

Understanding the Big Hill Dome Surface Uplift: Historical InSAR Study

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Abstract

The Big Hill salt dome, located in southern Texas, is one of four sites operated by the U.S. Strategic Petroleum Reserve (SPR). Since 2002 there has been an ongoing trend of measured surface uplift documented towards the eastern region of the site, whereas subsidence, though minor, has continued to occur across the rest of the site. In order to better understand the subsurface dynamics, historic interferometric synthetic aperture radar (InSAR) data were acquired. InSAR involves the processing of multiple satellite synthetic aperture radar scenes acquired across the same location of the Earth's surface at different times to map surface deformation. The analysis of the data can possibly detect millimeters of motion spanning days, months, years and decades, across specific sites. The intent in regards to the Big Hill site was (1) to confirm the surface uplift trend recorded by land survey, (2) to understand the regional surface behavior, and (3) to possibly be able to better understand the subsurface source causing the uplift. Our analysis of the InSAR data confirmed the validity of the subsidence trends shown by the historic monument subsidence data, and also provided new insight into the mechanical behavior of the caprock and salt dome. Ultimately, this knowledge will further our understanding of the geologic forces at the salt/caprock interface which are currently affecting well integrity at the site.

Key words: Subsidence, Salt Domes, Strategic Petroleum Reserves, Instrumentation and Monitoring, Geology