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Dust monitoring and investigation of its relationship

with topographical, climatic and vegetation factors

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Extended Abstract

Introduction: Airborne particles play an important role in the balance of atmospheric radiation and climate change. The relationship between aerosols and climate systems has received increasing attention as our understanding of these issues increases. A dust storm is a complex process that is influenced by the interactions of atmospheric systems and is basically caused by conditions such as high wind speed, bare soil and dry air.

Materials and methods: Aerosol optical depth (AOD) is one of the most important parameters in the field of dust related research. Aerosol optical depth actually refers to the distribution of dust aerosols in the atmosphere. In this research, the dust condition was investigated using the AOD parameter of MODIS product. In order to investigate the relationship between environmental factors, NDVI was used. For each year, based on the total images taken, which is about 24 images per year, the average vegetation cover index was calculated in the Google Earth Engine system as a time series. In this study, among the climatic factors, annual rainfall data from synoptic stations were used to investigate the effect of rainfall on the amount of dust changes in the period from 2013 to 2022. Also, a 90-meter DEM was prepared from the SRTM sensor in order to prepare layers of slope percentage, slope direction and elevation classes.

Results: In the research, firstly, to evaluate the dust situation, the aerosol optical depth product was obtained from the MODIS sensor. In order to highlight and monitor as much as possible, the dust phenomenon of the months of June to September, corresponding to the late spring and summer season of each year, when the majority of dust storms are concentrated in these months, was chosen. After downloading the images, the 9-year statistical period (2013-2022) was considered as the studied statistical period in Khuzestan province. The average optical depth of dust was obtained each year based on the images taken in the same year.
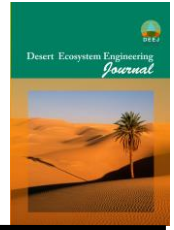
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The results show that most of the dust was spread in the years 2015, 2016, 2017 and 2018, so that a large part of the province faced the dust phenomenon in these years. The investigation of the dust situation in 2013 and 2014 showed that although most of Khuzestan province is facing a relatively low average AOD, the maximum AOD value is related to classes with values of 0.71 to 1.5 and more than 1.5 located in the southwest. is the province; The maximum value of AOD in these years was 2.82 and considering that AOD is between zero and 5 in the mentioned years, the southern regions have faced a high average dust phenomenon. The purpose of this study was to monitor dust and investigate its relationship with various factors of topography, vegetation and climate. The results of dust relationship with the mentioned factors showed that among all the factors, height and slope direction have the highest correlation (83 percent) and (72 percent) respectively with the phenomenon of dust in the opposite direction, so that an increase in the amount of height causes a decrease in dust and south-facing directions. And smooth areas will have an increase in the amount of this phenomenon. Therefore, by using remote sensing techniques, it is possible to identify dust centers as a valuable tool to combat the expression factor.

Discussion and Conclusion: Desertification is one of the most obvious ecological and environmental problems in arid and semi-arid regions. n this study, to identify dust spots, changes in the average occurrence of dust storms were obtained using MODIS sensor data from 2013 to 2022, and then its relationship with climatic factors, sun cover with NDVI index, and topography were evaluated. A decrease in the amount of precipitation that can lead to a decrease in soil moisture, vegetation covers and an increase in drought; Also, the changes in land use in recent years are all among the factors that have led to an increase in the phenomenon of dust, especially in Khuzestan province. Examining the influencing factors such as topography, vegetation and climatic factors is of great importance in identifying and prioritizing the control of dust centers, in addition, the MODIS optical depth sensor product can be of great help as a valuable tool for monitoring and managing this event.
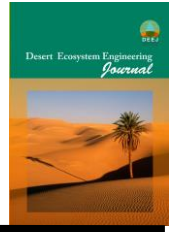
Keywords: MODIS, aerosol optical depth (AOD), time series, topography, climate, vegetation.

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