Introduction

Several cities in the Houston-Galveston (HG) region in Texas have subsided up to 13 feet over several decades due to natural and anthropogenic processes [Yu et al., 2014]. Consisting of 13 cities, including Houston, its largest city with 2.1 million people, HG has a population of 5.7 million people. Given the growing population and rise in urbanization, HG relies heavily on its groundwater resources to satisfy the high water demand for agricultural, domestic, and industrial use. Land subsidence, a gradual sinking of the Earth's surface, is an often human-induced hazard. A major environmental problem experienced by activities such as mining, oil and gas extraction, urbanization and excessive groundwater pumping.

Data and Methods

A total of 25 Sentinel-1A descending single look complex scenes (track 143, frames 493, 494) from July 2015 to May 2016 were acquired. The Sentinel-1A has a 12 day repeat period and acquires data on C band (4-8 GHz and wavelength of 5.6 cm). We used a 30 m Shuttle Radar Topography Mission (SRTM) digital elevation model (DEM) to extract deformation signal by subtracting the topography from the images.

Furthermore, we used Generic Mapping Tools 5 SAR (GMT5SAR) [Sandwell et al., 2011] software and supplementary python scripts by [Baker 2016] to pre-process the scenes and generate a stack of 138 interferograms (Figure f) in preparation for using GIAnT (Generic InSAR Analysis Toolbox) [Agram et al., 2013] software to apply the short baseline subset (SBAS) approach and create a time series. Our analysis included interferograms with perpendicular baselines of <100 meters and a temporal baseline of <100 days to reduce spatial and temporal decorrelation (Figure f).

Preliminary Results

Atmospheric corrections and corrections for the digital elevation model have yet to be applied to the preliminary results. Once these corrections have been applied, the signal-to-noise ratio will be reduced to the point of being canceled out. Therefore, the deformation signal will be more clear.

Final results of the time series data will be fully processed and presented by the American Geophysical Union Conference in December 2016.

Conclusion & Next Steps

- To update InSAR data to determine if subsidence has remained stable since 2012 (fill in the 5 year gap in data)
- Apply SBAS time-series processing to the stack and correct for atmospheric and DEM error (reduces signal-to-noise ratio across the stack; cancels out)
- Complement and validate the InSAR data with time-series data from GPS measurements
- Better management of water resources
- Creating stronger monitoring systems for land subsidence using geodetic methods

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