Dust Spatial Analysis in Northeastern Iran

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Extended Abstract

1. Introduction

Every year natural hazards damage various parts of the planet. One of the hazards of the desert margin with a dry and semi-arid climate, including the Middle East, is dust. Dust reduces horizontal visibility and cancellation of flights, causes crashes, pulmonary and ocular diseases, work closures, air pollution, reduced water quality and damage to the agricultural sector, etc. Today, air pollution with dust is reported in different cities of Iran, including the storm in the July 18, 2009 in 18 provinces, with particles suspended from the desert of Syria and Iraq to Tehran and the amount of suspended particles with 460 ppm showed the highest record of polluting (Ranjbar Saadat Abadi & Azizi, 2012). Estimated economic losses in the western Iran (Ilam, Khuzestan and Kermanshah) from 2006-2011 were 2227 million dollars in the first scenario to $ 13361 million in the fourth scenario (Khalidi, 2013). Every year, 108 tons of dust particles are imported into the atmosphere, with the largest share of Africa (Kutiel & Furman, 2003). The Arabian Rub' al Khali Desert, the Tigris and Euphrates suburbs of the Euphrates and the coasts of Oman are the main focus of Middle East dust production (Prospero, Ginoux, Torres, Nicholson & Gill,., 2002). In Iran, a significant dust storm trend was reported in the west (Rasouli, Sari Sarraf, & Mohammadi, 2011). Zabul with an average of 183 storms had the highest number, and Zahedan, Bushehr, Tabas, Bandar Abbas, Jask, Iranshahr, Hamadan and Ahvaz were the next, with the maximum number in July and minimum in December (Farajzadeh & Alizadeh, 2011). The two critical centers of dust in the southwest of Iran from 1979-2008, Dezful and Bushehr, have highest amount of dust in spring and lowest in December (Azizi, Miri, & Nabavi, 2012). The purpose of this study is to determine the pattern of spatial distribution, continuity, major sources and dust hour pattern in northeastern Iran.

2. Method

The extensive spatial pattern of dust (roundness, continuity, major resources and hourly pattern) was performed with the following steps: Hourly data of horizontal view, wind speed and wind direction of the synoptic stations of Quchan, Golmakan, Sarakhs, Mashhad, Neyshabur, Sabzevar, Kashmar, Torbat Heydarieh, Torbat-e-Jam and Gonabad have been received from the Iranian Meteorological Organization since its inception by 2010. Day of dust was defined as the day when the horizontal view was less than 10 km and with the present weather of 06-07-08-

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09 and 30-31-32-33-34-35, in one of 8 watches per day. Subsequently, the annual, seasonal and monthly frequencies were calculated. The data of wind speed in the dust dates of windrose during the year, the season and the month were illustrated. The speed and direction of the windrose were determined for estimation of dust hour with a 12-hour GMT basis with a maximum recorded dust concentration. The dust accumulation was determined in 2, 3, 4 and more days. In the next step, in order to determine the dust hour pattern, the frequency of occurrence of dust in the eight hours of data recording for each station was calculated and maps were drawn.

3. Findings

Sarakhs with the average 24 -40 days a year experience the largest dust, and the least dust was in Quchan and Kashmar with 9 days a year. Most of the winds run from Turkmenistan in the north, northwest, north east, and east directions. Dust days fluctuate around an average of 18 days a year. The highest winter dust is in Sarakhs, Sabzevar and Gonabad, and the lowest in Quchan, Golmakan, Neyshabur and Kashmar. The dust from the west and southwest is related to western winds, cyclones and the position of cold fronts in the Dasht Kavir and the Bajestan Desert. The region's largest dusting occurs in spring. In spring, Sarakhs and Sabzevar have the highest level of dust, and Ghouchan, Golmakan, Kashmar and Torbat Heidariyah have the least amount of dust. In this season, winds in the north, northwest, east, and southeast blow from Turkmenistan deserts. The peak of the April dust volumes is in Sabzevar, Mashhad and Sarakhs; in June, it is in Sarakhs and Sabzevar, and the lowest is in Quchan, Torbat Heydarieh and Kashmar. After spring, summer is the most dusty, with winds from north, northeast, east, and southeast. The source of spring and summer dust is Turkmenistan's desert and east of the region. The peak of the July dust is in Sarakhs, Sabzevar, Mashhad and Gonabad, with winds blowing from north, northeast, and east. In summer, Kashmar and Quchan are not dusty. The greatest continuous duration of dust is two days and more in Sarakhs, Mashhad, Gonabad, Golmakan and Sabzevar and the least continuous dust is in Kashmar, Quchan. From 1983 onwards, the continuity of dust has a positive trend. In 2008, the highest dust accumulation was recorded. The highest level of dust was recorded at 12 and 15 GMT, except for Sarakhs that recorded the highest dust at 6 GMT. Maximum recorded winter dust was at 12 and 9 o'clock, in autumn at 12 GMT, except for Sarakhs which was at 9 GMT. The maximum in spring was at 12 and 15 except for Sarakhs which was at 6 GMT, and the pattern of this season is similar to the annual pattern, the highest summer dust was at 15 and 12. In all seasons, the lowest dust incidence occurred at 0 and 21 GMT.

4. Conclusion

The dust spatial trend of the region is northeastern-southeast, indicating the arrival of dust from the desert of Turkmenistan and the eastern dry plains. The mountain direction, position of the station and the station's height affect channeling wind and dust from dry lands. Sarakhs has the lowest station that experienced the highest level of dust. The peak is in spring, summer, and the lowest levels occurred in December and January. This trend is also evident in other parts of Iran. In the cold

period, with the arrival of the wet system, the soil is stabilized. Summer dust is more homogeneous with stable atmospheres and surface heating, and it is heterogeneous in the semi-cold with unstable system. Most of the persistence of dust is in Sarakhs, Gonabad, Mashhad and Sabzevar, which is associated with a 120-day wind in the summer. Maximum dust is at 12 and 15 GMT, except for Sarakhs, which is similar to Zabul that experiences the highest level at 6 o'clock in the afternoon. Decrease in the dust of Kashmar confirms that the northeastern dusts of Iran are mainly from the Karakum desert and the northeastern postal areas of the region, and deserts of the Dashte Kavir in the east and the desert of the southwest of Bajestan play a less role. Therefore, recognition of atmospheric patterns and control of dust cores in the northeast of the region are useful for risk and crisis management in the northeast of Iran.

Keywords: Spatial analysis, Dust, Continuity, Hourly pattern, Northeast of Iran

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