

*Studying of Meteorological Patterns, Identifying of Dust Sources and  
Motion Track of Particles for Dust Storm, July 2009*

**Ranjbar Saadatabadi A.\***

Assistant Prof. of Meteorological Organization, Tehran

**Azizi GH.**

Associate Prof. Dep. of Physical Geography, University of Tehran

Received: 24/04/2011

Accepted: 16/10/2012

**Extended Abstract**

**Introduction**

In arid and semi-arid areas, dust storms occur frequently. When surface winds are strong, large amounts of sand and dust can be lifted from bare, dry soils into the atmosphere and transported downwind affecting regions hundreds to thousands of kilometers away. Dust storms are most commonly caused by strong pressure gradients which cause an increase in wind velocity over a wide area. For countries in and downwind of arid regions, airborne sand and dust presents serious risks to the environment, property and human health. In recent years, systematic research on dust storms has been carried out. Dust storm in the east of Asia, is quite well documented through the analyses of synoptic records over the past 50 years (Sun et al., 2001; Zhou, 2001; Chun et al., 2001; Qian et al., 2002; Natsagdorj et al., 2003; Kurosaki and Mikami, 2003; Shao and Wang, 2003). Sun et al. (2001, 10331) analyzed the synoptic reports over the 40-years period between 1960 and 1999 and found that Gobi in Mongolia and north of China are major dust sources. In this paper, we identify the main sources of dust production, test forward trajectory technique and investigate characteristics of pressure patterns of dust events in July 2009 in Western Iran.

**Methodology**

Throughout this study, it is attempted to determine characteristics of effective pressure patterns and main dust emission's sources and forward trajectory based on meteorological information including: meteorological maps at the standard levels (1000mb, 850mb, 700mb and 500mb), satellite images and some products of the numerical weather prediction models. Meteorological maps data analyzed at 00UTC and satellite images (interval time is 30min.) of dust events from 2<sup>th</sup> to 7<sup>th</sup> of July, 2009. Satellite images were used to compare the spatial pattern of a large scale dust event with the pattern predicted by the model.

\*E-mail: aranjbar@gmail.com

## Results and Discussion

Surveys show that in recent years the event frequency, intensity and the extent of the region affected by sand and dust have been increasing. Water irregular consumption and inhibition, particularly widespread constructing dams in the south of Turkey and the North of Syria and Iraq, cause the creation or development and spread of producing sources of dust in the eastern north of Syria and the north of Iraq especially Mesopotamia that provide suitable conditions for dust formation in these areas and delivering it to vast areas of Iran. On the other hand, it can be claimed that in past, the sources of dust were mostly in the south of Iraq, some parts of Jordan, Kuwait, and the north of Saudi Arabia. These sources has influenced already on the south west of Iran through the south westerly or the north westerly winds, now by spreading and creating sources in the north of Iraq and eastern north of Syria, the west of Iran is affected with more intensity, frequency and permanency by this event. The two following reasons are of most importance to produce dust storm:

- 1- There are soft soil particles and clay in the Region,
- 2- As these Regions are located nearer to the north comparing to the previous mentioned areas, meteorological condition is suitable for dust formation.

Maximum number of dusty days and severe dust events usually occur in summer. Because of strengthening the subtropical high pressure, the waves of Mediterranean have been delivered to northern latitudes, and there will be no possibility of moisture feeding and no precipitation. Thus, its deployment on dry areas provides suitable conditions for ascending air and dust particles. While low pressure system moves to the east, the conditions for high pressure system's deployment located in the west of upper trough, by convergence of upper flows, leads to its creation and strengthen of high pressure. So, intensive pressure gradient is created between low and high pressure systems which leads to creation of strong winds and causes dust storm. However, geographic condition might have an effective role in creating strong winds.

In this case study at 700hPa level, in addition to the lack of deep and noticeable trough, contour gradient is low and probably provides suitable situation for the persistency and accumulation of dust particles in this level and near levels. Then, regarding Zagros' height (in average 3 km above sea surface), the particles pass above the mountain and impacts expand areas of the east of Zagros such as Tehran.

Due to decreasing the wind speeds (on surface and low level troposphere) from Iraq to Iran and also confluence of west and east winds the convergence zones have been created over the west of Iran. This Convergence of winds has an important role in accumulation and suspended of particles over the region. For determining the convergence due to the winds with opposite

directions, an imaginary line can be considered which continues from Iran's low pressure center to eastern south of Turkey.

## Conclusion

Output results indicate that the sources of dust production were in the East of Syria and the

North West of Iraq that through storm movement to the east, the density of suspended particles were increased and had impacts on western of Iran. The main meteorological factors in creating storms and delivering the suspended dust particles over the western of Iran are as following order:

Extending of thermal low pressure system from the center of Iran to the north of Iraq and south of Turkey, spreading of high pressure system from the Black sea to Caspian sea, the north band of Iran and the south east of Turkey, the strong pressure gradient created between the two pressure systems and passing waves out of Mediterranean in the mid troposphere level have an essential role in creating storm and carrying the suspended particles.

During the years that precipitation decreases, the occurrence of the event increases; thus, there is a meaningful relation between drought and the increasing of the frequency and intensity of sand and dust.

**Keywords:** *Dust Storm, Dust Sources, Particle Path, Mediterranean Trough, Pressure Gradient.*

Archive of SID