Aquifer Characterization from Spaceborne Imaging Radar Data

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Abstract: There is growing recognition of the challenges we face in finding and maintaining water resources required for the rapid population and economic growth while balancing the needs of the natural world. Added to concerns that already exist about the environmental sustainability are the potential impacts of varying climate and associated extreme events such as droughts, floods, and heavy precipitation. The central goal of the proposed research is on the use of highquality satellite data to develop an improved understanding of the time-varying behavior, the capacity, and the sustainability of the groundwater system. This goal will be achieved by developing a prototype Aquifer Storage and Recovery (ASR) management system as a Bayesian inference framework that is informed by spaceborne InSAR data.

We have selected for our study area the H2Oaks ASR facility, located at Twin Oaks, Texas, near San Antonio. This region experiences both long dry periods and extreme rainfall events and the variability in precipitation causes an imbalance between water supply and demand. In 2004, the San Antonio Water System (SAWS) began to store unused water from the Edward's aquifer into the semi-confined Carrizo-Wilcox aquifer during wet years. During the drought between 2012 and 2014, 50,000 acre-feet of water was recovered to meet the water demand of SAWS customers. However, the maximum estimated recoverable volume is much less than half of the total storage volume. Our goal is to characterize aquifers using satellite data and inform ASR managers the optimal well placement and pumping/recharge schedule. Successful implementation of ASR at the H2Oaks site will boost drought resiliency and protect endangered local species, and the proposed computational framework can be adopted by ASR facilities in other cities, such as New Braunfels and Buda.