Simulation of long-period (5-10s) ground motions in the Oita basin during the 2000 Tottori-ken Seibu earthquake

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The 2000 Tottori-ken Seibu earthquake was the first M7 class inland crustal earthquake since strong-motion observation network was deployed all over Japan. This dense network enables to see the seismic wave propagation characteristics directly. The maximum velocity distribution maps for radial, transverse and vertical components in the period range of 5 to 10 sec, clearly show the strong excitation of SH and/or Love waves as expected from the source mechanism (e.g., Furumura et al., 2001; Hikita, 2001; Nagawa et al., 2001). We also found several high amplitude stations placed in sedimental basin of the Osaka, Nobi and Oita area. At these stations, maximum velocity amplitude is 3 to 10 times larger than its surrounding stations.

Semblance analysis by using observed seismograms at 3 stations in the Oita basin (BRI, JMA, K-NET) showed a very large later phase propagates dispersively from north to south. This direction is different from the epicenter direction (N036E) and this fact implies that the later phase is the surface waves excited by the basin structure.

We performed waveform simulation to explain this seismic wave propagation phenomena by using the 3D FDM with irregular grid (Pitarka, 1999). We constructed a 3D velocity model covering an area of 300km(East-West)*300km(North-South)*50km(Depth). We assumed horizontally multi-layered crustal structure model outside the Oita basin. The Oita basin structure model is assumed from the basement depth model by Gravimetric data (Kusumoto et al., 1997). We also referred to gravitational anomaly map given by Kanazawa Univ. homepage (http://hakusan.s.kanazawa-u.ac.jp/research/gravity/chu-shikoku.html). The assumed basin size is approximately 100km in length and 30km in width, with 3km at the deepest point.

We simply put a point source at 35.239N, 133.394E, H=6km, where corresponds to the main slip area from source inversion result by Sekiguchi and Iwata (2001). Other source parameters we used are a strike of 150 deg, a dip of 85 deg, a rake of -9 deg, with a seismic moment of 1.1*10^26 dyne-cm, and a bell-shaped source time function with 6 sec duration. We performed simulation based on the above assumptions in the period range of 5 to 10 sec.

Synthetic seismograms fit well to observed ones at stations from source region to the Oita basin. At the Oita basin station, the later phase of synthetic seismogram has the similar propagating direction, amplitude and particle-motion to observed ones. Therefore, the later phase is thought to be excited by the basin structure.

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