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Ground water distribution investigation by three-dimensional ground penetrating radar surveys - An example at Ara River, Saitama -

Toshiyuki Yokota[1]; Tomio Inazaki[2]; Shunsuke Shinagawa[2]; Takumi Ueda[3]

[1] Institute for Geo-Resources and Environment, AIST; [2] PWRI; [3] Geological Survey of Japan, AIST

In our country, surroundings of a river are highly developed, and there are many human activities and important buildings around a river. Therefore, it comes to be important that maintenance of the levee which had the enough strength to protect them from a flood and an earthquake impaction. For the levee maintenance, we should evaluate inside the levee body and its surroundings. For such evaluations, investigations on ground water are quire essential among all investigation menus.

For ground water investigations, the studies using boreholes have mainly be performed. Reliability of the results is quite high; however, the number of boreholes is generally limited by various reasons. Therefore, the data using boreholes with sufficient spatial density are not always provided. In such cases, spatial interpolation of borehole data incorporate with geophysical surveys is often performed. As geophysical surveys have non-invasive and non-destructive natures, they are desirable for levee surveys. For such purposes, electric and electro-magnetic survey methods are often used because they are effective for ground water surveys. Ground Penetrating Radar (GPR) survey has characteristics such as highest resolution and highest survey speed among all geophysical survey methods.

In this paper, we describe three-dimensional GPR survey results around a river levee. Data acquisitions are carried out at around Ara River, Yoshimi-town, Saitama. After flooding caused by a typhoon of last autumn, change of levee shape was observed behind the levee at some spots around Ara River. Therefore, it comes to be necessary to investigate ground water distributions around Ara River and inside its river levee.

In the GPR data acquisition, we used pulse radar antennas of central frequency 250 MHz and improved space resolution by carrying out series of dens three-dimensional GPR surveys. In addition, in data processing, we performed Kirchhoff type three-dimensional migration for the purpose to image three-dimensional shape of ground water distribution and geological layers. As a result, we obtained a highly precise subsurface image. In addition, we can understand subsurface visually and interactive interpretations are now possible on a precise three-dimensional image.

In future, we intend further subsurface interpretations by integrating observation results obtained from neighboring boreholes with GPR survey results.