QUANTIFYING LAND SUBSIDENCE IN THE COASTAL BEND OF TEXAS USING TEMPORAL GRAVITY MEASUREMENTS

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The Coastal Bend of Texas has been subject to the negative impacts of land subsidence due to the excessive withdrawal of groundwater, oil, natural gas resources, presence of growth faults, and compaction of Quaternary alluvium. As subsidence poses problems to all coastal communities, infrastructure, and wetland habitats, it is important to determine the rates, locations, and factors controlling this phenomenon. The rate of land subsidence can be quantified by collecting time-variable gravity measurements in certain locations. Temporal and spatial variations in Earth's gravitational field can be affected by the variability in oceanic and solid Earth tides, and because of this, tides must be accounted for and removed from the observed gravity data before converting them into elevations. Tide and drift corrected temporal variations in Earth's gravity field can then be converted to height variations, and those heights can be used to determine land subsidence rates. Over the course of this study, temporal bi-monthly gravity measurements have been collected at six locations along the Coastal Bend of Texas, including Packery Channel, Bob Hall Pier, Port Aransas, Rockport Harbor, Nueces Bay, and the Lexington. Because this region is underlain by sand, mud, and clay deposits, it is susceptible to sediment compaction, resulting in land subsidence. The gravity survey was conducted using a LaCoste & Romberg G-976 zero-length spring gravimeter. Metadata such as time, elevation, and coordinates are also recorded along with the gravimeter readings. For all stations, changes in gravity measurements were in the range of -0.107 to 0.106 mGal, with Port Aransas having the lowest trend, and Bob Hall having the highest trend. As expected, the changes in height were greatest at the stations with steepest gravity trends. More measurements are currently being collected to refine these land subsidence rates. Additionally, InSAR data have been acquired from 2015 to present and are currently being processed in order to further constrain these results by mapping the spatiotemporal variability in land subsidence within this area. Preliminary results of this study indicate that land subsidence in the Texas Coastal Bend is mainly a vertical motion that varies with both time and location. Based on the locations of the gravity stations, this subsidence is likely due to sediment compaction and growth faults instead of fluid extraction.