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GROUNDWATER QUALITY IN THE PROXIMITY OF A POLLUTED LAKE: A JOINT EXPERIMENTAL-MODELING STUDY

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Abstract

Ground water is an important source of clean water supply throughout the world. A growing literature on the management of groundwater which takes into account the interaction of groundwater with surface water resupply sources (e.g., streams or lakes) is driven by concerns of intensified global fresh-water use coupled with increasing industrial and agricultural pollution levels. Our joint laboratory and numerical experiments simulate water withdrawals via two pumping wells from an unconfined aquifer bounded by two surface water bodies (streams or lakes). The water table position in the experimental setup was visualized by eight piezometers and numerically computed using VISUAL MODFLOW PRO, for different pumping regimes and initial hydraulic slopes. We also analyze numerically pollutant transport from the aquifer's boundaries toward the pumping wells. We show that it is possible to minimize pollution in the wells downstream of a polluted lake by managing the relative pumping rates in the two wells and the overall water table slope in the aquifer. The goal of our research is to (a) observe the physical processes involved in water and conservative tracer flow in an aquifer system surrounded by two lakes (b) develop a joint laboratory-numerical modeling teaching tool for future research and classroom use and (c) provide a simple tool that can be further developed to assist in management decisions regarding water-flow and pollution levels in aquifers.

Key words: experimental research, groundwater modeling, pollution, unconfined aquifer

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