

Synoptic Analysis of Climatic Hazards in Yasouj Municipality: a case study of an episode of heavy rain on 11th March 2011

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Introduction

Precipitation, an intrinsic part of nature, is essential not only for the survival of human but also for that of plants and animals. Yet, this valuable natural phenomenon can also jeopardise human life, flora and fauna. Torrential rains are sudden events that wreak havoc in Iran and other parts of the world. In recent years, due to man's abuse of nature and disruption of environmental potentials, this phenomenon has become one of the biggest environmental hazards. Yasouj is an area of heavy rainfall in Iran, with semi-heavy and heavy precipitation occurring every year. In this research, an attempt was made to identify the causes of the heavy precipitation in Yasouj on 11th March 2011. The data at 8 isobaric levels 250, 300, 500, 600, 700, 850, 925 & 1000 hPa were analysed.

Study Area

Yasouj is located at the latitude of 30° 28' N and the longitude of 51° 36' E from the Prime Meridian. The capital of the Kohgiluyeh and Boyer-Ahmad province in the southwest of Iran, Yasouj is surrounded by the Bashar and Mehran rivers in the south and west, and the Dena Mountains in the north and east. Yasouj urban areas are located in the high and folded Zagros Mountains. This area is surrounded by steep and complex topography zones. On account of its geographical position, this city has always been exposed to southwest and west air masses, thereby experiencing heavy and semi heavy rainfalls in abundance every year.

Material and Methods

the heavy rainfall analysing of Yasouj, data from ground stations as well as from upper atmospheric levels were used. The ground station rainfall data consisted of the daily observations recorded at Yasouj station in the Kohgiluyeh and Boyerahmad province. Data from the atmospheric levels used to analyse the 99.5 mm precipitation of Yasouj were the Geopotential Height, Omega, Zonal Wind, Meridional Wind, Specific Humidity, Relative Humidity and sea level pressure which were obtained from the National Center for Environmental Prediction website (NCEP) ([www.esrl.noaa.gov / psd / data / gridded / data.NCEP_reanalysis](http://www.esrl.noaa.gov/psd/data/gridded/data.NCEP_reanalysis)).

Results and Discussion

The analysis of the atmospheric maps showed that during this heavy rainfall, intense high pressure developed on West and Central China, North East Pakistan and Siberia. This strong

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high pressure contrasted with the low pressures on Sudan, South East Asia and Iceland, and the pressure gradient resulted in unstable air. At the upper levels of the atmosphere, Omega-shaped blocking developed on Siberia and with Iran located in the South East of this blocking, the intensity of the instability increased. During the Yasouj heavy rainfall, a huge and thick polar front jet stream was deployed on Iran and the thickness of the atmosphere over the area was significant. At all levels of 500, 600, 700, 850, 925 and 1000 hPa, eddy values were negative, resulting in severe unstable conditions. Vertical movement of air at levels of 500, 600 & 700 hPa in the southern and southwestern parts was negative. This condition resulted in increased convergence and rising air which, coupled with moisture from the Mediterranean Sea, the Red Sea and the Persian Gulf, provided the necessary conditions for heavy rainfall.

Conclusion

In this research, the heavy rainfall episode of 11th March 2011 in Yasouj was studied from a synoptic and dynamic viewpoint. This heavy rainfall commenced on 10th March 2011 and continued until 14 March 2011, the highest precipitation occurring on 11th March 2011. The findings of this study reveal the strong influence of Sudanese low pressure systems in this heavy rainfall. The findings also indicate that the Mediterranean Sea, the Red Sea and the Persian Gulf were the moisture source regions for this heavy rainfall. This study provides researchers useful information regarding the production of heavy rainfall and its hazards.

Key Words: synoptic analysis, climatic hazard, heavy precipitation, Yasouj.

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