Repeated GPR surveys in the North-Kanto groundwater observation site

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In order to conduct the geological disposal of high-level radioactive waste safely, it is important to develop a monitoring technique that investigates the changes of hydrogeological environment around the disposal site in detail. The ground penetrating radar (GPR) is often used in hydrogeological and environmental surveys because of its high resolution capability. In this study, we have a plan to carry out the monitoring of the deep hydrogeological environment in the bedrock around the disposal site by installing GPR antennas at depth using a borehole or a tunnel. At the present stage, however, GPR measurements were repeated at the surface where it is easy to acquire geological, hydrogeological and geophysical information in order to verify the applicability of the GPR technique to the hydrogeological monitoring. Because an EM wave velocity is governed by the dielectric constant, and because the dielectric constant and moisture content are correlated well, it is expected that the GPR technique can monitor the subsurface hydrogeological environment in detail spatially.

Repeated GPR measurements have been done in the Kita-Kanto groundwater observation site, where a 350 m-deep observation well and a 90-m pumping well were drilled. In this site, meteorological and several geophysical observations have been conducted continuously or intermittently. In order to investigate the near-surface hydrogeological environment before the well digging, the first GPR measurement was carried out in February 2006. The following surveys were conducted three times after the well digging, in December 2006, January 2007 and February 2007. The purposes of these investigations were to detect the changes of near-surface hydrogeological environment caused by the well digging and pumping, and to monitor the subsurface water content in dry winter season. In these surveys, we acquired GPR profile data for shallow depth with a pulse GPR system and for deep depth with a continuous wave GPR system. At several points, wide angle measurements were done to find the EM wave velocity. We observed the changes of EM wave velocity and reflectors which were caused by the change of the near-surface soil moisture.