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RADAR REMOTE SENSING FOR LAND SURFACE STUDIES OVER THE UNITED ARAB EMIRATES

by

Muhagir Hashim Elkamali

Faculty Advisor

Abdelgadir Abuelgasim, Geography
Humanities and Social Sciences

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Abstract

This dissertation is concerned with the land surface deformations related to anthropogenic activities and how a monitoring strategy can be established for nationwide studies. The main objective of this dissertation is to study land surface fluctuations in regional and local scales over the dry semi-arid climate of the United Arab Emirates with the relation to subsurface layers mechanisms and groundwater dynamics. Radar Interferometry techniques have been developed to detect and monitor land surface movement from space with very high accuracy. This dissertation investigates the implementation of these techniques over highly decorrelated surfaces. The detected land surface movements have been correlated with groundwater and geophysical data. The study shows significant findings of various land surface subsidence zones with extensive subsidence over desert landcover. The study detected a maximum land surface subsidence rate overt two distinctive zones of Remah and Al Wagan with a subsidence rate of -60 mm/year and -50 mm/year, respectively with an accuracy measurement of ±2 mm/year in the period between 2017 to 2021. Results from Radar Interferometry have been confirmed by field observations where clear signs for ground movement have been observed. This dissertation implements Radar Interferometry techniques using the parallelization concept which aims to reduce the time-consuming that is always challenging for Radar Interferometry processing. Also, this dissertation processed big data of radar imageries to observe smaller ground movement with reliable accuracy. Moreover, this dissertation holds an integration between radar remote sensing and geophysical investigation which unveils a hidden relationship between ground motion from space and subsurface mechanisms. This dissertation shows that the land surface subsidence detected in the previous study is still active and more severe than before. Also, land surface movement over new areas that are unknown before have been detected and fully investigated with ground truth data.

Keywords: Radar Interferometry, Synthetic Aperture Radar, Groundwater, Surface Subsidence, Microgravity, Big data.