Characterized three-dimensional shallow S-wave structure in the western part of the Osaka plain

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We have characterized the shallow structure, to the depth of tens of meters corresponding to the bottom of Ma12, of the western part of the Osaka plain by using the data set from Geo-database Information Committee of Kansai.

S-wave model:

We assume that the geological structure in that region corresponds well to one for S wave , and that in each layer the average S wave does not show spatial variations. The above assumption will be satisfied in an appropriately limited zone. In such a zone, once the correspondence is established by examining PS logging data that simultaneously have information on the geological structure, we can estimate a three-dimensional S-wave structure from the data set of dense geological logging. In practice, the shallow geological structure along the coasts of Hanshin-Kobe regions was presented as 4 characteristic layers: 1 Surface layer; 2 Alluvial layer including Ma13; 3 First diluvial layer; 4 Ma12. According the data set used in this study, the number of PS logs that have all information on the boundary depths of these layers was 51.

Average S wave in each geological layer was modeled as follows. 1) We calculated site amplification effects by the 1D S-wave theory by directly using the PS logging data, and 2) calculated ones for an initial model of a velocity structure in which the S waves were assumed a priori and the depths of the layer-boundary were fixed to those of the geological structure. 3) The initial velocities of S -wave were iteratively refined in a sense of minimizing the L2 norm of site amplification effects. We assumed that the S-wave velocities in layers 2-4 are common among logs, while one in layer 1 is varies with log. As the results, we have S-wave velocities of 143, 363, 195 [m/s] for 2-4 layers, respectively.

Three-dimensional model of layer-boundary depth type:

We determine the empirical relations between the depths of layer-boundary in the shallow structure and the top depth of the seismic bedrock. Then, because a 3D model of this type with respect to the top depth of the seismic bedrock has already been established, through this model, we obtain a 3D model of the shallow structure.

Here we deal with a zone of a triangle (34.75,135.52),(34.58,135.46) and (34.73,135.31), which is the western pert of the Osaka plain including the mouths of large rivers, such as Yodo rives or Yamato river. The logging data within that zone is as follows: Bottom depths of Ma13 (4222(=No. of data)); Bottom depths of alluvial layer(3726), Top (3963) and bottom depths (2407) of the first diluvial layer, Top depths of Ma12(1065). Resulting empirical relations with the top depths of the seismic bedrock of Miyakoshi et al. (1999) are as follows: (layer-boundary depth in the shallow structure [m])=a (top depth of the seismic bedrock) + b, where (a, b, regression coefficient)=(0.0160, -3.6, 0.53),(0.0246, -11.9, 0.64),(0.0256, -13.2, 0.64),(0.0281, -9.5, 0.63), and (0.0376, -15.2, 0.58) for the above layers, respectively.

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