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Estimation of hydraulic parameter from geoelectrical measurements : A case study of the western Pingtung Plain in Taiwan

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In Taiwan, most of the rivers in the Pingtung Plain are ephemeral stream. In the dry season, the water source is unstable and cannot be used all the year round. Due to the uneven distribution of time and space, the supply and demand of water resources are often imbalanced. In order to provide a stable groundwater source strategy, it is necessary to understand the geologic characteristics of groundwater.

Electrical resistivity surveying methods have been widely used to determine the thickness and resistivity of layered media for the purpose of assessing groundwater potential and siting boreholes in fractured unconfined aquifers. In this study, we used CP configuration on the Electrical Resistivity Tomography (ERT) monitoring system at two study sites. One is the surface-borehole survey line at the Dashu, Kaohsiung City, Taiwan, and the other is the surface survey line at the Daliao, Kaohsiung City, Taiwan. Both of sites located on Quaternary alluvium of Pingtung Plain which composed of coarse sand and gravel.

The resistivity difference might be caused by the dynamic of the groundwater. We analyzed the change in the electrical properties of the gravel layer during the rainfall season at the Dashu site and analyzed the groundwater level change by ERT method during the pumping event at the Daliao site which is the pumping station to understand the groundwater replenishment situation. The ERT result can be calculated Relative Water Saturation (RWS) of the shallow formation fluid, and it reveal the permeability of the gravel layer and the hydrogeological characteristics of the sites. Furthermore, we assumed the different particle size and porosity to estimate the resistivity and the hydraulic conductivity coefficient theoretical trend line, compare the observation well data is used to estimate the actual porosity and the actual hydraulic conductivity range. Finally, for the groundwater conditions in the large area of the Pingtung Plain, we use the theoretical trend line to analyze the data of WRG's 34 wells in western Pingtung Plain. The results show (i) the well logging resistivity is positively correlated with the hydraulic conductivity. (ii) the sandstone and mudstones with small variables have smaller well-measured resistivity and a lower hydraulic conductivity. (iii) affected by compaction, the porosity tends to decrease with increasing depth. (iv) on the west side

of the Pingtung Plain, the particle sizes are relatively consistent, and the hydraulic conductivity is 10^{-3}~10^{-4} m/s.

This study is using ERT to provide hydrological data analysis on small areas and large areas in the Pingtung Plain, and also contributes to groundwater operations and management