

A Synoptic Analysis of January 2008 Sever Cold in Iran

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Extended Abstract

Introduction

January 2008 was one of the coldest days during the history of registering data in Iran. In this month an unusual cold air mass covered the most part of Iran particularly the north area of the country. As this air mass shifted southward, it produced very cold condition in all of the country and dry snowfall in the north parts and mountain area.

Materials and methods

In this paper in order to investigation of unusual cold event on Jan 2008 in Iran, a dataset includes daily minimum temperature of Jan 2008 has been gathered from synoptic stations all over the country. Then, by using cluster analysis extracted 21 stations as selected stations; the final stations almost covered all of the country area. Z score index used for calculated minimum daily temperature anomalies. Then the calculated Z scores applied as an indicator in order to compared January 2008 minimum temperature with the long-term average minimum temperatures of January. Also extracted the four hourly temperature, sea level pressure, geopotential height, and the wind speed components (U&V components) for synoptic analysis of Frost events in the period of study from NCEP/NCAR. Position and movement of the atmospheric systems such as cyclones, anticyclones, fronts and wind fields were identified using synoptic maps. Also the daily temperature data and the wind speed components are used for plotting the composite maps of temperature advection, thickness, temperature gradient's vectors, and thermal wind.

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Archive of SID Results and discussion

The result shown that the Z scores index of January 2008 has been more than (-5) Celsius degrees in majority of selected stations except 6 stations in south regions of Iran consist of Ahwaz, Bushehr, BandarAbbas, Shiraz, Kerman, and Iranshahr. The analysis of minimum temperature in case of 6 quintuple periods (consist of 5days periods) showed that the fourth period (16th -20th days of Jan 2008) have had the coldest temperatures. Almost during the study period the most observed prevailing event has been a Blocking system. The blocking situation created a suitable condition for cold advection to Iran during the period study. The sea level pressure field map in the forth quintuple (16th -20th January 2008) depicted that there is a high system that is closed by isobar 1025h_{pa} over the north of Aral Sea and it is extended over the north of Caspian Sea. The existence of severe cold in the most stations verifies this result. Isobar 1024h_{pa} is located over most of southern region simultaneously. An intensive decrease of temperature has been seen during the fourth quintuple in stations contains Saghez, Shahrekord, Birjand, Tehran, Gorgan, and Ramsar. These stations are as preventatives of northern regions of country that is exposed blowing of westerlies. In order to investigate the causes of severe cold we used the thickness map. The investigation of thermal wind in thickness map of 1000 up to 500 gpm levels presents an intense cold advection over the northern regions of Iran. This cold mass air is originated from arctic region and by passing cold territories such as Siberia it becomes colder and colder. Passing from the colder paths will create a colder advection and colder weather as a result. It transmitted the dry and cold air masses into the country in such a way that the maximum decrease of air thickness over latitude 32°N is between longitude 69E and 62E. It contains the north and north eastern part of Iran. Following intensive lessening of temperature we can observe frost in forth quintuple. So the advective frost outbreak in the east north and northern half of country could be explained by this intensive cold advection in the 4th quintuple period of study.

Conclusion

Cold advection to Iran during the study period has originated from north and North West area of the country as two main sources for cool advection. From other side it is evident that there is an active center for warm advection that it is located on Arabian Peninsula region and western neighboring area of Iran. The analysis of maps showed that the speed of thermal wind over south of Iran and Persian Gulf is over 30 m/s and it decreases the intense of frost and sever cold over south region by warm advection. Also another conclusion of this investigation is that the thermal wind over the southern region of country, Persian Gulf, and Oman Sea with velocity over than 30m.s⁻¹ has decreased the intense of cold events in southern regions of Iran. It seems that the higher minimum temperature of some southern stations such as Ahwaz, Bushehr, BandarAbbas, Shiraz, Kerman, and Chabahar is because of warm advection www.SID.ir

Keywords: Frost, Blocking system, Cold advection, Thermal wind, Synoptic patterns.