DEEJ (2021) 10 (32) 61-72

University of Kashan

Desert Ecosystem Engineering Journal

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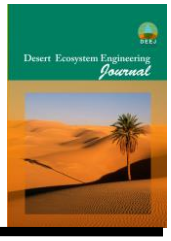

Monitoring the Subsidence of Abarkouh Plain and Analyzing its Effective Parameters Using Radar Interferometry

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Received: 01/05/2020 Accepted: 19/07/2021

Extended Abstract

Introduction: Rapid population growth, increasing water demand, decrease in precipitation, and occurrence of drought may increase the use of water resources, especially the extraction of groundwater resources, leading to a drastic decline in groundwater level, and consequently the occurrence of land subsidence phenomenon. There are various methods for monitoring land subsidence. However, from among ground and space-based methods for the detection of earth crust deformations, the application of Interferometric Synthetic Aperture Radar (InSAR) on the collected data is considered as the most proper method in terms of accuracy and continuous spatial coverage.

Materials and methods: Located in central Iran in the west of Yazd Province, Abarkouh plain is a part of the Abarkouh – Sirjan basin, covering an area of 1390 km2. The area consists of alluvial fans and plains, surrounded by mountains on the west, south, and southwest and bounded on the east by Abarkouh Playa. This study used 46 satellite images taken from 2014 to 2018 to measure the amount of land subsidence in the Abarkooh plain. Moreover, the Shuttle Radar Topography Mission (SRTM) DEM was applied with 30 m resolution to remove the topography effect. A small Baseline Subset (SBAS) time series analysis was also performed to examine the short-term and long-term behavior of the subsidence.

\ Decline in groundwater level and the subsurface sediment thickness are the two most important factors affecting the subsidence. The data used in this study were collected from 34 piezometric wells and 77 geologic logs. Finally, the most effective factors involved in subsidence and their relationship with other factors were investigated by comparing the output of the subsidence map and other existing maps.

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DOI: 10.22052/deej.2021.10.32.39:

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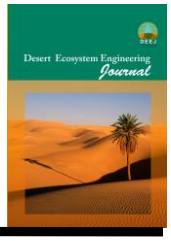

esults: The study's results indicated that the subsidence occurred in the east, northeast, and north of the area with the maximum accumulated value of 21, 10, and 6 cm, respectively, over four years. Moreover, the study of groundwater level and the thickness of fine-grained sediments showed that despite the decline in water level throughout the whole plain, subsidence is observed only in regions with clay subsurface sediments.

According to different trends of decline in the groundwater level of the study area, groundwater level variations are changed during three periods. Accordingly, the water level declines during the first period in the east, northeast, and north of the area, while it increases in the west and southwest of the region. However, the decline in water level occurs throughout the whole region during the second period, and it is decreased at a lower rate in the east, north, and northeast during the third period.

Discussion and Conclusion: In the first period, the comparison of the location of areas with increase or decrease in their water level with their corresponding areas on the Landsat showed that the water level declined in those residential and agricultural areas where there are more water wells, and, therefore, the subsidence rate is much more than other areas. On the other hand, the study of areas with an increase in water level suggested that the aquifer of these areas was recharged by mountains and alluvial fans.

In the second period, those areas whose water had declined in the previous period experience more decline. Therefore, it can be concluded that the aquifer had not sufficiently been recharged in wet periods. In other words, the increase in the decline of the areas' water level occurred due to the decrease in the recharging of the underground waters because of several years of drought, and the increased groundwater withdrawal caused by the development of agricultural lands. However, despite the sharp decline in the areas' water level, no subsidence was found in the region.

In the third period, some piezometric wells were dried, and the water level decline was significant in the west and southwest areas, which could be attributed to factors such as increased acreage, creation of new industrial centers, etc. Therefore, it could be argued that the subsidence rate of this four-year period will certainly return to the hydraulic conditions before this period. Thus, it can be concluded that in addition to the decline in groundwater level, other geological and hydrogeological factors play an important role in causing subsidence.

Keywords: Fine Sediment, Groundwater, Remote Sensing, Subsidence, Time series.