Temperature effect in resistivity monitoring in embankment dams

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It is well known that electrical resistivity decreases with temperature. In most resistivity monitoring studies, temperature effects are undesirable and therefore, often considered as noise that may create artefacts and misinterpretation of the resulting images. As a result, temperature corrections in time-lapse (monitoring) series may be necessary to correct electrical resistivity in order to avoid misinterpretation when explaining resistivity changes linked to other physical processes such as changes in contamination or porosity. For resistivity monitoring in the embankment dams to detect leakage zones, temperature effects together with 3D effects can produce significant inversion artefacts and finally lead to misinterpretation.

In this study, resistivity monitoring is conducted at an embankment dam in Korea. Furthermore, temperature variation is monitored at two boreholes drilled at the upstream and downstream shell of the embankment dam. At shallow part of embankment dam, the temperature is strongly dependent on the air temperature. However, the influence of the air temperature decreases rapidly with depth. At deeper part, the temperature of upstream and downstream borehole converged to a constant temperature as shown in Figure 1, suggesting that the resistivity at depth is not affected significantly by the seasonal variation of air temperature.

Generally, leakage at embankment dams develops below the reservoir water level. When anomalous seepage flows occur, the resistivity at depth will decreases due to the increase of water content around the leakage paths. The temperature monitoring at boreholes shows that temperature effects at depth are negligible. Thus the changes in resistivity are considered to be caused by the leakages much more than changes in temperature. Of course, temperature effect should be corrected for the precise interpretation of resistivity monitoring data. However, the influence of temperature variation is considered not severe as the 3D effect in the interpretation of resistivity monitoring data at embankment dams.

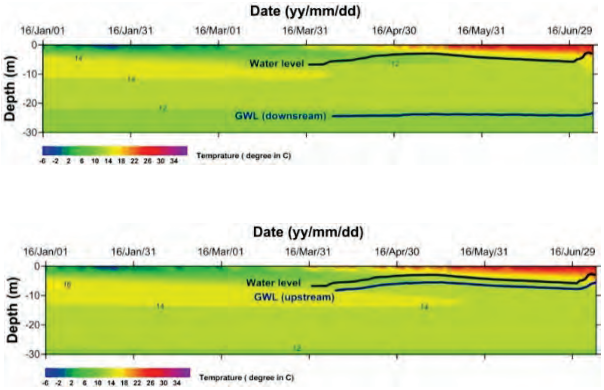

Figure 1: Temperature variations with time at the upstream (upper) and downstream (lower) boreholes.