

INSAR ANALYSIS OF SOUTHEASTERN NEW MEXICO: EXPLORING SURFACE DEFORMATION DUE TO WASTEWATER REINJECTION AND MUNICIPAL AND AGRICULTURAL GROUNDWATER USE

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Geodesists began utilizing interferometric synthetic aperture radar (InSAR) and time series analysis to observe deformation of the Earth's surface during the 1990's. In southeast New Mexico, municipal and agricultural production of groundwater, as well as brine reinjection after oil and gas production, are potential sources of surface deformation.

We aim to discover the extent of deformation and resolve the locations and depths of well sites and the volume of fluid injected and extracted by using InSAR to image this region. We use SAR scenes obtained by the European Space Agency's Sentinel -1A and 1B platforms, operational from 2014 and 2016 respectively, retrieved from the Alaska Satellite Facility's data portal. These freely available data provide full coverage of the region every ~12 days along different flight paths.

We utilize GMTSAR software for the interferometric analysis of individual SAR scenes dating as far back in time as October 2014. The resulting interferograms, all referenced to the same Master image, are then analysed with various time series techniques to reduce the noise in the individual interferograms and recover smaller amplitude signals. From the deformation observed at the Earth's surface, we recover the locations and volume of the injected wastewater and extracted groundwater using Bayesian inverse methods for pressure point sources embedded in an elastic half space.

Through the analysis of surface deformation, our preliminary work provides insight into dynamic processes at shallow depths such as the evolution of groundwater resources or the resultant propagation of injection plumes. Characterizing these dynamic processes with short lag-times is vital in making informed resource management decisions.

Keywords:

InSAR, Groundwater, Deformation

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