Basin-induced surface waves in the northern part of the Ishikari plain

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We have carried out strong motion observation at sites MED, KNN and TUN in and around the Ishikari plain. At the MED site, ground motion has been recorded at the depth of 500 m and at the surface simultaniously. P- and S-wave velocities were measured with suspension logging. In addition to suspension logging, deep S-wave velocity structure was investigated by microtremor exploration.

Some later phases are observed in the records of the near intermediate- or deep-earthquakes at MED. We analysed the characteristics of this later phases by the decomposition method using records of surface and borehole seismometer (Yoshida and Sasatani, 2003). We made an assumtion that surface waves propagate in NE-SW direction. In the analysis, we rotated records into NE-SW and NW-SE direction. Some records of intermediate- or deep-earthquakes are decomposed. Results of the analysis showed Rayleigh waves were identified at about 9 seconds after the S wave arrival in both NE-SW and U-D components, and Love waves were identified at about 12 seconds after the S wave arrival in NW-SE components. The particle motions of the decomposed Rayleigh waves show the elliptic orbits on the NE-vertical plane and the rotation direction of these orbits show that these Rayleigh waves propagated from southwest to northeast. Assuming the same origin for both Rayleigh waves and Love waves, a distance to the source of the surface waves from MED was estimated at about 3 km based on group velocity at MED and on delay time between S and later phases. There is a boundary between the mountain area and the plain area in the 3 km southwest of MED. For these reasons, these surface waves seem to be basin-induced surface waves generated at the mountain-plain boundary.

In order to reveal the mechanism of the generation of this basin-induced surface waves, we have performed FD simulation using a 2-D underground structure model of the northwestern part of Sapporo for a large depth range. In the frequency range of 0.1 to 1.0 Hz, basin-induced surface waves have been generated in P-SV and SH simulation. An overall good agreement is observed between observations (MED, KNN) and synthetics, which is convolved by a rock site (TUN) record.

Reference: Yoshida, K. and T. Sasatani, 2003, SSJ2003 Fall Meeting, P116.