Roles of Blocking in Extreme Cold Events over Iran

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Extended Abstract

Introduction

Iran experienced an unprecedented cold air during January 1964 and 2008. The study of January-temperature's anomalies during 50 years since 1964 up to 2005 showed that the maximum anomaly occurred during Januaries of two years including January of 1964 and 2008.Negative anomaly causes to become -30 degree Celsius Minimum daily temperature during mention Januaries over Iran such as Saghez and Shahrkord stations. The abnormally cold air masses hassled the irreparable damage of the agricultural, bestial even transport sectors and also People's life inrural-urban was paralyzed. So that the most parts of the country were affected. It seems necessary to review anomalies' factors. The fluctuations of planetary circulation are characterized by a relative dominance of meridional or zonal patterns. The meridional pattern of circulation is often attributed to the increased heat exchange between the equatorial region and middle and high latitudes. The turbulence of zonal flow and the intensification of meridional flow caused blocking processes. For investigating the hypothesis the quantitative blocking intensity index (BII) which was calculated by the method of Wiedenmann (2002), is used.

Methodology

By using Z score index, minimum temperature anomaly was calculated. Each concerned two months was divided into sixfive-day periods (pentagonal). For identifying blocking, we got mean sea level pressure and 500-hpa geopotential height levels maps from NCEP/NCAR. Temperature data and zonal and meridional wind components were used in order to draw maps of streamlines. In the research we have used quantity method to identify Blocking event. Here,

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the quantity (BII) calculated by applying the method of Wiedenmann (2002) was used. Blocking intensity index.

$$BI \text{ Index: } BI = 100.0[(MZ/RC) - 1.0]$$

The value was scaled in order that BI values rated from 1 to 10, with increasing values being stronger. The rationale used to stratify by weak ($BI < 2.0$), moderate ($2.0 < BI < 4.3$), and strong ($BI > 4.3$) blocking events (Lupo et al, 2002, 3461 after Wiedenmann, 2002).

Results and Discussion

After comparing mean minimum temperature in 1964 during last 50 years in Iran, we recognized it had experienced -6.1 degree siliceous. Reviewed stations had the most negative anomaly of mean minimum temperature in the fifth and third petagonals in sequence in 1964. Also we found during 1964 January cold, Middle West regions of the country (Hamadan, Arak, Sanandaj stations) had temperature less than -20 degree siliceous. In 2008 January the most negative anomaly of mean minimum temperature were experienced in the forth and second petagonals in sequence in comparison to other years. Also during cold days of the fifth pentagonal in 1964have been recorded -30 and -26 degree Celsius in Saqez and Shahrkord. Isotherm counter -30 degree from the north, -25 degree from the middle and -10 degree Celsius from the south of the country justify this extreme cold. Eventually the least temperature has been seen during 16th and 20th days. After analysis maps, for identifying blocking, BI Intensity (BII) was calculated.

It was found blocking intensity is an essential factor in climate anomalies and atmospheric flows deviation episodes, which is affected by the blocking pattern. The intensity of omega pattern in 1964 January is more than dipole pattern in 2008 January. The fifth and forth petagonals of 1964 and 2008 January had the coldest temperature in the country, so the BI was 3.02 and 1.1 in sequence. In another word this classification includes moderate and weak blocking. On the other hand, blocking situation has had an important role in cold advection in last two months. Appropriate blocking situation can justify these cold advecttions. During the cold days of the fourth petagonals in 2008 January appropriate blocking situation in latitude 42.5 and 40 longitude has influenced weak intensity of the fourth period. So mean minimum temperature has reached -9.26 degree Celsius, that is coordinated severe cold in most stations of the country.

Conclusion

We gained precise results by using quantity index. Blocking intensity was identified by BI. Also it was found the reason of cold in two considered Januarys was blocking. Although 1964 blocking was more severe, it is not main factor of the cold. In another word blocking situation was another factor in cold episodes. Z scores in 1964 January which have been gained are different from ex-similar research (Azizi and et al, 2008).