DEEJ (2021) 10 (30) 111-125

University of Kashan

Desert Ecosystem Engineering Journal

Journal homepage: http://deej.kashanu.ac.ir

Investigating the change in the Sand and Dust Storms' intensity in affected areas in Sistan Plain

Mohadeseh Mir[1] , Saeideh Maleki[2]*, Vahid Rahdari[3]

Received: 16/03/2020 Accepted: 11/11/2020

Extended Abstract

Introduction: Sand and dust storms (SDS) are naturally occurring phenomena in arid and semi-arid areas that cause some critical challenges in such areas, whose intensity have increased by drought and water scarcity. Located in eastern Iran, the Sistan plain is affected intensively by the negative effects of such storms, which also affect Afghanistan and Pakistan. This study sought to investigate the extent and range of changes in the effects of dust storms, the variations of the wind velocity, and the changes in climatic factors in the Sistan plain so that managerial measures could be developed for fighting against such storms.

Method: In this study, annual mean temperature and precipitation were selected as climate variables to measure the change in the study area's climate. These data were analyzed for 1977-2014 period, using the Mann-Kendall (M–K) test. The magnitude of slope in the MK test, is applied to determine the tendency of parameters. A positive slope magnitude indicates an increasing trend, while a negative slope magnitude suggests a decreasing trend. The changes in sand and dust storms intensity in Sistan plain was investigated through the Present weather data (WW). Also, the wind speed data during the study period were applied to investigate the changes in this parameter. The brightness temperature degree index was calculated to determine the affected sand and dust storms extend. This affected area was mapped for 2000, 2004, 2013, and 2018 to determine the changes made by sand and dust storms in the area.

Results: The study's findings showed that the intensity of sand and dust storms increased during the study period, and the area under their influence was expanded in recent years especially in years when the precipitation were low. Moreover, the results indicated that while the main hotspot in the Hamoun body was expanded to more distant areas out of Sistan plain especially in Afghanistan, the wind speed did not change significantly. On the other hand, MK test conducted on precipitation and mean annual temperature showed a decreasing trend in precipitation an increasing trend in annual mean temperature during the study period, indicating that the region's climate had been getting drier and warmer. Furthermore, the intensity of dust storms had increased and the number of dusty days was doubled, and a wider area was affected by such storms. The findings clearly indicate that the extent and intensity of the sand and dust storms in Sistan plain have increased.

1M.s.c student, Department of Natural Resources, Faculty of Natural Resources, University of Zabol, Zabol

2. Assistant Professor, Department of Environment, Faculty of Natural Resources, University of Zabol, Zabol; smaleki@uoz.ac.ir

3. Assistant Professor, Department of Environment, Faculty of Natural Resources, University of Zabol, Zabol

DOI: 10.22052/deej.2021.10.30.59

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Conclusion: The study's findings suggested an increase in the extent and intensity of sand and dust storms was in the Sistan Plain throughout the study period (1977-2014), which could be due to the changes in the wind speed or annual mean temperature and precipitation of the region. In this regard, it was found that while the changes in the wind speed was not significance, there were significant changes in the region's annual mean temperature and precipitation. Moreover, the results of Man-Kendal test showed a decreasing trend in precipitation and an increasing trend in temperature during the study period, indicating that the region had become drier and warmer, which in turn had increased the potentials for the rise of dusts in each storm. Therefore, with the dryness of the region, the soil moisture would decrease, providing the grounds for the occurrence of a dusty day by any wind. Moreover, as the areas affected by sand and dust storms have been expanded, this study emphasizes on long-term planning for protecting local people against such storms.

Keywords: Man-Kendal test, Brightness temperature degree, Mean annual temperature and precipitation, Remote sensing.