Title: Groundwater and Surface Water Responses to Climate Change: A Case Study in Georgia, USA

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Abstract

Georgia, located in the southeastern United States, is home to around 10 million people and its capital, Atlanta, is the country's 9th most populous metropolitan area according to U.S. census data. The southeastern United States has long been thought to be resilient to the water shortage issues that are seen in the western United States and around the world. Global climate trends are expected to cause regional variability in temperature and in precipitation, which in turn affects water flux near the earth surface. While climate change trends are expected to affect groundwater, the exact effects on water table and recharge are unknown and are likely to vary significantly based on location and local geology.

This study provides a regional scale view of surface and groundwater interactions and trends in Georgia while considering geologic regimes, land use change and climate variation using emerging data science techniques. Preliminary research on Georgia's streamflow data from 36 gauging stations and statewide precipitation data from 1951-2015 show decreasing streamflow trends downstream of areas experiencing decreasing precipitation. Annual minimum streamflow decreased throughout the entire state while annual maximum streamflow was found to decrease only in the northern areas of the state.

The USGS National Water Information System (NWIS) database hosts data for 404 groundwater monitoring wells throughout Georgia ranging from near surface unconsolidated deposits to deep confined, karst aquifers. Long-term, decadal, and seasonal low, medium, and high groundwater trends in four distinct geologic provinces (Valley and Ridge, Blue Ridge, Piedmont, and Coastal Plain) are analyzed using the Mann—Kendall test. The Mann-Kendall test is also applied to climate data to explore the relationship between climate variation and groundwater level change. Regionalization techniques are used to determine spatial clustering of wells and geologic provinces. Lastly, machine learning techniques are applied to monitoring well data to determine the applicability of using learned data to supplement real world data by cross-verification techniques.
