A study on velocity structure modeling for strong-motion evaluation

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Velocity-structure of deep sedimentary layers, which is the structure of sediments from the seismic bedrock up to an engineering bedrock layer with a shear velocity of 400m/s-700m/s, affect the low-frequency strong-motions and is an important factor for the evaluation of low-frequency strong-motions. In the modeling of whole of Japan, we use geological information to estimate velocity structure indirectly in order to make up for lack of information to model the velocity structure directly. It is important for our modeling procedure to clarify relationship between the geological structure and the velocity structure.

For the first step, we study the P-wave velocity versus depth in sedimentary basin in Japan and also consider relationship between the geological structure and the velocity structure by using the sonic logs obtained from the wells of NIED and the wells of Japan National Oil Corporation.

Although P-wave velocity versus depth relation is various for each sedimentary basin, we can see a common character among the relations if we restrict the conditions for comparison. For comparison of P-wave velocity profiles, we restrict a condition of sedimentation and we select a part that is regarded as uniform accumulation. In center of the Kanto area, strata in the Kazusa group are uniformly accumulated and the sedimentation in Niigata area is uniform. We compare the P-wave velocity versus depth relations for the wells which meet the above conditions. For the depth from 300m to 1,500m, the velocity versus depth relations are nearly common and explained by a linear equation.

We assume a linear equation to explain the velocity versus depth relation.

$Vp(x,y,z)=a*(z+d(x,y))+b$

where Vp is P-wave velocity (km/s) and z is depth (km). The term d(x,y) shows regional difference.

In center of the Kanto area, we can obtain a=0.46 for the P-wave velocity of strata in the Kazusa group and d([Youro])-d([Chiba])=0.465.

We expect that these relations become useful tools for the velocity structure modeling for sedimentary basins.