

Impact of Interface Soil Layer on Groundwater Aquifer Behaviour

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Abstract : The geological environment where the groundwater is collected represents the most important element that affects the behaviour of groundwater aquifer. As groundwater is a worldwide vital resource, it requires knowing the parameters that affect this source accurately so that the conceptualized mathematical models would be acceptable to the broadest ranges. Therefore, groundwater models have recently become an effective and efficient tool to investigate groundwater aquifer behaviours. Groundwater aquifer may contain aquitards, aquicludes, or interfaces within its geological formations. Aquitards and aquicludes have geological formations that forced the modellers to include those formations within the conceptualized groundwater models, while interfaces are commonly neglected from the conceptualization process because the modellers believe that the interface has no effect on aquifer behaviour. The current research highlights the impact of an interface existing in a real unconfined groundwater aquifer called Dibdibba, located in Al-Najaf City, Iraq where it has a river called the Euphrates River that passes through the eastern part of this city. Dibdibba groundwater aquifer consists of two types of soil layers separated by an interface soil layer. A groundwater model is built for Al-Najaf City to explore the impact of this interface. Calibration process is done using PEST 'Parameter ESTimation' approach and the best Dibdibba groundwater model is obtained. When the soil interface is conceptualized, results show that the groundwater tables are significantly affected by that interface through appearing dry areas of 56.24 km²; and 6.16 km²; in the upper and lower layers of the aquifer, respectively. The Euphrates River will also leak water into the groundwater aquifer of 7359 m³/day. While these results are changed when the soil interface is neglected where the dry area became 0.16 km²;, the Euphrates River leakage became 6334 m³/day. In addition, the conceptualized models (with and without interface) reveal different responses for the change in the recharge rates applied on the aquifer through the uncertainty analysis test. The aquifer of Dibdibba in Al-Najaf City shows a slight deficit in the amount of water supplied by the current pumping scheme and also notices that the Euphrates River suffers from stresses applied to the aquifer. Ultimately, this study shows a crucial need to represent the interface soil layer in model conceptualization to be the intended and future predicted behaviours more reliable for consideration purposes.

Keywords : Al-Najaf City, groundwater aquifer behaviour, groundwater modelling, interface soil layer, Visual MODFLOW

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