

Time evaluating of dust phenomenon in Alborz and Qazvin provinces

Tayebe Mesbahzadeh^{1*}, Nahid Alipour², Hasan Ahmadi³, Arash Malekian⁴, Mohammad Jafari⁵

1. Assistant professor, Department of Rehabilitation of Arid and Mountainous Regions, Faculty of Natural Resources, University of Tehran, Karaj, Iran
2. Ph.D. Student in Management and Control of Desert, Department of Rehabilitation of Arid and Mountainous Regions, Faculty of Natural Resources, University of Tehran, Karaj, Iran (nahidalipour@ut.ac.ir)
3. Professor, Department of Rehabilitation of Arid and Mountainous Regions, Faculty of Natural Resources, University of Tehran, Karaj, Iran (hasanahmadi@ut.ac.ir)
4. Associate Professor, Department of Rehabilitation of Arid and Mountainous Regions, Faculty of Natural Resources, University of Tehran, Karaj, Iran (malekian@ut.ac.ir)
5. Professor, Department of Rehabilitation of Arid and Mountainous Regions, Faculty of Natural Resources, University of Tehran, Karaj, Iran (jafari@ut.ac.ir)

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Expanded Abstract

Introduction

Dust is a phenomenon that mainly occurs on arid and semiarid regions due to the high wind speed and its turbulence on soil surface without any cover and talent to erosion (Khoshhal Dastjerdi et al., 2012). In recent years, dust of deserts has increasingly grown and has played an important role in climate change in the world (Yarahmadi & Khoshkish, 2013). Today pollution from dust particles has converted to one of the environmental problems, especially in developing countries (Aliabadi et al., 2015). Dust, as a phenomenon of desert areas, disrupts human activities, agriculture, social infrastructure, transportation, and industry (Takemi & Seino, 2005). Goudie et al. (2009) mentioned that Sahara Desert is the strongest sources of global dust in West Africa and western China. Kumar et al. (2015) investigated three major dust events that occurred in northern India during the monsoon season in 2010, by land measurements, satellite, and model estimation. The results showed that all dust storms originated from the desert or transported from it and they were created due to favorable conditions. In this paper, the annual and monthly frequency of dust phenomena in Qazvin and Alborz provinces has been studied during the statistical period in order to minimize the damage caused by this phenomenon using its results.

Material & Methods

Alborz province is located in the middle part of the Alborz Mountains that is adjacent to Mazandaran province from north, to Markazi province from south, to Tehran province from east and to Qazvin province from west. Qazvin province with 15821 km² located between 48°, 45' to 50°, 50' of east longitude and 35°, 37' to 36°, 45' of north latitude that are limited to Mazandaran and Gilan provinces from north, Hamedan and Zanjan provinces from west, Markazi province from south and Alborz province from the east.

Dust daily data in special codes for period of 15 years (2000-2014) was collected from seven selected stations in study area with suitable statistical period from meteorological organization that were processed using statistical methods for statistical study of dust. The extraction of days with dust was carried out using weather codes of 06 and 07 using MATLAB software. Code of 06 means the dust suspended in the air that is caused by soil and sand storm from distant points to the station and code of 07 means the dust or sands that are risen by wind at station or near it in observation time. In this research, monthly and annual frequency of days with dust was investigated and separated with regard to codes of 06 and 07.

Discussion of result

The annual survey of dust phenomena

The annual frequency of occurrence of days with dust showed that it has occurred 557 days with dust according to codes of 06 and 07 for selected station in Alborz and Qazvin provinces. Karaj and Qazvin stations with 173

* Corresponding Author:

E-mail: tmesbah@ut.ac.ir

and 117 days had the most day with dust respectively. Karaj station had high dust with 25 days in 2012 and 24 days in 2014 and there not have been dust in 2001 that annual average of dust was 11 days. Qazvin station had the high dust day with 23 days in 2011 and there was no dust in 2002 and 2007 and the annual average of dust was seven days. In 2008 to 2012, the high dust occurrences have been occurred and in 2012 and 2011 were recognize with 109 and 99 days as the high day with dust in whole statistical period respectively.

The frequency of days with dust with breakdown of 06 and 07 codes showed that the high days with dust according to 06 code has been occurred with 104 days at Karaj station and the lowest dust events have occurred with 36 days at Avaj station. Karaj station has been the most dust events with 22 days in 2014 and the annual average of dust days was seven days. Totally, Qazvin station had 91 days dust events that occurred the most dust occurrence with 22 days in 2011 and there was no dust in 2002, 2004 and 2007. Taleghan station had the most dust events with frequency of 19 days in 2012 and the lowest dust events with six days in 2014. Also, the average of days with dust was 11 days at Taleghan station that was higher than other stations. Karaj and Qazvin stations had the most frequency of dust events with 69 days and 27 days, respectively. Takestan, Buin Zahra and Avaj stations had the lowest dust occurrence with 7, 6 and 1 days, respectively; and Taleghan and Moalem Kelaye stations had no dust based on 07 code.

