Characterize preferential flow paths and heat transport in a shallow aquifer system by utilized heat as a groundwater tracer

Presenter：Yu-Huan Chang
Advisor：Prof. Chuen-Fa Ni
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Abstract

The better remediation plan for a contaminant site relies on well understanding of site-specific hydrogeologic conditions in the aquifer system. The hydraulic tomography surveys (HTs) had been recognized the efficient techniques for high resolution site characterization. With detailed flow information from HTS, the transport in a heterogeneous aquifer can be accurately characterized. This study aims to use numerical and experimental approaches to characterize flow and transport in a contaminated site in a shallow aquifer in northern Taiwan. The well field involves 19 wells with fully opened screens. Traditional single and multiple-well tests were conducted for comparison purpose. The heat tracer test was then conducted for comparison of numerical simulations. Results of the hydraulic tests show that the values of hydraulic conductivity at the site vary from 0.4×10^{-4} to 1.4×10^{-4} m/s. The influence radius of pumping wells is nearly 20 m for the pumping rate of 2.5 cmh and drawdown of 2 to 3 m. Tracking the temperature responses in wells indicate that the preferential flow path at the site is east-west direction. Based on the hydraulic properties from the site, the results of FEMWATER model agree well with the observed heat transport data in wells. The results can provide useful information for designs of on-site remediation plans.