

Applying the variably saturated flow model to simulate groundwater flow in Pingtung plain by using THMC

Presenter: Thanh-Nhan Pham

Advisor: Prof. Jui-Sheng Chen

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Abstract

In the past, groundwater in Pingtung plain was abundant, leading local people to rely more on groundwater than on supplied water, resulting in the lowest ratio of tap water use in this area compared with other areas in Taiwan. Moreover, this area has the main economic focus on agriculture, which is strongly affected by rainfall and has a high demand for irrigation water. With a large number of private pumping wells, it is difficult to control the groundwater abstraction rate. Over-exploitation of groundwater can lead to a drawdown in overall groundwater levels, seawater intrusion, and land subsidence. Understanding groundwater flow behavior is crucial for managing wells sustainably and developing management strategies. Additionally, this area receives high rainfall, and the terrain is conducive to groundwater formation. However, man-made structures like roads and buildings impact surface permeability, which is crucial for rainfall infiltration into groundwater. This study uses THMC software (Thermal-Hydrology-Mechanics-Chemical) to simulate groundwater flow in the Pingtung Plain using the variably saturated flow model. To create the model, the study area's surface is divided into permeable and impermeable areas, the precipitation is used as the infiltration and percolation into groundwater. Due to lacking of actual pumping rate, groundwater usage register is used as input for the pumping rate. For expediting groundwater flow in Pingtung and further purposes in the sustainable usage plan, a 3-D finite element method flow model is being created. The model has successfully simulated groundwater flow with high accuracy in the first aquifer and in the recharge area. Towards the south of the study area, the model is still being calibrated to improve the accuracy of the simulation.

Keyword: Groundwater, variably saturated, THMC, groundwater flow, 3-D flow model, FEM.