



Research Paper

Identification of the Most Important Synoptic Patterns of Dust Generation in Kohgiluyeh and Boyer-Ahmad County

Ashraf Asadi ^{a*}

^a. Department of Physical Geography Payame Noor University, Tehran, Iran

ARTICLE INFO

ABSTRACT

Keywords:

Circulation Patterns,
Dust,
Vorticity,
Geopotential Height
roughness,
Cluster Analysis.



Received:

08 July 2022

Received in revised form:

11 September 2022

Accepted:

27 October 2022

pp. 1-20

This research aims to identify the synoptic patterns of dust generation in Kohgiluyeh and Boyer Ahmad provinces. Therefore, two sets of data including the daily data of dust code 06 from Hamdid stations in the statistical years 2007 to 2017 and the variables of air temperature, geopotential height, sea level pressure, orbital wind, meridian wind, specific humidity, and omega were used as upper atmosphere data. To check the synergism of the dust-generating patterns in the given years, the uneven circulation patterns of the geopotential height of 500 hectopascals in the dusty days of the province were drawn. After determining the days of dust using cluster analysis and integration by the Ward method, 5 patterns were extracted and drawn on the roughness data of peninsular height of 500 hectopascals. The results of this research showed that there is the most significant relationship between the synoptic patterns of the Middle East region and dust events in the province by circulation patterns number 2 and 5 at the level of 500 hectopascals. For a better conclusion of the conditions and factors causing the dust phenomenon in Kohgiluyeh and Boyer Ahmad provinces, maps of average sea level pressure, specific humidity at levels of 1000, 850, and 700 hectopascals, omega (vertical air velocity in the atmosphere) at levels of 1000 and 400 hectopascals, Tavai (Convergence and divergence of wind) at 500, 700 and 1000 hPa levels and drawing of a jet (river of wind) at 200 hPa level during the rule of each of the models were drawn and analyzed.

Citation: Asadi, A. (2022). Identification of the Most Important Synoptic Patterns of Dust Generation in Kohgiluyeh and Boyer-Ahmad County. *Geographical planning of space quarterly journal*, 12 (3), 1-20.

<http://doi.org/10.30488/GPS.2021.256866.3329>

* . Corresponding author (E-mail: ashraf-asadi@pnu.ac.ir)

Copyright©2022 The Authors. Published by Golestan University. This is an open access article under the CC BY license (<https://creativecommons.org/licenses/by/4.0/>).

Extended Abstract

Introduction

Dust event is one of the important environmental issues in different parts of the world that can have adverse socio-economic effects. Studies show that fine dust particles that originate in most arid and semi-arid regions of the world can be transported over long distances with atmospheric currents and cause adverse effects such as changes in local weather conditions, air pollution, and biostatic change. The chemical water and surface water pollution, respiratory problems, and diseases such as asthma and infectious diseases, severe damage in agricultural sectors, disruption of the transportation system (land, rail, and air) due to reduced horizontal visibility, interruption of Radio services, and create colorful rainfall. One of the effective factors in the formation of this event is the change of land cover and land-use and, in some cases, the change in the pattern of surface currents and aquifers by humans. The transfer of dust into the atmosphere and its transfer by the atmosphere is closely related to climatic conditions and how spatial and temporal distribution of atmospheric variables such as pressure, temperature, wind, and humidity. If the unstable air has enough humidity, a thunderstorm and lightning storm will occur, and if it does not have enough humidity, a dust storm will occur. In recent years, Iran has been affected by the adverse effects of these events due to its special climatic conditions and proximity to a large part of desert areas. Recent studies on the nature of dust storms include Iran's origin, frequency, causes, effects, and consequences. Areas located in Mesopotamia are the main areas of dust production. In recent years, the dust has spread throughout the year and has the highest frequency in the warm seasons, especially in July and August.

Methodology

Two categories of surface data and high atmosphere data are needed to do this research and all synoptic studies. In the surface data section, first, the data of code 06 dust events hourly and daily from 6

synoptic stations during the statistical years 1986 to 2017, which was received from the Research Office of the Meteorological Organization of Kohgiluyeh and Boyer-Ahmad Provinces. For high atmospheric variables, air temperature data (in terms of Kelvin K), geopotential height (in terms of meters m), sea level pressure (in terms of hectopascals hPa), orbital component (in terms of meters per second m / s), The meridional wind component (in meters per second m / s), the specific humidity component (in grams per kilogram) and the omega component (vertical wind speed) were used. These variables are taken from the website www.cdc.noaa.gov as a 6-hour watch. To study the upper atmosphere data, the study area was wider than the territory of Iran in the framework of longitude 0 to 70 degrees east and latitude 0 to 60 degrees north.

Since the pattern of atmospheric currents of 500 hPa levels has a decisive role in the changes of the basic climatic variables of Iran. Drawing and examining the patterns of this level is the primary principle of synoptic study in this research. First, the daily geopotential height data of 500 hPa at 12 GMT during the 11 years and then during the selected 1019 days were extracted to draw the circulation patterns.

These data became a matrix with dimensions of 725×1019 , which includes 725 spatial cells and 1019 temporal cells (days). Finally, by performing base accumulation cluster analysis by integration method for 1019 days, 5 main circulation patterns of 500 hPa level were identified.

Results and discussion

Five main circulating patterns were identified at the level of 500 hPa to investigate the circulating patterns of the ruggedness of geopotential height at the level of 500 hPa on dusty days of the county in the selected days after the analysis of cluster accumulation in the integrated method for 1019 days,

Conclusion

The results showed that there is a significant relationship between the synoptic patterns of the Middle East region

with dust events in Kohgiluyeh and Boyer-Ahmad provinces. The most significant relationship between the two is observed by circular patterns No. 2 and 5 at the level of 500 hPa. The general result of the study of synoptic patterns showed that at the level of 500 hPa, the fact that southwestern Iran is located below the east of the western winds and the formation of western wind orbits is the cause of most dust events in Kohgiluyeh and Boyer-Ahmad county. However, in all models, the establishment of widespread and strong low pressure at ground level, atmospheric moisture deficiency at all levels, and wind convergence at 700 and 1000 hPa levels, which leads to dust

retention and increased intensity, were effective.

Funding

There is no funding support.

Authors' Contribution

Authors contributed equally to the conceptualization and writing of the article. All of the authors approved the content of the manuscript and agreed on all aspects of the work declaration of competing interest none.

Conflict of Interest

Authors declared no conflict of interest.

Acknowledgments

We are grateful to all the scientific consultants of this paper.