



Synoptic tracking and analysis of widespread heavy rainfall of February 2, 1988 in northwest Iran

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Abstract

Background and Aim: Heavy rainfall every year leads to heavy and unpredictable floods in the world and Iran, which cause severe financial and human losses. The aim of this article is to examine the synoptics of the heavy and widespread rainfall in the northwest region of Iran on February 2, 1988.

Methodology: First, the amount of heavy precipitation that occurred was identified by ground stations in northwest Iran, and by receiving and analyzing upper-level atmospheric data, the key factors for heavy and widespread precipitation were identified. Next, maps of geopotential height, sea level pressure, omega, relative humidity and precipitable water, wind speed, and thickness at the 500 hectopascal level were used for the days of January 31 to February 2, 1988.

Finding and Results: The weather maps for heavy and widespread precipitation on February 2, 1988, in the northwest region of Iran indicate the establishment of a Siberian high-pressure system over northern Iran and the intrusion of a thermal low-pressure system from migrating Europe into the northwestern area under study at the 500 hPa level. This created a steep pressure gradient, where the ascent of warm air, along with the transfer of moisture from surrounding warm water sources such as the Black Sea and the Mediterranean, played a key role in the intensity and distribution of the heavy precipitation in the area in question. In the upper levels of the atmosphere, the formation of omega-shaped and rex blockings, along with deep Mediterranean low formations produced by these blocking systems, which placed the area of study in front of the existing trough axis, combined with the influx of very warm and moist air, led to the continuation of heavy and widespread rainfall on February 2 in northwest Iran.

Keywords: Synoptic analysis, Northwest Iran, Siberian high pressure, European low pressure, Bandali systems.

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Extended Abstract

Introduction:

Among the climate crisis phenomena and one of the evidences of climate anomalies, we can mention torrential rains, which, with their sudden and severe occurrence, have led to great damage to various sectors, including agriculture, traffic and transportation, infrastructure, natural environments, etc., which is difficult to compensate for in the short term. With Iran being located in arid and semi-arid areas and being affected by the subtropical high-pressure belt, it has had little rainfall with severe fluctuations, which causes destructive floods at high and low levels. The northwestern region of the country is also one of the parts that brings very heavy rainfall, torrential rains, and thunderstorms to the region in different seasons of the year, especially in spring, due to the presence of westerly wind flows and dynamic and unstable systems. The purpose of this article is to investigate and analyze the atmospheric and synoptic patterns affecting the heavy and widespread rainfall of February 2, 1988 in the northwestern region of Iran.

Methodology:

For the present study, an environmental perspective on atmospheric circulation was used, in which the amount of heavy precipitation that occurred was initially identified by ground stations in northwest Iran, and in the next stage, by receiving and analyzing data from the upper levels of the atmosphere, the key factors for heavy and widespread precipitation were determined. In this study, synoptic maps, geopotential height, sea level pressure, omega, relative humidity and precipitable water, wind speed, and thickness at the level of 500 hectopascals were used for the days of January 31 to February 2, 1988.

Results and Discussion:

Synoptic analysis of atmospheric maps of the heavy and widespread rainfall on February 2, 1988 in the northwest of Iran indicates the establishment of a Siberian high-pressure system in the north of Iran and the penetration of a European thermal low-pressure system in the northwest of the study area at a level of 500 hectopascals, which, by creating a strong pressure gradient, the rise of warm air simultaneously with the transfer of moisture from surrounding warm water sources, including the Black and Mediterranean Seas, played a key role in the intensity and distribution of heavy rainfall in the target area. In the upper levels of the atmosphere, the formation of omega-shaped and Rex blockings, creating a deep Mediterranean descent resulting from these band systems, which, with the location of the study area in front of the existing trough axis along with the influx of very hot and humid air, has caused the continuation of heavy and widespread rainfall on February 2 in the northwest of Iran.

Conclusion:

The northwest region of Iran, due to its mountainous location and the influence of different weather patterns, has significant temporal and spatial variations in terms of rainfall. The existence of such a characteristic has made the analysis of the mechanism of occurrence of precipitation patterns in this region of particular importance and has a special position. Therefore, with a proper understanding of how atmospheric circulation works on a regional scale and the study of the synoptic mechanism of atmospheric events in seasons prone to precipitation, it is possible to make accurate and reliable predictions and, subsequently, take the necessary measures to prevent damages caused by such atmospheric phenomena.

Declarations

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Authors' Contribution

Authors contributed equally to the conceptualization and writing of the article. All of the authors approved the content of the manuscript and agreed on all aspects of the work declaration of competing interest none.

Conflict of Interest

The authors declare no conflict of interest.

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