

Simulation of Seawater Intrusion in the Goksu Delta at Silifke, Turkey

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ABSTRACT

The Goksu Delta is a valuable agricultural and environmental resource located on the Mediterranean Sea south of Silifke in south-central Turkey. Similar to many other coastal areas throughout the world, the groundwater aquifer in the delta is potentially threatened by saltwater intrusion. The delta, which covers an area of approximately 150 km², is bounded on the south and east by the Mediterranean Sea and on the west and north by outcrops of bedrock that form the Taurus Mountains farther inland. Alluvial deposits from the Goksu River extend to a maximum depth of approximately 500 m. A relatively low permeability clay unit, which extends from near land surface to depths of approximately 20 to 30 m, overlies sediments that consist of 130 m or more of sand, gravel, clay, and sandy clay. The clay unit confines the underlying sediments, in which the more permeable, hydraulically-interconnected coarse-grained materials function as aquifer units separated by relatively thin clay layers. In the delta, the water table occurs at or near land surface, and its elevation ranges from sea level to approximately 36 m, msl, along the northern boundary. The hydraulic head in the aquifer system ranges from near sea level at the seacoast to approximately 25 m, msl, along the northern boundary. A vertical cross-section of the aquifer system was simulated approximately along a streamline from the seacoast to the northern boundary using the variable density finite-element numerical code SUTRA. In the resulting model, which was calibrated using pressure head and chloride data collected in the summer of 1999, the horizontal hydraulic conductivity ranges from 53 to 410 m/day in the confined aquifer, and the vertical hydraulic conductivity in the overlying clay confining unit ranges from 1.5×10^{-2} to 6.0×10^{-2} m/day. Longitudinal dispersivities in the aquifer range from 30 to 300 m, and the transverse dispersivity is 0.1 m. Chloride concentrations in the groundwater model range from 0 mg/L for freshwater to 22,000 mg/L, which represents Mediterranean seawater that has intruded into the aquifer along its bottom boundary. In the aquifer, the vertical thickness of the zone of dispersion between freshwater and seawater is approximately 100 m, or about 20 percent of the vertical dimension of the aquifer system.

Keywords : coastal aquifers, groundwater quality, numerical modeling, saltwater/freshwater relations, SUTRA; Turkey

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