

# Spatio temporal analysis of land subsidence due to declining groundwater levels in arid region of Pakistan using Sentinel-1 SAR imagery

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## Abstract

In this paper we showed the application of European Space Agency's C-band Sentinel-1 Synthetic Aperture Radar (SAR) imagery to identify land subsidence in a heavily groundwater pumping area. We used the repeat pass satellite interferometry method in combination with persistent scattering (PS) interferometric technique to generate and analyze twenty-eight interferograms for the period October 2014 to November 2016. The interferometry results show that land subsidence is more pronounced in the urban areas. Excessive groundwater pumping in the study area is believed to be the main reason for land subsidence. The results are compared with the subsidence rate measured by GPS as reported in other studies and with the mean change in total water storage field of GRACE solutions provided by the Jet Propulsion Laboratory (JPL), the German Research Centre for Geosciences (GFZ) and the Center for Space Research (CSR). The comparison shows persistently decreasing trends during the period of study. A strong reliance of the trend of land subsidence on the temporal decline in total water storage proposes that much of the land subsidence can be attributed to heavy pumping of the groundwater.

*Key words:* Persistent scattering, Interferometry, Land subsidence, Aquifer, Sentinel-1, GRACE

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