The monthly survey of dust phenomena

The monthly dust survey showed the most frequency of dust events have been occurred in May with 116 and June with 115 days in selected stations in the statistical period of 2000 to 2014. In May, the most dust with 32 days at Qazvin stations and in June the most dust with 30 days at Karaj station were recorded. Then, in April with 79 days and in July with 70 days have been the most dust respectively. In April, Qazvin station had the most dust with 18 days and Karaj station had the most dust with 23 days. In November and December, the lowest dust with 9 days have been registered. The monthly survey of dust phenomenon according to 06 code showed that in May 90 events of dust and in June 85 events of dust have been occurred the most frequency of dust events at selected stations in the study period, respectively. In May, Qazvin station with 30 events, Avaj and Taleghan stations with 14 events had the highest frequency of dust occurrence among all stations according to 06 code, respectively. In June, Qazvin station with 19 incidences and Karaj station with 15 incidences had the highest frequency of dust. In November, five events had the lowest occurrence of dust compare to the other months during the statistical period. Five events were at Karaj station and the other stations had no dust in this month. The monthly survey according to 07 code showed that in June and October 15 incidences had the most dust that with regard to it Karaj station with frequency of 13 days in June and seven days in October had the most dust. In December and November with 1 and 2 days, the lowest frequency of dust were occurred, respectively, and in January according to 07 code, no dust has been during statistical period.

Conclusion

According to the results, it has been known that in the past, this phenomenon has a lot of abundance, but in 2008–2012 occurred the highest dust incidences that 2012 and 2011 with 109 and 99 days is known as the most dust years in the whole statistical period, respectively. The annual dust survey also showed that Karaj, Qazvin, Takestan, Moalem Kelaye and Avaj stations had ascending trend during statistical period, but Taleghan and Buin Zahra stations had descending trend. The remarkable point is that dust occurrence from beginning of study period to the end of it has almost been ascending trend at Karaj, so that in the last years it reached the highest rate, but in other stations, after 2011 and 2012, the incidence of this phenomenon has reduced. The study of annual frequency of days with dust according to 06 code showed that the high days with dust occurred at Karaj station and the lowest dust events occurred at Avaj station that Karaj station had the most dust incidence with 22 days in 2014. Furthermore, according to 07 code, Karaj and Qazvin stations had the most events of dust and Buin Zahra and Avaj had the lowest events of dust, respectively. Therefore, according to the results, it was found that the most of dust incidence entered from distant regions to studied stations. At Taleghan and Moalem Kelaye, all of the recorded events had external origin and these stations had no dust based on 07 code during study period. The monthly study of dust event showed that the highest frequency of dust occurred in May and Jun. In May, Qazvin station with 32 days and in June, Karaj station with 30 days had the most days with dust and in November and December also had the lowest incident of dust. Monthly investigation of dust based on 06 code showed that in May and June, the most frequency of dust event had been registered. Regarding to this, Qazvin station had the highest events in May with 30 days and in June with 19 days. According to 07 code, in June and October, the highest incidence of dust had been registered. Regarding to this, Karaj station had the most dust with 13 days frequency in June and seven days in October. In general, based on the results, it was found that in the study area, with the onset of the spring season and the warm period followed by the summer season, the frequency of days with dust has increased, which it can be due to increased hours of daily sunlight, thermal

surface, and also there are some local instabilities. Another important factor is the passage of waves of the western masses from the deserts of neighboring countries, which, due to the dryness of the air flow and desert environment in those regions, causes dust and its penetration into the central parts of Iran. Movahedi et al. (2014) monitored the climate phenomena related to dust according to weather codes for Iranian cities, and concluded that the dust phenomenon with the 06-meteorological code in western Iran has a maximum incidence, and in the summer is the highest and, in the fall, is the lowest amount of dust. Also, incidence of dust occurred according to 07 code in the before afternoon in the east of the Iran and occurred in the southeast and the coastal area of Oman sea in the late afternoon. Therefore, the findings of this study are consistent with some of the results of our study. According to the results obtained, it can be concluded that by examining the time and place of the occurrence of dust phenomena, it is possible to reduce the many damage caused by this phenomenon that threatens the environment and human health. It is very difficult to control dusts of external origin, mainly from the countries of Iraq and Syria. So, it is suggested that, for the accurate analysis of internal dust, factors such as drought and use change of the factors affecting the occurrence of dust should be determined.

Keywords: annual frequency, annual trend, dust, meteorology codes, monthly frequency.

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