Identification of Desert Dust Sources in the West Khuzestan Province using of Brightness Temperature Algorithms

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1. Introduction

A dust storm is a common environmental hazards in the world, especially in arid and semiarid regions of the world. The incidence of dust has been higher in recent decades in Iran, especially in Khuzestan Province, which has become an environmental crisis in recent years. The occurrence of dust in Khuzestan Province is due to natural conditions such as successive droughts and loss of moisture sources as well as human factors such as drying of the water zones and the reduction of river water discharge due to the dam. Various methods have been developed to identify dust sources, most notably the use of remote sensing techniques. Accordingly, for the detection of dust storms, a number of dust indices have been developed based on MODIS images, the most effective of which is the use of the BADI. Therefore, in this study, three consecutive dusts in winter and spring of 2018 in Khuzestan Province were studied through the BADI.

2. Study area

The study area includes the lands west of Khuzestan Province between north latitudes of 32°8'.62" to 30°57'.26" and east longitudes of 47°43'.21" to 48°32'.29". In terms of political divisions, this area has two cities, Shush city in the north, and the Dasht Azadegan is in the south, which has a common border with Iraq. Karkheh River is the most important river in the area which is flowing through Khuzestan plain to Hoor Al-Azim Wetland.

3. Material and Methods

In this study, the BADI index was used for desert dust detection. First, to use this index, Modis 1B satellite images were obtained from the NOAA Archive (https://ladsweb.modaps.eosdis.nasa.gov/search/).
Subsequently, geometric corrections were made to them and using calibrated images, the brightness temperatures were calculated in bands 20, 31 and 32 of Modis images. Also, Meteosat 8 satellite images were used to specify the dust source regions. In addition, Sentinel 3 satellite images were overlaid with Google Earth satellite images to determine the exact locations of dust particles.

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4. Results and Discussion

BADI Algorithm

According to BADI index extraction, in the dust of 20/1/2018 it was observed that the main source of dust is in the western part of Shush City and the dry bed of Huralazim wetland in Khuzestan Province. These conditions cause severe dusting due to local topography (flat area and non-vegetation lands). In addition, conditions for dust formation have been provided due to development plans and the elimination of local morphology as well as the loss of soil moisture (land drainage) in the south and west of Khuzestan Province. In the next dust storm that occurred about a month later in the winter (20/2/2018), the results show that erosion in the Hoor Al-Azim Wetland and the desert areas in the north of Susangerd can be considered as the main source of dust particles. Therefore, the amount of soil erosion after dust based on field operations and the measurement of fixed rod height indicates approximately one centimeter of height difference between the two successive dusts. In the third dust on 23/4/2018, a very large dust with high mass, several density cores were seen which would begin in the desert regions of Saudi Arabia and extend to Kuwait and Southwestern Iran and also Eastern Iraq.

Determining the sources of dust

Meteosat 8 satellite images were used at different times of the day to identify the high dust areas. The spatial area of dust particle loading was determined from the beginning to the time of the dust mass expansion. In the dust on 20/1/2018, first the inner sources of the Dust were activated due to the cyclonic motion of the air mass. In the dust of 19/2/2018, it can be stated that the soil erosion of the Hoor Al-Azim bed and the surrounding areas such as Gofer and arid lands of southern Bostan are the main cause of this phenomenon. In the next dust on 23/4/2018 the main sources of dust are the deserts of Saudi Arabia (Kuwait and Saudi Arabia) and the deserts of Northern Najaf and Southern Karbala in Iraq. Then, Sentinel 3 satellite images were used to determine more precisely the dust loading points in the study areas. Therefore, the results illustrated had a significant role in increasing the volume and concentration of dust in winter the eastern areas of Hoor Al-Azim (Gofer and Southwest Bostan) and the western deserts of Shush. Also, based on the detection of dust dumping sites, the results indicated that three areas in the west of Riyadh and east of Medina (Al-Dhakari, Al-Raqqa and Al-Bujadiyah) play an important role in the formation of the dust mass.

5. Conclusion

The purpose of this study was to monitor the dust and extract dust sources of West Khuzestan using the BADI index. Accordingly, in the three dusts investigated in winter and spring of the 2018, different areas within and outside the country supply dust particles in the west of Khuzestan Province. However, it is important to note that internal sources of dust due to proximity to cities and villages in Western Khuzestan are capable of creating dust storms with a radius of less than 1000 m, which makes them more vulnerable.
Keywords: BADI Algorithm, Dust Storm, Khuzestan Province, Satellite Image

Reference (In Persian)


Hoshmand, A., & Ahmadi, F. (2010). [Dust as one of the environmental problems of the Islamic world (Case study: Khuzestan Province)]. Presented in 4th International Congress of Islamic Geographers, Isfahan, Iran. ICIWG04_119.


Reference (In English)


