

UNTANGLING THE CAUSES OF INSAR-DERIVED LAND SUBSIDENCE IN GALVESTON COUNTY

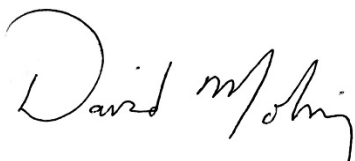
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ABSTRACT

Local areas of persistent land-surface subsidence near the Gulf Coast remain underexplored in Galveston County, Texas. Despite controls placed on groundwater extraction by the Harris-Galveston Subsidence District (HGSD), hot-spots in land-surface subsidence exceed 1 cm/year throughout the county. This region has numerous active extensional faults, and the century-long history of oil and gas extraction suggests that hydrocarbon production has a role in the subsidence distribution across the county. Here we take advantage of an InSAR-derived map of land-surface deformation between 2017 and 2020, to assess the correlation between local subsidence rates and production of subsurface fluids at well sites. We also examine the growth-faulting networks in this region by mapping fault-scarps observed in satellite images.

We observe that rates of land-surface subsidence at well sites generally increase with the total volumes of produced fluid. We find that hydrocarbon wells with a total produced subsurface fluid volume exceeding 1,000,000 barrels have higher subsidence values that are likely driven by significant depressurization in the subsurface system. There is also evidence of a delayed, or committed subsidence tied to large withdrawal volumes from now inactive hydrocarbon wells. Ongoing depressurization in the subsurface from deep-fluid production is also interpreted to be linked to remobilization of the local, growth-fault networks. It is inferred that this fault movement is now driving the primary subsidence hot-spot along the southwest county border, where there is a relative absence of any well production history. The long term coupled effects of hydrocarbon pumping and growth fault activity must be accounted for in policy interventions to mitigate ongoing subsidence in Galveston County.

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David Mohrig