CONSTRUCTION OF CRUSTAL STRUCTURE VELOCITY MODEL FOR ESTIMATION OF LONG-PERIOD STRONG GROUND MOTION

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Effects of crustal structure model on long-period (2 – 20sec) strong ground motion estimation are discussed in this study. Surface waves are dominant in the long period ground motions, they can affect on the far field sedimentary basins. In case of subduction zone earthquake, they are generated in the accretion prism above the source and then they are strongly affected by the propagation path and local ground conditions. Structure model of crust between the source fault and a target site take important role to estimate the long period ground motions.

Target of this work is strong ground motions simulation for the giant (Mw = 8.2) Tonankai and Nankai earthquakes assumed in near future in the Philippine Sea subduction zone, Japan. The 3-D velocity model for the area for the Philippine Sea subduction zone was constructed from several layers: (1) surface seismic basement layer, SB, (2) upper crust, UC, (3) lower crust, LC, (4) mantle wedge, MW, (5) accretion prism, AP, (6) oceanic crust layers, OC, (7) Philippine sea slab, SLB, (8) upper mantle, UM. Next data were used: off-shore seismic profiles (AP, OC), seismicity (UC and SLB), inland seismic profiles (LV, UC, LC), receiver function inversion results (UC, LC, SLB), 1-D waveform inversion results (LV), seismic tomography results (LC, SLB), and the gravity anomaly data (LV). An idea of multi-spline function is used for modeling layer boundaries. It can smoothly generate depth structure at any modeling point. Velocity parameters are assumed uniform in each layer; however, parameter gradients and fluctuations are required to be introduced as a next step.

We checked the effect of water layers (and/or topography of sea bottom) on the simulations of the Tonankai and Nankai earthquakes. Supposing focal depths of asperities of the earthquakes, the effect of water layer on the ground motions in inland area is not so large. This assertion contributes to economize computer resources for simulating the plate boundary earthquakes. Effect of inland topography is also important to consider. In order to validate the developed velocity model, we synthesized long period, i.e. 2 – 10sec, waveforms for several moderate earthquakes and compared them with the observed waveforms. Except for a few limited regions agreement is good and in some cases match is perfect. Therefore the model is acceptable for the simulation of the strong ground motions. Also it can be used as the initial model for farther tuning, using seismic waveforms or as initial model for tomography inversion, for example.