groundwater NGWA The Groundwater Association

Effects of Sea-Level Rise on Ground Water Flow in a Coastal Aquifer System

John P. Masterson, Stephen P. Garabedian

First published: 29 January 2007 | https://doi.org/10.1111/j.1745-6584.2006.00279.x | Citations: 49

Abstract

The effects of sea-level rise on the depth to the fresh water/salt water interface were simulated by using a density-dependent, three-dimensional numerical ground water flow model for a simplified hypothetical fresh water lens that is similar to shallow, coastal aquifers found along the Atlantic coast of the United States. Simulations of sea-level rise of 2.65 mm/year from 1929 to 2050 resulted in an increase in water levels relative to a fixed datum, yet a net decrease in water levels relative to the increased sea-level position. The net decrease in water levels was much greater near a gaining stream than farther from the stream. The difference in the change in water levels is attributed to the dampening effect of the stream on water level changes in response to sea-level rise. In response to the decreased water level altitudes relative to local sea level, the depth to the fresh water/salt water interface decreased. This reduction in the thickness of the fresh water lens varied throughout the aquifer and was greatly affected by proximity to a ground water fed stream and whether the stream was tidally influenced. Away from the stream, the thickness of the fresh water lens decreased by about 2% from 1929 to 2050, whereas the fresh water lens thickness decreased by about 22% to 31% for the same period near the stream, depending on whether the stream was tidally influenced. The difference in the change in the fresh water/salt water interface position is controlled by the difference in the net decline in water levels relative to local sea level.