REGIONAL, PASSIVE SALINE ENCROACHMENT IN THE FLORIDAN AQUIFER SYSTEM (1991-2011)

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For decades governmental agencies in Florida have been concerned about degrading groundwater quality. To better understand the changes, in the early 1990s, the state's water management districts, the Department of Environmental Protection, and the U.S. Geological Survey began efforts to coordinate groundwater monitoring in Florida. This evaluation investigates how aquifer potentials and major ion concentrations changed from 1991 through 2011 (21 years) in groundwater from the Floridan aquifer system (FAS). Data were obtained from 55 of the largest springs in Florida, along with 200 wells. During the period of record used in this analysis, discharge decreased in springs and groundwater levels declined in wells. Concentrations of saline indicators such as sodium and chloride increased, along with rock-matrix analytes such as calcium, magnesium, potassium, alkalinity, and sulfate. Analyses revealed the FAS, underlying all of Florida, experienced passive saline encroachment across about three-quarters of the state. Not only did passive encroachment occur along Florida's coasts, but also in the interior of the state. However, the rate of change was greater along the coasts. Statewide the rate of change for sodium and chloride, combined, was about 3.0 mg/L per decade. The rate of change for total dissolved solids was between 10.0 and 20.0 mg/L per decade. Data suggests that the predominant cause of the encroachment was declining rainfall, followed by groundwater extraction, and possibly sea-level rise. The source of the saline water is from salt water near Florida's coasts and relict sea water from the deeper portions of the FAS. The observed changes are in line with those predicted by the Ghyben-Herzberg principle in a coastal, carbonate aquifer experiencing declining aquifer potentials. Data from an independent investigation using more recent data suggests concentrations of saline indicators are continuing to slowly increase across Florida.

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