

Analyzing the effects of climate change on dust events, a case study: Khorasan Razavi province

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Extended Abstract

Introduction: Climatic components are the vital factors influencing the dust event. It was believed that changes in climate parameters play a crucial role in the occurrence of dust events. Former studies have shown that temperature, rainfall, and wind speed contribute to poor vegetation, providing requirements of dust events. Long-term dust data indicated that climate has a profound effect on dust events and the occurrence of dust storms compared to the desertification process (Zhang and Anastasio, 2003). Monitoring Iran's meteorological data indicates changes in precipitation and temperature in the last two decades (Rezaei and Ghasemieh, 2019). Alterations in the amount and pattern of rainfall and rising temperature can initiate the changes that cause natural hazards, including dust storms. Hence, in the present study, the trend of changes in climatic parameters in Khorasan Razavi province has been investigated. Note that the climatic parameters are consisting of rainfall, average temperature, wind speed, and frequency of erosive winds.

Material and methods: According to the objectives of the present study, the monthly precipitation, temperature, and wind speed of seven synoptic stations including, Mashhad, Sabzevar, Sarakhs, Neishabour, Torbat Heydariyeh, Kashmar, and Quchan, were obtained from the meteorological organization of Khorasan Razavi from 1990 to 2016. Hourly dust codes also were extracted to detect the number of dusty days in the study period. The relationship between climatic parameters of precipitation, temperature, wind speed, and erosive wind frequency was inspected by the Pearson correlation coefficient for each station. Later, the trend of dust events and climatic parameters was analyzed using the Mann-Kendall trend test.

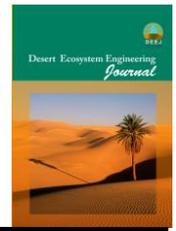
Results and discussion: Results of dust codes indicated the local origin for the highest frequency of dusty days. Even though Sarakhs and Mashhad stations had the highest dusty days, Quchan and Kashmar had the lowest one in the study region. The Mann- Kendall test pointed out an increase in temperature for all study stations except Neishabour. Meanwhile, the precipitation had a downward trend in the Mashhad, Kashmar, Sabzevar, Torbat Heydariyeh, and Sarakhs stations and an increasing trend in the Neishabour and Quchan. Raising the frequency of the erosive wind in Quchan, Kashmar, Sabzevar, Sarakhs, and Neishabour stations during the study period could also be stated. In most of the stations (except Mashhad and Neishabour) upward tendency in the number of dusty days is consistent with other researchers such as Mehrshahi and Nekounam (2009) in Sabzevar, Boochani, and Fazeli (2011) in Ilam, Shahsavani et al. (2011) in Khuzestan stated. Hence, the decreasing tendency of dusty days in Mashhad and Neishabour is also in line with Rafiei et al. (2015) in Yazd, Semnan, Kashan, Ramsar, and several other stations. The falling trend of wind speed in Mashhad station can be reflected as the main reason for

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the reduction of dust events. In addition, the rising tendency of precipitation and possible decline of drought in Neishabour can be considered as the main reasons for the decrease in the number of dusty days. To understand the effect of climatic factors on the occurrence and intensification of dust events, the relationship between the number of dusty days and climatic parameters was determined. The results of correlation analysis between dust events and climatic parameters showed that the temperature directly affects the dust events in all stations except Mashhad. The positive correlation between temperature and dust events was stated in other studies (Bahrami et al., 2013; Amgalan et al., 2017). The correlation coefficient between dust event and precipitation showed a negative relationship between them which was significant at 95% level in Sarakhs station. Other studies (Ali et al., 2016; Broomandi et al., 2017; Amgalan et al., 2017) have also indicated the inverse effect of precipitation on dust events, which is following the findings of this study. The results of correlation analysis between the number of dusty days and wind speed and the frequency of erosive wind showed that the enormous influence on dust events is wind speed. While, at Neishabour station, there is a significant negative relationship between dust and wind speed. Indeed, the inverse relationship between dust and wind speed indicates that with increasing wind speed, the dust emission does not increase and another factor reduces the effect of wind speed. As Kimura (2012) reported the impact of vegetation on reducing the wind speed impact on the dust occurrence.

Conclusion: It was proven that the number of dusty days is in line with the variations of the climatic parameters. The decrease in rainfall, increase in temperature, and wind speed has been accompanied by an increase in dusty days in the region. In general, correlation analysis of dusty days and climatic parameters in Khorasan Razavi province indicated that wind speed and the frequency of erosive wind have considerable influence on dust events. However, the effect of wind speed on dust events at the Neishabour station reflected the significance of vegetation cover on reducing the transfer of soil particles.

Keywords: Climatic parameters, Dust, Khorasan Razavi Province, Mann – Kendall, Multivariate regression.