

## **REGIONAL, PASSIVE SALINE ENCROACHMENT IN THE SPRINGS OF FLORIDA (1991 – 2020)**

*Rick Copeland, Gary Maddox, and Andy Woeber*

AquiferWatch Inc., Tallahassee, FL USA

Due to awareness of degrading groundwater quality in Florida's freshwater springs and beginning in the early 1990s, the state's water management districts, the Florida Department of Environmental Protection, and the U.S. Geological Survey began efforts to coordinate monitoring of Florida's first- and second-magnitude springs. This study investigates how spring discharge and two saline indicator concentrations changed from 1991 through 2020 (30 years) in the Floridan aquifer system (FAS), underlying all of Florida. Data were obtained from 32 major springs and three additional stream discharge gaging stations. During the study period, discharge decreased, while concentrations of sodium as  $\text{Na}^+$  and chloride as  $\text{Cl}^-$  increased. As a group, the FAS springs experienced passive saline encroachment. Not only did encroachment occur along Florida's coasts, but also in the interior of the state. The rate of change for the median concentrations of sodium and chloride increased by an estimated range of seven to eleven percent per decade. Three potential drivers of the observed changes were investigated: declining rainfall and subsequent declines in recharge, groundwater extraction, and sea-level rise. Evidence suggests the major driver is decreasing rainfall and subsequent declines in recharge to the FAS, followed by sea-level rise. The sources of the saline water are 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 coastal, carbonate aquifers.

**PRESENTER BIO:** Dr. Rick Copeland is the Director of AquiferWatch Inc. He has over 40 years of experience as a hydrogeologist. He established numerous networks to monitor water quality and has administered Florida's statewide groundwater and surface water monitoring networks. He has authored many papers regarding the analyses of water quality.