatial interpolation. Furthermore, we verify and modify the structure model if it is necessary by using the above structure model to compare its simulation result of strong-motion to the recorded seismograms. In fact, however, it is difficult to obtain sufficient data required in the above ideal procedure for 3-D modeling of velocity structures in many cases. In such a case, available information distributed spatially is only the data from gravity survey and geological structure information. Using these data, we estimate velocity structures indirectly. Uncertainty in a velocity-structure modeling is increase if we use only gravity data because a gravity data represent a density structure. Therefore we also use the information on geological structures to reduce the uncertainty. The model is an initial model and it should be modified with additional data.